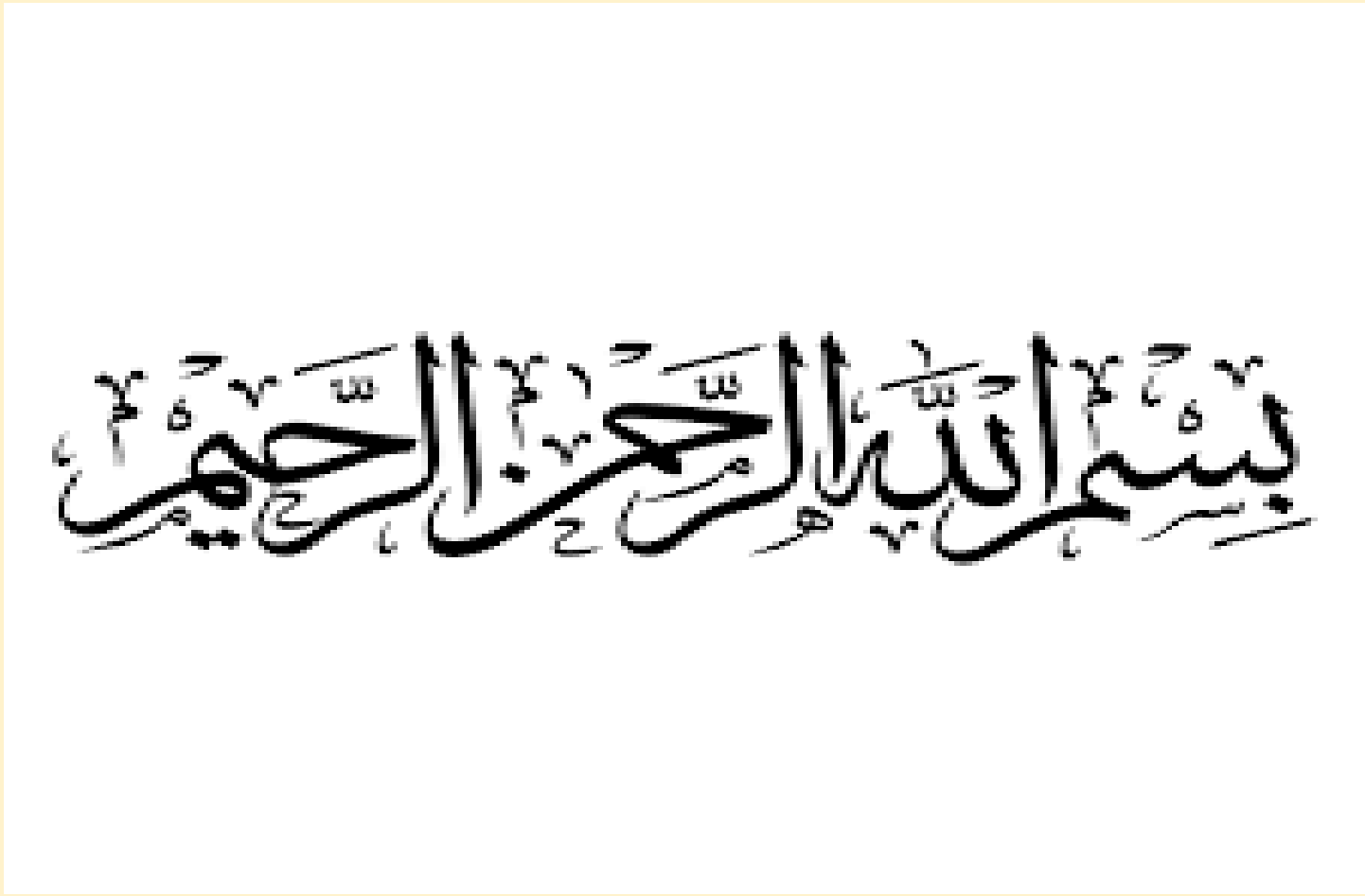
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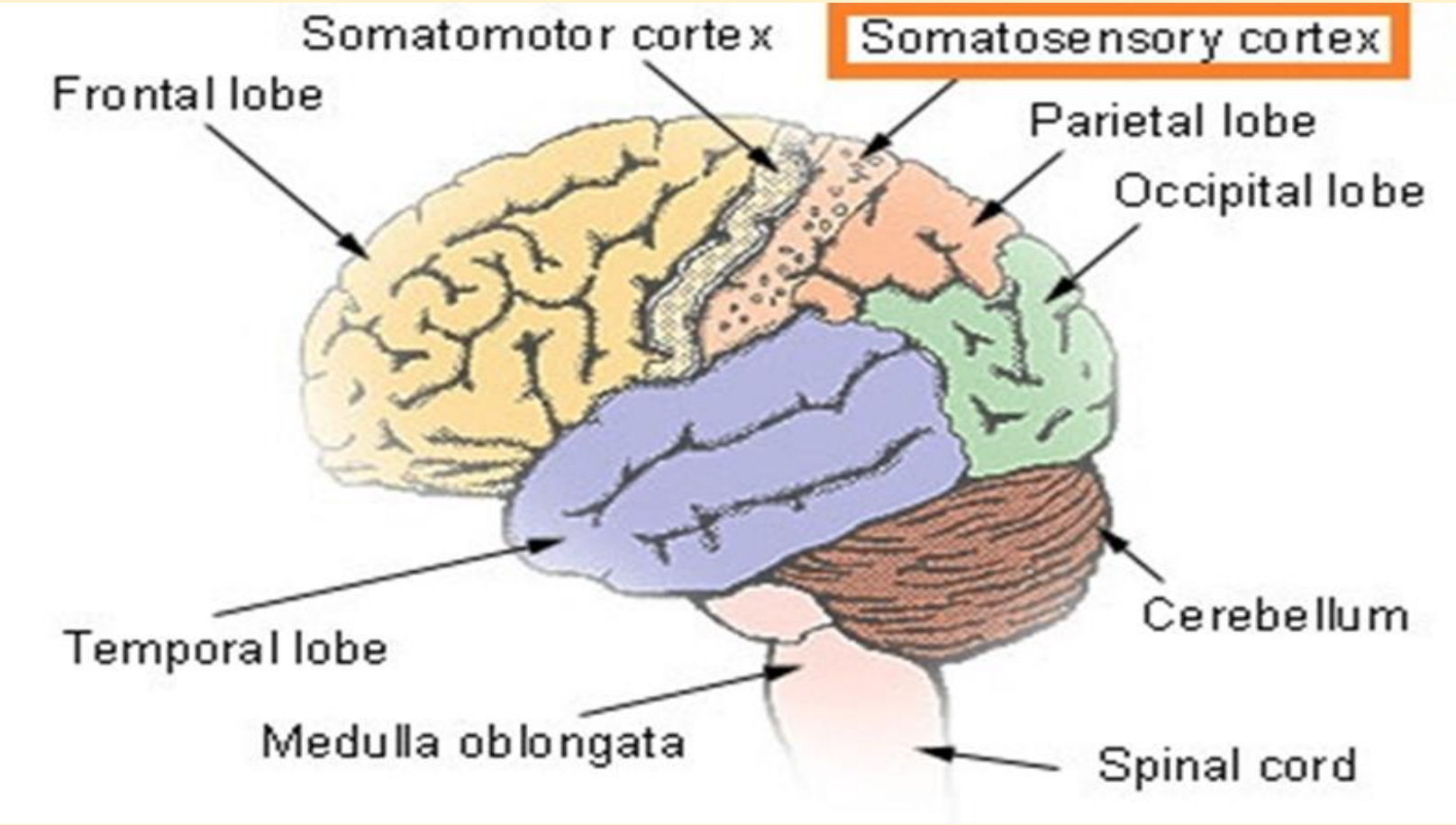
