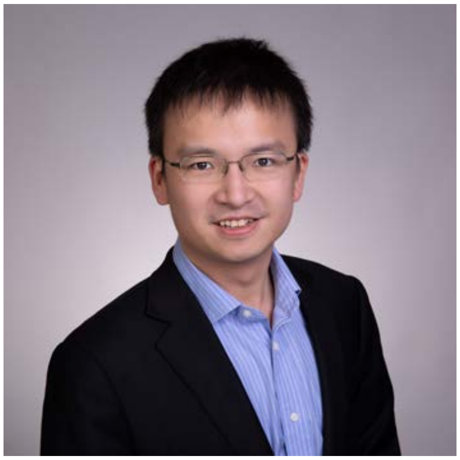
UCLA Engineering

HENRY SAMUELI SCHOOL OF ENGINEERING AND APPLIED SCIENCE

BIOENGINEERING

PRESENTS

Targeted Neural Interfacing with Non-Genetic, Minimally Invasive Nanotechnology



THURSDAY, March 12th, 2020
12:00 – 1:00 PM
2101 ENGINEERING V

Huiliang (Evan) Wang, Ph.D.

Stanford

Postdoc,
Department of Bioengineering

ABSTRACT:

Recent developments in optogenetic and viral technologies have demonstrated that modulating the targeted neurons and projections in the brain is capable of rescuing behavioral deficits associated with depression, autism, anxiety, and epilepsy. However, optogenetics faces two major challenges to clinical translation: First, due to limited tissue penetration of visible light, invasive craniotomy and intracranial implantation of optical fibers are generally required. Second, this approach requires genetic modification of neurons via viral transduction, which poses significant safety challenges. In this presentation, I will discuss nanoparticle-based approaches to address these two challenges. First, I describe the application of mechanoluminescent nanoparticles for minimally invasive optogenetic neural stimulation, triggered by a brain-penetrant focused ultrasound. The nanoparticles are injected into the circulating blood, thus, neither craniotomy nor intracranial implantation is required for this targeted neuromodulation approach. Second, I describe the application of functionalized gold nanorods in the nervous system, including that they are rapidly internalized by neuronal axon terminals, transported through axons, and reliably modulate neural activity and animal behavior under near-infrared light both *in vitro* and *in vivo*. This method is a first-time demonstration of projection-specific neural modulation via a non-genetic method. Finally, I will briefly discuss how nanoparticle and electronic approaches will further advance the development of targeted neural interfacing technology via a minimally invasive manner.

BIOGRAPHY:

Dr. Huiliang (Evan) Wang obtained his undergraduate degree in Materials Science from the University of Oxford and PhD degree in Materials Science and Engineering at Stanford University. During his graduate studies with Professor Zhenan Bao, he worked on sorting of carbon nanotubes by conjugated polymers and their applications in flexible electronics. After his PhD studies, he started his postdoctoral work with Professor Karl Deisseroth at Stanford Bioengineering, developing nanomaterial-based technologies for targeted modulation of neural activity. Dr. Wang has received several awards and fellowships including the Materials Research Society (MRS) Link Foundation Energy Fellowship and the NIH F32 Ruth L. Kirschstein National Research Service Award (NRSA) Postdoctoral Fellowship. He is currently supported by the NIH K01 Mentored Research Scientist Development Award.