



Biomedical Engineering

Lecture Series Seminar

**Photonic Microsystems on Silicon for Biomedicine
- From Genetic Regulation, Cell Manipulation to Cancer Imaging**

Friday, February 19th, 2010

1:00pm, EC 1115

John X.J. Zhang, Ph.D.

Translational biomedical engineering plays an important role in assimilating the advancement of device engineering towards developing innovative diagnosis, treatment and prevention of important human diseases at genetic, molecular and cellular levels. The micro-nano scale photonic tools for genetic regulation, cell manipulation, near field imaging, and in vivo microscopy contribute to the continuity of investigations across the biological hierarchy of multiple scales with minimal invasions, culminating in the understanding of whole body functions in health and disease. In this talk, I will review our research on exploring miniaturization technology and scale-dependent physical phenomena to: (1) develop new diagnostic devices and methods on probing and regulating complex cellular processes and biological networks critical to development and disease, (2) develop light emitting quantum dots (QD) on near-field scanning probe tip for biomaterials imaging, and (3) most recently, develop the "CancerScope", where nano-micro fabricated photonic sensors are integrated in handheld device for cellular imaging and microscopy towards miniaturized endoscopic pre-cancer detection and diagnosis. Nano-Micro, Photon, and Bio are integrative components of our research, in which engineering expertise in photonic microsystems, nanotechnologies, and semiconductor physics is synergized to advance the frontiers of biomedical research and point-of-care (POC) diagnostics towards global health initiatives. A better understanding of the fundamental problems in life science will in turn benefits the advancement of engineering research and its effect on biomedical research and clinical practice.

Biography:



Dr. Zhang is an Assistant Professor at the University of Texas at Austin (UT Austin) in the Department of Biomedical Engineering, with joint affiliations with Microelectronics Research Center (MRC), Texas Materials Institute (TMI), Center for Nano & Molecular Science & Technology (CNM), and Institute for Cellular and Molecular Biology (ICMB). He received his Ph.D. in electrical engineering from Stanford University, California in 2004, and was a Research Scientist at Massachusetts Institute of Technology (MIT), Cambridge, before joining the faculty at the University of Texas at Austin in 2005. Zhang laboratory is developing integrated photonic microsystems (MEMS, micro-electro-mechanical systems), semiconductor chips and nanotechnologies for advanced imaging, sensing and regulating cellular processes critical to healthcare, environmental and defense applications. His research group has invented radically new tools to illuminate the impact of genetic variation and microenvironmental perturbation on intra-cellular biochemical signaling pathways, cell mechanics and the robustness of development networks. Dr. Zhang's early efforts to provide massively parallel micrograting embedded cantilevers for force measurement on self-assembled cells may potentially lead to significant breakthroughs in genetic studies. His current research focus includes: micro-optical systems that exploit near and far-field effects as well as multispectral analysis of cells; handheld optical scanners for *in vivo* epithelial cancer imaging; MEMS and microfluidics coupled with live imaging for high-throughput, high-resolution genetic and drug screening; and physics and the scaling law of biochips. Nano-Micro scale science, Information, and Biomedicine are integrative components of the research that are used with advanced engineering tools to facilitate biomedical studies and develop point-of-care diagnostics for global health initiatives. Dr. Zhang was a recipient of many prestigious awards, including the *Wallace H. Coulter Foundation Early Career Award for Translational Research in Biomedical Engineering* in 2006, the *British Council Early Career RXP Award* in 2008, and *NSF Faculty Early Career Development Program (NSF CAREER) Award* in 2009.