



PROGRESS IN NEUROSCIENCE PINS

Seminar Series of the
Brain & Mind Research Institute
Weill Cornell Medical College (WCMC)
&

The Graduate Program in Neuroscience of
WCMC and Sloan Kettering Institute

Thursday, 2/15/18, 4 PM, coffee at 3:45 PM
Weill Auditorium



“Paired brain and spinal cord stimulation for recovery of movement”

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Convergent activity in neural circuits can generate changes at their intersection. The rules of paired electrical stimulation are best understood for paradigms that stimulate input circuits and their targets. We took a different approach by targeting the interaction of descending motor pathways and large-diameter afferents in the spinal cord. We hypothesized that pairing stimulation of motor cortex and cervical spinal cord would strengthen motor responses through their convergence. We placed epidural electrodes over motor cortex and the dorsal cervical spinal cord in rats to enable stimulation of awake animals. Motor evoked potentials (MEPs) were measured chronically from biceps. MEPs evoked from motor cortex were robustly augmented with spinal epidural stimulation delivered at an intensity below the threshold for provoking an MEP. Augmentation was critically dependent on the timing and position of spinal stimulation. When the spinal stimulation was timed to coincide with the descending volley from motor cortex stimulation, MEPs were more than doubled. We also tested effect of repeated pairing of motor cortex and spinal stimulation. Repetitive pairing caused strong augmentation of cortical MEPs and spinal excitability that lasted up to two hours after just 5 minutes of pairing. Additional physiology experiments support the hypothesis that paired stimulation is mediated by convergence of descending motor circuits and large diameter afferents in the spinal cord. The large effect size of this paradigm and the conservation of the circuits being manipulated between rats and humans makes it worth pursuing for recovery of sensory-motor function after injury to the central nervous system

Recent Relevant Publications:

1. Paired motor cortex and cervical epidural electrical stimulation timed to converge in the spinal cord promotes lasting increases in motor responses. Mishra AM, Pal A, Gupta D, **Carmel JB**. J Physiol. 2017 Jul 28. PMID: 28752624
2. Paired Stimulation to Promote Lasting Augmentation of Corticospinal Circuits. Harel NY, **Carmel JB**. Neural plasticity. 2016; PMID:7043767.
3. Chronic softening spinal cord stimulation arrays. Garcia Sandoval, Aldo; Pal, Ajay; Mishra, Asht; Sherman, Sydney; Parikh, Ankit; Joshi-Imre, Alexandra; Gutierrez-Heredia, Gerardo; Duran Martinez, Adriana Carolina; Arreaga-Salas, David; Nathan, Jordan; Hosseini, Seyyed Mahmoud; **Carmel JB**; Voit, Walter. In revision.



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