Discuss the somatosensory pathways

The somatosensory pathways

The somatosensory system is a part of the sensory nervous system. The somatosensory system is the part of the sensory system concerned with the conscious perception of touch, pressure, pain, temperature, position, movement, and vibration, which arise from the muscles, joints, skin, and fascia.

The somatosensory system is a 3-neuron system that relays sensations detected in the periphery and conveys them via pathways through the spinal cord, brainstem, and thalamic relay nuclei to the sensory cortex in the parietal lobe The somatosensory system is a complex system of sensory neurons and neural pathways that responds to changes at the surface or inside the body. The axons (as afferent nerve fibers) of sensory neurons connect with, or respond to, various receptor cells. These sensory receptor cells are activated by different stimuli such as heat and nociception, giving a functional name to the responding sensory neuron, such as a thermoreceptor which carries information about temperature changes. Other types include mechanoreceptors, chemoreceptors, and nociceptors which send signals along a sensory nerve to the spinal cord where they may be processed by other sensory neurons and then relayed to the brain for further processing. Sensory receptors are found all over the body including the skin, epithelial tissues, muscles, bones and joints, internal organs, and the cardiovascular system.

General Sematosensory Pathways

All afferent touch/vibration info ascends the spinal cord via the posterior (dorsal) column-medial lemniscus pathway via gracilis (T7 and below) or cuneatus (T6 and above). Cuneatus sends signals to the cochlear nucleus indirectly via spinal grey matter, this info is used in determining if a perceived sound is just villi noise/irritation. All fibers cross (left becomes right) in the medulla.

A somatosensory pathway will typically have three neurons: first-order, second-order, and third-order.

The first-order neuron is a type of pseudounipolar neuron and always has its cell body in the dorsal root ganglion of the spinal nerve with a peripheral axon innervating touch mechanoreceptors and a central axon synapsing on the second-order neuron. If the somatosensory pathway is in parts of the head or neck not covered by the cervical nerves, the first-order neuron will be the trigeminal nerve ganglia or the ganglia of other sensory cranial nerves).

The second-order neuron has its cell body either in the spinal cord or in the brainstem. This neuron's ascending axons will cross (decussate) to the opposite side either in the spinal cord or in the brainstem.

In the case of touch and certain types of pain, the third-order neuron has its cell body in the ventral posterior nucleus of the thalamus and ends in the postcentral gyrus of the parietal lobe in the primary somatosensory cortex (or S1).

Touch can result in many different physiological reactions. Here, a baby laughs at being tickled by an older sister.

Photoreceptors, similar to those found in the retina of the eye, detect potentially damaging ultraviolet radiation (ultraviolet A specifically), inducing increased production of melanin by melanocytes.[14] Thus tanning potentially offers the skin rapid protection from DNA damage and sunburn caused by ultraviolet radiation (DNA damage caused by ultraviolet B). However, whether this offers protection is debatable, because the amount of melanin released by this process is modest in comparison to the amounts released in response to DNA damage caused by ultraviolet B radiation.

In the periphery, the somatosensory system detects various stimuli by sensory receptors, such as by mechanoreceptors for tactile sensation and nociceptors for pain sensation. The sensory information (touch, pain, temperature, etc.,) is then conveyed to the central nervous system by afferent neurons, of which there are a number of different types with varying size, structure, and properties.

Generally, there is a correlation between the type of sensory modality detected and the type of afferent neuron involved. For example, slow, thin, unmyelinated neurons conduct pain whereas faster, thicker, myelinated neurons conduct casual touch.

Ascending Pathways

In the spinal cord, the somatosensory system includes ascending pathways from the body to the brain. One major target within the brain is the postcentral gyrus in the cerebral cortex. This is the target for neurons of the dorsal column–medial lemniscal pathway and the ventral spinothalamic pathway.

Note that many ascending somatosensory pathways include synapses in either the thalamus or the reticular formation before they reach the cortex. Other ascending pathways, particularly those involved with control of posture, are projected to the cerebellum, including the ventral and dorsal spinocerebellar tracts.

Another important target for afferent somatosensory neurons that enter the spinal cord are those neurons involved with local segmental reflexes.

Difference between sensory systems and somatosensory systems

The somatosensory system is the part of the sensory system concerned with the conscious perception of touch, pressure, pain, temperature, position, movement and vibration which arise from the muscles, joints, skin and fascia. The somatosensory system relays sensations detected in the periphery (such as from Golgi tendon organs, Pacinian corpuscles, Ruffini endings etc.) and conveys them via pathways through the spinal cord, brainstem, and thalamic relay nuclei to the sensory cortex in the parietal lobe.

Broadly speaking sensory selection refers to the activation of either of the 5 traditional senses of sight/vision, hearing, taste, smell or touch while the Somatosensory system is also often referred to as extrasensory.