



# Gaza Ophthalmic Centre

## 7.1.1 Cerebral Cortex Functional Anatomy

1

### Neurosciences I

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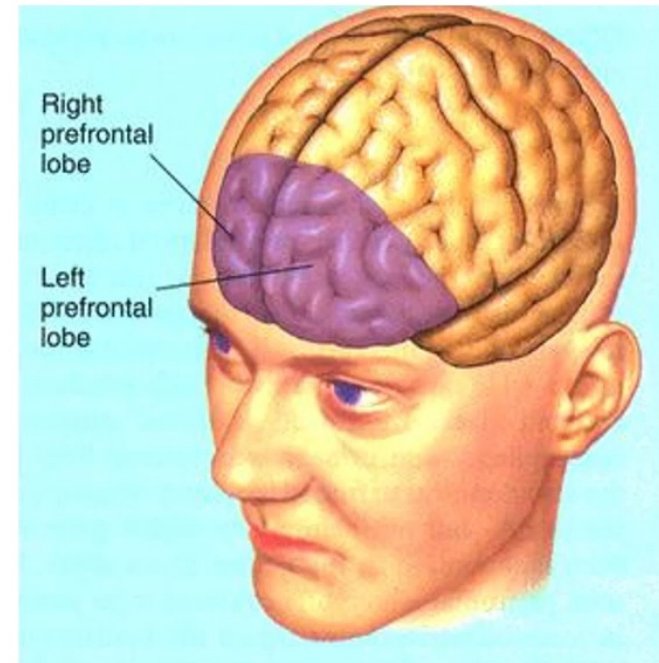
Gaza Ophthalmic Centre

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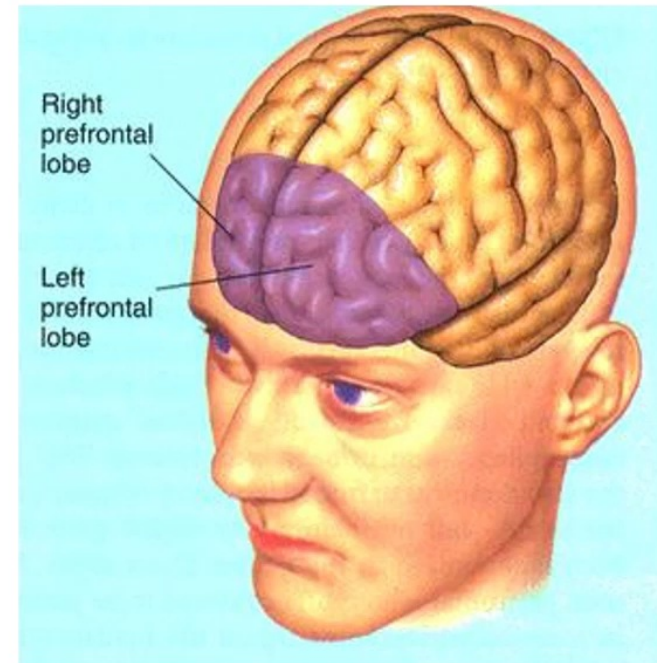
# Frontal lobe anatomy

