Christopher L. Passaglia, Ph.D., a Professor of Medical Engineering at the University of South Florida in Tampa, has led pioneering work at the intersection of ocular neuroscience and bioengineering. His Ocular Neuroscience & Neuroengineering Lab—focuses on understanding how networks of retinal neurons encode visual signals in normal and diseased states and translating that understanding into diagnostic and therapeutic ocular devices. A centerpiece of his work is the development of wireless implantable devices that measure and regulate intraocular pressure (IOP) in animal models, enabling precisely controlled experiments on glaucoma progression. Lab publications showcase their sophisticated investigations into IOP variability in conscious rats, biofeedback-driven pumps to monitor outflow facility, and the interplay between intracranial pressure and aqueous humor dynamics. Dr. Passaglia's work is funded by a renewed NIH R01 grant (5R01EY027037), first awarded in 2016, that was recently awarded an additional ~$1.875 million to sustain and expand the work on continuous IOP measurement and control. Dr. Passaglia's innovative integration of retinal physiology, medical engineering, and neurotechnology is helping to redefine experimental glaucoma research. His renewed NIH R01 grant—the latest in a multi-year trajectory of funding—will allow his lab at USF to deepen its investigations into IOP regulation, retinal response, and vision preservation under stress. His continued leadership underscores both scientific achievement and translational promise in ocular health.

Title: Continuous monitoring and control of intraocular and intracranial pressure in rats

Intraocular pressure (IOP) is necessary for maintaining the optical properties of the eye and for providing biomechanical support to internal tissues. Deviations from baseline can induce an assortment of vision problems depending on the magnitude, direction, and duration of IOP change. IOP measurement is vital therefore for understanding eye physiology and for diagnosing and monitoring onset and progression of eye diseases like glaucoma. Tonometry methods used by clinicians and researchers are noninvasive but only give sparse snapshots of the IOP history of an eye. The snapshots belie the breadth and richness of IOP dynamics, which fluctuate from moment-to-moment due to eyeblinks, saccades, blood pulsations, and other physical and physiological factors. These fluctuations may perhaps factor as much or more than the well-known role of mean IOP elevation in glaucoma etiology. Additional factors may contribute as well since the disease can continue to progress in patients with therapeutically-lowered IOP, and one that has attracted growing attention is intracranial pressure (ICP). The interest stems from several retrospective and prospective clinical studies of patients with normal and elevated IOP, which concluded that low ICP enhances glaucoma risk while high ICP is protective.

In his talk, Dr. Passaglia will describe one-of-a-kind technologies that his lab has developed and deployed to measure and manipulate IOP and ICP round-the-clock in rats. IOP and ICP statistics in anesthetized and conscious animals will be presented, along with their modulation by stress, light cycle, and other factors. A biomechanical model will then be presented and used in conjunction with portable eye perfusion system to estimate ocular fluid dynamics round-the-clock in free-moving animals. Lastly, a rat glaucoma model will be introduced that is entirely different from existing experimental models in functionality, reproducibility, and reversibility.