

Next Generation Deep Brain Stimulation: Collaborative Engineering Solutions

Deep brain stimulation (DBS) is a relatively recently established neurosurgical treatment for movement disorders, and it is a rapidly emerging therapy for a number of psychiatric issues. At Mayo Clinic we have developed collaborative teams of engineers, physicians and scientists to understand the mechanism of DBS and to create novel equipment, to result in improved patient outcomes. We have addressed this critical clinical goal in stereotactic and functional neurosurgery by combining two powerful technologies, functional Magnetic Resonance Imaging (fMRI) and in vivo neurochemical monitoring to provide DBS modulation of neural activity.

During the past few years, we have collaboratively developed a wireless neurochemical monitoring device that combines fast scan cyclic voltammetry (FSCV) with wireless telemetry. We have further developed a novel wirelessly controlled neurostimulation device which provides electrical stimulation interleaved with neurotransmitter detection. The combination of these two devices provide the backbone of a system to provide DBS with feedback control to provide patients with novel therapies to solve their most refractory problems of pain, psychiatric issues and movement disorders.

This presentation will provide background on the problems, technical solutions and the direction for future enhancements created through collaboration between physicians, scientists and engineers.