NAME: OSAKUADE AANUOLUWAPO ADESOLA

MATRIC NO: 18/MHS02/168

DEPARTMENT: NURSING

COURSE: PHS 212

DISCUSS THE SOMATOSENSORY PATHWAYS

- The somatosensory system is composed of the neurons that make sensing touch, temperature, and position in space possible of three neurons: primary, secondary, and tertiary.
    - In the periphery, **the primary neuron** is a type of pseudo unipolar 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 secondary neuron** acts as a relay and is located in either the spinal cord or the brainstem. This neuron's ascending axons will cross, or decussate, to the opposite side of the spinal cord or brainstem and travel up the spinal cord to the brain, where most will terminate in either the thalamus or the cerebellum.
    - **Tertiary neurons** have cell bodies in the thalamus and project to the post central gyrus of the parietal lobe, forming a sensory homunculus in the case of touch. Regarding posture, the tertiary neuron is located in the cerebellum.

- **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 post central 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 spino cerebellar tracts.

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

➢ Parietal Love: Primary Somatosensory Area

The primary somatosensory area in the human cortex is located in the postcentral gyrus of the parietal lobe. This is the main sensory receptive area for the sense of touch.

Like other sensory areas, there is a map of sensory space called a homunculus at this location. Areas of this part of the human brain map to certain areas of the body, dependent on the amount or importance of somatosensory input from that area.

For example, there is a large area of cortex devoted to sensation in the hands, while the back has a much smaller area. Somatosensory information involved with proprioception and posture also target an entirely different part of the brain, the cerebellum.

➢ Cortical Homunculus

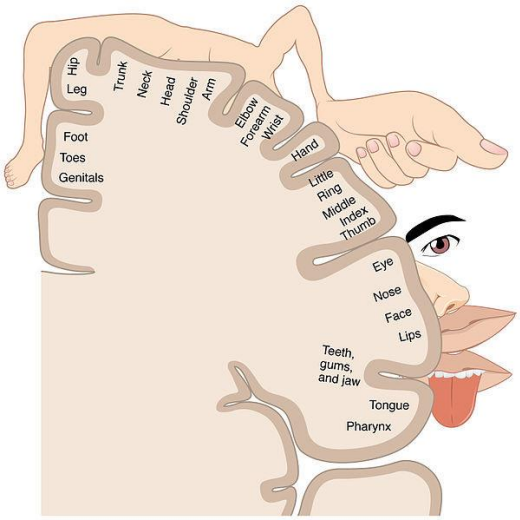
This is a pictorial representation of the anatomical divisions of the primary motor cortex and the primary somatosensory cortex; namely, the portion of the human brain directly responsible for the movement and exchange of sensory and motor information of the body. It is a visual representation of the concept of the body within the brain—that one's hand or face exists as much as a series of nerve structures or a neuron concept as it does in a physical form. There are two types of homunculus: sensory and motor. Each one shows a representation of how much of its respective cortex innervates certain body parts.

The primary somesthetic cortex (sensory) pertains to the signals within the postcentral gyrus coming from the thalamus, and the primary motor cortex pertains to signals within the precentral gyrus coming from the premotor area of the frontal lobes.

These are then transmitted from the gyri to the brain stem and spinal cord via corresponding sensory or motor nerves. The reason for the distorted appearance of

the homunculus is that the amount of cerebral tissue or cortex devoted to a given body region is proportional to how richly innervated that region is, not to its size.

The homunculus is like an upside-down sensory or motor map of the contralateral side of the body. The upper extremities such as the facial body parts and hands are closer to the lateral sulcus than lower extremities such as the leg and toes.



- **Thalamus**

The thalamus is a midline symmetrical structure within the brain of vertebrates including humans; it is situated between the cerebral cortex and midbrain, and surrounds the third ventricle.

Its function includes relaying sensory and motor signals to the cerebral cortex, along with the regulation of consciousness, sleep, and alertness.

Tactile feedback

The tactile feedback from proprioception is derived from the proprioceptors in the skin, muscles, and joints.

Balance

The receptor for the sense of balance resides in the vestibular system in the ear (for the three-dimensional orientation of the head, and by inference, the rest of the body). Balance is also mediated by the kinesthetic reflex fed by proprioception (which senses the relative location of the rest of the body to the head). In addition, proprioception estimates the location of objects which are

sensed by the visual system (which provides confirmation of the place of those objects relative to the body), as input to the mechanical reflexes of the body.

Fine touch and crude touch

Fine touch is a sensory modality that allows a subject to sense and localize touch. The form of touch where localization is not possible is known as crude touch. The posterior column–medial lemniscus pathway is the pathway responsible for the sending of fine touch information to the cerebral cortex of the brain.

Crude touch is a sensory modality that allows the subject to sense that something has touched them, without being able to localize where they were touched. Its fibers are carried in the spinothalamic tract, unlike the fine touch, which is carried in the dorsal column. As fine touch normally works in parallel to crude touch, a person will be able to localize touch until fibers carrying fine touch (Posterior column–medial lemniscus pathway) have been disrupted. Then the subject will feel the touch, but be unable to identify where they were touched.

Neural processing of social touch

The somatosensory cortex encodes incoming sensory information from receptors all over the body. Affective touch is a type of sensory information that elicits an emotional reaction and is usually social in nature, such as a physical human touch. This type of information is actually coded differently than other sensory information. Intensity of affective touch is still encoded in the primary somatosensory cortex and is processed in a similar way to emotions invoked by sight and sound, as exemplified by the increase of adrenaline caused by the social touch of a loved one, as opposed to the physical inability to touch someone you don't love.

Meanwhile, the feeling of pleasantness associated with affective touch activates the anterior cingulate cortex more than the primary somatosensory cortex. Functional magnetic resonance imaging (fMRI) data shows that increased blood-oxygen-level contrast (BOLD) signal in the anterior cingulate cortex as well as the prefrontal cortex is highly correlated with pleasantness scores of an affective touch. Inhibitory transcranial magnetic stimulation (TMS) of the primary somatosensory cortex inhibits the perception of affective touch intensity, but not affective touch pleasantness. Therefore, the S1 is not directly involved in processing socially affective touch pleasantness, but still plays a role in discriminating touch location and intensity.