

Targeting plasticity with vagus nerve stimulation to treat neurological disease

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Abstract

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. 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, and posttraumatic stress disorder. Targeted plasticity therapy utilizing VNS is currently being translated to humans to treat chronic tinnitus and improve motor recovery after stroke. This chapter will discuss the current progress of VNS paired with experience to drive specific plasticity to treat these neurological disorders and will evaluate additional future applications of targeted plasticity therapy.

Keywords: acetylcholine; cortical plasticity; neuromodulators; norepinephrine; recovery; targeted plasticity; vagus nerve stimulation (VNS).

Figures

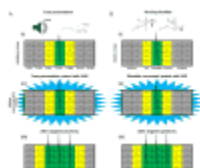


FIGURE 1 Model of targeted plasticity therapy...

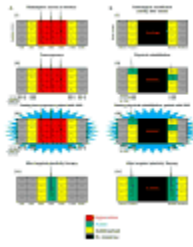


FIGURE 2 Model of VNS paired with...



FIGURE 3 Vaccination and targeted plasticity therapy...

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