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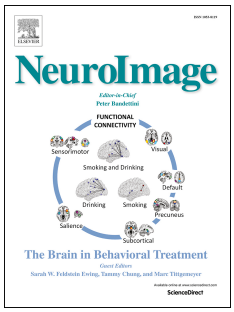

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Resting-state white matter-cortical connectivity in non-human primate brain

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ABSTRACT. Numerous studies have used functional magnetic resonance imaging (fMRI) to characterize functional connectivity between cortical regions by analyzing correlations in blood oxygenation level dependent (BOLD) signals in a resting state. However, to date, there have been only a handful of studies reporting resting state BOLD signals in white matter. Nonetheless, a growing number of reports has emerged in recent years suggesting white matter BOLD signals can be reliably detected, though their biophysical origins remain unclear. Moreover, recent studies have identified robust correlations in a resting state between signals from cortex and specific white matter tracts. In order to further validate and interpret these findings, we studied a non-human primate model to investigate resting-state connectivity patterns between parcellated cortical volumes and specific white matter bundles. Our results show that resting-state connectivity patterns between white and gray matter structures are not randomly distributed but share notable similarities with diffusion- and histology-derived anatomic connectivities. This suggests that resting-state BOLD correlations between white matter fiber tracts and the gray matter regions to which they connect are directly related to the anatomic arrangement and density of WM fibers. We also measured how different levels of baseline neural activity, induced by varying levels of anesthesia, modulate these patterns. As anesthesia levels were raised, we observed weakened correlation coefficients between specific white matter tracts and gray matter regions while key features of the connectivity pattern remained similar. Overall, results from this study provide further evidence that neural activity is detectable by BOLD fMRI in both gray and white matter throughout the resting brain. The combined use of gray and white matter functional connectivity could also offer refined full-scale functional parcellation of the entire brain to characterize its functional architecture.

KEYWORDS: fMRI, BOLD, resting-state, white matter, non-human primates