PHGY 212 - Physiology

SENSORY PHYSIOLOGY

Sensory Neural Pathways

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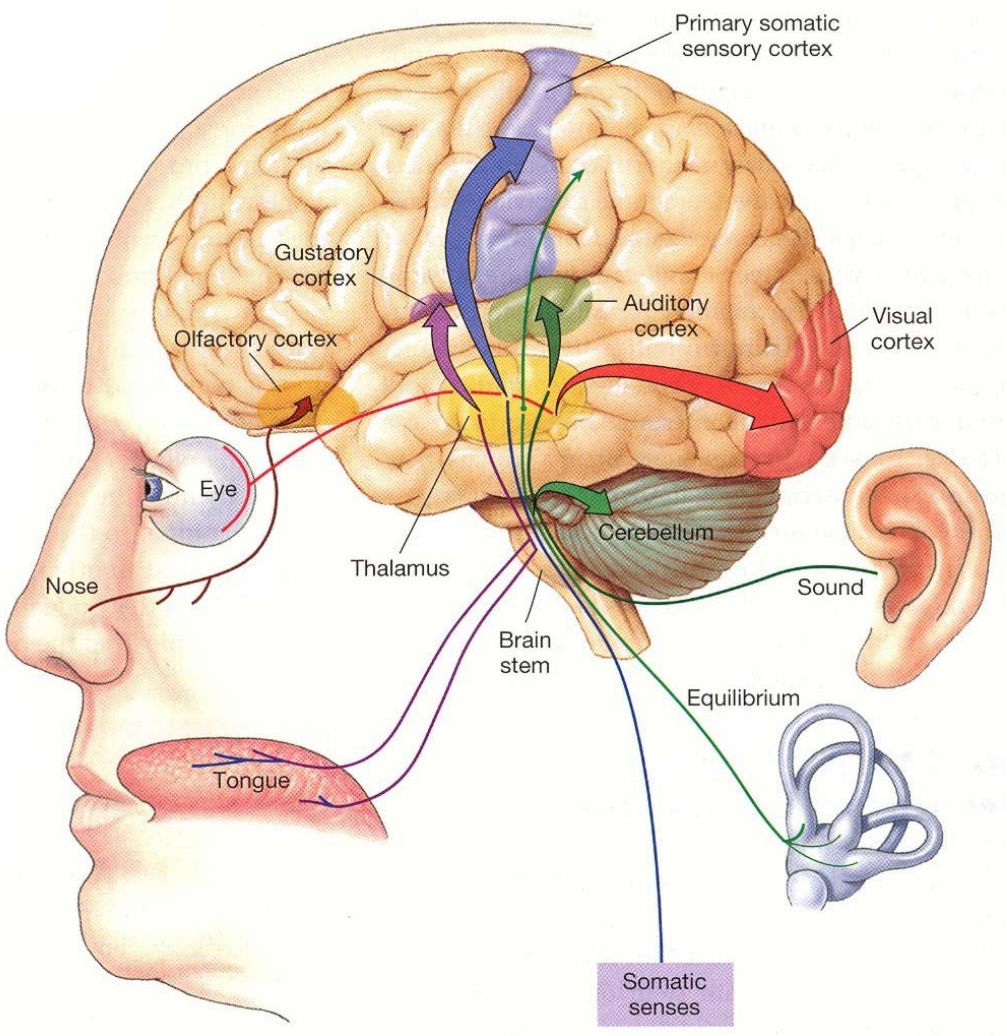
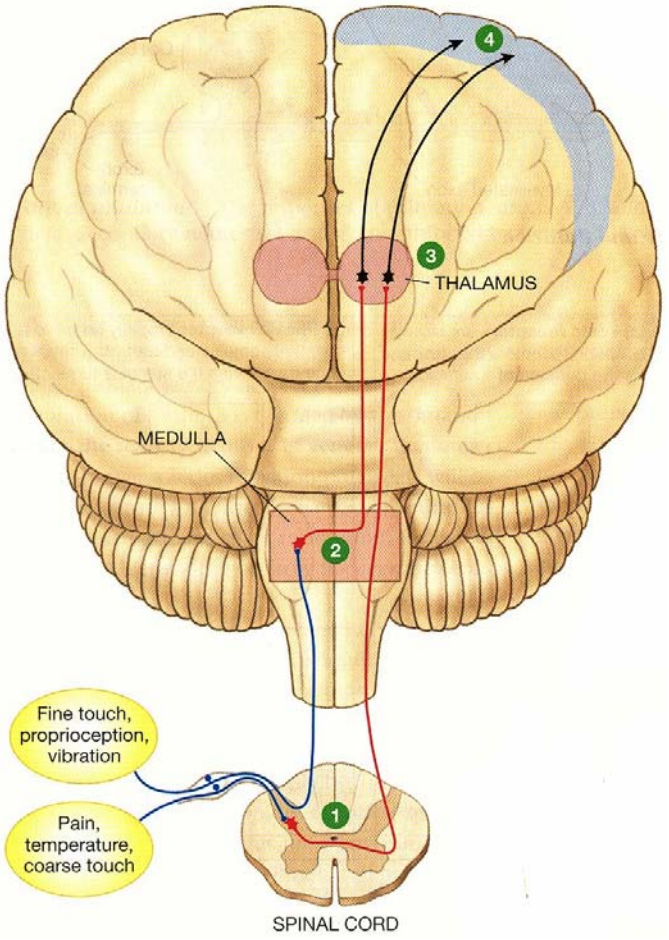
Pathways for Sensory Perception



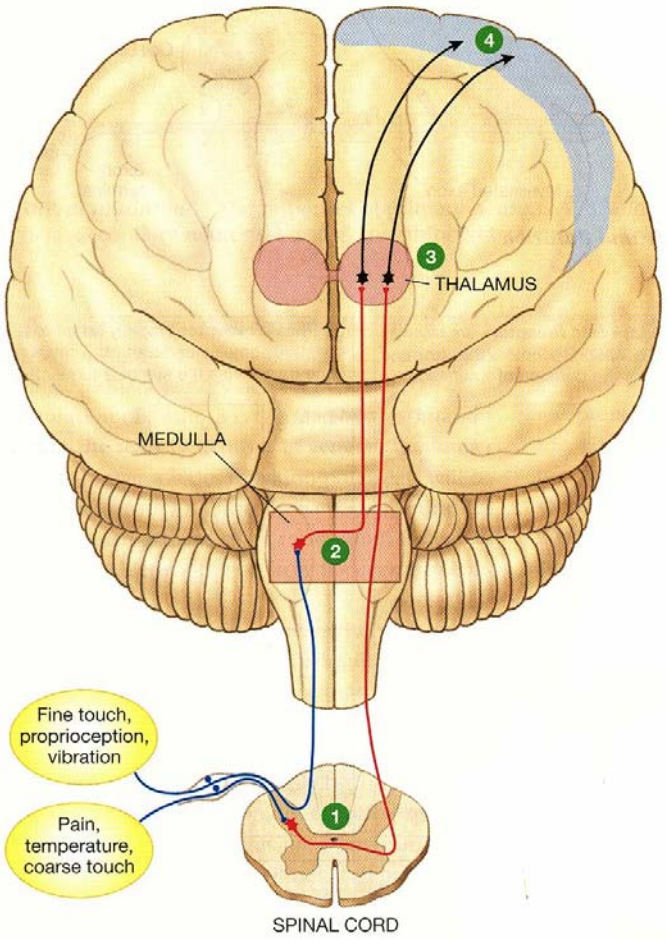
Pathways for Sensory Perception

Primary sensory neurons bring information from somatic receptors to secondary sensory neurons in the CNS.



Pathways for Sensory Perception

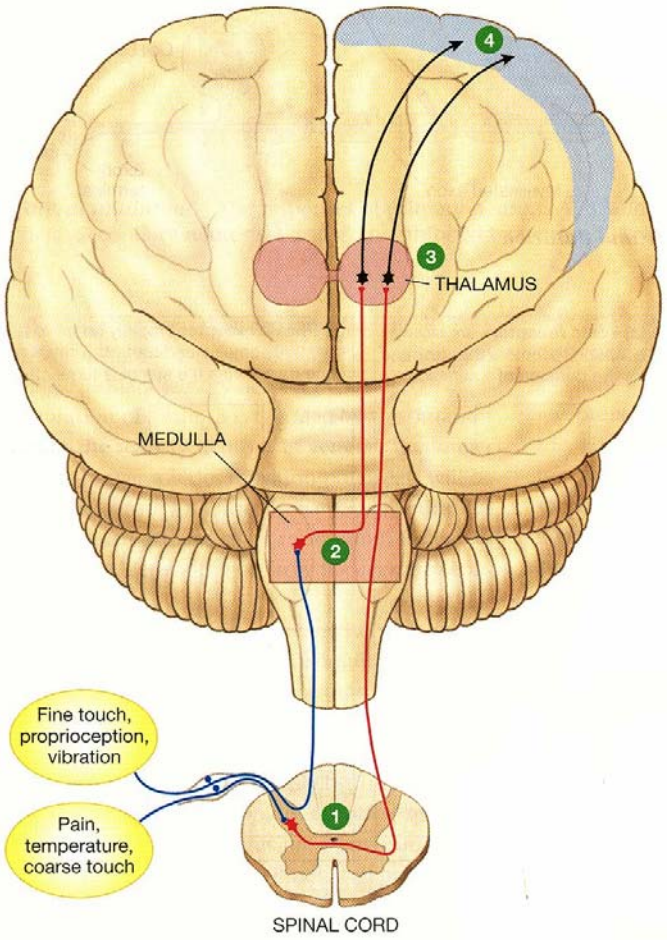
The location of the synapse between primary and secondary sensory neurons varies according to the type of receptor.



