Joint Department of
BIOMEDICAL ENGINEERING

UNC CHAPEL HILL | NC STATE UNIVERSITY

Coulter Seminar Series Presents

Rehabilitation Engineering

Acute intermittent hypoxia: a breath-taking therapy to boost motor function after spinal cord injury

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Randy Trumbower, P.T., Ph.D. is an Assistant Professor and Associate Chair within Harvard Medical School's Department of Physical Medicine and Rehabilitation. He also serves as Director of the Spinal Cord Injury Division at Spaulding Rehabilitation Hospital.

Dr. Trumbower earned M.S. and P.T. degrees in Physical Therapy from Duke University and M.S. and Ph.D. in Biomedical Engineering from the University of Connecticut. After postdoctoral training at the Rehabilitation Institute of Chicago and Northwestern University, Dr. Trumbower became an Assistant Professor in the Departments of Rehabilitation Medicine and Biomedical Engineering at Emory University. During his time at Emory, he maintained several affiliations that included Clinical Research Scientist at the Shepherd Center in Atlanta, Georgia, Program Faculty in Applied Physiology and Robotics at the Georgia Institute of Technology, and Training Faculty in the Neuroscience Graduate Program.

As Director of the INSPIRE Laboratory at Spaulding Rehabilitation Hospital, Dr. Trumbower leads a research team that focuses on identifying novel, complementary treatments to promote the restoration of limb function in persons with spinal cord injury (SCI). His interest is in establishing therapeutics that trigger endogenous mechanisms of neural plasticity and subsequently enhance motor recovery after paralysis.

ABSTRACT

Persons with spinal cord injury (SCI) endure life-long functional struggles due to limited or no movement or control of their affected limbs. Spinal injury often results in partial sparing of residual neural pathways to motor neurons that enable some return of limb movement. Although reorganization and strengthening of these preserved networks may occur after injury, restoring function remains frustratingly limited. Thus, there is an overwhelming need for targeted therapies that may guide the reorganization of these spared pathways toward functionally meaningful recovery.

One promising strategy to augment motor recovery is to induce neuroplasticity via repetitive exposures to modest bouts of low oxygen (acute intermittent hypoxia, AIH). Rodent models of SCI demonstrate that AIH elicits remarkable respiratory and non-respiratory motor plasticity, which appears pronounced when repetitive (up to 7 consecutive days) AIH pairs with motor training (e.g., breathing, locomotor training). Detailed mechanistic studies show that up-regulation of brain-derived neurotrophic factor (BDNF) along the spinal cord plays an important role in this plasticity. Several clinical studies support the possibility of repetitive AIH with motor training as a combinatorial approach to enhance motor recovery in humans with SCI. Despite these exciting findings, essential questions about the clinical translation of AIH remain. The purpose of this presentation is to introduce an automated pressure-swing delivery system for administering AIH safely and to discuss the potential impact of several confounding factors that may undermine AIH efficacy. Understanding the extent to and the mechanisms by which neural pathways may contribute to the enduring effects of AIH on motor recovery is crucial to the success (or failure) of AIH as an adjuvant to SCI rehabilitation.

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