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Neuromodulation using focused ultrasound

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Non-pharmacological and non-invasive neuromodulation of selective brain areas would provide unprecedented opportunities in neuroscience and neurotherapeutics. Low-intensity focused ultrasound (LIFU) has emerged as a novel neuromodulation modality with its exquisite spatial selectivity and depth penetration compared to conventional non-invasive neuromodulation methods, such as transcranial magnetic stimulation (TMS) and transcranial current stimulation (tCS). LIFU given in pulsed mode also provides bi-modal (both excitatory and suppressive) neuromodulation capability. In this talk, I will present various region-specific FUS-mediated neuromodulatory effects that have been demonstrated on animal species (rodents, rabbits, and sheep) and humans from our group. The evidences of successful neuromodulation will be given by functional magnetic resonance imaging (fMRI), electrophysiological recordings (EEG, EMG), positron emission tomography (PET), and direct behavioral responses. I will also introduce our recent efforts on optimizing LIFU pulse scheme for excitatory and suppressive neuromodulation with the basis on recently suggested potential FUS-mediated neuromodulation mechanism on central nervous system (CNS).

Key Words: Focused ultrasound, Neuromodulation, Non-invasive

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