Neurotransmitter Function and Intrinsic Brain Functional Connectivity: Studies of GABAergic Inhibitory Neurotransmitter Actions

Organizer:
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Functional magnetic resonance imaging (fMRI) using blood oxygenation level dependent (BOLD) contrast of brain functional connectivity (FC) is a powerful tool for studying the function of large-scale brain networks that are engaged during task performance and that are also active while a person is simply resting. The resting state FC approach assesses the extent to which endogenous fMRI signals measured from multiple brain regions are synchronized, indicating a functional connection, or formation of a network, between them. However, the neurobiological mechanisms giving rise to synchronous resting state fMRI signal oscillations are not known and this is an active area of research. Challenging neurotransmitter receptor systems pharmacologically with concurrent measurements of fMRI FC may shed some insight into the neural substrates of resting state FC. We will discuss the effects of challenging the GABAergic system on measurements of brain FC as well as the convergence of findings across GABAergic drugs and additional evidence from other imaging modalities to present a case for the link between GABA concentration and BOLD signals and the neurobiological importance of measuring FC-fMRI combined with drug challenges in assessments of intrinsic brain function.

Learning Objectives: Having completed this workshop, participants will be able to:
1. Discuss the use and limitations of measurements of resting state FC using fMRI in conjunction with pharmacological challenges to elucidate the contribution of neurotransmitter function to brain functional connectivity;
2. Discuss the utility of using multi-modal MRI to better interpret fMRI measurements, especially in the context of drug administration; and
3. Discuss the effects of GABAergic drug actions on brain functional connectivity and the interpretation of these drug actions and baseline GABA concentration toward understanding the neurobiological underpinnings of fMRI measurements.

Functional Magnetic Resonance Imaging of Drug Actions in the Brain
Bruce Jenkins, Massachusetts General Hospital and Harvard Medical School, Boston, MA, USA

GABA and the Transition from Resting State to Stimulus-Induced Activity
Georg Northoff, University of Ottawa Institute of Mental Health Research, Ottawa, ON, Canada

Alterations in the Power and Synchrony of BOLD fMRI Signals Associated with GABA-A Receptor Modulation by Midazolam
Vesa Kiviniemi, University of Oulu, Oulu, Finland

The GABA-A Receptor Modulator Zolpidem Induces Increases in the Synchrony of BOLD Signal Fluctuations in Widespread Brain Networks
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