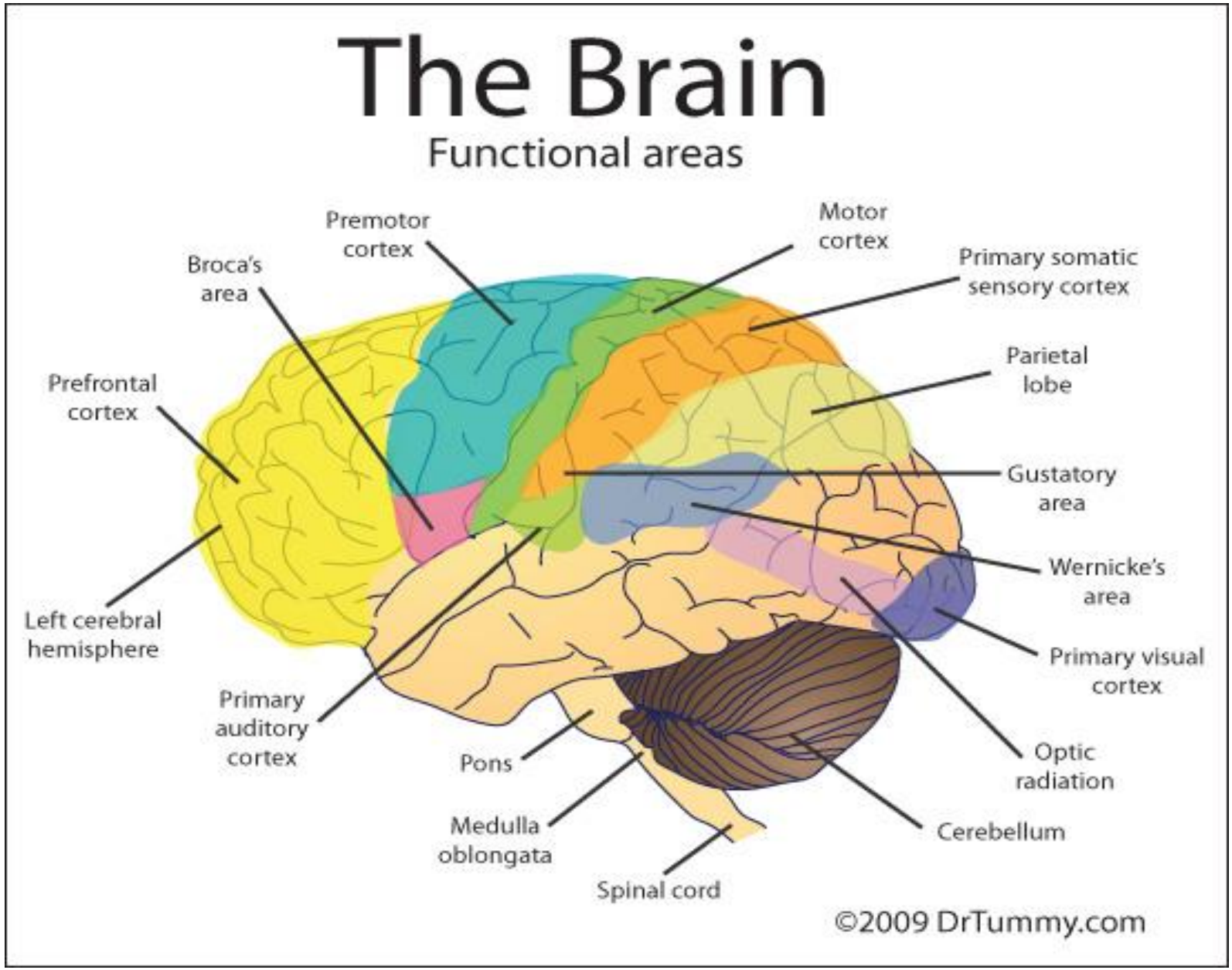
