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**SOMATOSENSORY PATHWAYS**

• FOR CONSCIOUS PERCEPTION:

1. Anterolateral system

2. Dorsal Column Medial Lemniscussystem

• FOR UNCONSCIOUS PERCEPTION:

1. Spinocerebellar

2. Spino-olivary

3. Spinotectal

4. Spinoreticular

The pathways have to cross over at some time because the cerebral cortex works on a contralateral basis. THE FIBERS OF THE SENSORY PATHWAYS SYNAPSE AND THEN CROSS (The crossing occurs at different levels for different pathways). DCML is a crossed sensory system, which conveys information for discriminative touch, proprioception and vibration sense from the body to the sensory cortex.

1. **The dorsal column–medial lemniscus pathway (DCML)** (also known as the posterior column-medial lemniscus pathway, PCML): This is a sensory pathway of the central nervous system that conveys sensations of fine touch, vibration, two-point discrimination, and proprioception (position) from the skin and joints. It transmits information from the body to the primary somatosensory cortex in the postcentral gyrus of the parietal lobe of the brain. The pathway receives information from sensory receptors throughout the body, and carries this in nerve tracts in the white matter of the dorsal columns of the spinal cord to the medulla, where it is continued in the medial lemniscus, on to the thalamus and relayed from there through the internal capsule and transmitted to the somatosensory cortex. The name dorsal-column medial lemniscus comes from the two structures that carry the sensory information: the dorsal columns of the spinal cord, and the medial lemniscus in the brainstem. There are three groupings of neurons that are involved in the pathway: first-order neurons, second-order neurons, and third-order neurons. The first-order neurons are sensory neurons located in the dorsal root ganglia, that send their afferent fibers through the two dorsal columns the gracile fasciculus, or gracile tract, and the cuneate fasciculus, or cuneate tract. The first-order axons make contact with second-order neurons of the dorsal column nuclei (the gracile nucleus and the cuneate nucleus) in the lower medulla. The second-order neurons send their axons to the thalamus. The third-order neurons are in the ventral nuclear group in the thalamus and fibres from these ascend to the postcentral gyrus. Sensory information from the upper half of the body is received at the cervical level of the spinal cord and carried in the cuneate tract, and information from the lower body is received at the lumbar level and carried in the gracile tract. The gracile tract is medial to the more lateral cuneate tract. The axons of second-order neurons of the gracile and cuneate nuclei are known as the internal arcuate fibers and when they cross over the midline, at the sensory decussation in the medulla, they form the medial lemniscus which connects with thalamus; the axons synapse on neurons in the ventral nuclear group which then send axons to the postcentral gyrus in the parietal lobe. All of the axons in the DCML pathway are rapidly conducting, large, myelinated fibers.

**2. ANTERIOLATERAL SYSTEM:** The anterolateral system refers to a set of neurons that send signals towards the brain. These neurons carry information regarding temperature and pain, but also crude touch. Activity at this pathway often has a salient motivational component, since painful stimuli or temperature information encourages an action - get away from the painful stimuli or the hot object. Additionally, the brain needs to learn to avoid these potentially damaging stimuli. The first order sensory neurons have their receptors in the skin, and the cell bodies in the dorsal root ganglion. These cells project into the spinal cord, where they can ascend or descend one or two segments via the posterolateral tract (also called Lissauer’s tract). Then, these neurons synapse onto the second order neurons in the substantia gelatinosa or the nucleus proprius. These cells send their axons across the midline to the other half of the spinal cord, which is the process of decussation. Then, these second order neurons ascend towards the brain, where they synapse onto the third order neurons in the rostral ventromedial medulla. This incoming pain and temperature information then gets passed to the thalamus before eventual processing in the cortex.

**FUNCTIONS:**

1. Pain- (Fast and Slow Pain) (Free nerve endings)

2. Temperature- (cold & warmth) (Free nerve endings and Krause’s End bulb)

3. Crude touch (Merkel’s discs)

4. Pressure (Pacinian Corpuscle)

5. Tickle & Itch (Free nerve endings)

**NEURONS:**

1. A-delta fibers

2. C unmyelinated fibers

**TRACTS:** There are 2 tracts in the Anterolateral System.

1. Anterior Spinothalamic Tract: carries fibers for crude touch, tickle, itch and pressure.

2. Lateral Spinothalamic Tract: carries fibers for pain and temperature. There is a double system of pain innervation in the Lateral Spinothalamic tract:

**1. NEOSPINOTHALAMIC PATHWAY:** For FAST pain carried by A-delta fibers

**2. PALEOSPINOTHALAMIC PATHWAY**: For Slow pain carried by C fibers. Because of this double system of pain innervation, a sudden painful stimulus often gives a "double" pain sensation: a fast-sharp (also called First pain) that is transmitted to the brain by the Aδfibers, followed a second or so later by a slow (Second pain) that is transmitted by the C fibers. Even though all pain receptors are free nerve endings, these endings use two separate pathways for transmitting pain signals into the central nervous system. The two pathways mainly correspond to the two types of pain-a fast-sharp pain pathway and a slow chronic pain pathway.