TARGETED PLASTICITY: CLOSING THE LOOP

ROBERT L. RENNAKER II, PH.D.
DEPARTMENT HEAD BIOENGINEERING
DIRECTOR, TEXAS BIOMEDICAL DEVICE CENTER
BEHAVIORAL AND BRAIN SCIENCES
UNIVERSITY OF TEXAS AT DALLAS

ABSTRACT
Targeted plasticity is a method of pairing the activation of neuromodulatory pathways with during therapy. The goal of targeted plasticity is to drive specific and functional changes in neural circuits. Pathological neural activity in a variety of neurological disorders could be treated by directing plasticity to specifically renormalize aberrant neural circuits, thereby restoring normal function as well. It has been shown that brief bursts of acetylcholine and norepinephrine can enhance the neural plasticity associated with coincident events. Vagus nerve stimulation (VNS) represents a safe and effective means to trigger the release of these neuromodulators with a high degree of temporal control. VNS-event pairing can generate highly specific and long-lasting plasticity in sensory and motor cortex. Based on the capacity to drive specific changes in neural circuitry, VNS paired with experience has been successful in effectively ameliorating animal models of chronic tinnitus, stroke, controlled cortical impact, and fear conditioning (post-traumatic stress disorder). Targeted plasticity therapy utilizing VNS is currently being translated to humans to treat chronic tinnitus and improve motor recovery after stroke. This talk will review our current progress using targeted plasticity to treat these neurological disorders as well as the work that remains to understand the underlying mechanisms and potential efficacy.

Recent Publications