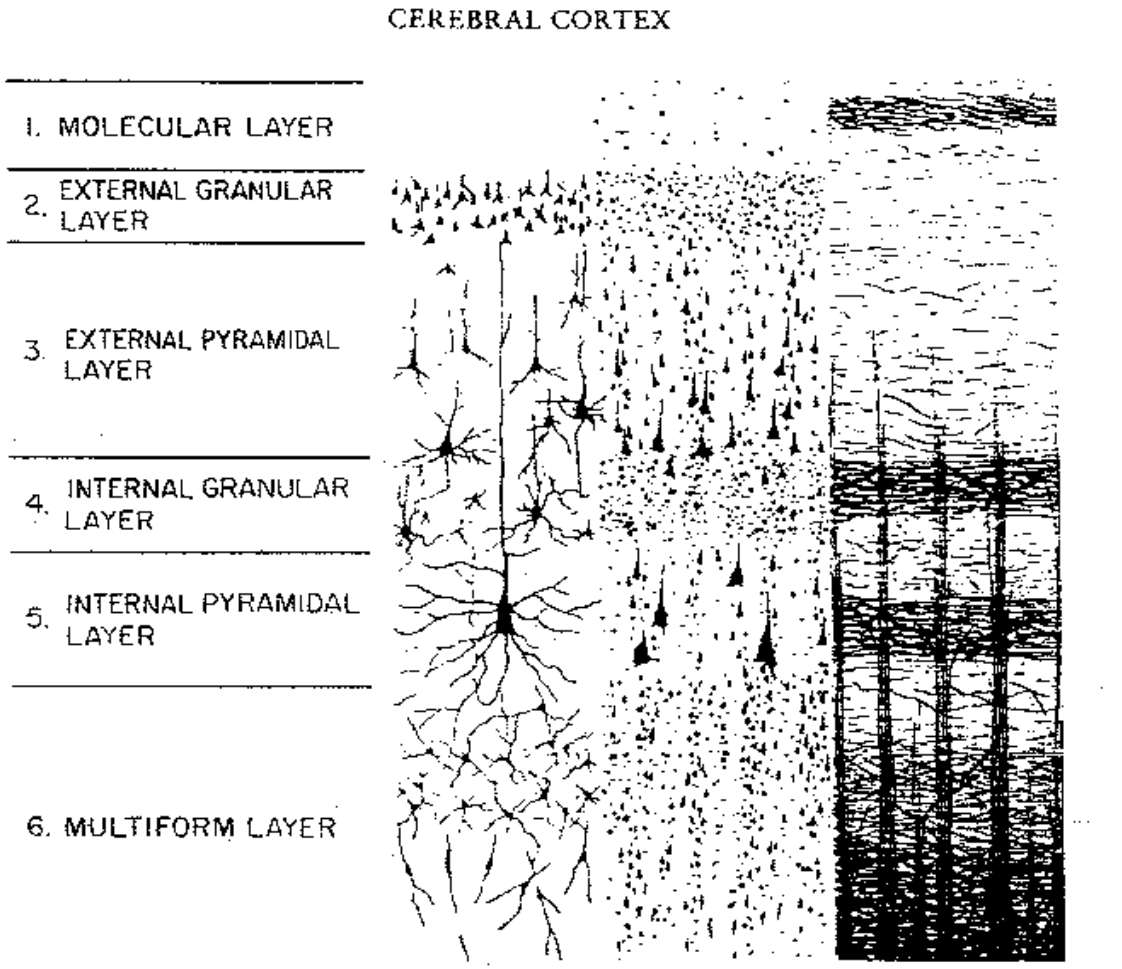
SENSORY CORTEX