Pathways for Sensory Perception

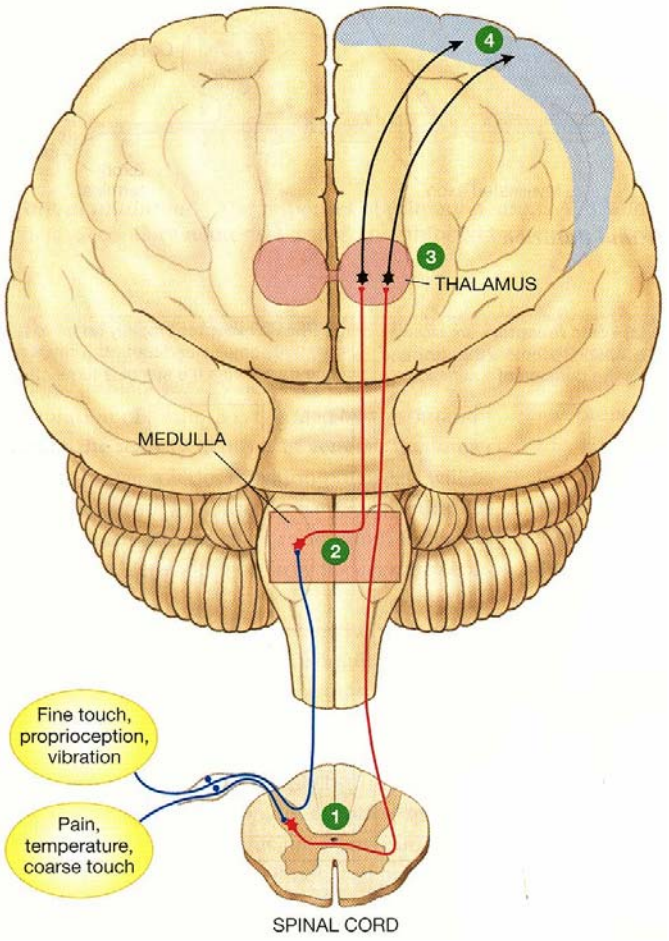
Secondary sensory neurons

cross the midline of the body, so that sensations from the left side of the body is processed in the right hemisphere of the brain.



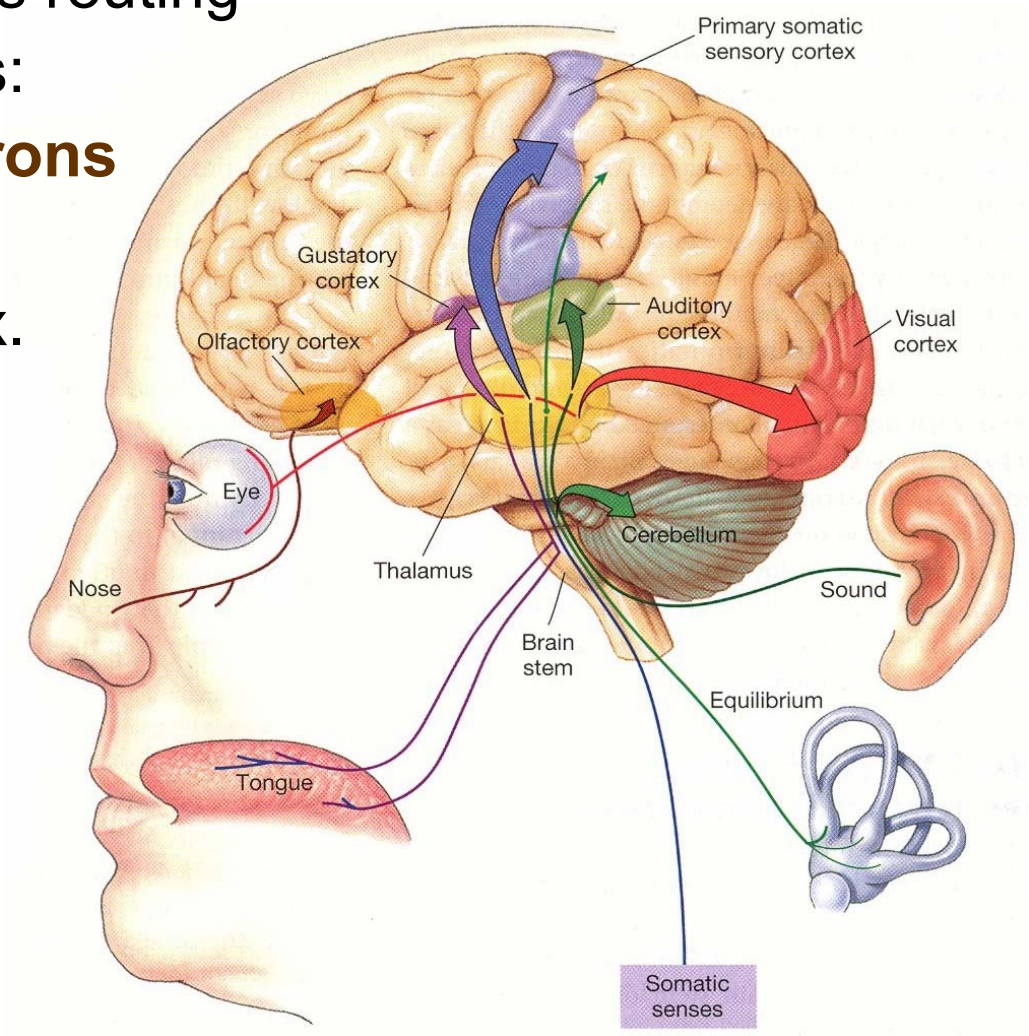
Pathways for Sensory Perception

In the thalamus,
secondary sensory neurons
synapse onto tertiary sensory neurons,
which in turn project
to the cerebral cortex.



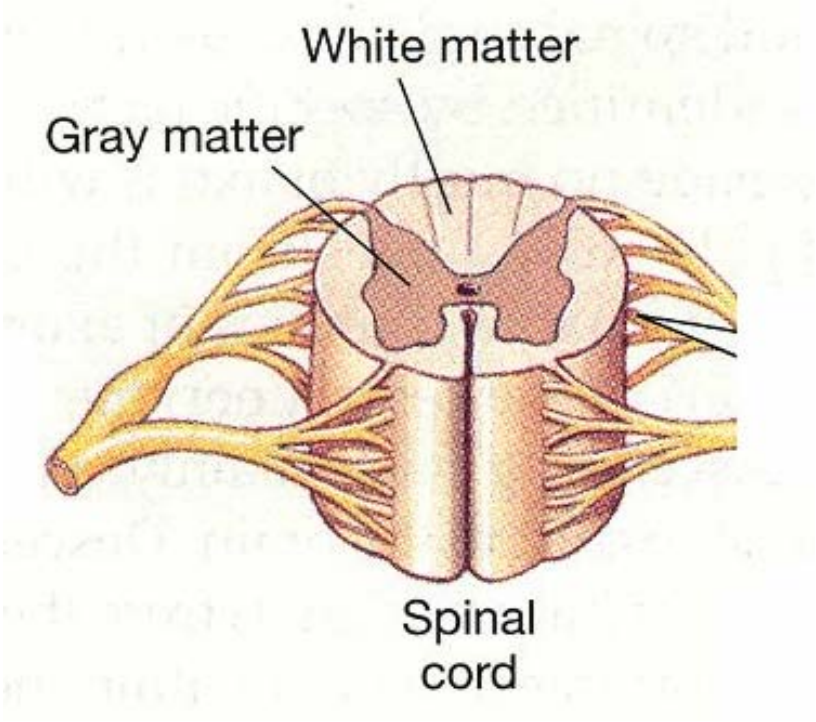
Pathways for Sensory Perception

There is one exception to this routing through the thalamus: **olfactory sensory neurons** project directly to the cerebral cortex.



