Research Category and Technology and Methods
Clinical Research: 9. Transcranial Direct Current Stimulation (tDCS)
Keywords: Fear, tDCS, Extinction, PTSD

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Abstract key: PL- Plenary talks; S- Regular symposia oral; FS- Fast-Track symposia oral; OS- On-demand symposia oral; P- Posters

S2b.3

THE EFFECTS OF LEFT FRONTAL INTERMITTENT THETA BURST STIMULATION ON THE EFFICACY OF EXPOSURE-BASED THERAPY IN ACROPHOBIA

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Abstract
Evidence-based treatments for anxiety disorders, as cognitive behavioral and pharmacological therapy achieves good therapeutic results. However, studies have shown that the therapy can be further optimized. Transcranial magnetic stimulation (TMS) may be useful as an adjunct to exposure-based therapy for anxiety disorders, as laboratory studies in healthy subjects have shown (Raij et al., 2018) that extinction learning, as an underlying mechanism in exposure therapy, can be improved using rTMS. The aim of this double-blind, randomized, placebo-controlled clinical trial with 76 patients with acrophobia is to verify whether the stimulation localization (left frontal cortex), shown to be benefical in healthy subjects, can be effectively used to enhance exposure therapy. For this purpose, patients underwent neuronavigational stimulation over the individually defined stimulation localization using the activating intermittent theta burst stimulation (iTBS) protocol before exposure therapy in virtual reality. Clinical symptoms were evaluated via questionnaires and two behavioral approach tests before, after, and for follow-up after 6 months. Furthermore, process variables during the exposure sessions, such as duration of exposure, and maximal anxiety depending on the stimulation groups were investigated.
Research Category and Technology and Methods
Clinical Research: 10. Transcranial Magnetic Stimulation (TMS)
Keywords: rTMS, Anxiety disorders, Psychotherapy

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S2b.4

'CUT THE ROOTS': RTMS REVEALS THE CRUCIAL ROLE OF PREFRONTAL CORTEX IN THREAT MEMORY CONSOLIDATION IN HUMANS

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Abstract
It is unclear how the brain consolidates aversive memories and whether this process can be disrupted. We hypothesized that targeting the dorsolateral prefrontal cortex (dlPFC) within the consolidation time window by repetitive transcranial magnetic stimulation (rTMS) could block the encoding of a threat memory, disclosing the crucial involvement of this brain region in consolidation. To this aim, fifty-four healthy participants took part in a two-days threat conditioning paradigm. On the first day, participants underwent an acquisition phase. Immediately after, in different groups, an inhibitory rTMS protocol was applied to the dlPFC, or over an occipital control site or as sham. Subsequently, a threat memory recall was performed to test the effect of the rTMS on the consolidation of the previously acquired threat memory. The same procedure occurred after 1 hour to assess rTMS effect outside its inhibitory window, and 24 hours later to test the stability of the offline effects of the rTMS. The results suggested that all groups correctly acquired the threat conditioning, and no differences between groups were observed. The control groups showed memory recall across the three sessions after rTMS, while, critically, the dlPFC group did not recall threat responses in any of the three recall phases. We provide causal evidence that selectively targeting the dlPFC within the consolidation time window prevents the return of threat. Furthermore, memory disruption lasted longer than the inhibitory time window of the rTMS. This effect reveals that we have not only affected the dlPFC activations, but we have hampered the underlying time-locked consolidation process. Together with our previous findings targeting the reconsolidation process, the present results provide new evidence for future clinic applications aiming at interfering with the consolidation and the reconsolidation of traumatic memories.
Research Category and Technology and Methods
Basic Research: 10. Transcranial Magnetic Stimulation (TMS)
Keywords: Threat conditioning, Repetitive transcranial magnetic stimulation, Consolidation, Dorsolateral Prefrontal Cortex

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Abstract key: PL- Plenary talks; S- Regular symposia oral; FS- Fast-Track symposia oral; OS- On-demand symposia oral; P- Posters

S3a.1

MODULATION OF STRIATAL ACTIVITY TO STUDY REINFORCEMENT LEARNING OF MOTOR SKILLS IN HUMANS

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Symposium title: Non-invasive deep brain stimulation via Temporal Interference (TI) of electric fields – New mechanistic insights and human translation
Symposium description: Cognitive functions, such as learning and memory, rely on neural processing in deep brain structures (e.g., basal ganglia or hippocampus). Their dysfunction is a critical pathophysiological hallmark of many neuropsychiatric disorders. It is not possible to neuromodulate the activity of these important deep brain regions directly with conventional non-invasive brain stimulation techniques, as the required stimulation intensities would exceed safety guidelines and result in strong co-activation of overlying brain regions. The promising technique of transcranial temporal interference electric brain stimulation (tTIS) provides a novel interventional opportunity for direct and non-invasive modulation of deep brain targets (Grossman 2017). It is a strategy for non-invasive steerable stimulation of neurons deep in the brain using multiple kHz-range electric fields with a difference frequency within the range of neural activity. The superposition of the fields leads to a slowly "beating" envelope oscillating at the difference (target) frequency. The peak amplitude of this envelope can be focused towards deep brain targets driving their neuronal activity. This session will briefly introduce the tTIS concept and present physics experiments, computational modeling, preclinical validation and new mechanistic insights. We will demonstrate the opportunities and challenges in non-invasively probing neural activities in deep brain structures, such as the hippocampus and striatum, using functional magnetic resonance imaging (fMRI) and behavioural paradigms. We will also demonstrate the ability to measure the direct electroencephalogram (EEG) response without confounding stimulation artefact. Based on these promising findings, we will discuss and present first approaches translating the tTIS technique towards investigational applications in healthy humans and patients. We aim to provide an up-to-date overview and strive to prime future work in this promising field in basic and clinical-translational neuroscience.

Abstract
The striatum is a crucial brain region for reinforcement learning. However, because of its deep localization in the brain, modulating striatal activity to understand its causal role has not been possible in healthy humans non-