The Brain
Functional areas
Premotor cortex
Motor cortex
Broca's area
Primary somatic sensory cortex
Parietal lobe
Prefrontal cortex
Gustatory area
Wernicke's area
Left cerebral hemisphere
Primary visual cortex
Primary auditory cortex
Optic radiation
Pons
Cerebellum
Medulla oblongata
Spinal cord
©2009 DrTummy.com

PHYSIOLOGICAL ANATOMY OF CEREBRAL CORTEX

- Functional part of the cerebral cortex is a thin layer of neuron covering the surface of all convolutions of cerebrum
- Layer is only 2-5mm thick
- Total cerebral cortex contains about 100 billion neurons

LAYERS OF CEREBRAL CORTEX



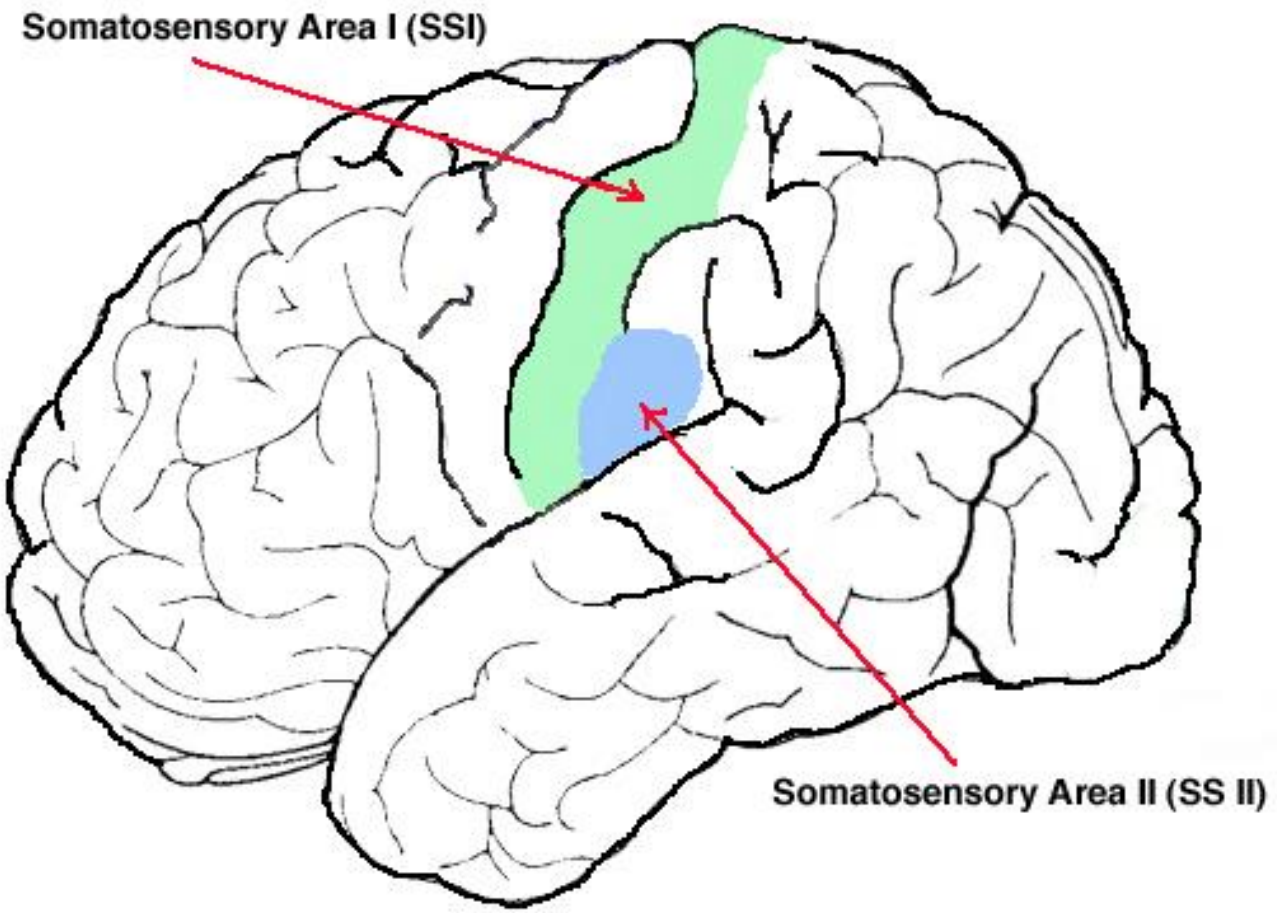
SOMATOSENSORY AREA

- 2 separate sensory areas in anterior parietal lobe
- Somatosensory area I and somatosensory area II
- Reason for division into two areas is that
- Distinct and separate spatial orientation of different part of body is found in each of these area

SOMATO SENSORY AREA I

- General somatic sensations projects to somatosensory cortex
- Predominently in the postcentral gyrus
- Immediately behind central sulcus
- Broadmann's area 3,1,2
- These area constitutes Primary somato sensory area **SI**
- High degree of localization of different parts of the body