Spinal Cord

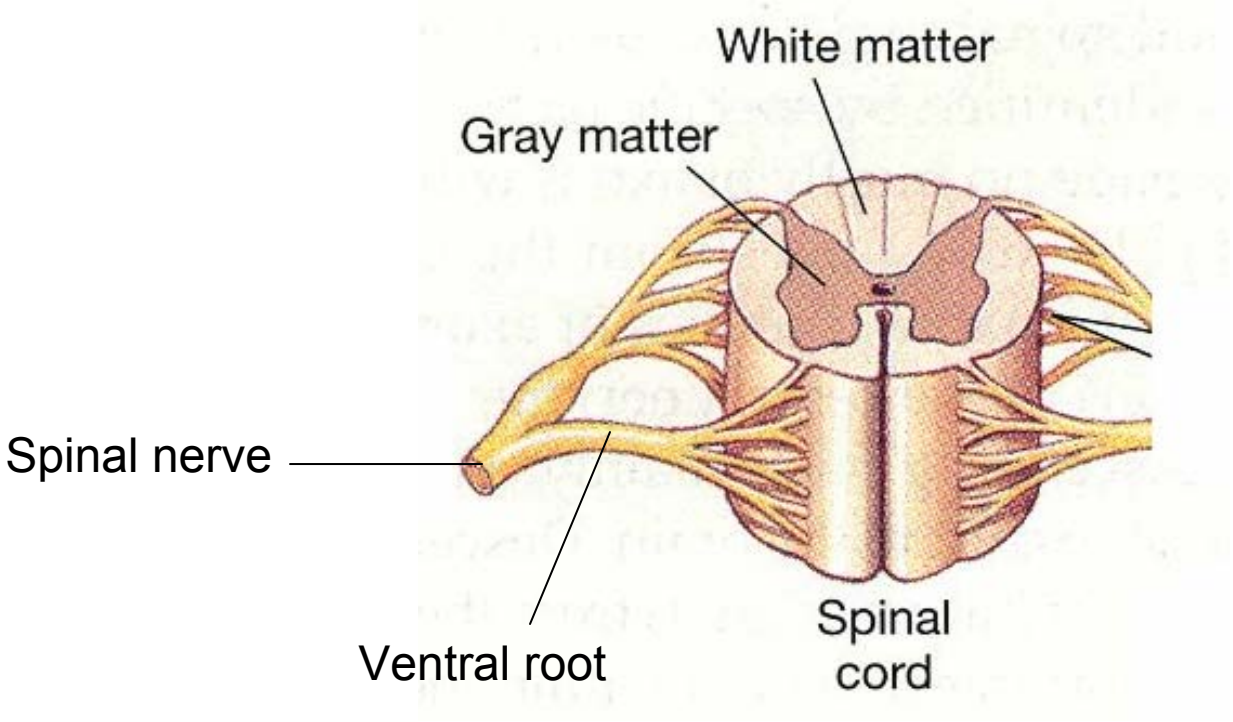
The spinal cord has a core of **gray matter** (neuron cell bodies) and a surrounding rim of **white matter** (nerve fibers).



Spinal Cord

Spinal nerves divide into two branches called **roots**.

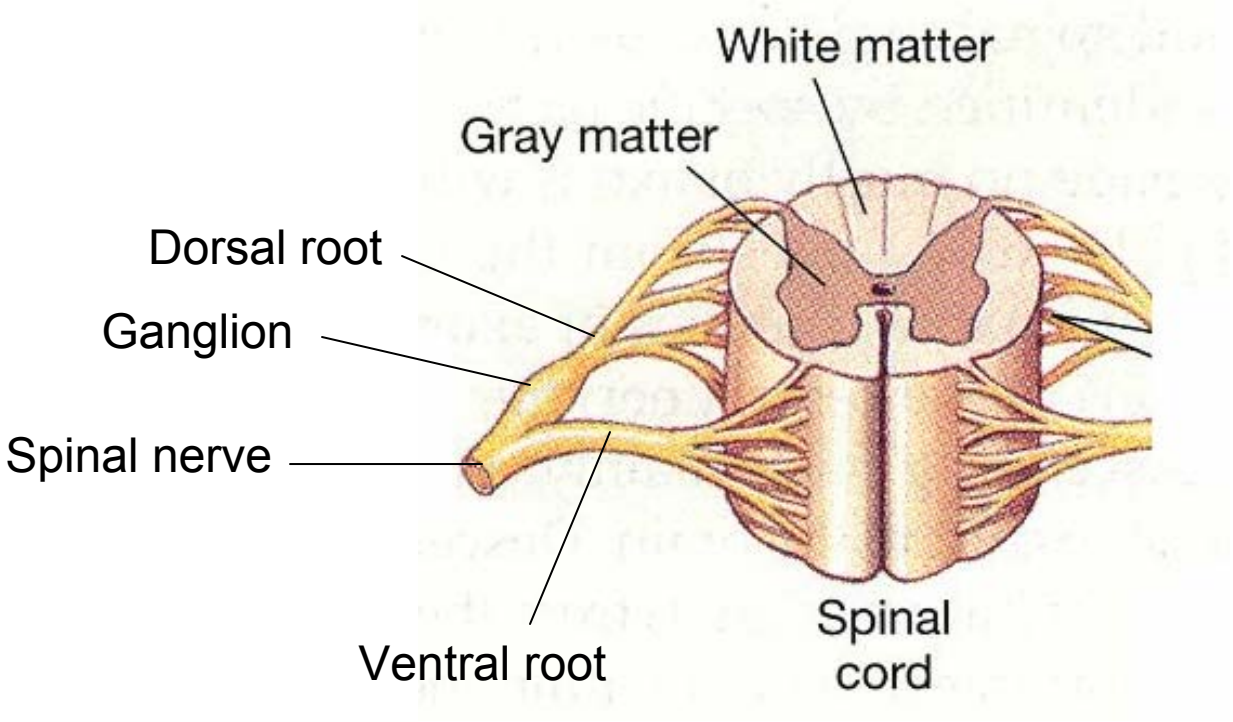
The **ventral root** of each spinal nerve carries information from the CNS to the muscles and glands.



Spinal Cord

The **dorsal root** of each spinal nerve is specialized to carry incoming sensory information.

The **dorsal root ganglia** contain cell bodies of sensory neurons.

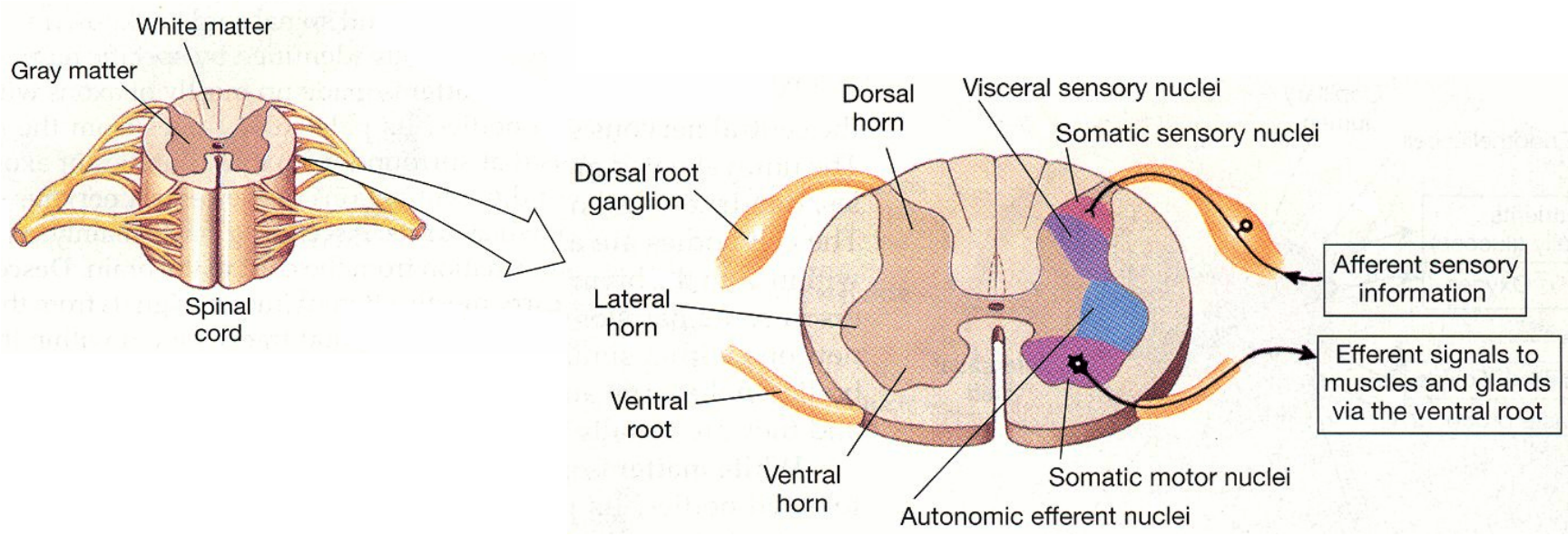


Spinal Cord

The **gray matter** contains the cell bodies of interneurons.

Cell bodies in the **dorsal horn** form two sensory nuclei receiving somatic and visceral information.

