

## Functional integration between brain regions at rest occurs in multiple-frequency bands

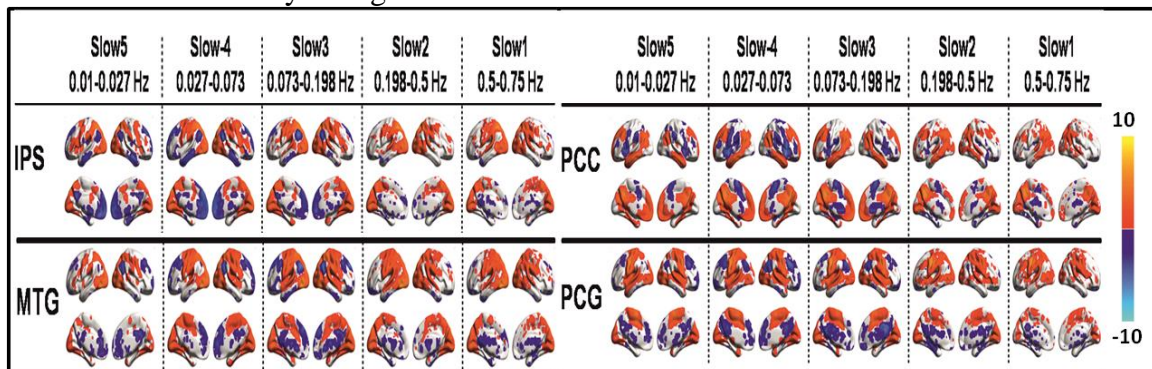
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**Background:** BOLD signal fluctuations during rest have been shown to be highly correlated across spatially remote though functionally related brain regions predominantly in the low-frequency range (LFFs) (0.01-0.1 Hz) [1]. Earlier neurophysiological and single cell studies during rest have shown that neuronal networks show oscillations up to 500 Hz [2]. Exploration of RSFC in frequency bands higher than 0.1 Hz has been limited due to hardware limitations till date. In the current study, using BOLD fMRI data acquired at high sampling frequency (TR=0.645s), we investigate presence of RSFC for multiple frequency bands as defined by earlier neurophysiological studies [3].

**Methods:** 21 subjects resting state fMRI data (TR= 0.645s, #volumes 900) and anatomical MPRAGE scan was obtained from open sharing data repository, Enhanced Nathan Kline Institute-Rockland (NKI) Sample [4]. Each of the subjects data was pre-processed using similar processing scheme as employed in [5] and temporally filtered in five different frequency bands (1) slow-5 (0.01-0.027 Hz) (2) slow-4 (0.027-0.073 Hz) (3) slow-3 (0.073-0.198 Hz) (4) Slow-2 (0.198-0.5 Hz) and (5) slow-1 (0.5-0.75 Hz). Seed based correlation was performed using four different seed regions (posterior cingulate cortex(PCC), Inferior parietal sulcus (IPS), precentral gyrus(PCG), middle temporal gyrus (MTG)). One-sample ttest ( $p < 0.05$ , FDR corrected) was performed to derive group level connectivity maps.

**Results:** Resting state networks such as, default mode network (PCC seed), motor network (PCG seed), dorsal attention network (IPS seed), temporal network (MTG seed) were consistently observed across multiple frequency bands with variation in spatial extent and connectivity strength.



**Conclusions:** Functional integration between brain regions at rest occurs over a wider frequency bands and RSFC is a multi-frequency band phenomenon. RSFC at these higher BOLD frequencies may represent inter-network connectivity and may provide further insight in functional integration between various neuronal processes and their roles in cognition.

**References:** Biswal BB, Hyde JS, 1995 MRM, 34(4), 537-541. Llinas RR, 1988 Science, 242(4886), 1654-1664. Buzsáki G Science, 304(5679), 1926-1929. Nooner KB 2012, Front Neurosci, 6:152. Biswal BB, PNAS, 2010, 107(10), 4734-4739.