

THE SOMATOSENSORY PATHWAYS

Somatosensory pathways consist of a chain of neurons, from a receptive organ to the cerebral cortex which are responsible for the perception of sensations. All somatosensory pathways include a thalamic nucleus. Somatosensory pathways start by specialized receptors in the periphery receiving information and transmitting this through a series of neurons and synaptic relays in the central nervous system. The two main sensory pathways are the dorsal column pathway which conveys information regarding fine touch, vibration, proprioception, and two-point discrimination and the spinothalamic or anterolateral pathway which conveys information on crude touch, pain, and temperature. The somatosensory system consists of the two main paired pathways that take somatosensory information up to the brain: the medial lemniscal or posterior pathway, and the spinothalamic or anterolateral pathway.

The somatosensory pathways are made up of a relay of three neurons.

The first neuron is called the first order neuron or sensory neuron, which has the sensory receptors and converts stimuli from the outside world into an impulse that can be passed through a synapse to the next neuron in series. The cell body of the first order neuron is housed in the dorsal root ganglion of a spinal nerve, or the ganglia of the trigeminal or cranial nerves if sensation is in the head or neck.

Next is the second order neuron, and it may have its cell body in the spinal cord or up in the brainstem. This neuron's ascending axons will cross, or decussate to the opposite side of the spinal cord or brain stem and travel up the spinal cord to the brain, where most will terminate in either the thalamus or the cerebellum.

The second order neuron then takes the impulse to the third order neuron, which has its cell body in the thalamus.

The third order neurons project to the postcentral gyrus of the parietal lobe, forming a sensory homunculus in the case of touch. In regards to posture, the third order neuron is found in the cerebellum.

The sensory information processed by the somatosensory systems travels along different anatomical pathways depending on the information carried. For example, the posterior column-medial lemniscal pathway carries discriminative touch and proprioceptive information from the body, and the main sensory trigeminal pathway carries this information from the face. Whereas, the spinothalamic pathways carry crude touch, pain and temperature information from the body, and the spinal trigeminal pathway carries this information from the face. The posterior (dorsal) column - medial lemniscal pathway, carries and processes discriminative touch and proprioceptive information from the body. It is important to keep in mind that within the medial lemniscal pathway, the afferents carrying discriminative touch information are kept separate from those carrying proprioceptive information up to the level of the cerebral cortex.