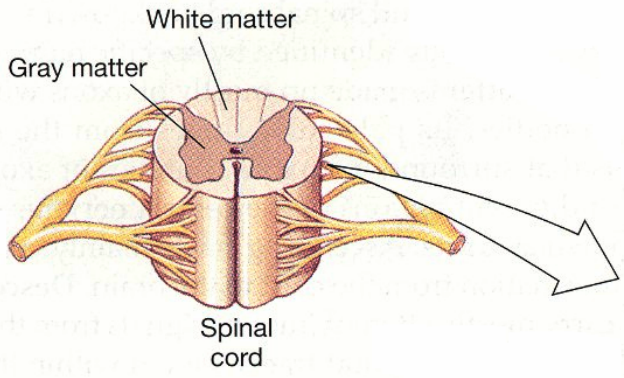
Cell bodies in the **ventral horn** form two efferent nuclei sending somatic and autonomic information.

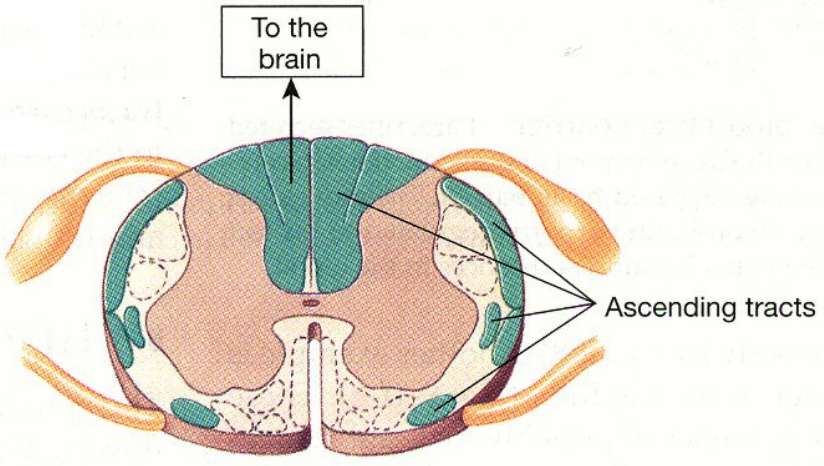


Spinal Cord

The **white matter** contains axons that transfer information up and down the spinal cord.

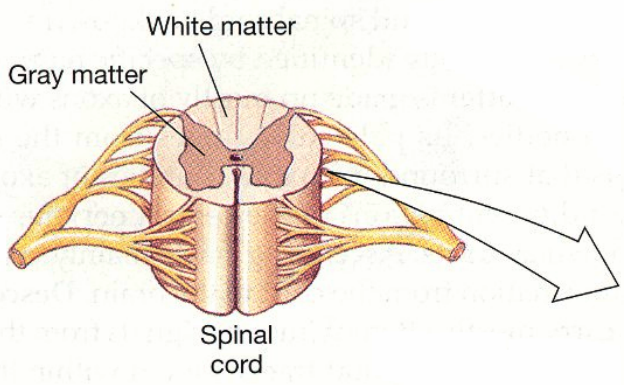
Ascending tracts that take sensory information to the brain occupy the *dorsal* and *external lateral* portions of the cord, e.g., lateral spinothalamic tract.

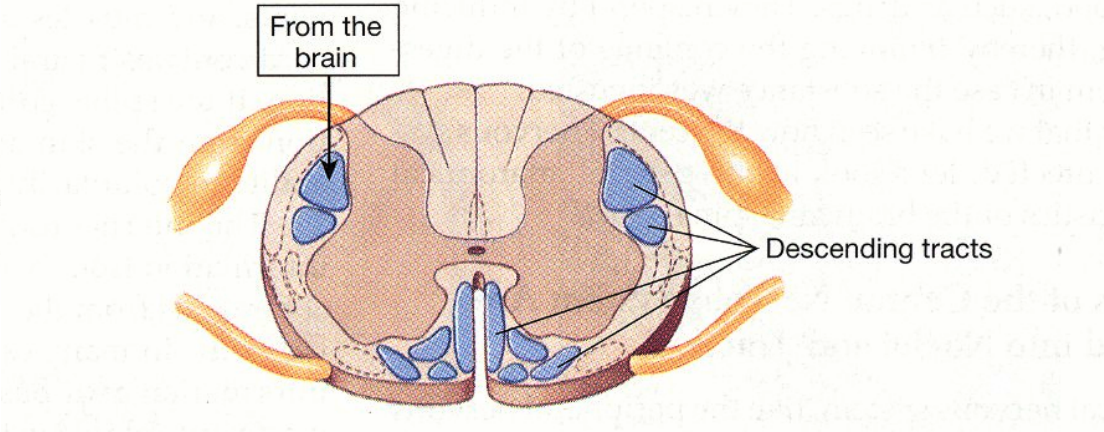




Spinal Cord

Descending tracts that carry commands to effector organs occupy the *ventral* and *internal lateral* portions of the cord, e.g., ventral corticospinal tract.





Somatic Pathways

Midline

Sensory Cortex

Thalamus

Medulla

Lateral spinothalamic tract

Dorsal column

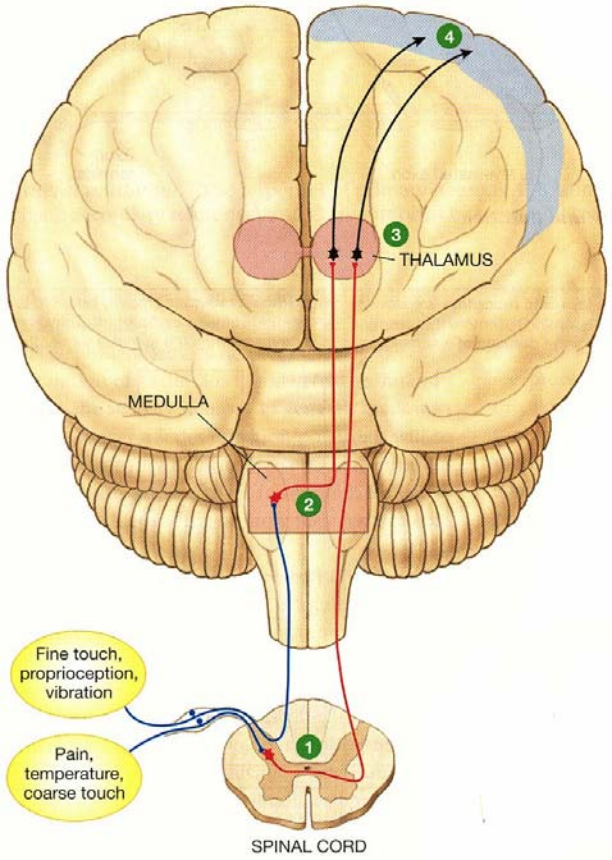
Ventral spinothalamic tract

Spinal Cord

fine touch, pressure

coarse touch

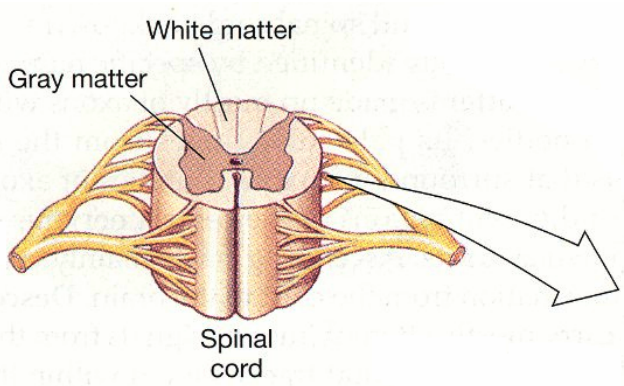
pain, temperature

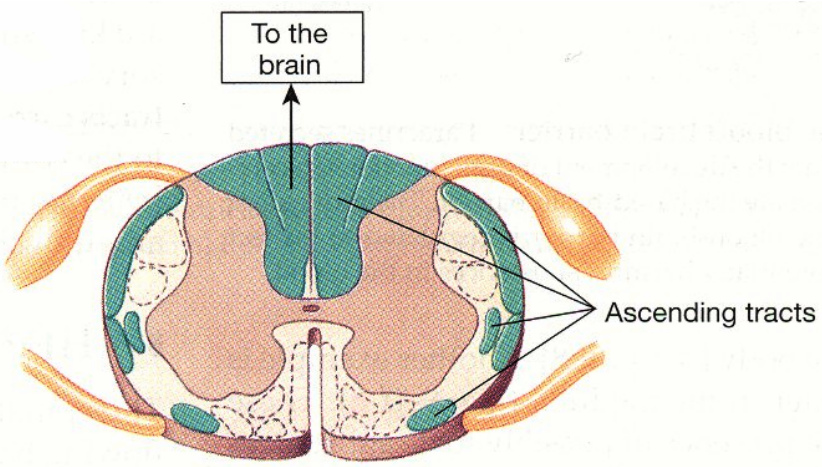


Somatic Pathways

Dorsal column consists of large myelinated axons that carry fine touch information. They cross over at the medulla.

