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Chronic Sensorimotor Cortex Stimulation: Analysis Of Histological Effects

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Chronic sensorimotor cortex (SMC) stimulation gradually increases H-reflex (HR). This study assessed the histological effect of stimulation on the SMC.

Rats were chronically implanted with recording and/or stimulating electrodes. When soleus EMG remained in a specific range, nerve stimulation at M response threshold elicited soleus HR. After control (i.e., no SMC stimulation) data collection, rats were subjected to SMC stimulation according to a 20-day-on/20-day-off protocol while HR collection continued. SMC stimulation caused no distress and produced little or no visible response.

The SMC stimulation strength needed to maintain a constant descending output rose steadily over the 20-day on-period. It fell during the off-period and rose again when stimulation resumed. This increase was probably not due to changes in electrode function and/or to tissue damage because: (1) stimulation amplitude returned to nearly its original size during the 20-day off-periods; and (2) analysis of confocal images of sections stained with Nissl (neuron staining), GFAP (astrocyte staining), or CyQuant (nuclear staining) found no difference in cell counts between the stimulated and the unstimulated SMC. These results suggest that the increase in stimulation strength may be due to stimulation-induced activity-dependent plasticity in SMC neurons or synapses.

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