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영문 강연제목: Elucidating Mechanism of Action of DBS in Drug Addiction

Abstract
Substance use disorder (SUD) is a prevalent problem globally. It is thought that drugs of abuse (DoA) increase tonic ventral tegmental area (VTA) dopamine output to the nucleus accumbens (NAc), contributing to addiction. We hypothesize that VTA DBS may inhibit dopamine release into the NAc, thereby mitigating the addictive potential of DoA. To test this hypothesis, we utilized multiple cyclic square-wave voltammetry (M-CSWV) to track tonic dopamine concentrations with high spatiotemporal resolution (~10s/scan) during DoA (cocaine, oxycodone, and ethanol) action and VTA DBS. A carbon fiber microelectrode was stereotactically implanted into NAc of urethane-anesthetized Sprague-Dawley rats. After one hour of baseline dopamine recording was obtained using M-CSWV, cocaine, oxycodone, or ethanol was administered. 30 minutes after drug administration, deep brain stimulation (90Hz, biphasic 200μs pulse-width, 0.2mA) was delivered continuously to the VTA for 30 minutes, and the resulting effects on tonic dopamine levels were tracked. To capture the entire time course of DoA action, 3 hours of tonic dopamine measurements were performed. As expected, tonic extracellular dopamine concentrations were increased from baseline by cocaine, oxycodone, and ethanol in the rat NAc as measured by M-CSWV. DBS of VTA abolished this DoA-elicited dopamine increase. In the case of ethanol, tonic dopamine levels rose again after discontinuation of stimulation. Electrical stimulation of the VTA reversed the acute dopamine increase resulting from DoA exposure. These results suggest the exciting possibility that DBS can modulate the addictive potential of DoA and may perhaps be a treatment for SUD.

Brief Biosketch
I received my PhD in Neural Engineering from the Department of Biomedical Engineering, Hanyang University, South Korea. My work at the Neural Engineering Laboratory of Hanyang University involved developing novel neurochemical recording techniques to measure neurotransmitters in the brain, especially dopamine. Currently, I am an Associate Professor in the Department of Neurologic Surgery and co-Director of the Neural Engineering Laboratories at Mayo Clinic in Rochester, Minnesota.
My experience is in the areas of *in vitro* and *in vivo* electrochemistry and electrophysiological recordings and signal processing. In particular, I am the main developer of a novel technique for the quantification of tonic extracellular dopamine and serotonin levels in the brain.