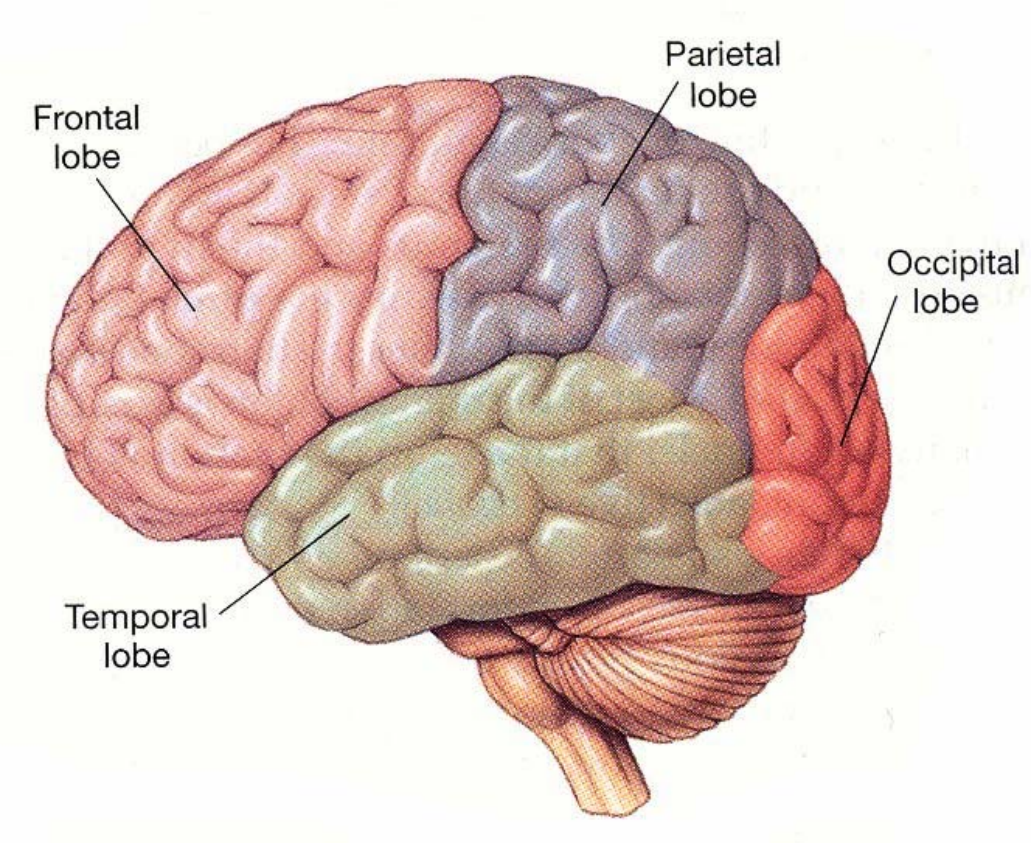
Spinothalamic tracts consist of small unmyelinated axons that carry pain, temperature, and coarse touch.
They cross over at the level of the spine.





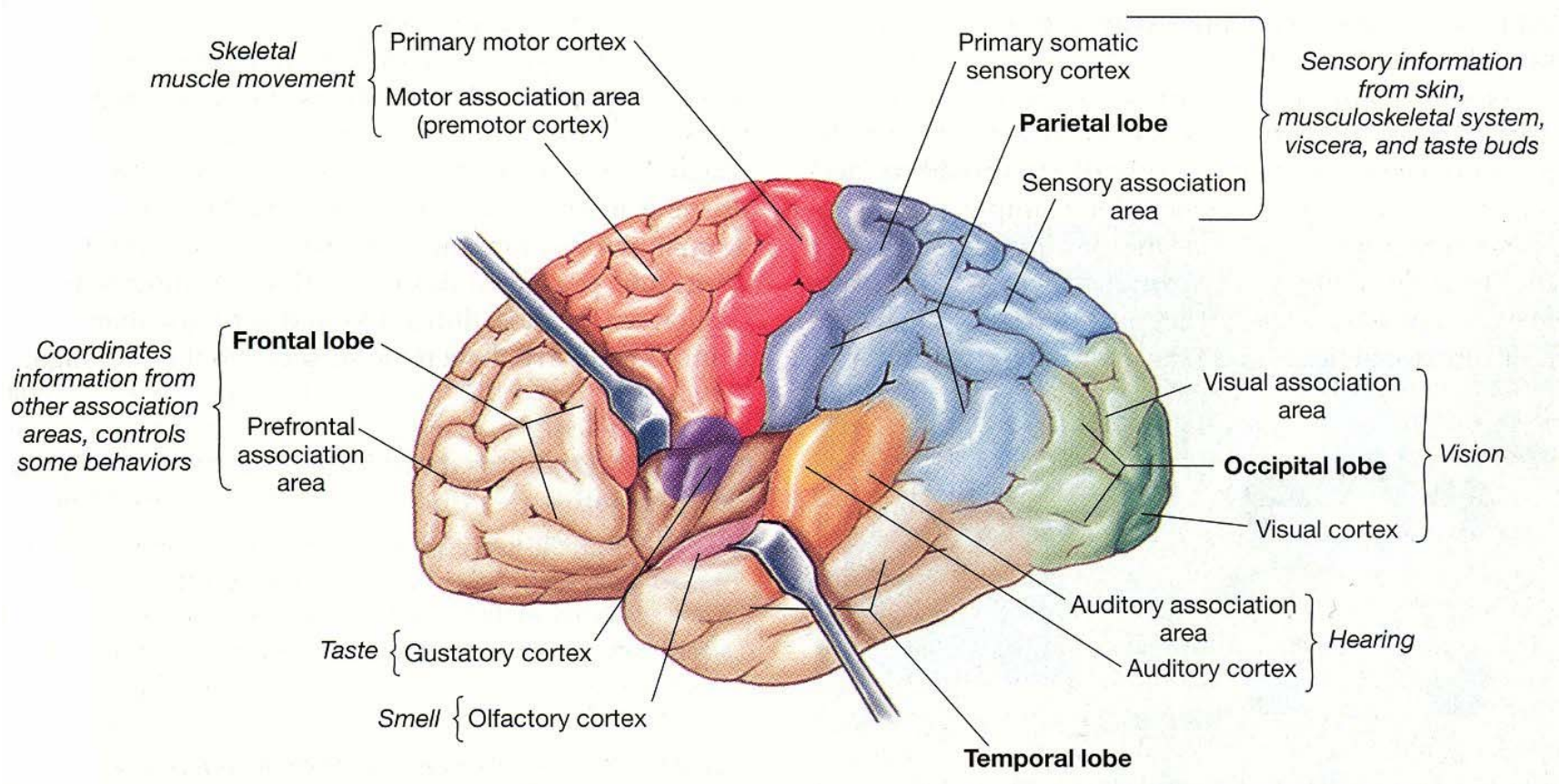
Cerebral Cortex

Cerebral cortex contains **four lobes** linked to distinct functions.



Cerebral Cortex

Somatic senses are processed in the primary somatic sensory cortex (**parietal lobe**).

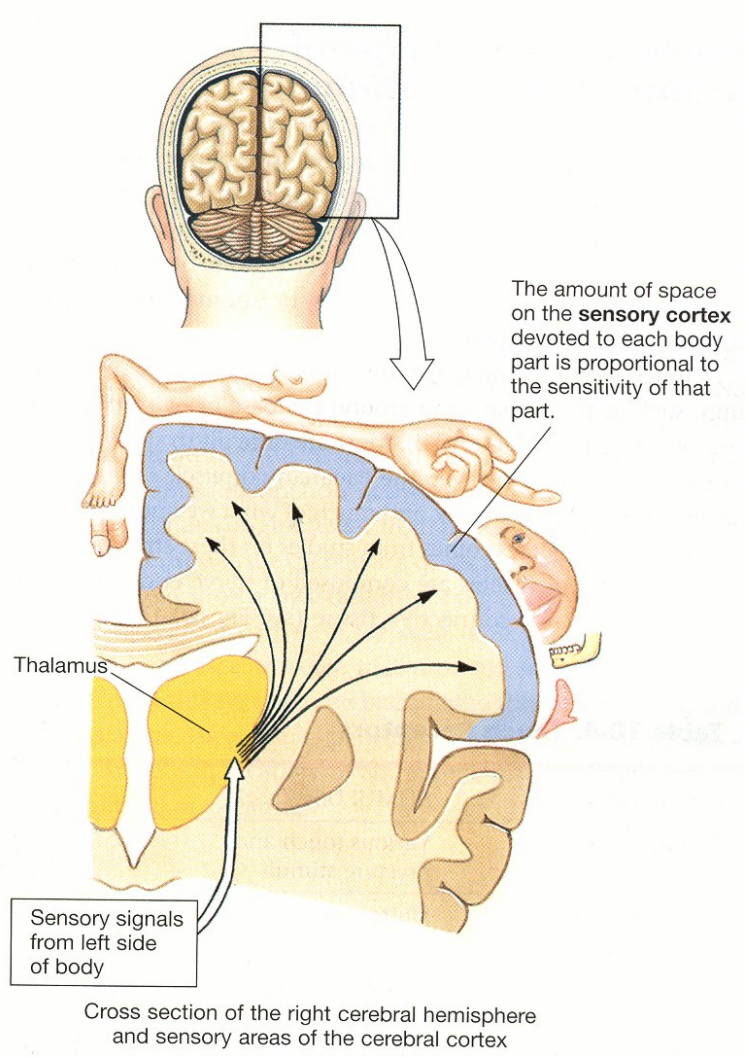


Somatosensory Cortex

Sensory receptive fields are orderly organized in somatosensory cortex to form a map of the body: **the Homunculus**

