Department of
Biomedical Engineering
UNIVERSITY OF WISCONSIN–MADISON

Spring 2018 Seminar Series

The Nervous System at Single Cell Resolution:

Quantitative Mircroscopy and the Study of Neurodevelopment in vivo

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Postoctoral Scholar, MSK Cancer Center

How do individual cells communicate and coordinate to produce organized and functional tissues? This question lays at the heart of our understanding of tissue development, homeostasis, and disease. Advances in 3D fluorescence microscopy and automated image analysis have enabled new approaches to the study of organism and tissue-level phenomena with single cell resolution. We take advantage of the optical transparency and rapid development of the nematode Caenorhabditis elegans to study the conserved mechanisms which establish structure and function in developing nervous systems.

In our recent work on the spatial patterning of the C. elegans ventral nerve cord, we uncovered a novel and convergent function of two conserved signaling pathways: the planar cell polarity pathway and the sax-3/Robo receptor. Inspired by this work, we strove to surmount the limitations of genetic perturbations in the study of transient and dynamic cell-cell interactions during development. Toward this goal, I have developed ShootingStar, a platform for tracking thousands of cells in real-time during continuous 3D fluorescence imaging of living tissues and embryos. We used this platform to automate single cell resolution optical perturbations for the study of cell polarity in the zebrafish lateral line and the morphogenesis of C. elegans' brain. I am now using ShootingStar along with high-speed and super-resolution microscopy, advances in computer vision, and new optical methods for manipulating single neurons in vivo to understand how neural circuits initiate function and mature during embryonic development, a critical process into which little mechanistic insight currently exists.

ABOUT the SPEAKER

Dr. Shah earned his B.S. in Biomedical Engineering from North Carolina State University in 2009. He went on to graduate school under the mentorship of Dr. Nancy Allbritton at the University of North Carolina at Chapel Hill. where he developed microfabricated systems for single cell analysis and cell sorting. This work led to a spin-out company, Cell Microsystems Inc., where Dr. Shah served as Chief Engineer while commercializing the cell sorting microarrays the team had developed.Since earning his PhD in Biomedical Engineering in 2014, Dr. Shah has been a postdoctoral scholar in the Developmental Biology program at Memorial Sloan Kettering Cancer Center in NY in the lab of Dr. Zhirong Bao. At MSK, he has been using and further developing techniques based on 3D fluorescence microscopy and automated image analysis for the study of neurodevelopment in animal models.

Monday, January 29, 2018
12 PM in Tong Auditorium (1003 Engineering Centers)