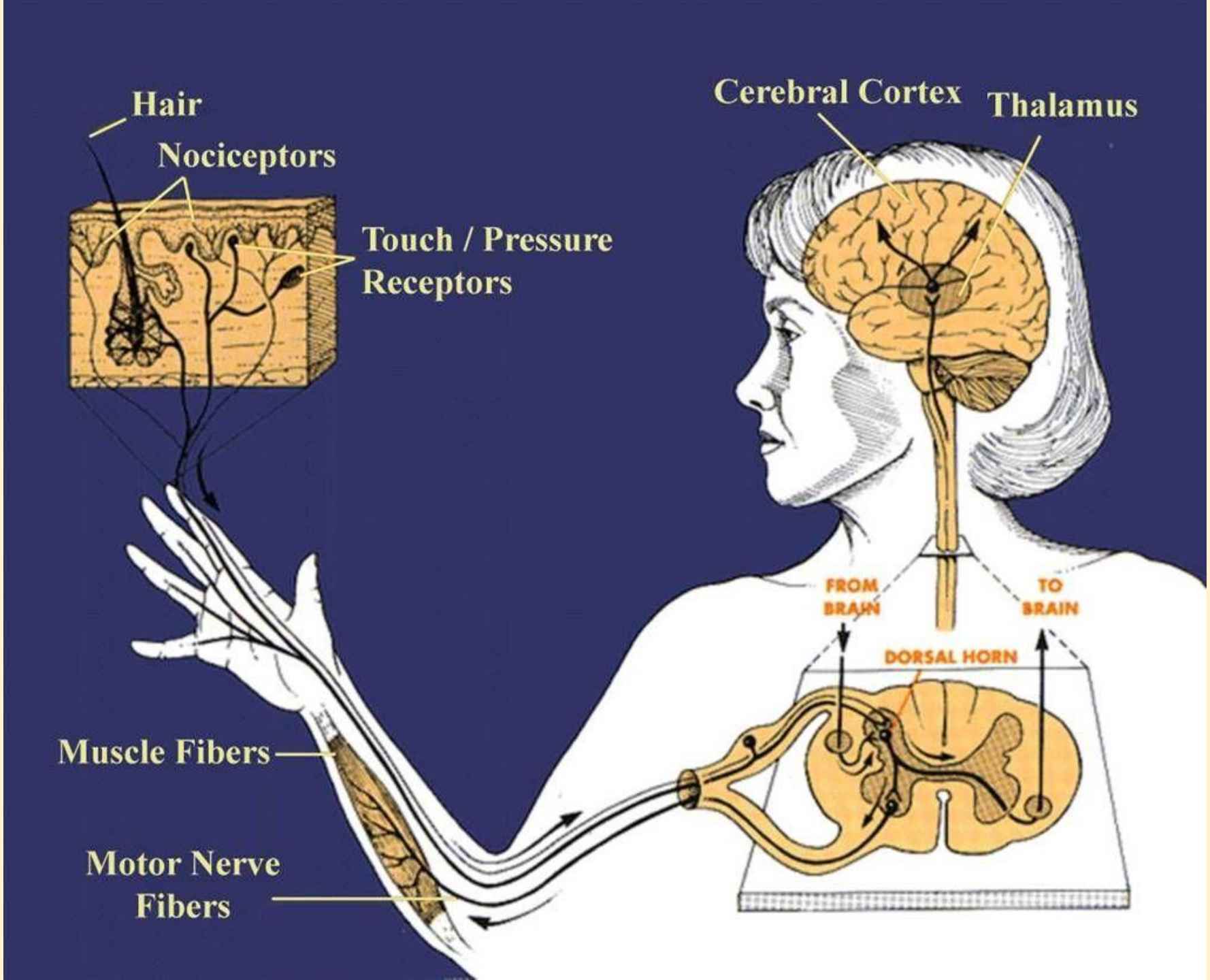
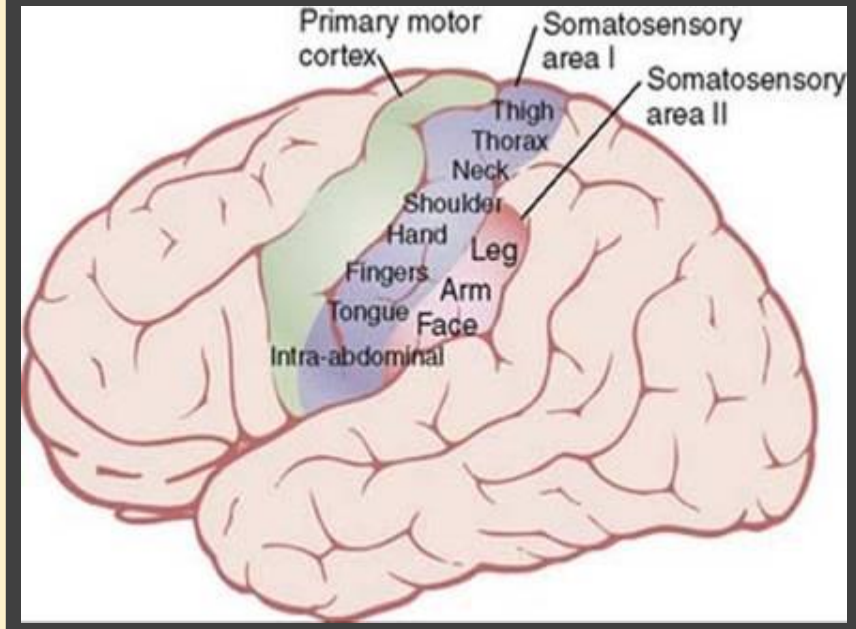
Somatosensory Cortex