Density of sensory receptive fields dictates in which proportions the body parts are represented

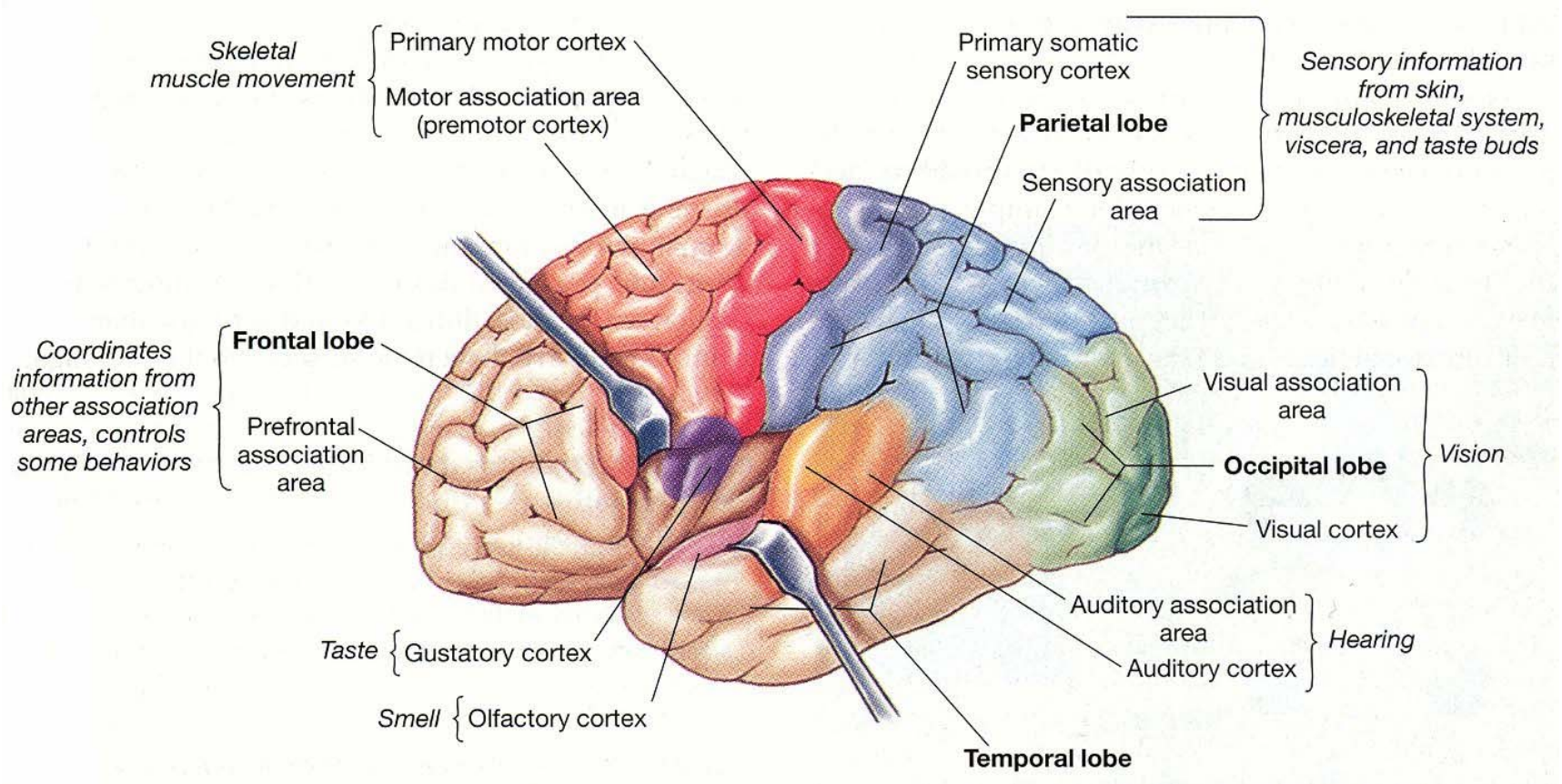
Boundaries of this map are not fixed; **plastic** changes occur.



Cross section of the right cerebral hemisphere and sensory areas of the cerebral cortex

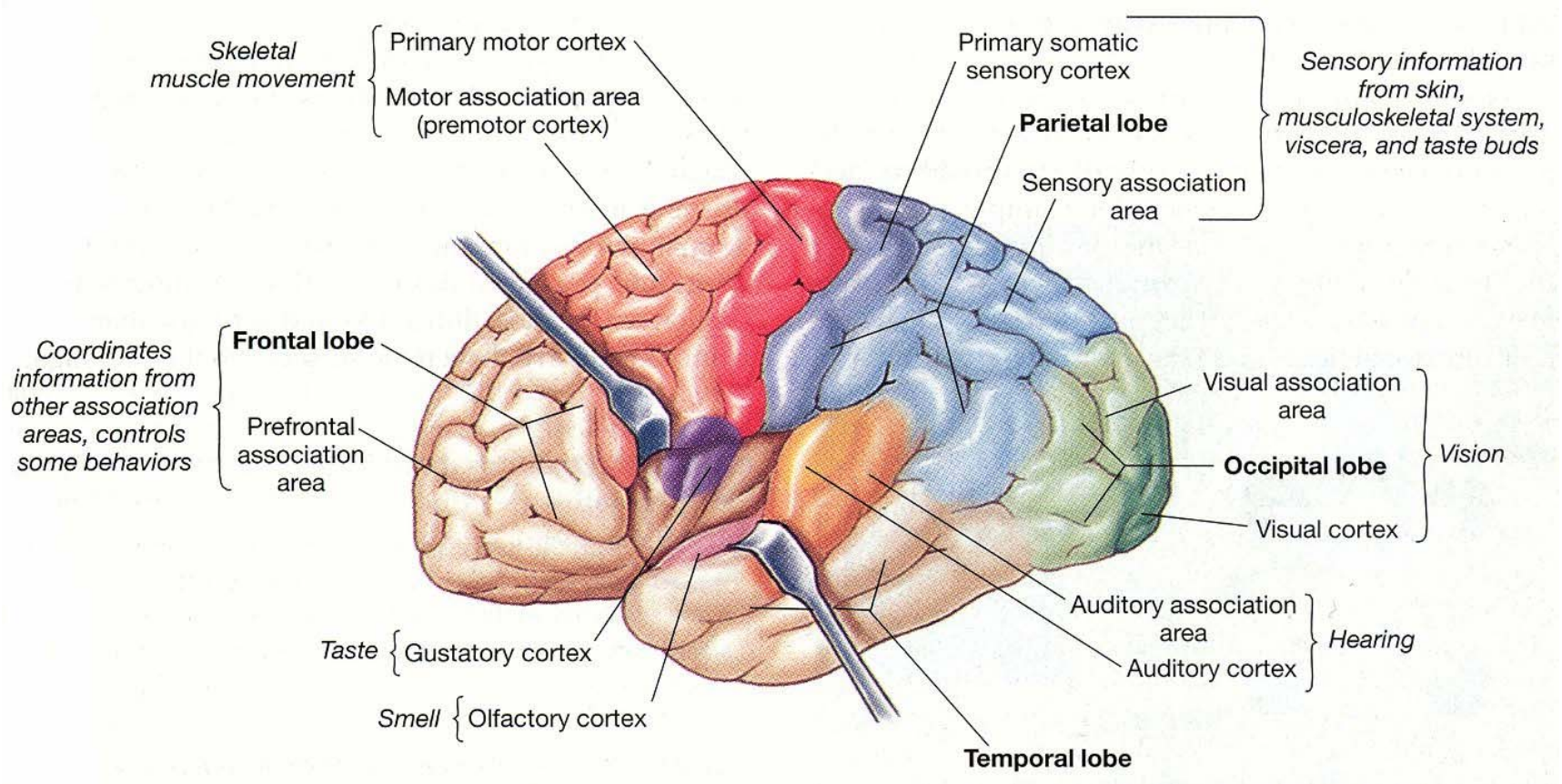
Cerebral Cortex

Taste is processed in the gustatory cortex (**parietal lobe**).



