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Somatosensory System

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A sensory system involved in the inter-related sensations of touch, body position, temperature, and pain, the somatosensory system is a diversified processing complex. It includes many sensory receptors located all over the skin, bones, joints, skeletal muscles, internal organs and the parts of the cardiovascular system.

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Structure

The somatosensory system is comprised of sensory (efferent) receptors and sensory (afferent) neurons that are distributed in the periphery up to the central nervous system. The sensory receptors are classified into four major types: chemoreceptors, thermoreceptors, nociceptors, and mechanoreceptors. When a physical stimulus, for example heat, triggers a sensory neuron (in this case, a thermoreceptor), the neuron creates nerve impulses via a process called transduction. Then sensory nerves carry the information from the receptors to the spinal cord and finally to the brain using spinal tracts. The primary somatosensory area of the brain initially processes the neural information. This is located in the parietal lobe of the cerebral cortex.

Pathway

Generally, a pathway of the somatosensory system includes three neurons – primary, secondary and tertiary neurons. The primary neuron's cell body is located in a spinal nerve's

dorsal root ganglion. The secondary neuron's cell body is positioned either in the brainstem or the spinal cord. The ascending axons of the secondary neuron are long enough to decussate or cross to the opposite side in either the brainstem or spinal cord. The axons of the tertiary neurons mostly terminate in the relay center of the brain, the thalamus. Other axons end in either the cerebellum or the reticular activating system, which is important in wakefulness and sleep.

Functions

The somatosensory system has interrelated functions in three different areas of the human body: the periphery, the spinal cord, and the brain. In the periphery level, this body system includes sensory receptors that detect various physical stimuli. These receptors include nociceptors (pain), mechanoreceptors (tactile sensation), thermoreceptors (temperature), and others.

In the spinal cord, the somatosensory system ^[1] is comprised of ascending pathways that serve as highways of information from the periphery and the rest of the body to the brain. The ascending pathways called ventral spinothalamic pathway and the dorsal column medial lemniscal pathway of the system target the postcentral gyrus of the brain. The postcentral gyrus is also called the primary sensory area as it receives most skin sensations. Other ascending pathways such as the ventral and dorsal spinocerebellar tracts target the cerebellum of the brain where posture, balance, and movement sensations are usually processed.

In the brain, the postcentral gyrus contains the primary somatosensory cortex or SI. It has four regions referred to as Brodmann area 1, 2, 3a, and 3b. Tactile and other skin sensations are mainly received and processed in these areas.

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Links

[1] http://courses.washington.edu/psych333/handouts/coursepack/ch10-Somatosensory_system.pdf