BME Special Seminar
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Ocular Biomechanics, Glaucoma, and VIIP Syndrome

Glaucoma is the second most common cause of blindness. Biomechanics appears to play an important role in this disease: all existing clinical treatments are based on lowering the pressure in the eye, and there is much circumstantial evidence implicating the connective tissues of the posterior eye as key players in glaucoma. Visual Impairment and Intracranial Pressure (VIIP) syndrome is a recently-identified sight-threatening pathology that occurs in some astronauts during long-duration space flight. It is characterized by a spectrum of ophthalmic changes including posterior globe flattening, choroidal folds, distension of the optic nerve sheath and optic nerve kinking. Its etiology is poorly understood, but is postulated to be related to changes in cerebrospinal fluid pressure secondary to cephalad fluid shift in space, and the resultant remodeling of connective tissues in the posterior eye. Thus, although these clinical conditions are distinct, they appear to share a dependence on ocular biomechanics. Dr. Ethier will describe a program of experimental and computational studies designed to better understand the pathophysiology of these two conditions. Experimental studies are based on several approaches: micro-CT, MRI and optical imaging; mechanical testing; and fluid permeation studies. Computational studies rely on finite element models of the complex soft tissues of the posterior eye. These studies have shown: the important role of the peripapillary sclera in glaucoma; the effects of optic nerve head (lamina cribrosa) microarchitecture in determining the biomechanical environment of the optic nerve head; and the permeability characteristics of the optic nerve meninges.

Dr. Ethier, a world-renowned scientist in the field of ocular biomechanics, completed his doctoral training in Bioengineering and Mechanical Engineering at the Massachusetts Institute of Technology in 1986. Prior to joining the Department of Biomedical Engineering at the Georgia Institute of Technology, Dr. Ethier served as the Head of the Department of Bioengineering at the Imperial College London. He has more than 130 peer-reviewed journal publications, cited over 6000 times. Dr. Ethier is a fellow of the American Society of Mechanical Engineers, American Institute for Medical and Biological Engineering, Association for Research in Vision and Ophthalmology (Silver Level), International Academy for Medical and Biological Engineering, and City and Guilds London Institute. He serves as the associate editor and/or editorial board member for more than eight scientific journals.

Contact Dr. Rouzbeh Amini for questions about BME Special Seminar at: ramini@uakron.edu.