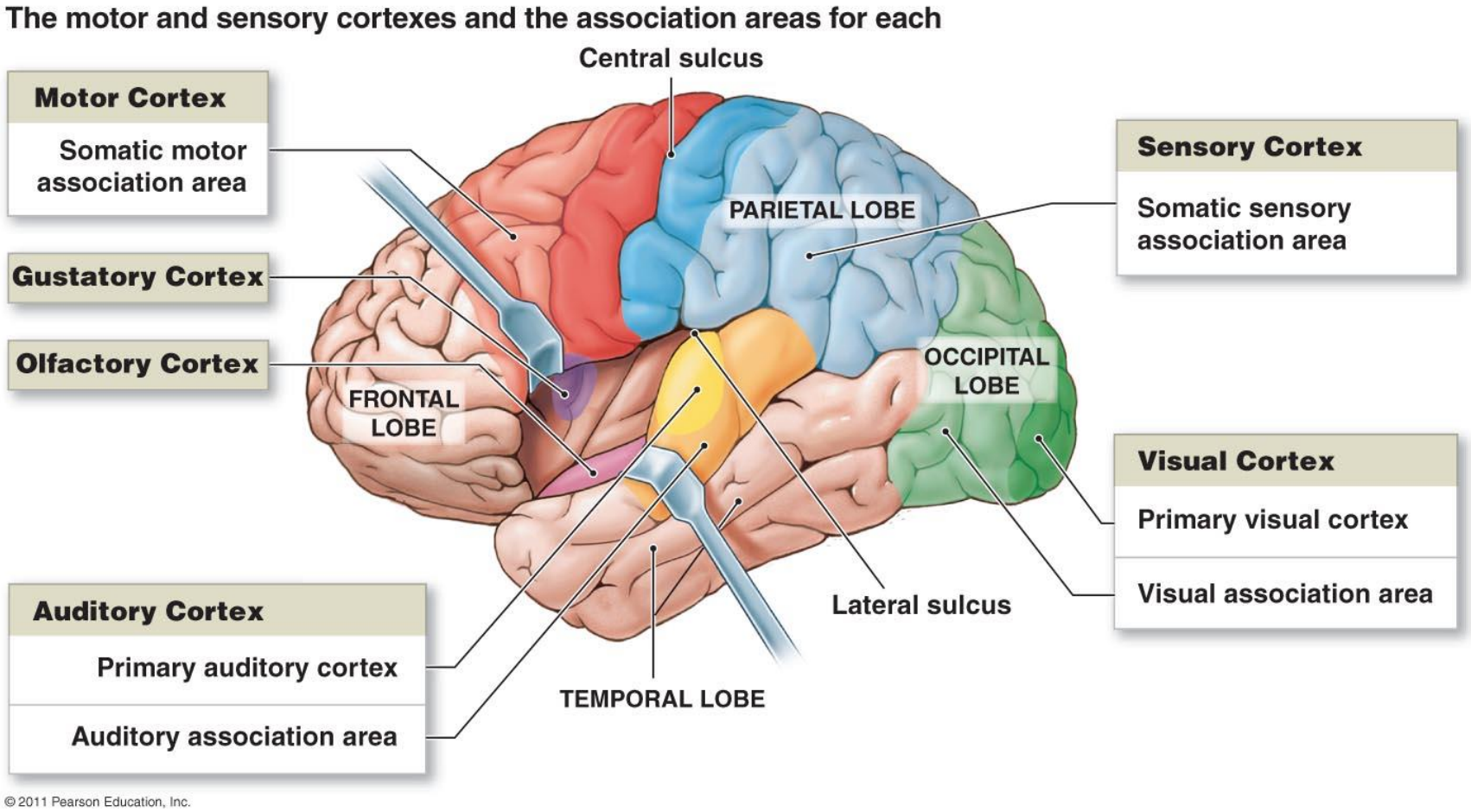
SOMATOSENSORY AREA



SOMATOSENSORY AREA SII

- Located in the wall of Sylvian fissure (Lateral fissure) that separates the temporal from frontal and parietal lobe
- This region receives input from SI
- Less degree of localization of different parts of the body than SI

SENSORY CORTEX



SENSORY ASSOCIATION AREA

- Parietal cortex
- Broadmanns area 5 &7
- Secondary somatosensory cortex and sensory association area receive input from primary somatosensory cortex

