

Somatic Sensory Systems and Posterior Parietal Cortex

Most of our senses are grouped together into what are called **the somatic sensory systems or general sensory systems**. The somatic sensory systems include the senses of **touch, temperature, pain, and proprioception**. The receptors that are responsible for these senses are scattered throughout the body both internally and externally. The receptors of the general senses can be divided into four types: **nociceptors, mechanoreceptors, thermoreceptors, and chemoreceptors**. I discussed the chemoreceptors of the general sensory system when we covered gustation. Each of these four types of receptors can be further divided into subcategories, which were reviewed in lecture and you should know each type and subtype. You should also know the four types of primary sensory afferents that innervate the different receptor types.

The cell bodies of the primary sensory afferents lie in the **dorsal root ganglia** of the spinal cord and they send their axons to terminate on the neurons of the **dorsal horn**. Within the CNS there are two pathways by which somatic sensations from the body reach the cerebral cortex: the **dorsal-column medial lemniscal pathway**, and the **spino-thalamic pathway**. Each of these pathways convey different sensory information and follow a different course in the CNS. Sensory information from the face is conveyed to the CNS primarily by the **trigeminal nerve** (VII, IX, and X also contribute). The pathways conveying sensory information from the face are similar to those of the body.

The **primary sensory cortex** (Brodmann Areas 3a,b, 2, and 1) are located on the **post-central gyrus**. Each of the areas defined by Brodmann serves different sensory modalities and the input to each is organized **somatotopically** (each area has a "body map"). In these somatotopies the area of cortex devoted to a body part is correlated with the density of receptors in that body area. The greater the density of receptors, the greater the area of cortex devoted to that part of the body.

The information from the somatosensory, auditory, visual, and gustatory cortices come together in a part of the cortex called the **posterior parietal cortex** (Brodmann Areas 5 & 7), also known as **association cortex**. The response characteristics of neurons in this part of the cortex are very complex, most require multi-sensory stimuli to be activated. Most of what we know about this part of the cortex comes from people that have had damage to this part of the brain. Damage to the posterior parietal cortex can cause a variety of deficits ranging from **agnosia**- inability to recognize common objects to **neglect syndrome**, in which part of the body is not recognized as belonging to the body. These sorts of studies have led to the realization that the right and left posterior parietal cortices are not functionally symmetrical. Language skills, such as writing, speaking and reading appear to reside in the left posterior parietal cortex. Math skills also appear to be a "left-brain" function. Spatial skills, such as understanding and reproducing spatial relationships between objects, appear to reside in the right posterior parietal cortex. The ability to identify objects by touch also appears to be a "right-brain" function. Damage to the respective hemisphere will result in deficits in the skills that reside in that side of the brain. For example, damage to the left hemisphere that involves the posterior parietal cortex may result in the inability to speak and/or understand spoken or written language, whereas damage to the right hemisphere involving the posterior parietal cortex may result in the inability to copy a simple drawing of a clock face, or the inability to identify a coin when it is placed in your hand.