Understanding the Basis of Resting-State fMRI Connectivity Dynamics

Organizers:
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Resting-state fMRI has become a promising tool for better diagnosing and monitoring many mental and neurological disorders, as well as for elucidating the functional architecture of the human brain. Although resting-state fMRI is widely applied toward such clinical and scientific goals, many questions regarding analysis practices and interpretation remain open. One such question is the potential biological significance of dynamic changes in connectivity patterns observed at short temporal scales (on the order of seconds to minutes), and how this dynamic behavior may impact the acquisition, analysis, and interpretation of resting-state data. To better understand the biological significance of connectivity dynamics, our session will focus on studies aimed at determining relationships between connectivity changes and measures of neuronal activity, cognition, and behavior. The four speakers in this symposium probe changes in fMRI connectivity using distinct approaches. Shella Keilholz investigates the neural basis of resting-state dynamics using simultaneous MRI and microelectrode recordings; Olaf Sporns will describe how computational models of neuronal networks predict changes in network connectivity across time; Javier Gonzalez-Castillo conducts behavioral interventions (i.e., tasks with different cognitive demands) to evaluate whether dynamic changes in fMRI resting state connectivity at short time scales correlate with experimentally controlled changes in mental processes; and Stephen LaConte applies real-time fMRI to determine whether subjects can modulate resting state networks, and also uses network activity levels to control experimental events. These talks will provide perspectives on new ways to study spontaneous activity and how to best link the insights from task-based and resting fMRI studies.

Learning Objectives: Having completed this workshop, participants will be able to:

1. Learn about current research attempting to elucidate the potential biological significance of fMRI resting state connectivity dynamics;
2. Gain awareness of how dynamic changes in resting state connectivity can inform analysis practices and interpretation of resting state data; and
3. Learn about potential applications for resting state dynamics.

Neural Basis of Dynamic Network Activity
Shella Keilholz, *Wallace H. Coulter Department of Biomedical Engineering, Georgia Tech and Emory University, Atlanta, GA, USA*

EEG Correlates of Functional Connectivity States
Elena Allen, *K.G. Jebsen Center for Research on Neuropsychiatric Disorders and the Department of Biological and Medical Psychology at the University of Bergen, Norway; Mind Research Network, Albuquerque, New Mexico, USA*

When Does a Task Disturb Rest?
Javier Gonzalez-Castillo, *Section on Functional Imaging Methods, NIMH, NIH, Bethesda, MD, USA*

Directly Testing the Roles of Resting-State Networks with Real-Time fMRI
Stephen LaConte, *Virginia Tech, Carilion School of Medicine, Roanoke, VA, USA*