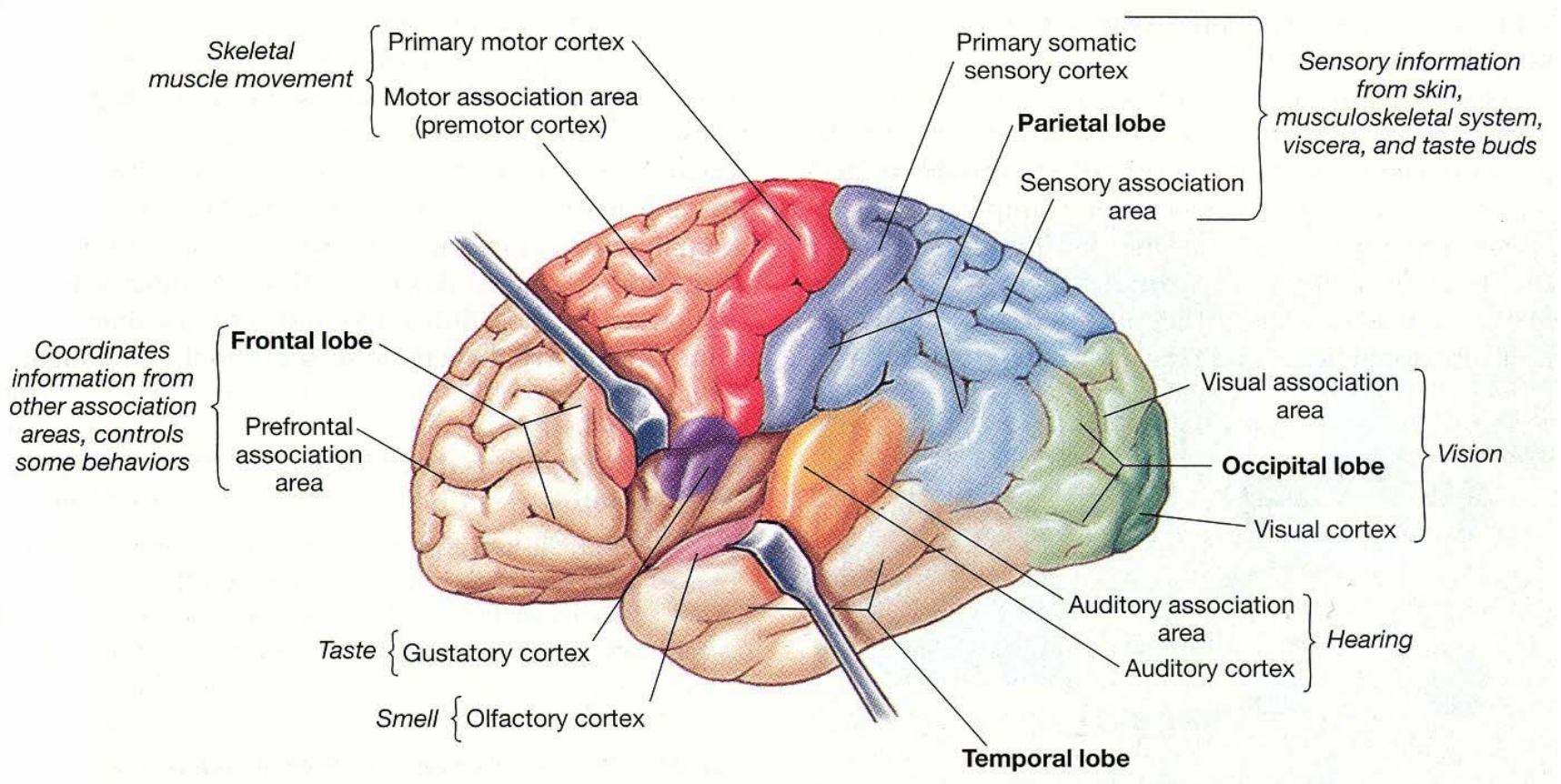
Cerebral Cortex

Hearing is processed in the auditory cortex (**temporal lobe**).



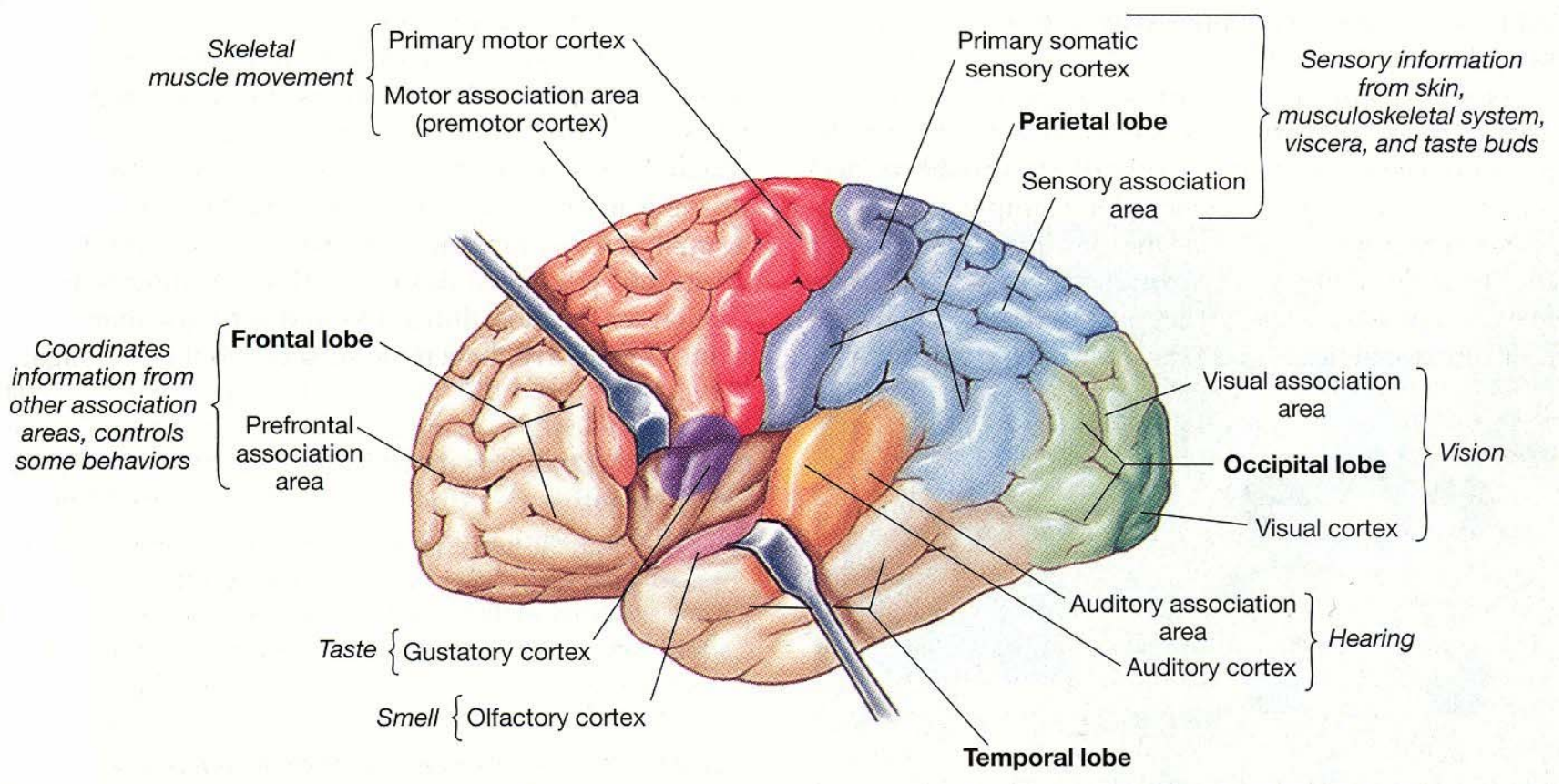
Cerebral Cortex

Smell is processed in the olfactory cortex (**temporal lobe**).



Cerebral Cortex

Vision is processed in the visual cortex (**occipital lobe**).

