18/mhs07/018

Phs 212 Assignment

June 20, 2020

Discuss the somatosensory pathways.

The **somatosensory system** is a part of the [sensory nervous system](/wiki/Sensory_nervous_system%22%20%5Co%20%22Sensory%20nervous%20system). The somatosensory system is a complex system of [sensory neurons](/wiki/Sensory_neuron%22%20%5Co%20%22Sensory%20neuron) and [neural pathways](/wiki/Neural_pathway%22%20%5Co%20%22Neural%20pathway) that responds to changes at the surface or inside the body. The [axons](/wiki/Axon%22%20%5Co%20%22Axon) (as [afferent nerve fibers](/wiki/Afferent_nerve_fiber%22%20%5Co%20%22Afferent%20nerve%20fiber)) 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](/wiki/Nociception%22%20%5Co%20%22Nociception), giving a functional name to the responding sensory neuron, such as a [thermoreceptor](/wiki/Thermoreceptor%22%20%5Co%20%22Thermoreceptor) which carries information about temperature changes. Other types include [mechanoreceptors](/wiki/Mechanoreceptor%22%20%5Co%20%22Mechanoreceptor), [chemoreceptors](/wiki/Chemoreceptor%22%20%5Co%20%22Chemoreceptor), and [nociceptors](/wiki/Nociceptor%22%20%5Co%20%22Nociceptor) which send signals along a [sensory nerve](/wiki/Sensory_nerve%22%20%5Co%20%22Sensory%20nerve) to the [spinal cord](/wiki/Spinal_cord%22%20%5Co%20%22Spinal%20cord) where they may be processed by other sensory neurons and then relayed to the [brain](/wiki/Brain%22%20%5Co%20%22Brain) for further processing. Sensory receptors are found all over the body including the [skin](/wiki/Skin%22%20%5Co%20%22Skin), [epithelial tissues](/wiki/Epithelium%22%20%5Co%20%22Epithelium), [muscles](/wiki/Skeletal_muscle%22%20%5Co%20%22Skeletal%20muscle), [bones](/wiki/Bone%22%20%5Co%20%22Bone) and [joints](/wiki/Joint%22%20%5Co%20%22Joint), internal [organs](/wiki/Organ_%28anatomy%29%22%20%5Co%20%22Organ%20%28anatomy%29), and the [cardiovascular system](/wiki/Cardiovascular_system%22%20%5Co%20%22Cardiovascular%20system).

The **somatosensory system** is a part of the [sensory nervous system](/wiki/Sensory_nervous_system%22%20%5Co%20%22Sensory%20nervous%20system). The somatosensory system is a complex system of [sensory neurons](/wiki/Sensory_neuron%22%20%5Co%20%22Sensory%20neuron) and [neural pathways](/wiki/Neural_pathway%22%20%5Co%20%22Neural%20pathway) that responds to changes at the surface or inside the body. The [axons](/wiki/Axon%22%20%5Co%20%22Axon) (as [afferent nerve fibers](/wiki/Afferent_nerve_fiber%22%20%5Co%20%22Afferent%20nerve%20fiber)) 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](/wiki/Nociception%22%20%5Co%20%22Nociception), giving a functional name to the responding sensory neuron, such as a [thermoreceptor](/wiki/Thermoreceptor%22%20%5Co%20%22Thermoreceptor) which carries information about temperature changes. Other types include [mechanoreceptors](/wiki/Mechanoreceptor%22%20%5Co%20%22Mechanoreceptor), [chemoreceptors](/wiki/Chemoreceptor%22%20%5Co%20%22Chemoreceptor), and [nociceptors](/wiki/Nociceptor%22%20%5Co%20%22Nociceptor) which send signals along a [sensory nerve](/wiki/Sensory_nerve%22%20%5Co%20%22Sensory%20nerve) to the [spinal cord](/wiki/Spinal_cord%22%20%5Co%20%22Spinal%20cord) where they may be processed by other sensory neurons and then relayed to the [brain](/wiki/Brain%22%20%5Co%20%22Brain) for further processing. Sensory receptors are found all over the body including the [skin](/wiki/Skin%22%20%5Co%20%22Skin), [epithelial tissues](/wiki/Epithelium%22%20%5Co%20%22Epithelium), [muscles](/wiki/Skeletal_muscle%22%20%5Co%20%22Skeletal%20muscle), [bones](/wiki/Bone%22%20%5Co%20%22Bone) and [joints](/wiki/Joint%22%20%5Co%20%22Joint), internal [organs](/wiki/Organ_%28anatomy%29%22%20%5Co%20%22Organ%20%28anatomy%29), and the [cardiovascular system](/wiki/Cardiovascular_system%22%20%5Co%20%22Cardiovascular%20system).