Learning Objectives

- Define somatosensory cortex.
- Describe the different areas of somatosensory cortex.
- Describe Brodmann’s areas.
- Describe the sensory homunculus.
- Describe the layers of somatosensory cortex and their functions.
- Explain the organization of sensory cortex.


Hair
Nociceptors
Touch / Pressure Receptors
Cerebral Cortex
Thalamus
FROM BRAIN
TO BRAIN
DORSAL HORN
Muscle Fibers
Motor Nerve Fibers

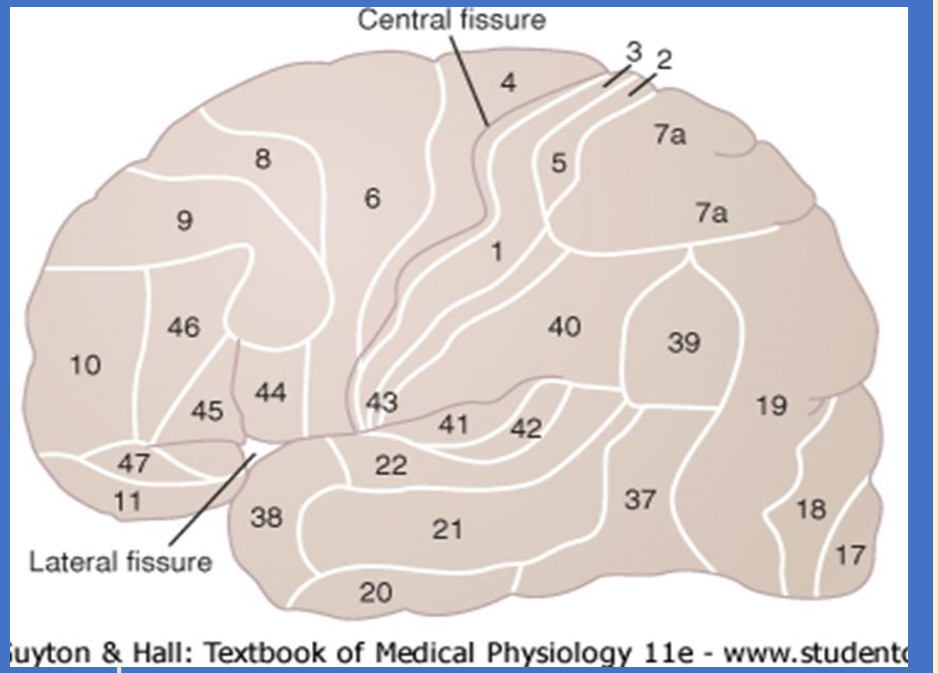


Somatosensory Cortex

Sensory signals end in cerebral cortex posterior to central sulcus

Anterior half of parietal lobe → reception and interpretation of sensory signals

Posterior half of parietal sensory cortex → higher levels of interpretation



Somatosensory cortex

