

**STEVENS INSTITUTE OF TECHNOLOGY  
DEPARTMENT OF MECHANICAL ENGINEERING**

Thursday, April 13, 2006  
Carnegie Bldg, Room 315, Time 1:30 PM

**BioMEMS and BioNanotechnology:  
A Novel Approach to Glaucoma Diagnosis and Treatment**

**Dr. Tingrui Pan**  
University of Minnesota

In this burgeoning “Biomedical Century”, it is unfortunate that glaucoma, the leading cause of irreversible vision loss worldwide, has seen only marginal change in the diagnosis and treatment methods over the last several decades. Our focus has been on developing new diagnosis and treatment approaches to glaucoma, based on implantable Microelectromechanical systems (MEMS) and Nanotechnology. Our research efforts include: 1) modeling and analysis of a commercially available glaucoma drainage device, 2) modeling of the deformation of lamina cribrosa under applied intraocular pressure (IOP), 3) development of a microfluidic drainage system, and 4) development of a nano artificial drainage system. We have reported the first fluidic and mechanical model for analyzing the mechanics of the most commonly used glaucoma drainage device (Ahmed Glaucoma Valve). Our numerical and bench test results have challenged the current prevailing belief in this area. More importantly, we have developed a microfluidic drainage system, including a wirelessly adjustable microvalve and a remotely actuated micropump along with an intraocular pressure sensing unit, and a novel nano artificial drainage system with a biocompatible surface coating. These emerging technologies offer several new opportunities for the treatment of glaucoma.

-----  
**Dr. Tingrui Pan** received the B.Eng. degree in Mechanical Engineering from Tsinghua University, Beijing, China, in 2000, and both the M.S. degree in Biomedical Engineering and the Ph.D. degree in Electrical Engineering from the University of Minnesota, Minneapolis, MN, in 2005. After completion of his doctoral study, he joined the Ophthalmology department at the University of Minnesota to extend his research in diagnosis and treatment of glaucoma using BioMEMS and BioNanotechnology. Dr. Pan has authored and co-authored more than twenty refereed journal and conference publications and held several US patent applications. His current research interests include implantable wireless micro and nanosystems for glaucoma diagnosis and treatment, biomimetic sensors and actuators, bioartificial implants, and remotely controllable drug delivery systems.