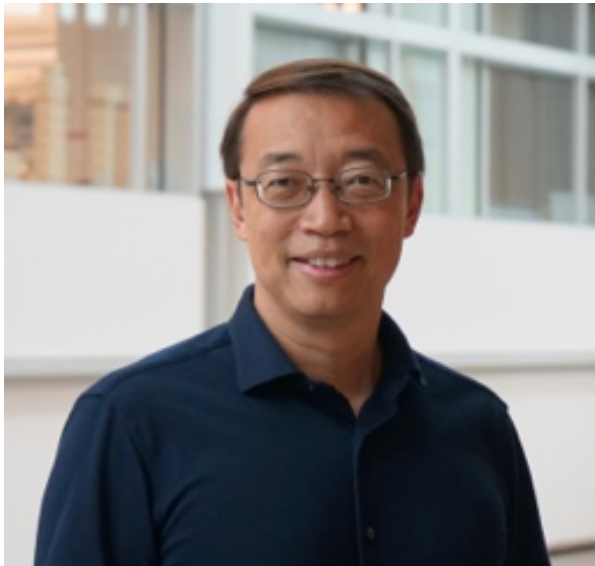


# Department Lecture Series



## In Vivo Deep Imaging of Brain Structure and Function

**Dr. Chris Xu**

**Professor, Applied & Engineering Physics**  
**Director Cornell NeuroNex Hub**  
**Co-director - Cornell Neurotech**  
**Cornell University**

### ECE Seminar Committee

Aswin Sankaranarayanan  
[saswin@ece.cmu.edu](mailto:saswin@ece.cmu.edu)

Maysam Chamanzar  
[mchamanz@andrew.cmu.edu](mailto:mchamanz@andrew.cmu.edu)

Swarun Kumar  
[swarun@cmu.edu](mailto:swarun@cmu.edu)

Giulia Fanti  
[gfanti@andrew.cmu.edu](mailto:gfanti@andrew.cmu.edu)

**Thursday, April 18th**

**4:30pm Scott Hall 6142**

### **Abstract:**

Over the last two decades, multiphoton microscopy has created a renaissance in the brain imaging community. It has changed how we visualize neurons by providing high-resolution, non-invasive imaging capability deep within intact brain tissue. Multiphoton imaging will likely play an essential role in understanding how the brain works at the level of neural circuits, which will provide a bridge between microscopic interactions at the neuronal level and the complex computations performed at larger scales. In this talk, the fundamental challenges of deep tissue, high-resolution optical imaging are discussed. New technologies for in vivo structural and functional imaging of mouse brain using long wavelength excitation and three-photon microscopy will be presented. We will illustrate the requirements for imaging the dynamic neuronal activity at the cellular level over a large area and depth in awake and behaving animals, and show applications where 3-photon microscopy outperforms conventional 2-photon microscopy in both signal strength and image contrast. Finally, we will discuss several future directions, including adaptive optics and new laser sources, to further improve the imaging depth and speed in biological tissues.

### **Bio:**

Professor Chris Xu is the founding co-director of Cornell Neurotech, and the director of Cornell NeuroNex Hub, an NSF funded center for developing and disseminating neurotechnology. Prior to Cornell, he was a member of technical staff at Bell Laboratories, and pioneered breakthrough development of fiber optic communication systems. He received his Ph.D. in Applied Physics from Cornell University, and contributed to the early development of 2-photon microscopy. His current research areas are biomedical imaging and fiber optics, with major thrusts in multiphoton microscopy for deep brain imaging, multiphoton microendoscopy for clinical applications, and fiber-based devices and systems for telecommunications and optical imaging. His research is supported by major grants from NIH, NSF, DARPA, and IARPA. Dr. Xu has chaired or served on numerous conference organization committees and NSF/NIH review panels. In addition to hundreds of journal and conference papers, he has 32 patents granted or pending. He has won the NSF CAREER award, Bell Labs team research award, the Tau Beta Pi Professor of the Year Award, and two teaching excellence awards from Cornell Engineering College. He received the 2017 Cornell Engineering Research Excellence Award. He is a fellow of the Optical Society of America, and a fellow of the National Academy of Inventors.

**(REFRESHMENTS SERVED AT 4:00 PM)**