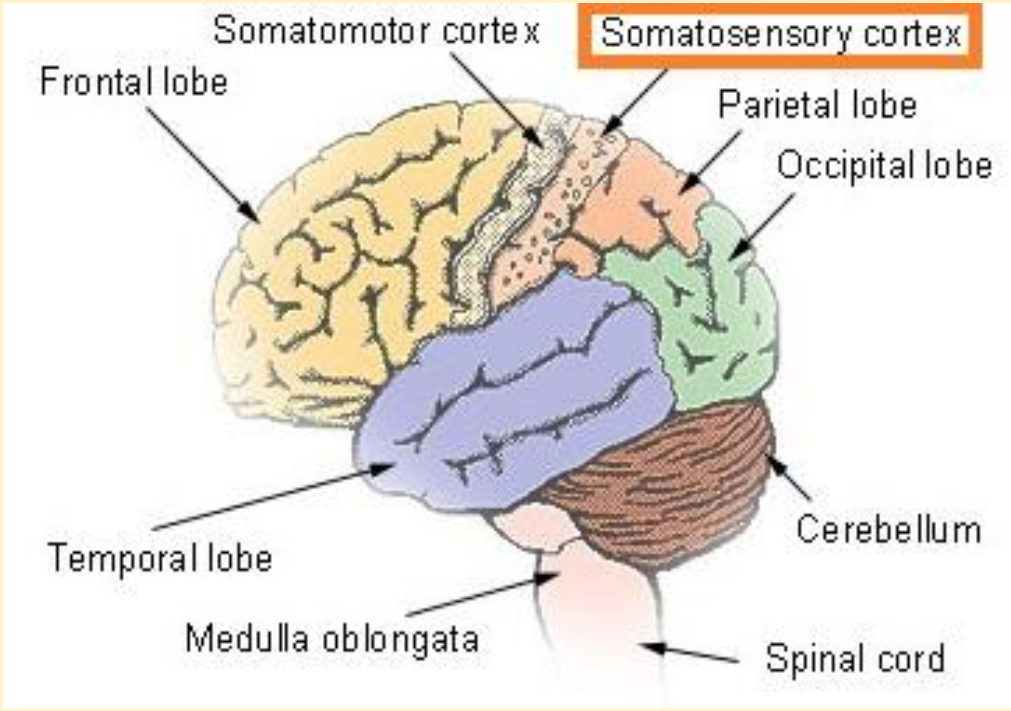
Map of human cerebral cortex divided into **50 distinct areas** called **Brodmann's areas** on histological differences

Brodmann was a histologist who divided cerebral cortex into numbered areas based on **histological characteristics**

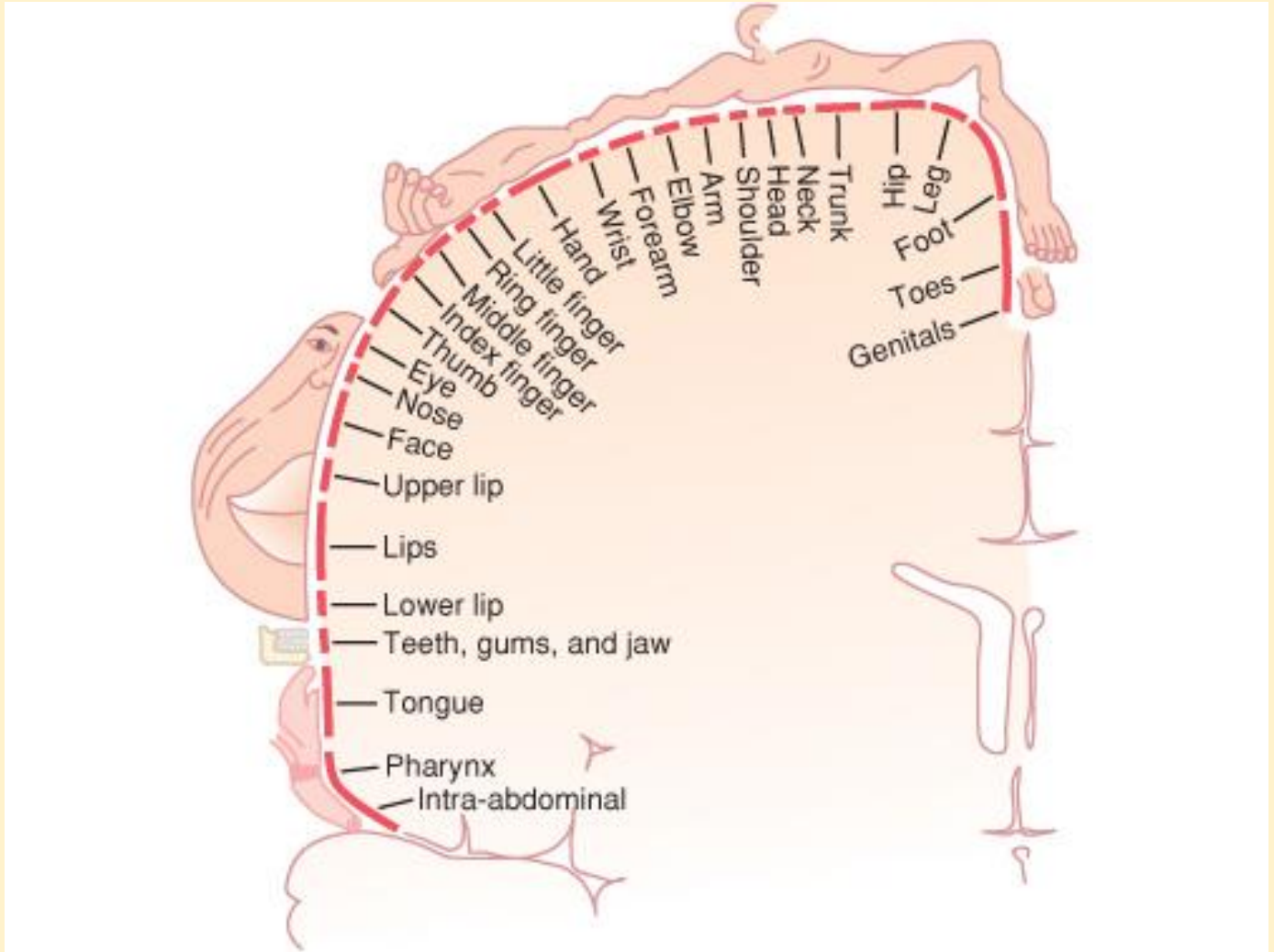
Neurophysiologists and neurologists use it to refer by number the different functional areas of human cortex

Somatosensory Areas I &II

- Somatosensory Area I is more extensive and important with **high degree of localization**
- Area II → **tactile object recognition and memory**
- Area I receives peripheral sensory information, it requires the area II to store, process, and retain this information.



