PURDUE
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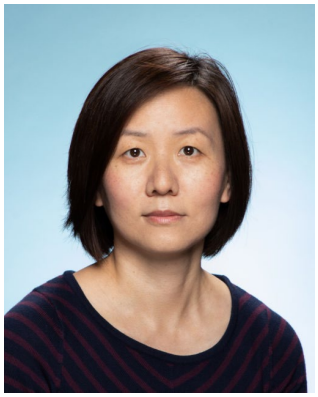
Analytical Chemistry Seminar

Tuesday, April 26, 2022
3:30 PM, WTHR 320

"High Precision Photoacoustic Neural Modulation"



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Abstract

Neuromodulation at high precision poses great significance in advancing fundamental knowledge in the field of neuroscience and offering novel clinical treatments. Here we reported our research on developing the photoacoustic neural interface based on highly efficient photoacoustic materials and applying them in neural stimulation in vitro, in vivo and for neural regeneration. Specifically, four different platform technologies with implantable or noninvasive capabilities will be discussed, including fiber based photoacoustic emitters, nanocomposite based photoacoustic films, photoacoustic nanotransducers and optic-driven focus ultrasound based on photoacoustic lenses. Precision neuromodulation with high spatial resolution of sub-millimeter up to single neuron and sub-cellular structures, such as axons and dendrites have been achieved. Single acoustic pulse of sub-microsecond converted from a single laser pulse of 3 ns is shown as the shortest acoustic stimuli so far for successful neuron activation. Direct and non-invasive stimulation of brain target, electrophysiology recording and behavior responses have been demonstrated in vivo. Promoted outgrowth of neural tissue upon photoacoustic stimulation has been shown. Our work demonstrated that photoacoustic stimulation, a high precision and non-genetic neural stimulation, offers various neural interfaces with clinical applications in deep brain stimulation, vision prothesis as well as surgical guidance.