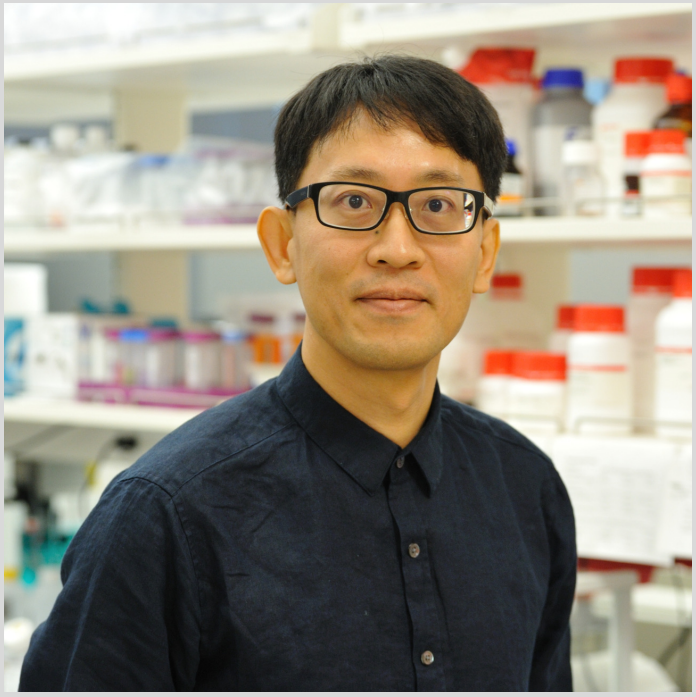
Biomedical Engineering
Wallace H. Coulter Foundation Lecture Series

Dissecting behaviourally-relevant neuronal population at cellular resolution



Hyungbae Kwon
Research Group Leader at
Max Planck Florida Institute

Lecture: Friday, March 1, 2019
9:00AM-10:00AM
Room EC 2300
10555 West Flagler Street
Miami, FL 33174

FIU Engineering & Computing
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Biography

Hyungbae Kwon received his Ph.D. in Dr. Pablo Castillo's lab at the Albert Einstein College of Medicine, and postdoctoral training with Dr. Bernardo Sabatini at Harvard Medical School. During his postdoctoral period, he used cutting-edge laser-based optics to understand mechanisms of excitatory synapse formation at single synapse resolution. In 2012, he began his independent laboratory at the Max Planck Florida Institute for Neuroscience, where he continued to study mechanisms of synapse formation during early brain development and created novel optogenetic approaches that enable to dissect animal sensation, cognition, behaviors at high spatiotemporal resolution. Using these newly developed techniques together with other approaches, current research in the Kwon laboratory focuses on understanding principles underlying various forms of cognitive brain actions. In 2019, Dr. Kwon's laboratory is moving to the Solomon H. Snyder Department of Neuroscience at Johns Hopkins University of School of Medicine.

Abstract

A central question in neuroscience is how neural activity is linked to complex behaviors. However, monitoring activity patterns in the mammalian brain has been particularly challenging because of its complexity and the limited availability of tools with high spatiotemporal precision. We recently developed a novel optogenetic technique that can translate neuronal activity to gene expression in vivo at a high spatiotemporal resolution. We have created a dual-control system named Calcium and Light-Induced Gene Handling Toolkit, "Cal-Light", that allows gene expression to be initiated by calcium and light. Cal-Light directly links neuronal firing to gene expression, thereby allowing us to map out the activity profile of individual neurons in animals and test their causal relationship with specific behaviors. We also developed a novel light-gated method to label and manipulate specific neuronal populations activated by neuromodulators in a highly temporally precise manner. We created an inducible dual protein switch system that is turned on and off by not only a ligand but also light. We named this technique "iTango2. In this talk, I will present these novel optogenetic methods that label active neuronal ensemble and neuromodulation-sensitive populations and further discuss current ongoing development of new techniques.

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