Somatosensory Area I



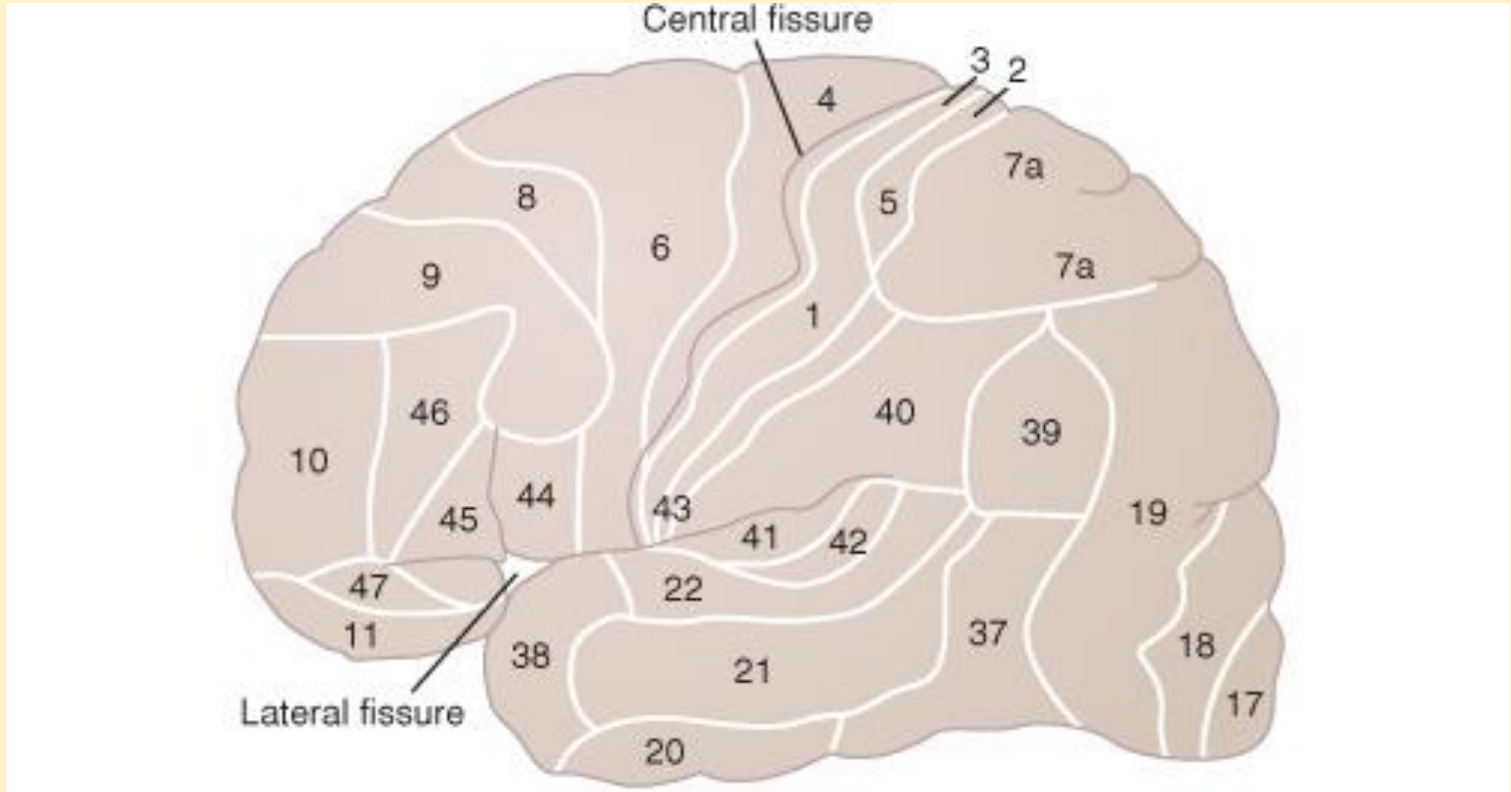
Spatial Orientation of Signals in Somatosensory Area I

- Immediately behind central fissure in postcentral gyrus of human cerebral cortex (**Brodmann's areas 3, 2 and 1**)