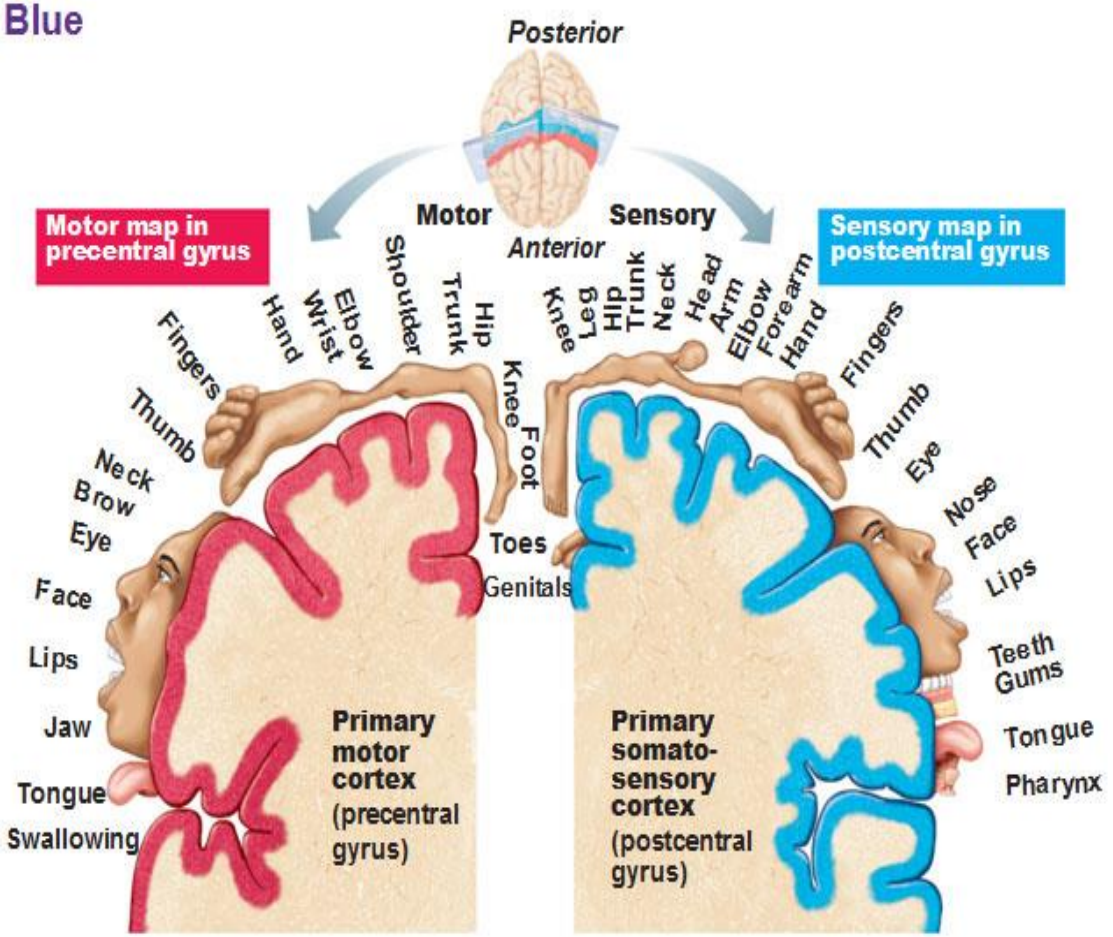
CORTICAL HOMUNCULUS

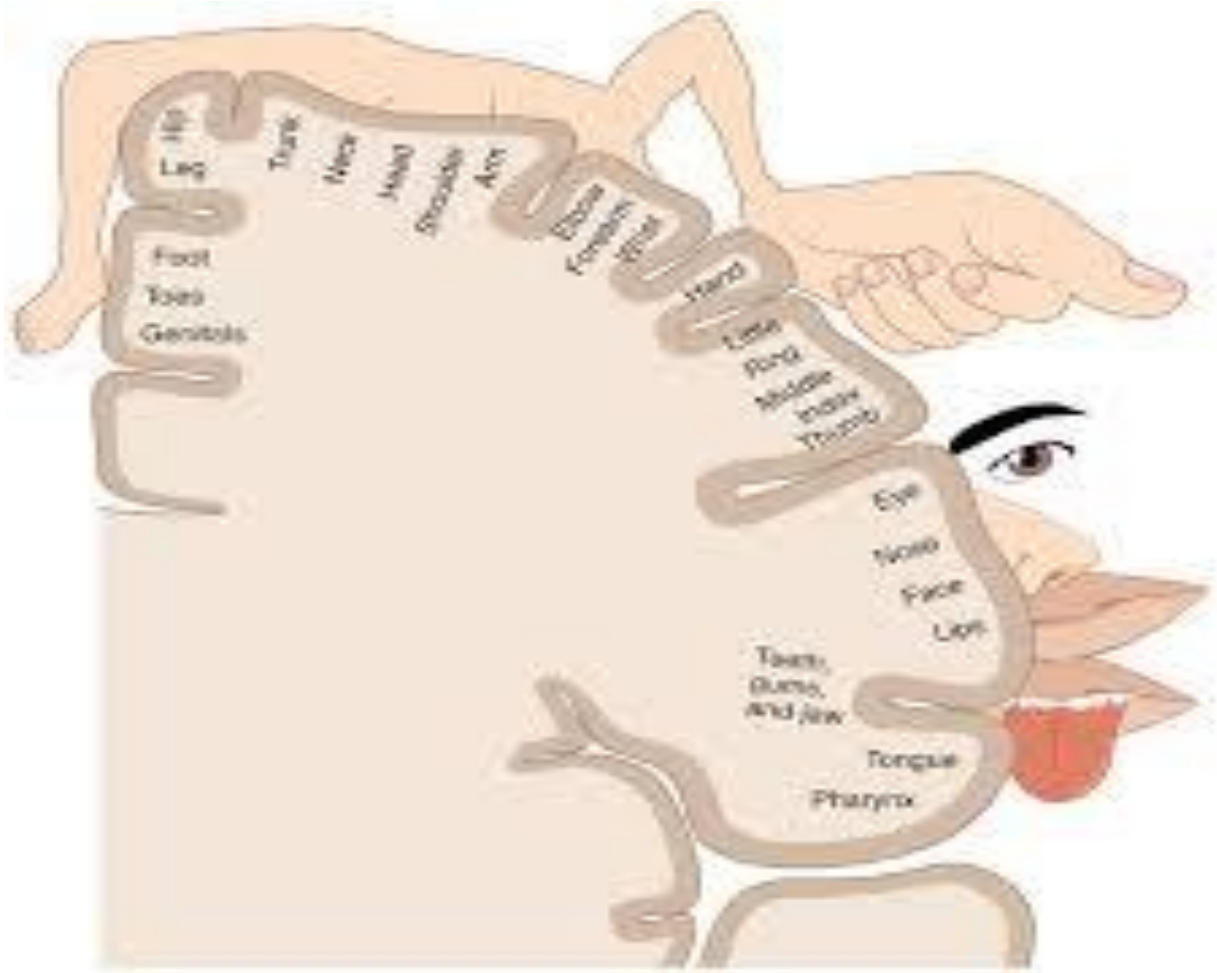
- Topographic representation of the human body in the brain
- Proportions of the brain dedicated to the functions from different body parts
- Homonculus is Latin word for “little man”