- Prefrontal
- Frontal



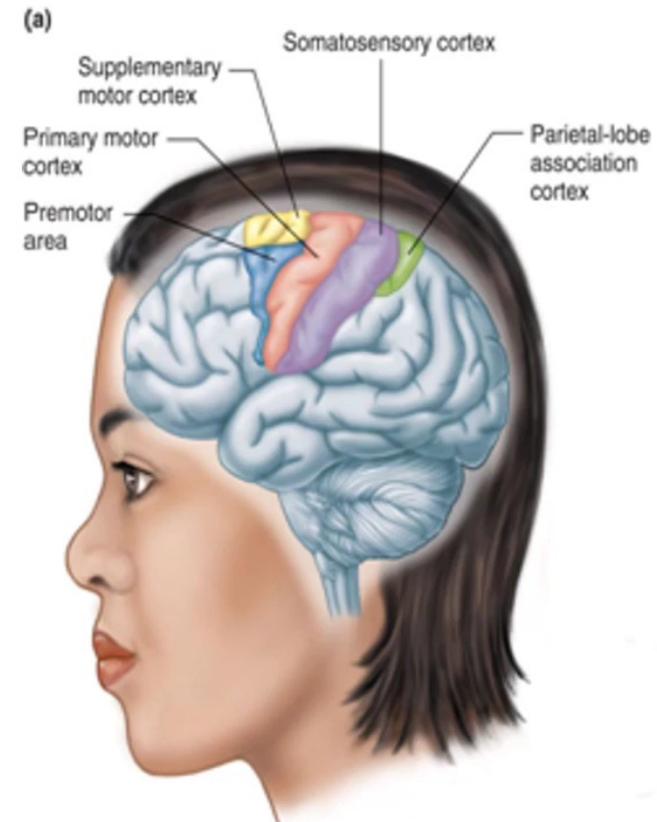
# Frontal lobe anatomy

- **Prefrontal:**
  - Personality
  - Adaptation of the personality to events and experiences
  - Foresight and imagination
  - Sense of self



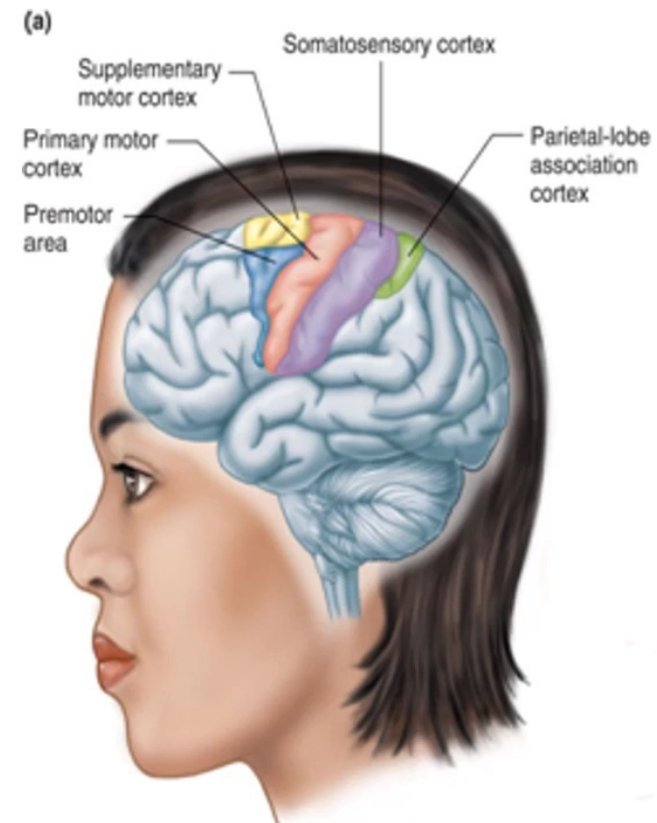
# Frontal lobe anatomy

- **Frontal**
  - **Main motor areas**
    - 3 Skeleto Motor areas
    - 3 Specific Motor areas
  - Originate movement that is
  - Co-ordinated elsewhere



# Frontal lobe anatomy

- **3 Skeleto Motor areas**
  - Primary motor area 4
  - Premotor area 6
  - Supplementary motor area
- **3 Specific Motor areas**
  - Frontal eye field area 8
  - Broca's speech area
  - Exner's writing centre