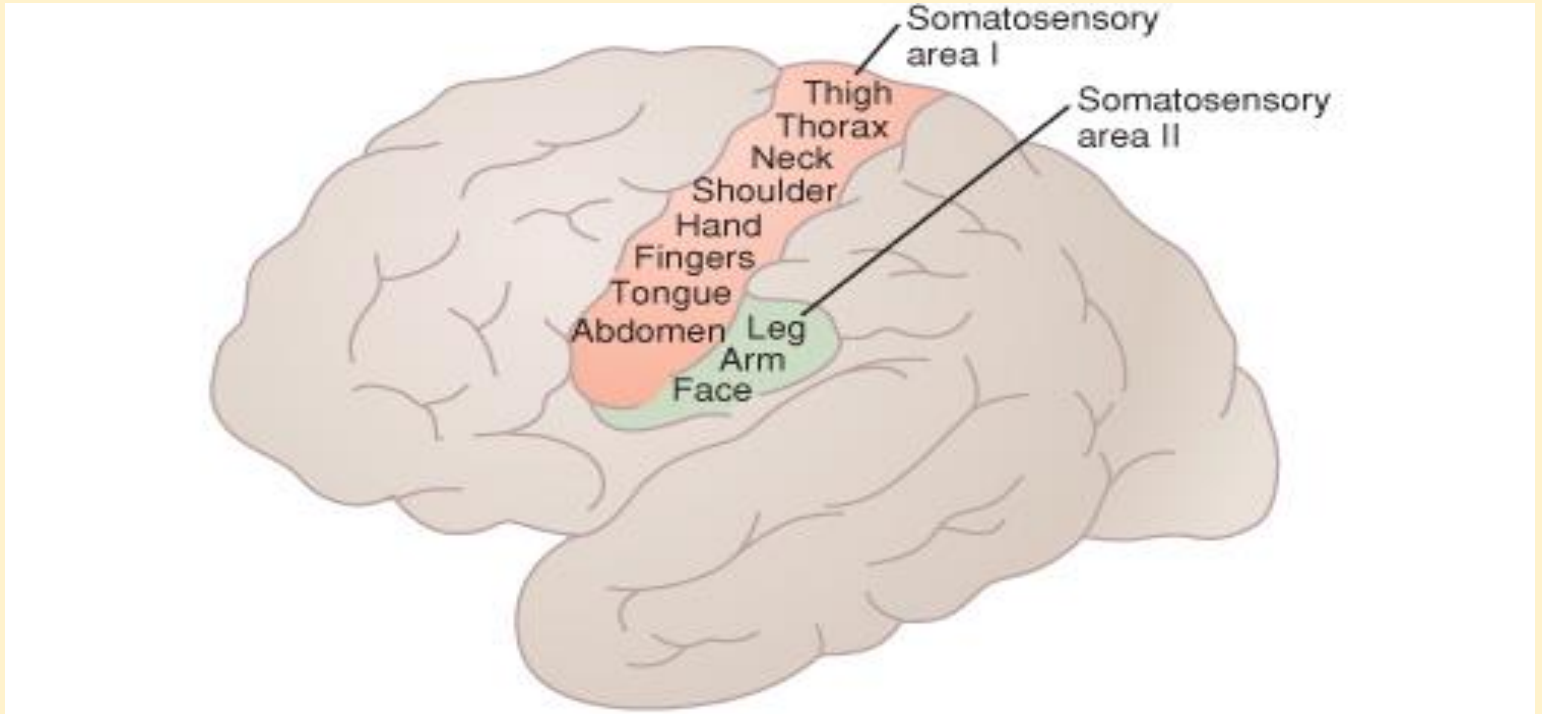
- Each side of cortex receives information from **opposite side of body**
- **Lips followed by face and thumb** → more representation
- **Trunk and lower part** of body have small representation

- Depends on **number of specialized sensory receptors** in body

Brodmann's Areas



Somatosensory cortex



Cortical Homunculus

A **physical representation** of the human body, located within the brain

It is a **neurological "map**" of the anatomical divisions of the body

two types of cortical homunculus; **sensory and motor**

Cortical Homunculus

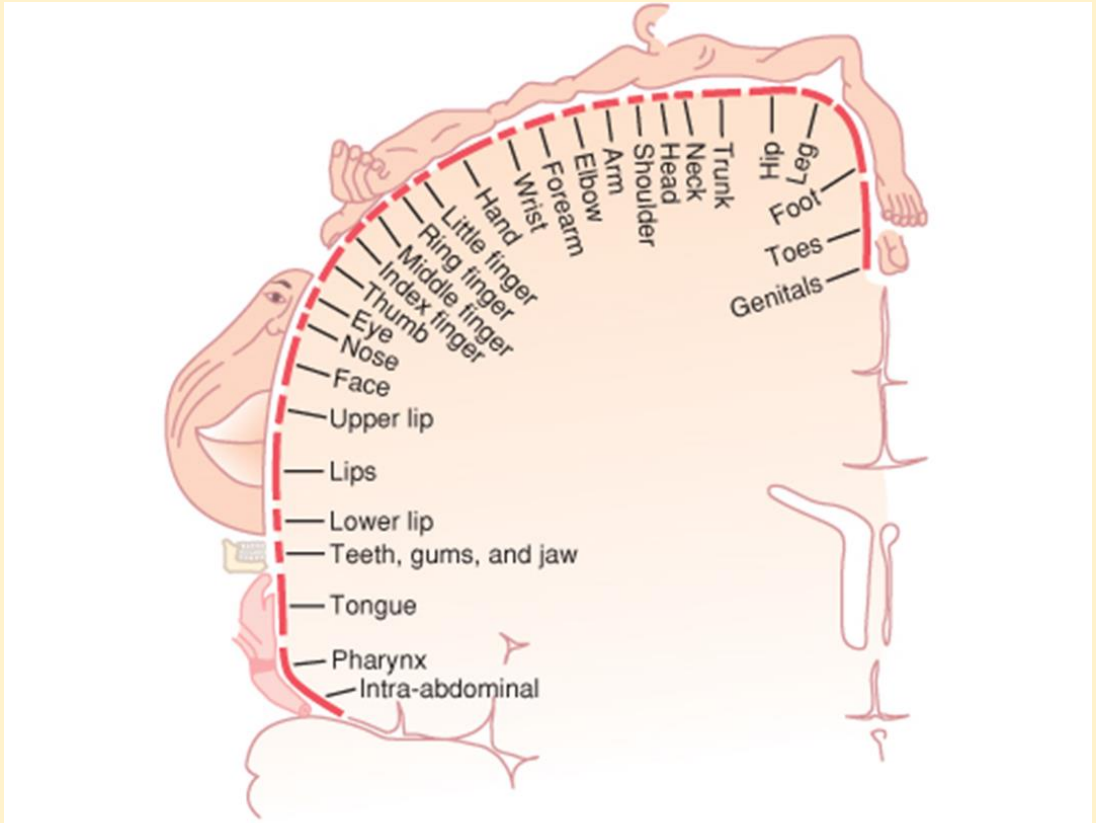
The most striking aspect of this map is that the areas assigned to various body parts on the cortex are proportional not to their size, but rather to the **complexity of the movements** that they can perform

