

Intracranial Electrophysiology of Resting State Networks

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Network architecture of brain areas is commonly described using functional connectivity measures derived from statistical analyses of fluctuations of the blood oxygen level-dependent (BOLD) signal recorded by functional magnetic resonance imaging (fMRI). However, the contributions of artifactual sources of apparent functional connectivity may be difficult to account for using standard motion correction and signal regression paradigms. Electrophysiological method provides another window into brain connectivity as well as a measure by which fMRI signal processing may be evaluated. Speakers of this symposium have solved the challenges of electrophysiological source localization by invasive recordings using subdural electrode arrays that are surgically implanted over the cerebral cortex enabling a direct recording from the surface of the human and non-human primate brains. This unique opportunity to study human brain electrophysiology during rest provides a means of intraindividual corroboration of noninvasive and invasive functional connectivity measures. Furthermore, direct electrical stimulation of individual electrodes among arrays with simultaneous recording of the corticocortical evoked potential (CCEP) helps address effective connectivity among different nodes of the resting state networks. Finally, in conscious human subjects, the subjective effects of electrical stimulation of the resting state networks can also be studied.

Learning Objectives:

1. understand the basics of resting electrophysiology
2. learn the neurophysiological mechanisms of resting state networks in the human and non-human primate brains as recorded from inside the brain.
3. review perceptual and subjective changes associated with the electrical stimulation of resting state networks in conscious human subjects

Intracranial EEG recordings and electrical brain stimulations in human resting state networks

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Intrinsic covariation of brain activity

Pascal Fries, Ernst Strüngmann Institute (ESI) in Cooperation with Max Planck Society, Frankfurt, Germany

Dynamics and informational content of spontaneous (resting state) electrophysiological fluctuations recorded intracranially from the human cortex

Rafi Malach, The Weizmann Institute of Science , Rehovot, Israel

Analysis of Functional and Effective Brain Networks using Electrocorticography and Corticocortical Evoked Potentials: Correspondence with fMRI and beyond

Ashesh Mehta, Department of Neurosurgery. Hofstra North Shore LIJ School of Medicine, Manhasset, NY.