

Somatosensory system: deals with the perception of touch, pain, temperature, and proprioception (sense of one's position in the environment)

- **Proprioception system:** supplies the brain with information about of body position through receptors in muscles, joints, and organs of balance
- **Interoceptive system:** deals with general information about internal bodily conditions (ie. Blood pressure)
- **Exteroceptive system:** involves all external stimuli applied to skin
 - There are several different types of receptors located under the skin that respond to different types of external stimuli. Some adapt quickly, others adapt very slowly (not necessary to know which types are which):
 - **Free nerve endings:** activated in response to pain and temperature
 - *Slowly* adapting
 - **Pacinian Corpuscles:** respond to sudden skin displacement; *not constant* pressure
 - *Rapidly* adapting
 - **Merkel's disks:** respond to *gradual* skin indentation
 - *Slowly* adaption
 - **Ruffini's endings:** respond to *gradual* skin stretching
 - *Slowly* adapting
 - *Rapidly adapting* nerves fire action potentials at the *onset and offset* of a stimulus despite constant stimulation, while *slowly* adapting nerves fire *continuously* during constant stimulation
- **Somatosensory pathways:** Each pathway will ultimately project to the *contralateral* side of the brain; thus, an external stimulus on the right side of the body will be perceived on the right side of the brain
 1. **Dorsal-column medial lemniscus pathway:** carries info about touch and proprioception; axons travel up the dorsal column and cross over to the contralateral side at the medial lemniscus
 - A mechanoreceptor is activated in response to external stimuli and projects to the **dorsal root** and enters the spinal cord in the **dorsal horn**
 - This axon branches and ascends the spinal cord via the **dorsal column** (simply a series of ascending axons)
 - The same axon travels up to the **medulla** where it synapses onto **dorsal column nuclei**
 - These neurons project to the *contralateral side* and travel up through the **medial lemniscus** (another cluster of ascending axons) to synapse on the **ventral posterior nucleus** of the **thalamus**
 - From here, these neurons project to the primary somatosensory cortex (**SI**) *and* the secondary somatosensory cortex (**SII**)

2. **Anterolateral system:** carries info about pain and temperature; axons *immediately* project to the contralateral side as soon as sensory axons enter the dorsal horn of the spinal cord
- There are *three separate tracts* within the anterolateral system, named based on where they project:
 - **Spinothalamic:** carries information to the *ventral posterior nucleus* of the *thalamus* about pain, temperature, itch, and crude touch
 - Sensory axons enter the spinal cord via the dorsal horn and immediately cross to the contralateral side. From here, they travel *directly* to the thalamus to allow quick transmission. Thalamic axons then project to the primary and secondary somatosensory cortex
 - **Spinoreticular:** this tract is responsible for autonomic responses to painful stimuli, projects through to the *reticular formation*
 - Similar to the spinothalamic tract, this tract projects directly to the thalamus and later to the somatosensory cortex in the exact same manner. The only difference is that this tract synapses at the *parafascicular and intralaminar nuclei* of the thalamus
 - **Spinotectal:** synapses in the inferior and superior colliculi of the *tectum* and is responsible for mediating reflex postural movements of the head in response to visual and auditory stimuli
 - This is the only tract that does not go beyond to project to the thalamus and somatosensory cortex; it terminates in the tectum
 - The somatosensory cortexes have a somatotopic, columnar arrangement with neurons of similar receptive fields in similar body areas
 - The primary somatosensory cortex receives contralateral inputs, whereas the secondary somatosensory cortex can receive inputs from both sides
 - The homunculus is located on the primary cortex