Sensory Homunculus

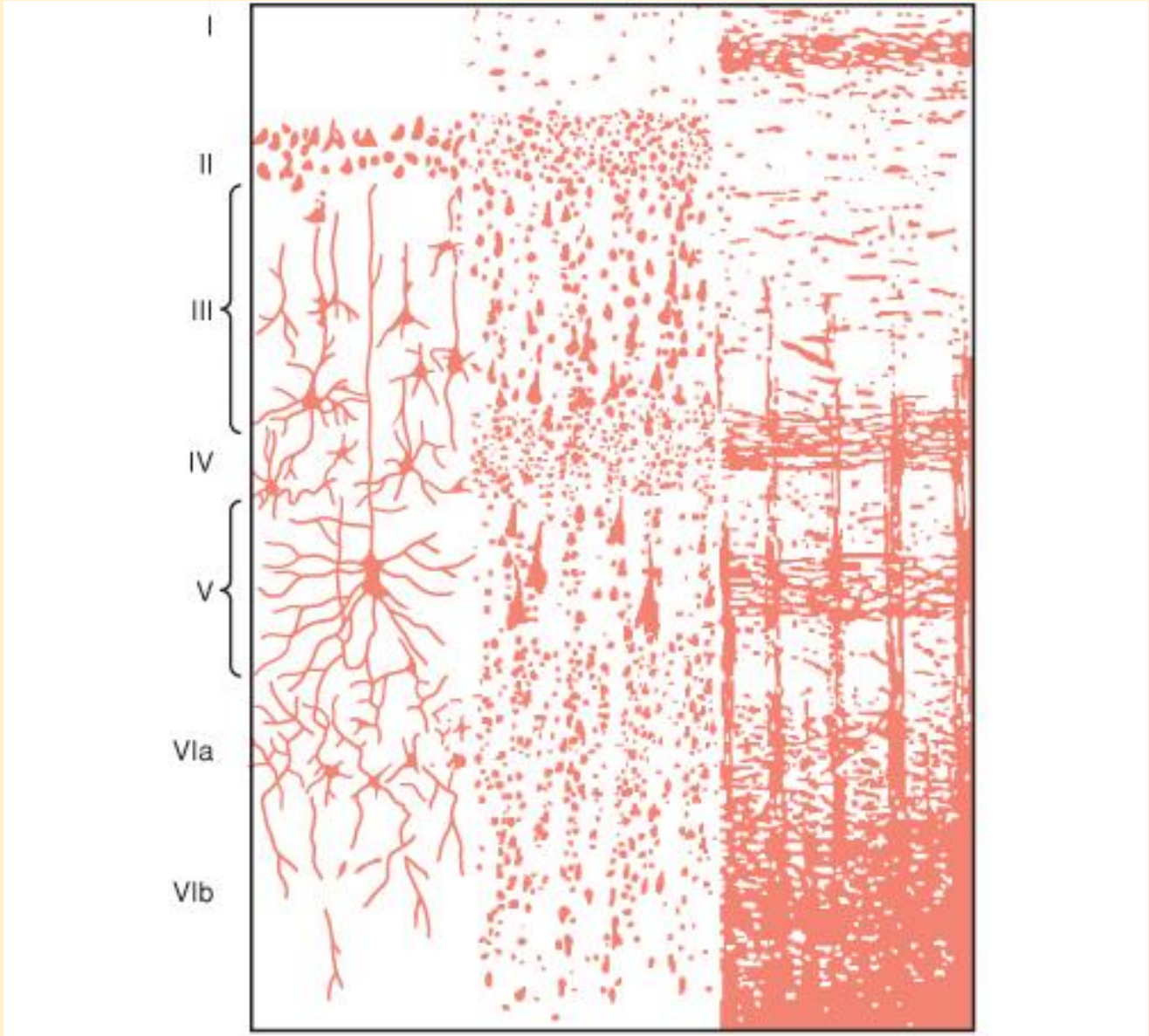
The cortical area for receiving impulses from a part of the body is proportionate to the use of that part **(complexity of movement**)

Large for hand, mouth, lips

Small for trunk and back



Layers of Somatosensory Cortex



Functions of Layers of Somatosensory Cortex

6 Layers of neurons

Incoming sensory signal excites neuronal **layer IV** first

Layers I and II receive diffuse nonspecific signals from lower brain centers

Layers II and III send axons to related areas on opposite side through corpus callosum

Layers V and VI send axons to deeper parts of nervous system.

Organization of Sensory Cortex

- Functionally the neurons are arranged in vertical columns extending through 6 layers
- Each column has a diameter of 0.3-0.5 mm containing 10,000 neuronal cell bodies
- Each column serves a single specific sensory modality; some respond to stretch receptors around joints, some to tactile receptors or pressure receptors

→ **LABELLED LINE PRINCIPLE**

- At layer IV where signals enter, they are separate

Organization of Sensory Cortex

- **Anterior most portion** of postcentral gyrus 5-10mm deep in central fissure in Brodmann's area 3A → respond to **muscle, tendon and joint stretch receptors**
- **Posterior** to this vertical columns respond to **Slowly adapting cutaneous receptors**
- **More posteriorly** in somatosensory area I; 6% of vertical columns respond to a **stimulus in a specific direction**

Functions of Somatosensory Area I

Widespread **bilateral excision** of somatosensory area I causes inability to

1. **Discretely** localize sensations (crude intact)
2. Judge critical degrees of **pressure** against body
3. Judge the **weight of objects**
4. Judge the **shapes /forms of objects** → inability - **ASTEREOGNOSIS**
5. Judge **texture of materials**

Pain and temperature sensations are intact but poorly localized

What is Astereognosis?

Astereognosis (tactile agnosia)

- Inability to discriminate size and shape of objects and identify them by touch alone.

