P4.26.

Suppressing epileptic spike-and-wave discharges by extracranial alternating current stimulation

Berényi, A.[1, 2*]; Belluscio, M.[1]; Buzsáki, G.[1]

1: Center for Molecular and Behavioral Neuroscience, Rutgers University, Newark, USA
2: Department of Physiology, Faculty of Medicine, University of Szeged, Szeged, Hungary

Direct electrical stimulation of non-specific higher order thalamic nuclei by deep brain stimulation proved to be effective to modulate the ongoing resonant activity in the reticulo-thalamo-cortical loop during epileptic seizures. Previous research in our laboratory demonstrated, that extracranially applied low frequency low intensity alternating current (AC) stimulation can efficiently modify neuronal activity at the single neuron level. The aim of this study was to attenuate absence epilepsy with extracranial AC stimuli. We recorded extracellular multiunit and field potentials in different cortical areas of freely moving rats. We have developed an automated online spike and wave discharge (SWD) detection and stimulus control system. We delivered pulses through galvanically isolated electrodes placed extracranially under the temporal muscles, triggered by the detected spikes and delayed to coincide with the wave segments of the SWDs. In some of the experiments we delivered continuous 1 Hz sinusoidal stimulation to estimate its direct effect on SWD spike amplitude. The continuous low frequency AC stimulation significantly modified the amplitude of SWDs. Bipolar stimulation with half-sinusoidal pulses substantially decreased the length of seizures compared to non-stimulated control epochs. These results suggest that the extracranial bipolar AC stimulation is an effective way to terminate epileptic seizures, without the negative side-effects of invasive intracerebral stimulation.