The role of network architecture and control in working memory

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Presentation Abstract Summary Executive function (EF) enables attention control and working memory (WM), among other skills. WM is an essential component of the executive system, allowing for information to be held in a short-term buffer for further processing, and failures of EF are a major source of morbidity and mortality. Past efforts to enhance WM, motivated by activation studies, have focused on stimulation of the dorsolateral prefrontal cortex (DLPFC), with mixed results. Here, we supplement these efforts by identifying networks, and connections between them, that are important for WM performance in a large cohort of 539 adults. In fMRI data acquired during performance of an n-back working memory task, we find that the strength of the functional connection between the frontoparietal control network (FPC) and the default mode network (DMN) is correlated with WM accuracy. We build, test, and validate a theory for the modulation of this circuitry that links underlying white matter architecture, task-related activation, functional connectivity, and behavioral performance. Building on principles of engineering in network control theory, this theoretical framework identifies a portion of the superior parietal lobe as an effective modulator of the FPC-DMN connection, suggesting its utility as a target for interventions to improve WM performance.

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