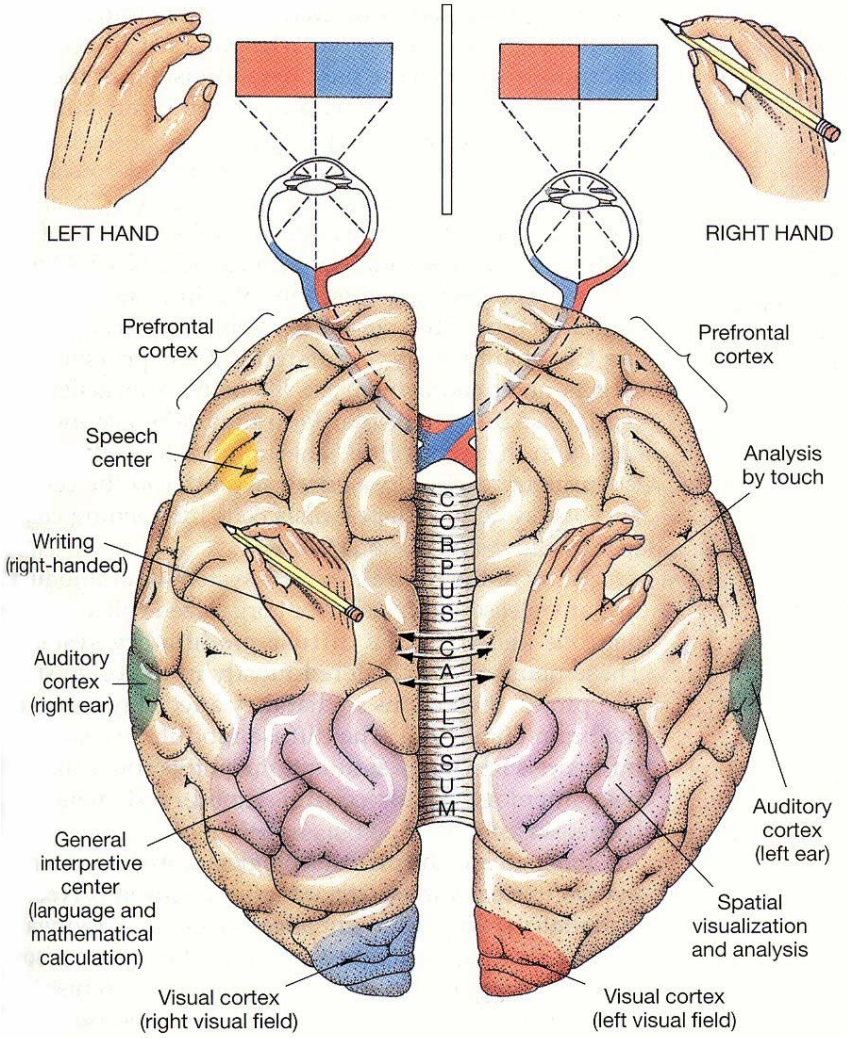


Cerebral Lateralization

The functional areas in the two hemispheres are not symmetrical.

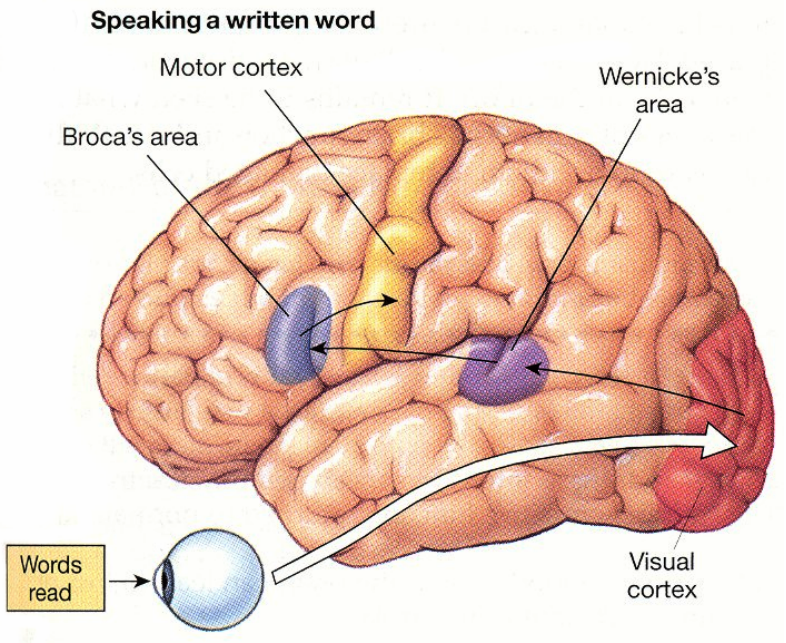
Spatial and musical skills are concentrated on the right.

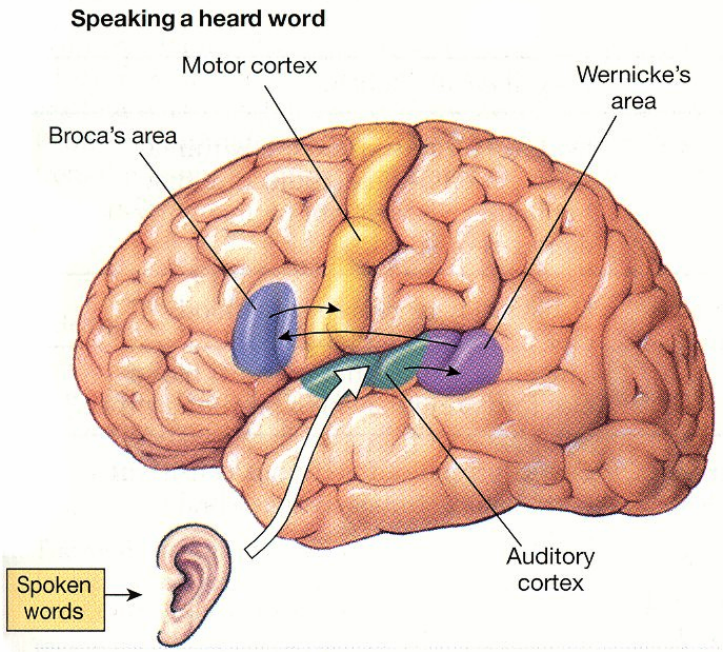
Language and verbal skills are concentrated on the left.



Language

Spoken and written language are processed through their respective sensory areas. The information is passed to **Wernicke's** area, where it is interpreted, then to **Broca's** area for the coordination of speech and writing.

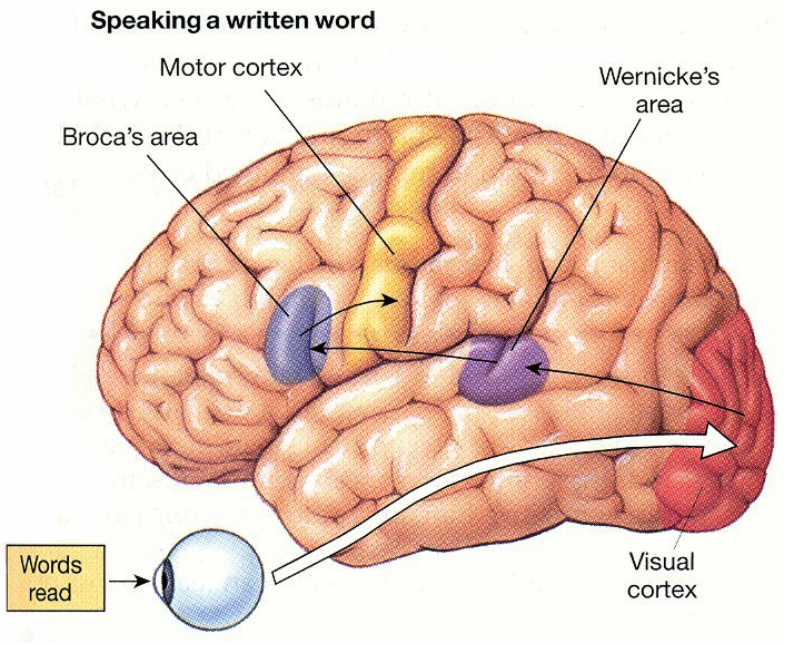


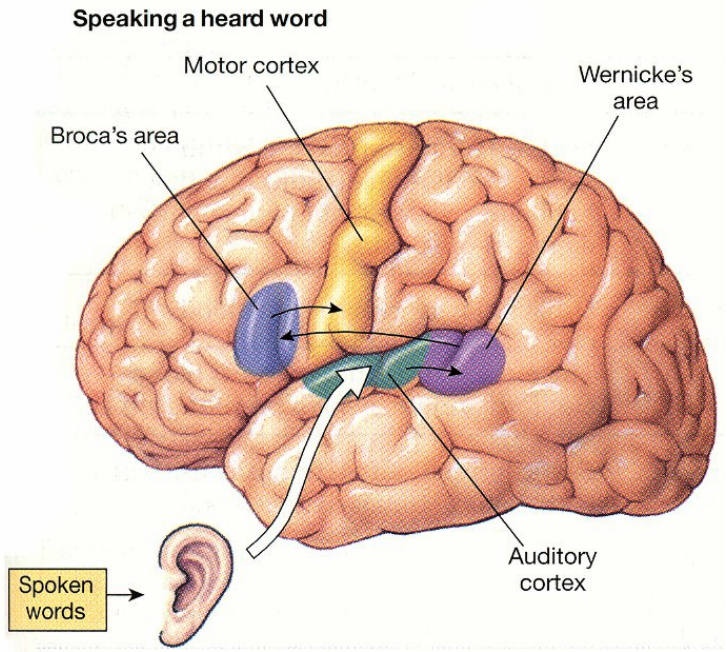


Language

Damage to **Wernicke's** area disrupts language comprehension (*receptive aphasia*).

Damage to **Broca's** area disrupts language expression (*expressive aphasia*).





Reading

Silverthorn (2nd edition)

pages 289 - 290

pages 259 - 260 (*spinal cord*)

pages 265 - 266 (*cortex*)

pages 274 - 275 (*language*)

Silverthorn (1st ed)

pages 272

pages 242 - 243

pages 247 - 248

pages 257 - 258