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The New Perspectives in fMRI Research Award: Exploring Patterns of Default-Mode Brain Activity

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The neuroimaging of cognitive function typically depends upon the detection of relative differences in BOLD signal between task conditions. Most researchers have tended to focus more heavily on those brain regions that show a relative increase relative to a baseline level of activity. However, what is meant by this ''baseline'' has drawn recent attention, in particular its basis in brain metabolism, oxygen consumption, and blood flow (Raichle & Gusnard, 2002). The medial prefrontal cortex and posterior cingulate, as well as the hippocampus are among those brain regions having high baseline metabolic activity at rest but that routinely exhibit decreases from this baseline across a variety of goal-directed behaviors in functional imaging studies. According to current thinking, this high metabolic rate and predilection for deactivation are hallmarks for the existence of an organized mode of default brain function (Greicius et al., 2003; Gusnard, Akbudak, Shulman, & Raichle, 2001; Gusnard & Raichle, 2001; Raichle et al., 2001). These regions form part of a distributed network that appears particularly sensitive to the cognitive states evoked during self-referential tasks (Simpson, Snyder, Gusnard, & Raichle, 2001) and may form a neurological basis for certain aspects of social cognition, such as social perception (Geday, Gjedde, Boldsen, & Kupers, 2003). More recently, studies have found additional evidence suggesting that patterns of resting-state connectivity are decreased in normal aging but more so in patients having dementia (Greicius et al., 2004). Thus, departures from a normal degree of default-mode activity may be important in the clinical etiology of age-related brain diseases.

In this issue, we feature the article of Michael Greicius and Vinod Menon of Stanford University, winners of the 2004 New Perspectives in fMRI Research Award. Now in its third year, this award seeks to identify the most novel use of previously published fMRI data contained in the fMRI Data Center archive (http://www.fmridc.org). Although a number of contending articles were submitted for the competition, this one stood out due to its timeliness, novel approach, and implications for understanding the scope of baseline brain activity. Their analysis of data from the original study of Laurienti, Burdette, Wallace, Yen, Field, & Stein (2002) explores epoch-related BOLD functional connectivity using independent components analysis and suggests that certain degrees of default-mode activity may persist through both stimulus and rest block contingent on task difficulty. Such findings may have important bearing on task complexity and automaticity (McKiernan, Kaufman, Kucera-Thompson, & Binder, 2003; Raichle et al., 1994). We are delighted that Paul Laurienti has provided an insightful commentary on this article and a critique of data normalization procedures that are pertinent to the results of many examinations using fMRI.

This unique article and accompanying commentary demonstrate the power of shared data from the published literature to shed new light on fundamental aspects and help drive scientific discourse. The New Perspectives Award is one means by which fMRI data may be re-used to move cognitive neuroscience toward a science of discovery.

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