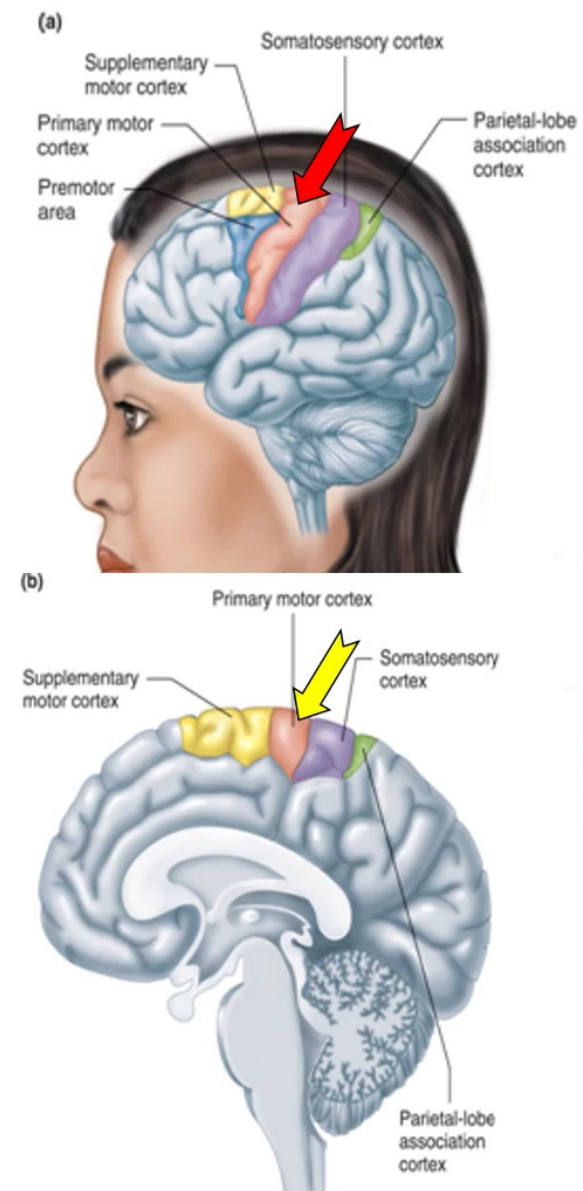
# Primary Motor Area 4

- **Site**

- Precentral gyrus
- Extends on the Medial Surface →
- Anterior part of the
- Paracentral lobule

- **Representation**

- All the body except EYES
- Controls opposite ½ of the body
- Inverted
  - Face down
  - LL up & medial