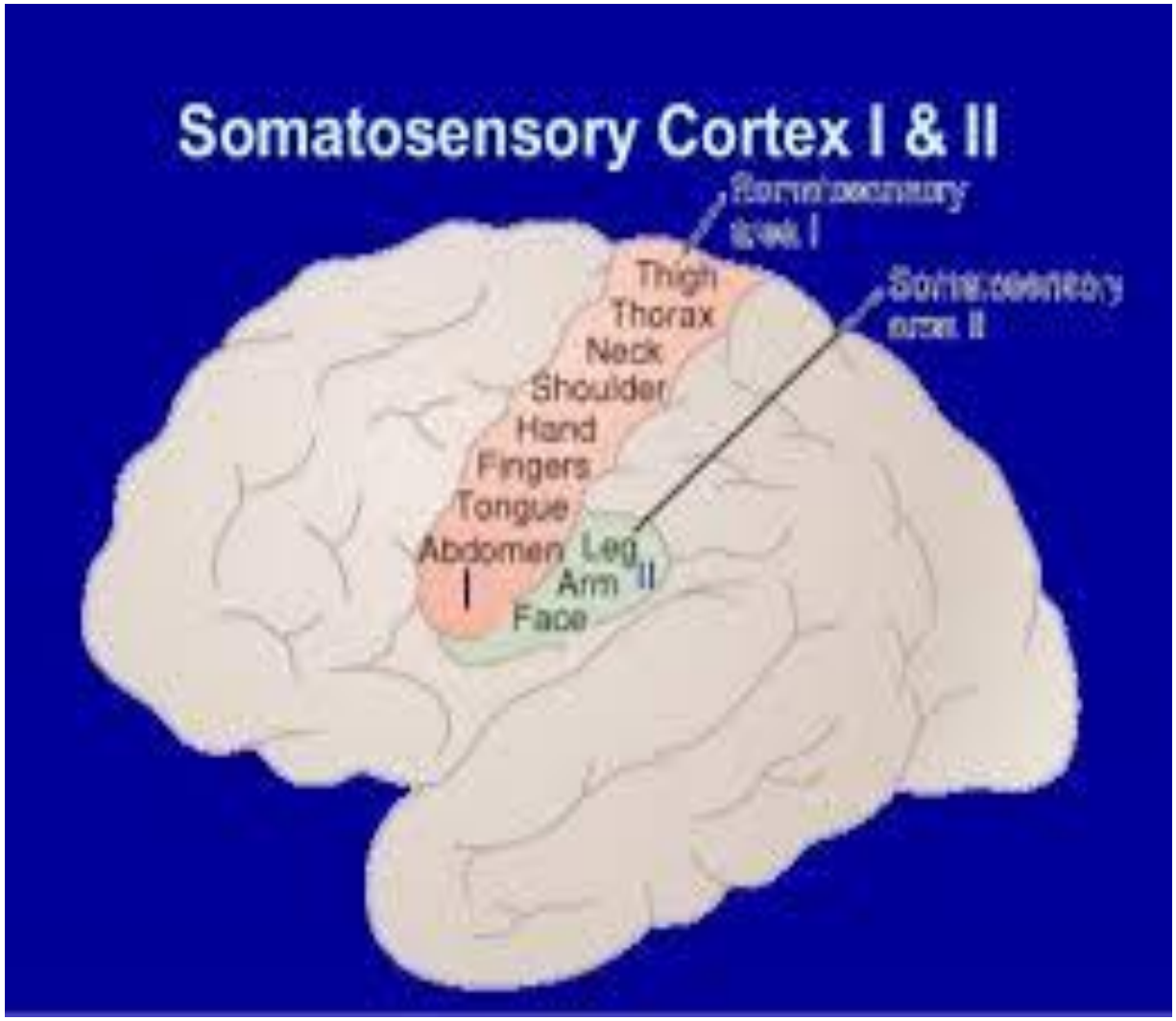
SENSORY HOMONCULUS

Homunculus of Primary Somatosensory Cortex in Blue

Note that each hemisphere receives info from the opposite side of the body




Leg
Foot
Toes
Genitals
Hand
Eye
Nose
Face
Lips
Tongue
Pharynx


Somatosensory Cortex I & II
Thigh
Thorax
Neck
Shoulder
Hand
Fingers
Tongue
Abdomen
Leg
Arm
Face
II

PRIMARY SOMATOSENSORY AREA

- This area has a complete and orderly representations of the body with feet up & head down

- The representation is not only upside down but also grossly distorted
  - with face and fingers taking up disproportionately large area
  - Trunk and back – small area

SENSORY HOMONCULUS

- The area dedicated to the part of the body seems to be related to the precision with which stimuli are perceived
- Proportional to the use of that part

SII

- Complete representation of the body in SII also

SENSORY HOMONCULUS

- Contributions from Penfield & Rasmussen
- Studies in Neurosurgical patients whose cortex had been exposed under local anaesthesia
- Stimulation of discrete points in sensory cortex led to sensory experiences referred to specific part of the body

ARRANGEMENT OF CELLS

- Cells in the postcentral gyrus are organized in vertical columns
- Cells in the given column are all activated by afferents from a given part of the body
- All responds to same sensory modality

ARRANGEMENT OF CELLS

- Eg. In thumb area of somatosensory cortex , one column may be specific for touch, another column for temperature stimulus applied to the thumb.
- Columns dedicated to processing of touch stimuli are far more in no. than those for pain or temperature
- That is why tactile stimuli is more localized precisely than a noxious or thermal stimulus

