

From Mapping to Modulation: Using Neuroimaging to Guide Brain Stimulation Treatment for Addiction

Organizers:

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Our understanding of the neural circuitry of addiction - from vulnerability to relapse- has never been greater - due in part to significant advances in clinical and preclinical neuroimaging. Our challenge now, however, is to take that knowledge and develop a neural circuit based treatment for addiction. Both the National Institute of Drug Abuse and the European Commission have designated brain stimulation as a target area for growth in the next 5 years. In order for these efforts to be fruitful however, neuromodulation strategies of the future must be grounded in our rich neural mapping data which continues to improve.

Specifically, through advances in imaging we know that drug taking behavior can be modified by selectively enhancing or attenuating activity in frontal-striatal circuits. We also know that it is possible to independently activate frontal-striatal circuits that govern executive control and arousal with non-invasive transcranial magnetic stimulation (TMS). Several weeks of repetitive TMS can have long term effects on frontal-striatal circuits and decrease clinical depression. We do not, however, know if repetitive TMS will be an effective therapeutic tool for substance dependent populations. We also do not know whether attenuating craving or amplifying cognitive control will likely be a more efficacious approach. Before the field of substance abuse research embarks on large, multisite trials of rTMS as a treatment option for addiction, it is wise to consider the appropriate location for stimulation and frequency of stimulation. This workshop will thematically be linked by two questions - "Where should we stimulate? (Raij)" & "Which frequency should we use at this location? (Lee)." It will begin with an introduction to the neural circuits and candidate neural biomarkers involved in substance dependence (Yang), and conclude with a summary of previous and new data on the efficacy of rTMS as a therapeutic tool in treatment seeking cocaine users, alcohol users, and smokers (Hanlon).

Both senior and junior investigators will be featured and will all use information from human neuroimaging studies to guide their presentations. Discussion from the audience will be encouraged at the end of each presentation as well as in an open forum at the end of the workshop.

Educational component: Searching for imaging biomarkers of cocaine addiction: implications for the target and efficacy of TMS treatment

Yihong Yang, NIDA-IRP, Baltimore, MD, United States

Choosing a location: "Where should we stimulate: Probabilistic cortical and network-level therapeutic atlases for the human brain"

Tommi Raij, Northwestern University, Chicago, IL, United States

Selecting a frequency: "How fast should we stimulate: measuring the effect of deep rTMS on task-based and resting state functional connectivity"

Mary Lee, NIH-NIAAA, Rockville, MD, United States

Emerging data from substance dependent populations: "The effect of medial PFC theta burst stimulation on frontal-striatal connectivity in cocaine users, alcohol users, and smokers"

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