

■ Review article

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# The precuneal cortex: anatomy and seizure semiology

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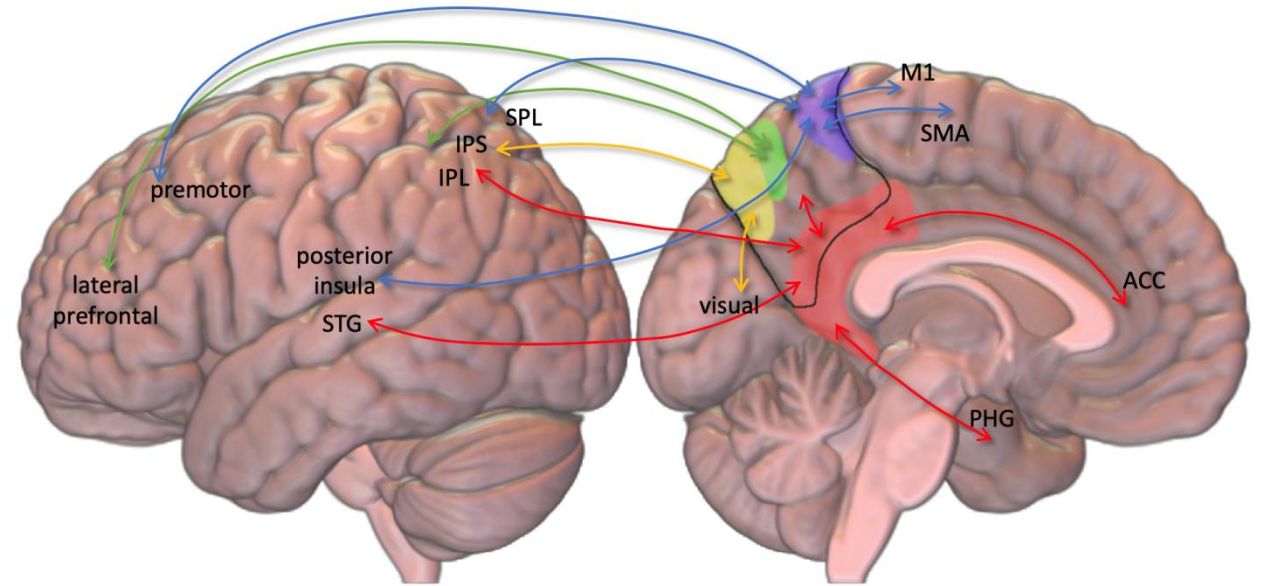
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# Anatomy and connections

- The precuneus is a structure that occupies the posterior medial portion of the parietal lobe, and it has broad cortical and subcortical connections.
- Neuroanatomical tracings and functional imaging, as well as electrical stimulation studies, of humans and other primates have elucidated many complex integrative functions of the precuneus including visuo-spatial imagery, sensorimotor functions, and consciousness.<sup>1</sup>



- **Functional regions of the precuneus and their connections.** The four functional subdivisions of the precuneus are depicted: sensorimotor (blue), cognitive (green), visual (yellow) and limbic (red). Basic connections are depicted. ACC: anterior cingulate cortex/region. IPL: inferior parietal lobule. IPS: intraparietal sulcus. M1: primary motor cortex. PHG: parahippocampal gyrus. SMA: supplementary motor area. SPL: superior parietal lobule. STG: superior temporal gyrus.

# Anatomical divisions of the precuneus and their functions

Precuneus Subsections	Connections of the precuneus	Function
Anterior dorsal	Primary and secondary sensory-motor cortices	a. Sensory motor function b. Specially guided movement (Zhang and Li, 2012)
Posterior dorsal	Primary and secondary visual cortices	a. Episodic memory and reasoning (Wang et al., 2019) b. visual special coordination
Ventral precuneus	a. Posterior cingulate gyrus b. Limbic mesial temporal cortex	a. Default mode network (DMN), a network involved in memory, emotion and language processing during resting state (Wang et al., 2019) b. Attention control (Cauda et al., 2010)
Central precuneus	Prefrontal area	Higher cognitive functions (Margulies et al., 2009; Passarelli et al., 2018)

# Seizure semiology

- The majority of literature describing precuneal seizures attributes the wide range of semiologies to the extensive connectivity to multimodal association areas.
- Possible semiology based on known reports and known function of precuneus:
  - **Sensorimotor Anterior Precuneal Region:** This can lead to simple or complex motor or sensory manifestations due to connections with paracentral lobule, Brodmann Area (BA) 2, BA6 and supplementary motor area (SMA). Tonic, clonic, versive, hypermotor, bilateral asymmetric tonic manifestations have been reported.<sup>1</sup>
  - This area is also connected with the parietal operculum and the insula which may contribute to vestibular and body image disturbance.
  - **Cognitive/Associative Central Precuneal Region:** This region connects with the angular gyrus and the dorsolateral prefrontal cortex including area 8, and therefore, could cause eye movement-related semiology, such as eye deviation.<sup>1</sup>
  - **Visual Posterior Precuneal Region:** Complex visual hallucinations and visual illusion can be predicted based on connectivity to the posterior fusiform gyrus. The involvement of the primary visual cortex can lead to elementary visual hallucinations. Blurred vision has been reported which may also be related to this region.
  - **Limbic Precuneal Region:** This area is closely related to the posterior cingulate/retrosplenial region which connects to limbic medial temporal region, including the parahippocampal gyrus and hippocampus. This can lead to mesial temporal-like manifestations. Given its connectivity with BA32 and 25, a variety of autonomic and emotional responses could be seen.

1. Harroud, A. *et al.* (2017) 'Precuneal epilepsy: Clinical features and surgical outcome', *Epilepsy & behavior: E&B*, 73, pp. 77–82.