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.

1. The **first-order neuron** is a type of [pseudounipolar neuron](/wiki/Pseudounipolar_neuron%22%20%5Co%20%22Pseudounipolar%20neuron) and always has its [cell body](/wiki/Cell_body%22%20%5Co%20%22Cell%20body) in the [dorsal root ganglion](/wiki/Dorsal_root_ganglion%22%20%5Co%20%22Dorsal%20root%20ganglion) of the [spinal nerve](/wiki/Spinal_nerve%22%20%5Co%20%22Spinal%20nerve) with a peripheral [axon](/wiki/Axon%22%20%5Co%20%22Axon)innervating touch [mechanoreceptors](/wiki/Mechanoreceptor%22%20%5Co%20%22Mechanoreceptor) 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](/wiki/Trigeminal_ganglion%22%20%5Co%20%22Trigeminal%20ganglion) or the ganglia of other sensory [cranial nerves](/wiki/Cranial_nerves%22%20%5Co%20%22Cranial%20nerves)).
2. The **second-order neuron** has its [cell body](/wiki/Cell_body%22%20%5Co%20%22Cell%20body) either in the spinal cord or in the brainstem. This neuron's ascending [axons](/wiki/Axons%22%20%5Co%20%22Axons)will cross ([decussate](/wiki/Decussate%22%20%5Co%20%22Decussate)) to the opposite side either in the [spinal cord](/wiki/Spinal_cord%22%20%5Co%20%22Spinal%20cord) or in the [brainstem](/wiki/Brainstem%22%20%5Co%20%22Brainstem).
3. In the case of touch and certain types of pain, the **third-order neuron** has its [cell body](/wiki/Cell_body%22%20%5Co%20%22Cell%20body) in the [ventral posterior nucleus](/wiki/Ventral_posterior_nucleus%22%20%5Co%20%22Ventral%20posterior%20nucleus) of the thalamus and ends in the [postcentral gyrus](/wiki/Postcentral_gyrus%22%20%5Co%20%22Postcentral%20gyrus) of the [parietal lobe](/wiki/Parietal_lobe%22%20%5Co%20%22Parietal%20lobe) in the [primary somatosensory cortex](/wiki/Primary_somatosensory_cortex%22%20%5Co%20%22Primary%20somatosensory%20cortex) (or S1).

Photoreceptors, similar to those found in the [retina](/wiki/Retina%22%20%5Co%20%22Retina) of the [eye](/wiki/Eye%22%20%5Co%20%22Eye), detect potentially damaging [ultraviolet radiation](/wiki/Ultraviolet_radiation%22%20%5Co%20%22Ultraviolet%20radiation) ([ultraviolet A](/wiki/Ultraviolet_A%22%20%5Co%20%22Ultraviolet%20A) specifically), inducing increased production of [melanin](/wiki/Melanin%22%20%5Co%20%22Melanin) by [melanocytes](/wiki/Melanocytes%22%20%5Co%20%22Melanocytes). Thus tanning potentially offers the skin rapid protection from DNA damage and sunburn caused by [ultraviolet radiation](/wiki/Ultraviolet_radiation%22%20%5Co%20%22Ultraviolet%20radiation) (DNA damage caused by [ultraviolet B](/wiki/Ultraviolet_B%22%20%5Co%20%22Ultraviolet%20B)). 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](/wiki/Ultraviolet_B%22%20%5Co%20%22Ultraviolet%20B) radiation.