Taken together, anatomical and connectivity data seem to suggest a relevant role for the precuneus in the implementation of a wide range of higher-order cognitive functions, the exact nature of which has long been a subject for speculation. In fact, the few lesion studies of both humans and non-human primates have been unsuccessful in illuminating a specific function. Fortunately, the results of lesion studies have been informed by a number of recent functional imaging studies that have demonstrated activity within the medial parietal areas during certain forms of complex behaviours. These studies suggest that the precuneus plays an important role in a diverse array of highly integrated functions that can no longer be regarded as a simple extension of the visuo-spatial processes subserved by the lateral parietal cortices. In the following section we review the literature on the behavioural correlates of precuneus activity, with special reference to imaging neuroscience. We focus on haemodynamic techniques, namely functional MRI (fMRI) and PET, which investigate neural activity by measuring changes in blood flow, and these have been widely used to explore the functional neuroanatomy of cognitive functions. However, a few magnetoencephalography (MEG) and neuropsychological studies have been included in the discussion, where relevant. Tables 2–4 summarize the results of fMRI and PET studies demonstrating patterns of activation within the precuneus (BA 7). Neuroimaging studies covering different aspects of cognitive functions have been analysed and arbitrarily classified into four broad categories (visuo-spatial imagery, episodic memory retrieval, self-processing and consciousness), based on similarity of addressed tasks and clusters of cross-references.

Reference:

Cavanna, A. E., & Trimble, M. R. (2006). The precuneus: a review of its functional anatomy and behavioural correlates. *Brain*, *129*(3), 564-583.

Considerable prior neuroimaging has implicated the precuneus as a central node in the human brain, important for supporting complex cognition and behavior. The precuneus comprises a core region of

the DMN, exhibiting decreased activation during most externally driven tasks (Raichle et al., 2001; Fransson, 2005), and reliable increases in activation in response to both rest and specific tasks, such as autobiographical memory (Addis et al., 2004), as well as unique interactions with the rest of the network (Fransson and Marrelec, 2008). Its role in the DMN has been of particular interest as it shows the highest resting metabolic rate within the network, requiring ~35% more glucose than any other region in the human brain (Gusnard and Raichle, 2001). Further, the widespread connectivity of the precuneus, involving higher association regions, suggests an important role in integrating both internally and externally driven information (Cavanna and Trimble, 2006). Still, the function of the region is unknown. While the precuneus shows heightened activation during episodic (Fletcher et al., 1995; Lundstrom et al., 2005) and autobiographical memory (Addis et al., 2004; Eustache et al., 2004) tasks, it similarly shows heightened activation during rest (Raichle et al., 2001), an effect that is augmented in single units during increased disengagement from the task being performed (Hayden et al., 2009). Our results extend a unifying function of these competing results (Leech et al., 2011) by acknowledging that the precuneus is functionally variable, exhibiting connectivity with different neural networks according to task state or level of engagement with one's surroundings and demonstrating that connectivity between the precuneus and the DMN reflects this level of engagement.

Reference:

Utevsky, Amanda V., David V. Smith, and Scott A. Huettel. "Precuneus is a functional core of the default-mode network." *The Journal of Neuroscience* 34.3 (2014): 932-940.