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5th International Brain Stimulation Meeting — Plenary Abstracts

[PL01]

TARGETED MODULATION OF NEURAL POPULATION DYNAMICS TO IMPROVE MOVEMENT CONTROL

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Stroke is a leading cause of motor disability in the world. While brain stimulation to enhance motor function after stroke has shown promise, large clinical trials in human stroke patients have not found consistent benefits. These trials were conducted using open-loop stimulation, where the neural responses to stimulation were not measured. It remains unclear how to precisely tailor brain stimulation to effectively modulate neural dynamics in the motor network in order to improve motor control after stroke. Our recent studies have demonstrated that the reliability of single trial population dynamics associated with low-frequency oscillatory activity are important for movement control and can serve as a target for modulation using electrical stimulation (e.g., Ramanathan et al., *Nature Medicine*, 2018; Lemke et al., *Nature Neuroscience*, 2019; Khanna et al., *Cell*, 2021). Specifically, epidural cortical stimulation was found to both boost low-frequency power in animals recovering from injury and increase neural co-firing; this also reliably improved movement control during recovery from stroke. Our results have also demonstrated that relatively high electrical field strengths (~ 3 mV/mm) were effective in regulating neural spike entrainment and co-firing. More recently, we have also studied how activity associated with movement preparation changes with recovery. We find that the reliable transition from preparation to movement control appears to be governed by 'bistable' transition dynamics. Notably, improvements in transition dynamics were closely correlated with recovery of prehension. Moreover, epidural electrical stimulation was found to be capable of modulating both preparatory and movement related dynamics. Our work provides insight into how to design therapeutic stimulation that selectively targets population dynamics in the distributed motor network and to improve dexterity after stroke. The information gained may also help improve approaches for non-invasive brain stimulation for stroke.

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[PL02.1]

HOME-BASED TRANSCRANIAL ELECTRICAL STIMULATION TO SCALE CLINICAL TRIALS: METHODOLOGY, SAFETY, AND BEYOND

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Clinical trials of transcranial electrical stimulation (tES) are rapidly increasing in number as research explores potential therapeutic uses across a wide range of neurological and psychiatric conditions. Both human and mechanistic studies have shown that tES can have a cumulative benefit across multiple stimulation sessions, but this presents a practical challenge for investigators when participants are required to travel to a clinic or lab for daily treatment. The ability to deploy tDCS and other emerging TES at home is a key advantage in scaling clinical trials. Home-based tES delivery has the potential to increase participation and accommodate a larger number of tES sessions, which may be necessary for a thorough evaluation of its effects. However, there are several important factors to consider such as methodology, safety, and ethical aspects when conducting home-based tES clinical trials.

This lecture will provide a comprehensive review of the methodology, instruments, and safety considerations surrounding the growing body of home-based tES trials. The discussion will also include the current regulatory landscape surrounding the home use of tES devices, addressing some of the concerns such as the lack of oversight, and how to ensure patient safety when using tES devices at home. Additionally, it will provide insights into how home-based tES clinical trials can support the scaling up of tES and its long-term benefit for patients.

Research Category and Technology and Methods: Clinical Research: 9. Transcranial Direct Current Stimulation (tDCS)
Keywords: Scalability, tES, tDCS, home use

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[PL02.2]

MODULATION OF BRAIN-LUNG INTERACTIONS USING HD-TDCS: MECHANISMS, CLINICAL PRACTICE, AND RECENT ADVANCES

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The pathophysiology of the brain-lung interactions are complex and involve inflammation, neurodegeneration and disruptions into the respiratory control system. Recently, it has been suggested that noninvasive brain stimulation could be a valuable tool for the management of the early and post acute phase of patients with respiratory dysfunction. In this session, we will provide data that supports the use of HD-tDCS as an useful therapeutic approach for modulating the respiratory function at the neurophysiological and clinical levels.

Research Category and Technology and Methods: Clinical Research: 9. Transcranial Direct Current Stimulation (tDCS)
Keywords: Brain–lung interactions, Respiratory modulation, Non-invasive brain stimulation, Rehabilitation

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[PL03]

RESPONSIVE NUCLEUS ACCUMBENS DEEP BRAIN STIMULATION FOR LOSS-OF-CONTROL EATING

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Loss of control (LOC) eating is pervasive in eating disorders and obesity. The presence of this phenotype appears to predict treatment-resistance, including to gastric bypass surgery. Cravings that precede LOC over food consumption present an opportunity for intervention in patients with the binge eating disorder (BED). Responsive deep brain stimulation (DBS)