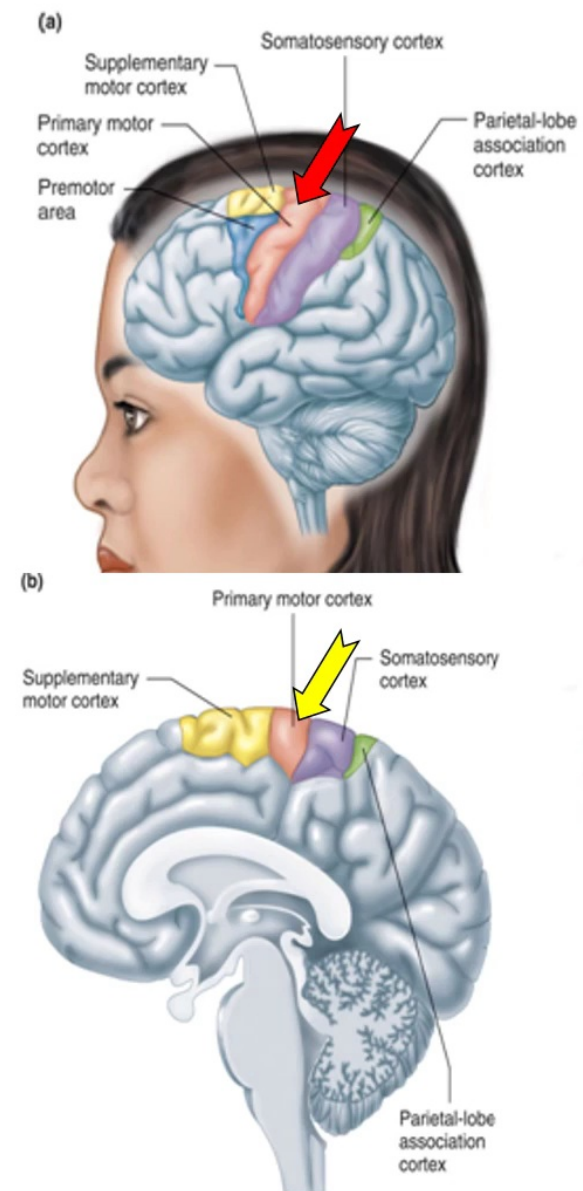
# Primary Motor Area 4

- **Input**

- Cerebellum via thalamus
- Supplementary motor area

- **Output**

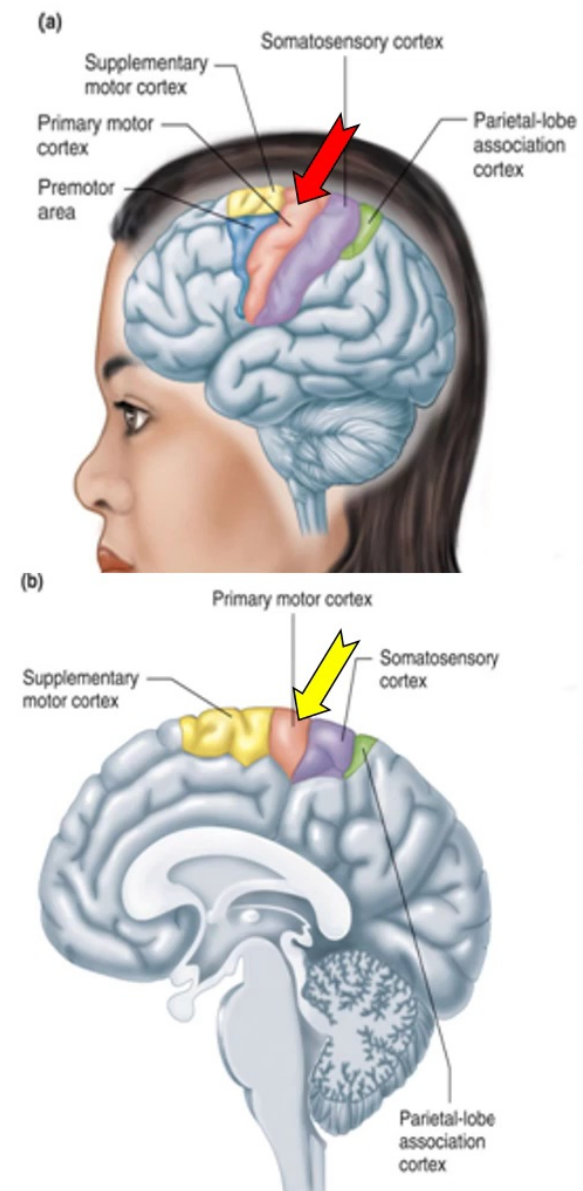
- Gives origin to the Pyramidal Tract
  1. Corticospinal &
  2. Lateral Corticobulbar fibers



# Primary Motor Area 4

- **Function**

- Execution of movement
  - Voluntary
  - Fractionated
  - Skilled
- Facilitates Flexor muscle tone



# Primary Motor Area 4

- **Damage**

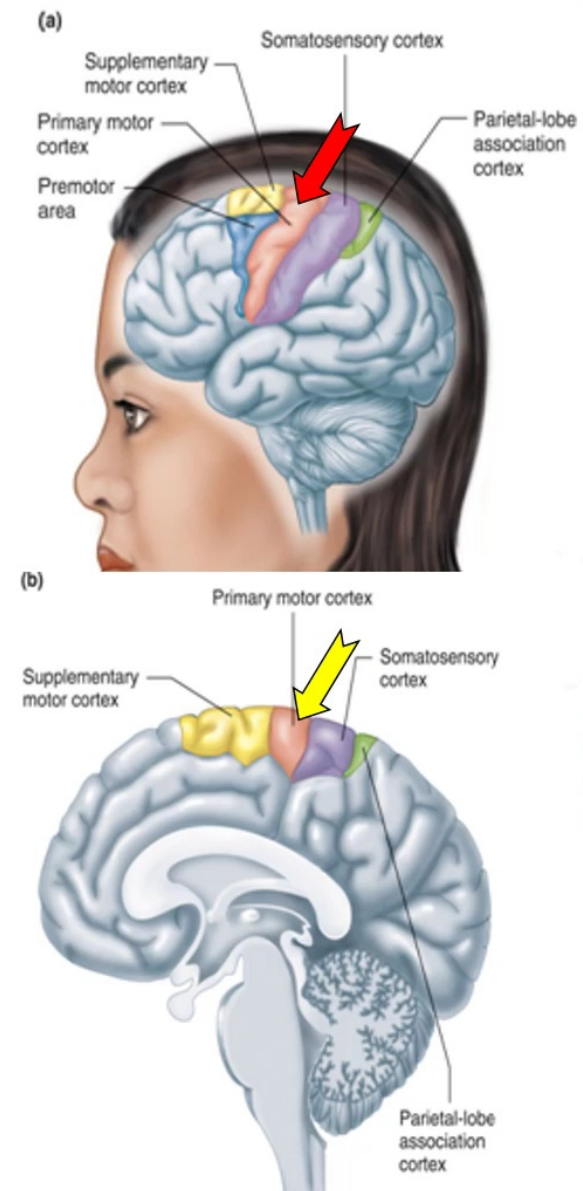
- CL Hemiplegia
- X Skilled fine movements
- X Distal muscles of limbs