Tests

- Patient identifies by touch such common objects as a coin, paperclip, pencil, or key (each hand tested separately)
- Patient judges the relative size of a series of coins
- Patient judges the texture of a series of objects, such as cloth, wire, sandpaper

Somatosensory Association Areas

- Brodmann's Areas 5 and 7 of parietal cortex behind somatosensory area I →

  understanding deeper meanings of sensory information

Somatosensory association area receives input from

1. Somatosensory area I
2. Thalamus
3. Visual cortex
4. Auditory cortex

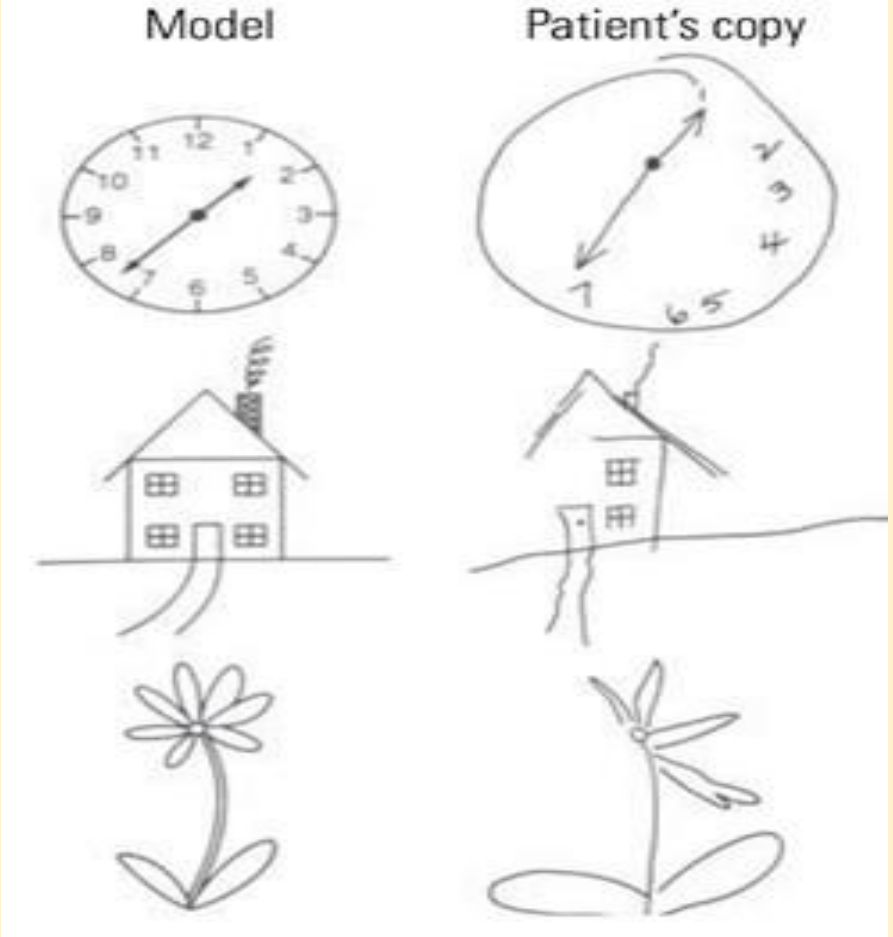
What is Amorphosynthesis?

Amorphosynthesis

- When somatosensory association area is removed from one side of brain →
- inability to recognize **complex forms of objects on opposite side of body**
- inability to **sense his/her body parts on opposite side of the body**

- This complex sensory deficit is called **Amorphosynthesis**

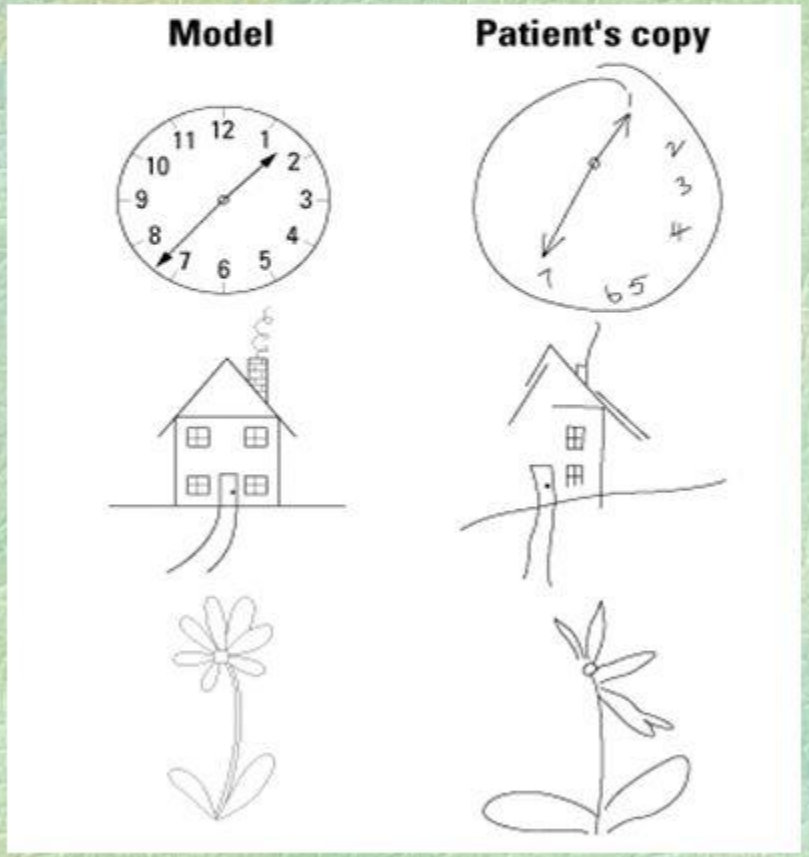
Amorphosynthesis – Right Parietal Lobe Lesion



The Brain
The Split Brain

- A patient with a stroke in the right hemisphere was asked to copy the drawings.
- Typical of neglect syndromes, the left side of the model is almost completely ignored.

Neglect Syndrome



References

- Guyton and Hall
- Ganong’s Physiology
- Sherwood


Thank
YOU