Relationships Between Striatal Gray Matter Integrity and Implicit Associative Learning

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Previous studies have implicated striatal structures (i.e., caudate, putamen) in implicit associative learning (IAL), or the learning of associations between events without conscious awareness that subserves language and habit learning. While previous neuroimaging studies have examined IAL in relation to striatal function and the integrity of white matter tracts emanating from the striatum, none have examined the relationship between striatal gray matter integrity and IAL. Gray matter integrity can provide valuable information about microstructural properties of caudate and putamen (e.g., degree of neuronal density) that may complement previous examinations of the neural substrates of implicit learning. In this study, 25 young adults (21.33 ± 2.20 years old) underwent diffusion tensor imaging and completed the Triplets Learning Task, which requires the acquisition of associations between two cues (location of red circles) with a target (location of green circle). Task performance (IAL scores and mean reaction times) correlated with measures of bilateral caudate and putamen gray matter integrity (e.g., mean diffusivity [MD], axial diffusivity [AD], radial diffusivity [RD]). That is, better IAL scores were significantly related to lower bilateral caudate and putamen MD, AD, and RD. Additionally, faster overall reaction time was marginally significantly related to lower right caudate MD and RD. These results for striatal gray matter integrity are consistent with previous neuroimaging studies demonstrating involvement of striatum in IAL. Moreover, it supports the notion that gray matter integrity is sensitive to individual differences in cognition, even among healthy younger adults.