**Upper ½ Head & Axial muscles**

- → bilateral representation
- → not affected!

## **Movements**

- (not Muscles) are
- Represented



# Premotor Area 6

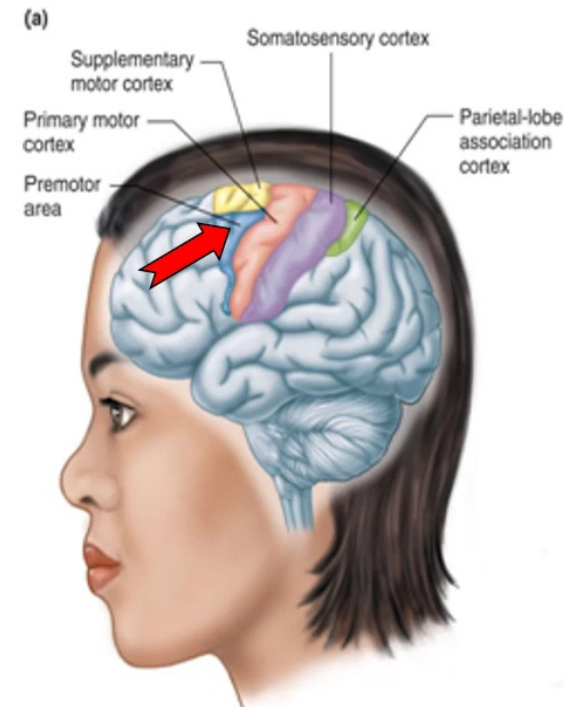
Located just

- Anterior to precentral gyrus

Involved with

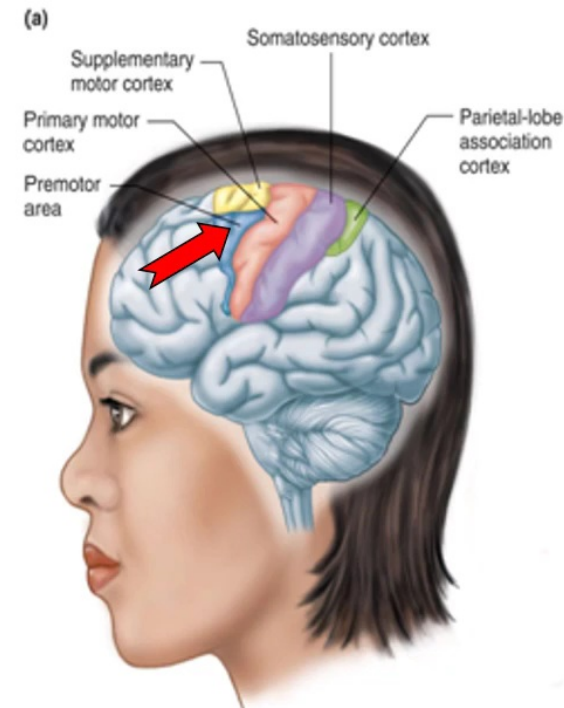
- Controlling &
- Planning
- Learned movement

■ Responses



# Premotor Area 6

- Premotor Area: Area 6
  - In front and parallel to the Motor area 4
  - Posterior parts of
    - Sup, Mid & Inf
    - Frontal Gyri
  - Upper end → 5 cm wide
  - Lower end → 1 cm wide



