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Type: **Keynote Lecture**

Causal Mapping: From Connectomic Deep Brain Stimulation toward the 'Human Dysfunctome'

Wednesday 29 October 2025 09:00 (1 hour)

Brain disorders manifest along a spectrum of symptoms that involve disruptions in mood, cognition, or motor function. These symptoms originate from dysfunctions of specific brain circuits and may hence be seen as 'disorders of the human connectome', or 'circuitopathies'

However, exactly which circuits become dysfunctional in which disorder remains elusive. Moreover, it remains unclear which circuits map to which specific symptoms. Invasive and noninvasive brain stimulation methods are applied to focal points in the depth or on the surface of the brain. However, their focal application leads to network effects that are distributed along brain circuits across the entire brain. By nature, applying brain stimulation is a causal intervention that engages specific brain circuits: If an intervention leads to symptom improvements, we may suspect that the modulated circuit was causally involved in these symptoms.

In this talk, I will review the effects of deep and superficial brain stimulation onto the human connectome. We will cover results in diseases ranging from the movement disorders spectrum (Parkinson's Disease, Dystonia, Essential Tremor) to neuropsychiatric (Tourette's & Alzheimer's Disease) and psychiatric (Obsessive Compulsive Disorder, Depression) diseases. I will also demonstrate how findings in seemingly different diseases (such as Parkinson's Disease and Depression) could be transferred to cross-inform one another and how the same method may be used to study neurocognitive effects, such as risk-taking behavior or impulsivity.

Andreas received an MD from Freiburg University and a PhD from Charité Berlin. He directs the Institute for Network Stimulation at the University Hospital Cologne. He is further affiliated with the Center for Brain Circuit Therapeutics at Mass General Brigham in Boston.

His lab studies how focal neuromodulation impacts the human connectome to refine clinical treatments for neurological and psychiatric disorders. A key question is which networks should be modulated for improvements of specific symptoms –in disorders such as Parkinson's Disease, Obsessive Compulsive Disorder, Depression, or Alzheimer's Disease. Further, the lab develops methods to segregate the human connectome into functional domains by combining brain stimulation with functional and diffusion-weighted MRI.

Presenter: Prof. HORN, Andreas (Institute for Network Stimulation, University Hospital Cologne & Center for Brain Circuit Therapeutics, Mass General Brigham in Boston)

Session Classification: Andreas Horn