Joint Department of

BIOMEDICAL ENGINEERING

UNC CHAPEL HILL | NC STATE UNIVERSITY

Coulter Seminar Series Presents

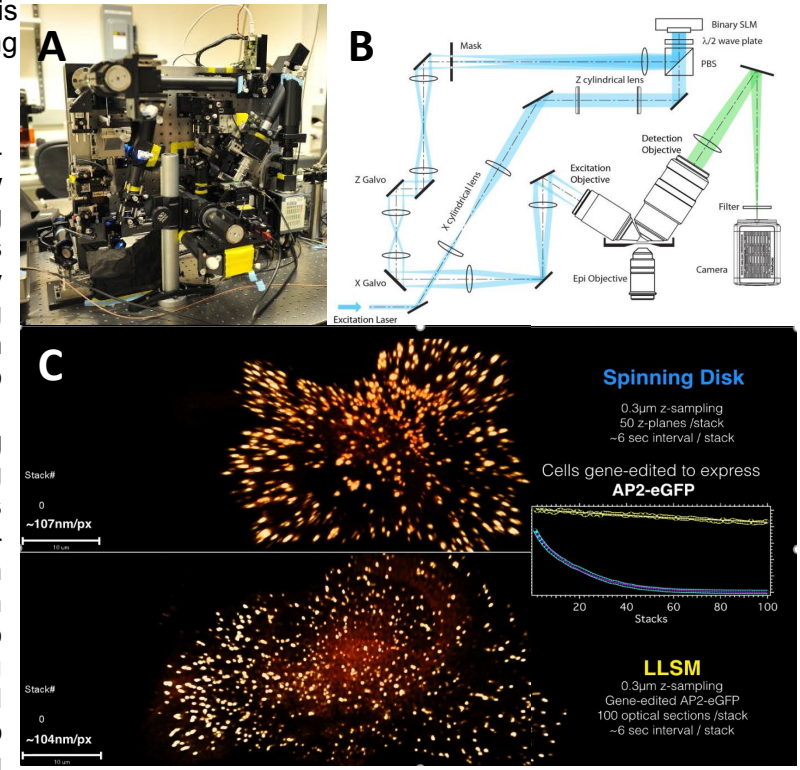
"Lattice light sheet microscopy – innovations, applications and future directions"

Wesley Legant, PhD
Assistant Professor
Joint Department of Biomedical Engineering, UNC Chapel Hill & NC State
Department of Pharmacology, UNC Chapel Hill

Dr. Legant's lab is developing new optical imaging techniques and applying them to investigate the biophysics of cell migration, tumor metastasis, and tissue remodeling. Prior to joining UNC, he was a research scientist at HHMI Janelia Research Campus, where he worked together with Eric Betzig to develop and apply novel light microscopy technologies including Lattice Light Sheet; super resolution structured illumination and single molecule localization microscopy; and adaptive optics for fundamental applications in cell biology. Dr. Legant received his PhD in Bioengineering from the University of Pennsylvania, where he used microfabrication techniques and mathematical modeling to study how cells sense and exert forces on their surroundings. Prior to completing his doctorate, Dr. Legant received a BS in Biomedical Engineering from Washington University in St. Louis.

ABSTRACT

Living specimens are both animate and three-dimensional. Lattice Light Sheet Microscopy (LLSM) is a new light-sheet microscopy method that utilizes non-diffracting beams and is capable of imaging fast 3D dynamic processes in vivo at signal to noise levels approaching those obtained by total internal reflection fluorescence (TIRF) illumination. Using this technique, we demonstrate substantial advantages in speed, sensitivity and reduced phototoxicity compared to conventional point scanning and spinning disc confocal microscopes as well as light-sheet microscopes utilizing single Gaussian or Bessel beams. In addition to discussing recent biological applications, I will highlight the advantages of combining lattice light sheet with: 1) single molecule super-resolution imaging and novel fluorescent probes for high spatial resolution, 2) adaptive optics for deeper penetration depth, and 3) interferometric fluorescence microscopy to increase signal collection and spatial resolution in living samples. Finally, I will discuss the current challenges (and some potential solutions) to applying these methods to biological samples as well as future research directions being initiated in my lab using LLSM to investigate cytoskeletal dynamics, propulsive force generation and cell migration in three-dimensions.



A) Photograph of prototype lattice light sheet microscope. **B)** Simplified Optical Path. **C)** Comparative bleaching curves for spinning disc and LLSM using endogenously expressing gene edited AP2-eGFP cells.

Friday, April 20th
12:00 Noon

Presented From: 2004 Marsico Hall (UNC)
Videoconferenced to: 4142 Engineering Building III (NC State)
& East Carolina University (ECU)