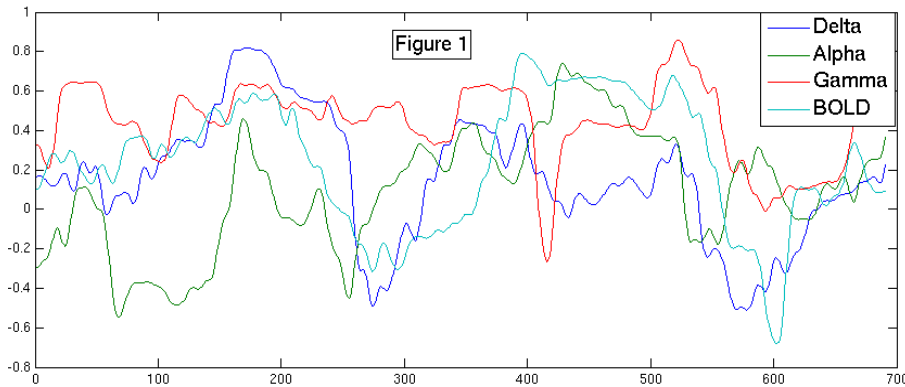


The Electrical basis of dynamic functional connectivity measured with sliding window correlation.

Mac Merritt¹, Garth Thompson¹, Wenju Pan¹, Matthew Magnuson¹, and Shella Keilholz¹
¹BMED, Georgia Institute of Technology and Emory University, Atlanta, Georgia, United States

Purpose: While functional connectivity is typically calculated using data from a 5-8 minute scan, it has been shown that the relationship between areas varies over time¹. Sliding window correlation (SWC) has been used to study these dynamics, but similar variations in correlation can be observed in randomly matched BOLD time courses that share no temporal information², making it difficult to interpret the changes in correlation from the BOLD signal alone. This study uses simultaneous resting state MRI and microelectrode recording to investigate the relationship between the temporal dynamics of bilateral electrical activity and bilateral BOLD fluctuations using Sliding Window Correlation (SWC)

Methods: 13 rats anesthetized with isoflurane were used in this study. Simultaneous electrophysiology and fMRI was recorded using the methods described in³. Band limited power (BLP) was calculated for each specific frequency band of the electrophysiological signal. Each BLP time course and the BOLD time course were then low pass filtered between .01 and .1 Hz. Each low pass filtered time course in the right hemisphere was then compared to each low pass filtered time course in the left hemisphere using Sliding



Window Correlation with a window length of 100 scans (50s) using Pearson correlation. In order to compare BOLD functional connectivity to electrical connectivity, each BLP SWC time course was compared to the BOLD SWC time course using Pearson correlation. As a control, each BOLD SWC time course was paired with a randomly-matched set of BLP SWC time courses.

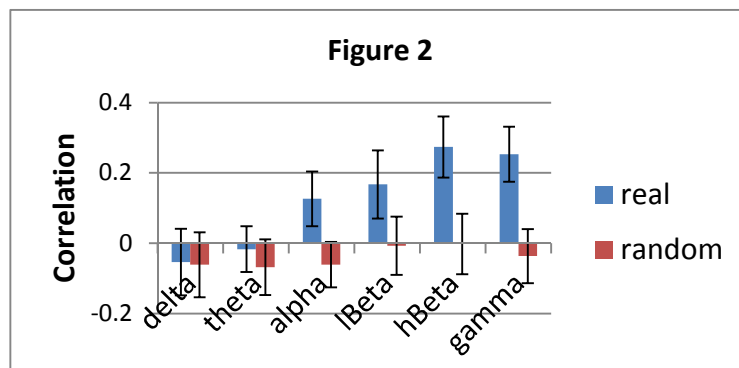
Results: Figure 1 depicts a time course of selected BLP and time course. Fig. 2 shows the average between BLP SWC time course and Alpha, high Beta, and Gamma bands were significantly different random pairings using a student t-test

Discussion: Previous studies that BOLD-based SWC could not whether the changes in correlation neural activity². This study shows that observed with BOLD

SWC corresponds to variability in LFP power correlation, providing a definitive link to neural activity and establishing a firm foundation for future studies of network dynamics.

References:

1. Chang, Glover. 2010. Time-frequency dynamics of resting-state brain connectivity measured with fMRI. *Neuroimage* 2010 50:81-98
2. Pan, Thompson, Magnuson, Majeed, Jaeger, Keilholz. 2011. Broadband Local Field Potentials Correlate with Spontaneous Fluctuations in Functional Magnetic Resonance Imaging Signals in the Rat Somatosensory Cortex Under Isoflurane Anesthesia. *Brain Connectivity* 1-2:119-131
3. Keilholz, Magnuson, Pan, Willis, Thompson. 2012. Dynamic Properties of Functional Connectivity in the Rodent. *Brain Connectivity* doi:10.1089/brain.2012.0115



representative BOLD SWC correlation BOLD SWC. Frequency than their ($p < 0.05$). examined only determine were linked to the variation