Functional Connectivity or Causality in the Brain: How Do We Know?

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The past years have seen an escalation of interest in brain connectivity and causality. Numerous studies have been published on this topic using various modeling approaches including Granger Causality, Dynamic Causal Modeling, and Partial Correlation Mapping, etc. A Google Scholar search for “functional connectivity” returned over 100,000 publications since 2014. However, crucial methodological and conceptual issues remain unresolved. These include: (a) which modeling approach should be used for which data, (b) how can we validate connectivity/causality estimators, and (c) how can we reconcile functional connectivity data obtained from functional MRI and EEG/MEG, which reflect very different aspects of neuronal activity. This symposium will review the state of the art of functional/effective connectivity and causality mapping approaches, and discuss the key challenges ahead. Participants will learn the pros and cons of various modeling approaches for connectivity/causality estimation, experimental validation of connectivity estimates, and the complementary nature of estimates based on fMRI and EEG/MEG data.

Brain Modes and Network Discovery
Karl Friston, University College London, London, United Kingdom

Mapping Brain Electrophysiological Connectome
Bin He, University of Minnesota, Minneapolis, United States

Bicoherence - The Higher Harmonics Strike Back
Guido Nolte, University Medical Center Hamburg-Eppendorf, Hamburg, Germany

Methods for Estimating Brain Connectivity using MEG/EEG and Why There Are Contradictory Connectivity Findings?
Sheraz Khan, Harvard Medical School, Boston, United States