Medical Neuroscience | Tutorial Notes

Associational Cortex of the Parietal Lobe

MAP TO NEUROSCIENCE CORE CONCEPTS[1]

NCC5. Intelligence arises as the brain reasons, plans, and solves problems.

NCC7. The human brain endows us with a natural curiosity to understand how the world works.

LEARNING OBJECTIVES

After study of the assigned learning materials, the student will:

1. Discuss the major functions that are localized to the associational cortex of the parietal lobe.

TUTORIAL OUTLINE

I. Parietal associational cortex

- A. anatomical location:
  - 1. cortex posterior to the primary somatic sensory cortex in the postcentral gyrus
  - 2. **superior parietal lobule**: cortex medial to the intraparietal sulcus, including the medial cortex in the precuneus gyrus
  - 3. **inferior parietal lobule**: cortex lateral to the intraparietal sulcus, including the supramarginal and angular gyri
- B. function
  - 1. involved in *directing attention* toward perceptual cues in the environment (recall that the posterior parietal lobe processes "Where" visual signals)
  - 2. attentional modulation of sensory processing
    - a. attentional mechanisms lead to increases in the firing rates of posterior parietal neurons that sustain attention in lower-order sensory cortex (see **Figure 26.9**[2])
      - i. attentional modulation of sensory responses in primary sensory cortex is likely dependent upon cortico-cortical feedback from posterior parietal cortex (see **Figure 26.10**)

[1] Visit **BrainFacts.org** for *Neuroscience Core Concepts* (©2012 Society for Neuroscience) that offer fundamental principles about the brain and nervous system, the most complex living structure known in the universe.

[2] Figure references to Purves et al., *Neuroscience, 5th Ed.*, Sinauer Assoc., Inc., 2012. [click here]

b. thus, "paying attention" (or not), likely reflects the depth of modulation of ongoing activity in sensory cortex by sensory stimuli

i. strong modulations of sensory activity are associated with improved perceptual and behavior performance

ii. weaker modulations are associated with increased frequency of perceptual "failures"

3. cortical asymmetry of attention

a. the left parietal lobe is mainly concerned with the *right* hemifield, while the right parietal lobe is engaged by stimuli in *either* hemifield (see **Figure 26.6B**)

b. thus, lesions of the right parietal lobe tend to produce profound deficits in attention directed toward the left hemifield, termed **contralateral neglect syndrome**, while lesions of the left parietal lobe produce few attentional deficits (see **Figure 26.6A**)

i. such patients display an inability to attend to objects, or even their own body, on the left side of the midline

ii. this attentional deficit may present without impairments in visual function, somatic sensation or motor ability

4. posterior parietal cortex is involved in maintaining a neural representation of self; which is sometimes referred to as the *body image* or *body schema*

a. parietal associational cortex builds a model of self relative to its component parts (musculoskeletal units) and to the external environment

STUDY QUESTION

A colleague described a patient that he studied who had a cortical stroke, which resulted in limb weakness and a bizarre denial of impairment (anosognosia). Which limb was (most likely) impaired?

[Hint: this women's anosognosia can be considered an extreme form of hemineglect.]

A. left lower extremity
B. right lower extremity
C. left upper extremity
D. right upper extremity
E. bilateral weakness of the lower extremities