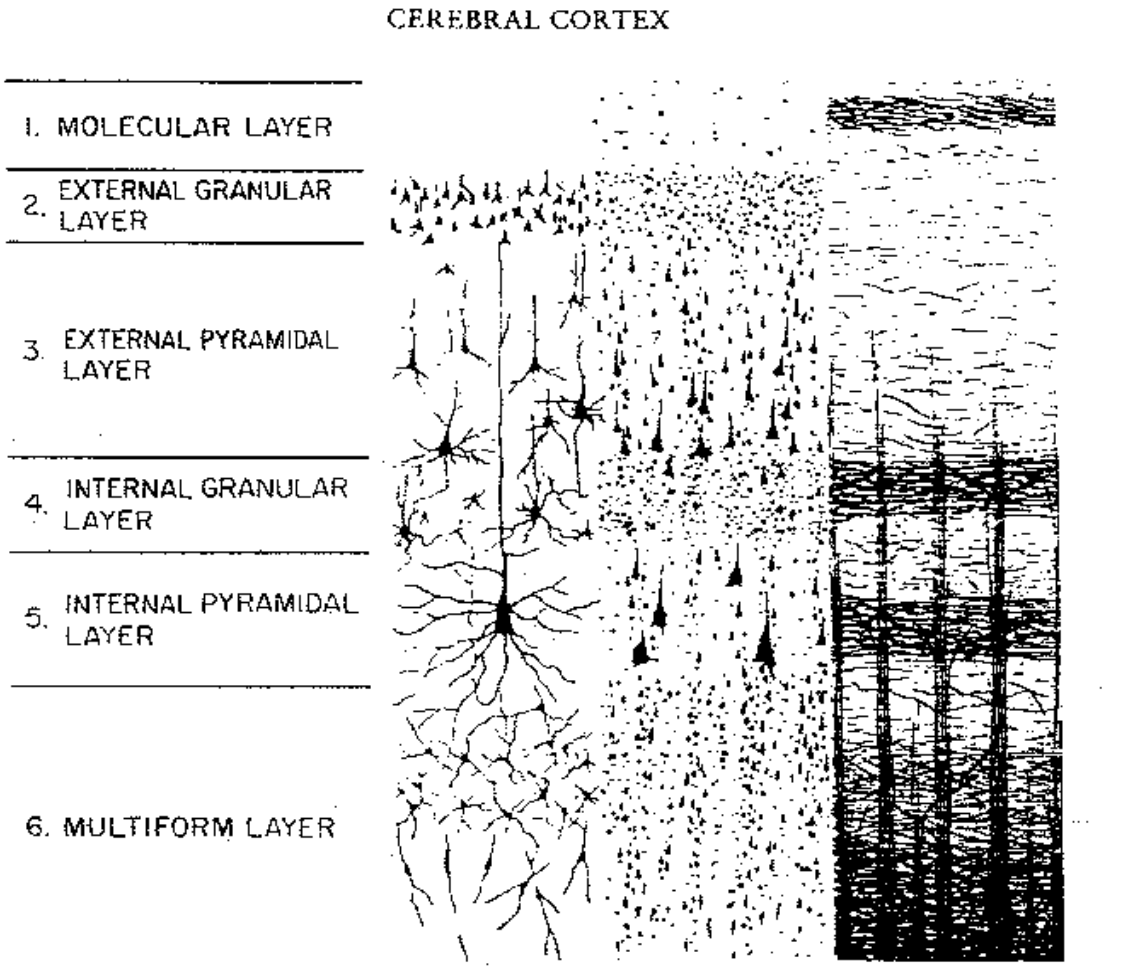
LAYERS OF SOMATOSENSORY CORTEX

- Sensory information is received in layer IV
- So this layer is particularly tick in S1 & S2 and area serving special senses
- Having received the signal from layer IV, cells of layer III convey the information to association areas
- In association areas sensory signals from multiple points on the body are put together to arrive a meaningful interpretation of the signals

LAYERS OF SOMATOSENSORY CORTEX

- Most of the out put signals leave the cortex through neurons located in layers V & VI
- Fibres to brainstem and cord arise in layer V
- Fibres to thalamus- layer VI
- Intra cortical association function- I , II & III

LAYERS OF CEREBRAL CORTEX



FUNCTION OF S1

- Area S1 has a disproportionate but complete representation of all types of sensory stimuli originating anywhere in the contralateral half of the body

FUNCTION OF S1

- 1. Conscious perception
  - Conscious awareness of a stimulus means knowing that the stimulus exists
  - Some crude awareness is there at Thalamic level
  - Full awareness is achieved only at cortical level
- 2. Awareness of exact location and modality of stimulus

FUNCTIONS OF SII

- Analyze the meanings of specific sensory signals
- Interpretation of the shape and texture of the object in one's hand

EFFERENT CONNECTIOS FROM SI

- Some fibres project to motor cortex
  - Plan muscular activity in light of sensory information- e.g in case of position sense
- To SII & Contralateral SI
  - Synthesis of sensory informations from 2 sides of the body
- To association area
  - Combine sensory information from multiple points and give it a meaning

FUNCTIONS

- Eg, when we hold a piece of chalk
- Area SI perceive it as a touch stimulus of a particular intensity originating from a no. of points located at specific areas of x,y,z fingers
- Association areas synthesize this information to mean a rounded object of a particular length and texture

- This may be coupled with the visual information about colour and appearance of the object (eyes open)
- Even with eyes closed, once the association areas have arrived at a conclusion about the shape, size and texture of the object ,
- In light of past experience, association area can interpret the stimulus as a piece of chalk

EFFECT OF LESION OF SOAMTOSENSORY AREA

- Astereognosis

- Stereognosis- Perception of the form and nature an object without looking at it

AMORPHO SYNTHESIS

- Effect of removing somatosensory association area
- Person poses the ability to recognise complex objects and complex forms felt on opposite side of the body
- Loses most of the senses from opposite side of the body
- He or she forgets to use other side for motor functions also

Occlusion & Subliminal fringe