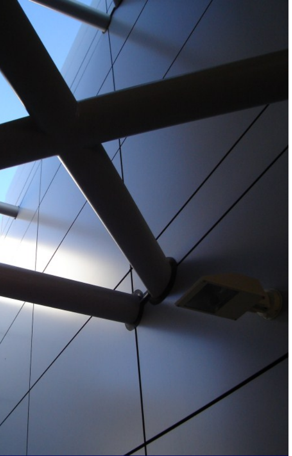

COLLOQUIUM
MECHANICAL ENGINEERING

The Department of Mechanical Engineering presents:

Dr. John A. Viator

Departments of Biological Engineering and Dermatology
University of Missouri, Columbia

Friday, February 4, 2011
11:10AM-12:00PM
Bourns Hall A265

Photoacoustic detection and isolation of circulating tumor cells in blood

Abstract: Detecting circulating tumor cells (CTCs) in blood and lymph systems has the potential to monitor therapy, detect relapse, and guide clinical management of cancer treatment. Detecting CTCs is an ongoing effort that has met with some success in the research arena using immunocytochemical and molecular methods. However, these methods require biomolecular labeling, are time consuming, require dedicated specialists to conduct, and have limited sensitivity for tumor cell detection. We developed a photoacoustic system that provides an immediate, sensitive, and unambiguous assay of CTCs for melanoma, known as circulating melanoma cells (CMCs). The technique is label free and targets melanin, a native absorber within the cells themselves, instead of molecular precursors.

Our apparatus consists of a flowmetry system in which blood samples are irradiated with laser light and photoaoustic waves are detected and counted, indicating the presence of melanoma cells. Monitoring CMCs over time can indicate disease state and can be performed much earlier in the metastatic process than conventional imaging for tumors. In order to improve the specificity of our system, we exploit the distinct optical absorption spectra of biological chromophores such as melanin and hemoglobin. We use a dual wavelength technique that distinguishes melanoma cells from red blood cells by statistical classification of the photoacoustic waves.

Using antibody targeting, we have extended this method to non-pigmented CTCs, including breast and prostate cancer cells. Furthermore, by inducing two phase flow in the detection path, we sequester small numbers of cells for isolation and purification. We have isolated single CMCs in the blood of Stage IV cancer patients using this method. Isolation of CTCs has great potential for optimizing treatment parameters for individual cancer therapy as well as providing a means for basic studies in cancer biology.

Bio: John Viator is an associate professor in the Departments of Biological Engineering and Dermatology at the University of Missouri. He is also a faculty investigator in the Christopher S. Bond Life Sciences Center where he conducts research in biomedical optics, the area of science and engineering concerning the use of lasers and light to improve human health. He is particularly interested in using photoacoustics, or laser induced ultrasound, to diagnose medical problems. He is using photoacoustics to detect the early spread of cancer in human blood in order to improve the management of cancer therapy. He also uses optics to study skin cancer, burn injury, and other diseases and injuries in the fields of dermatology, surgery, and oncology.

Dr. Viator has a BS in physics from the University of Washington in Seattle, an MS in mathematics from the University of Oregon in Eugene, an MS in applied physics from the Oregon Graduate Institute, and a PhD in electrical engineering from Oregon Health & Science University.

Dr. Viator has conducted research in a nuclear physics laboratory at the University of Oregon, at the Oregon Medical Laser Center, the Beckman Laser Institute, the Department of Dermatology at Oregon Health & Science University, as well as at his current position at the University of Missouri. He is the founder of Verapulse, LLC, a company dedicated to commercialization of photoacoustic technologies for medical diagnosis and therapy. Dr. Viator's research is supported by the National Institutes of Health, Wallace H. Coulter Foundation Early Career Award for Translational Research, the Missouri Life Sciences Research Board, and the American Society for Laser Medicine and Surgery.