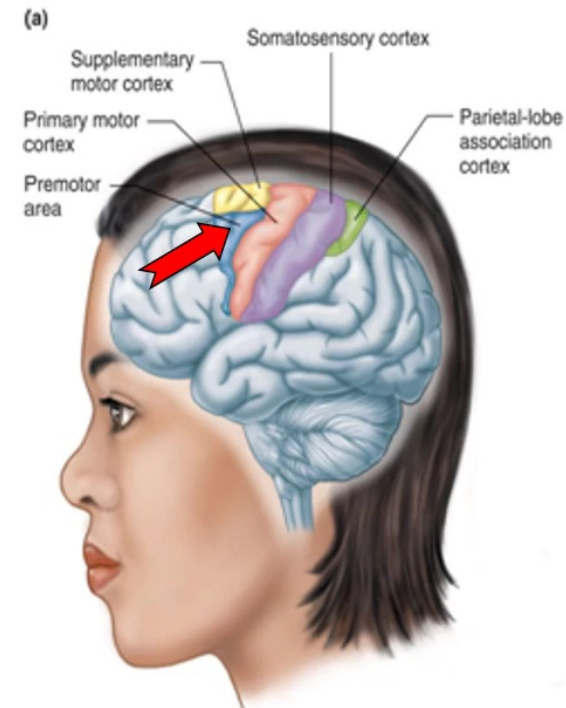
# Premotor Area 6

- **Input**

- Cerebellum via thalamus
- Supplementary motor area

- **Output**

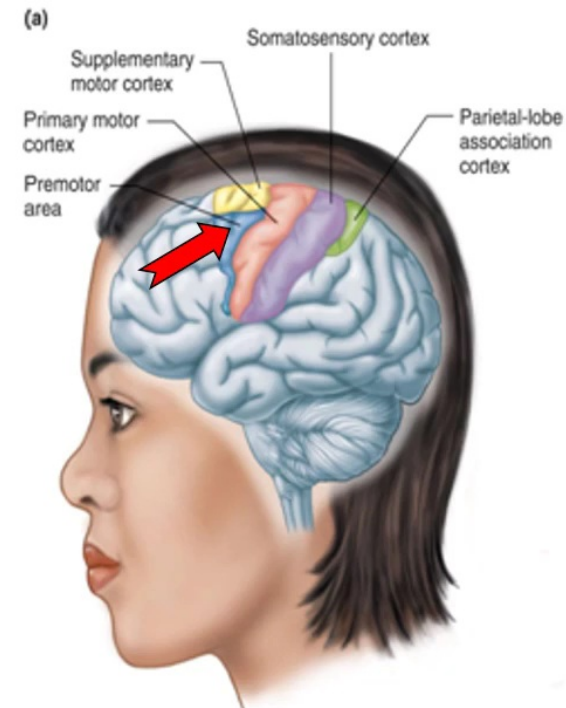
- Cortico Cortical → area 4 → planning of movement
- Cortico Spinal
- Cortico Reticulo Spinal fibers → Extrapyramidal



# Premotor Area 6

- **Function**

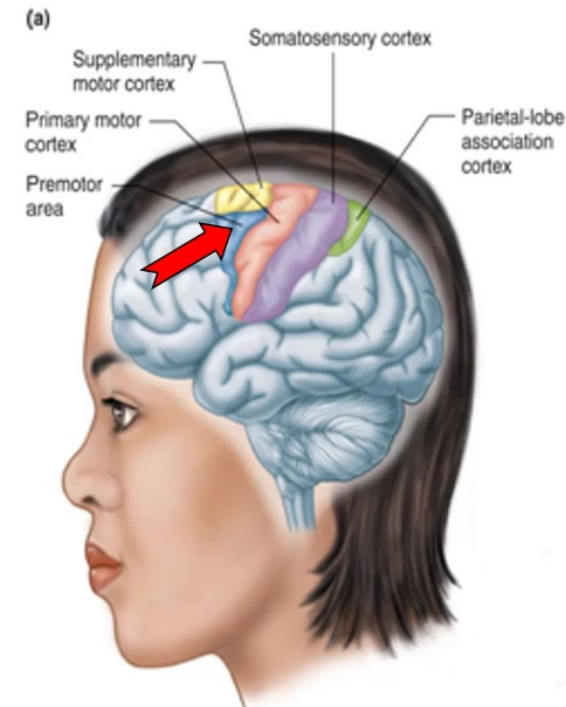
1. Pyramidal
2. Extrapyrarnidal



# Premotor Area 6

## Pyramidal

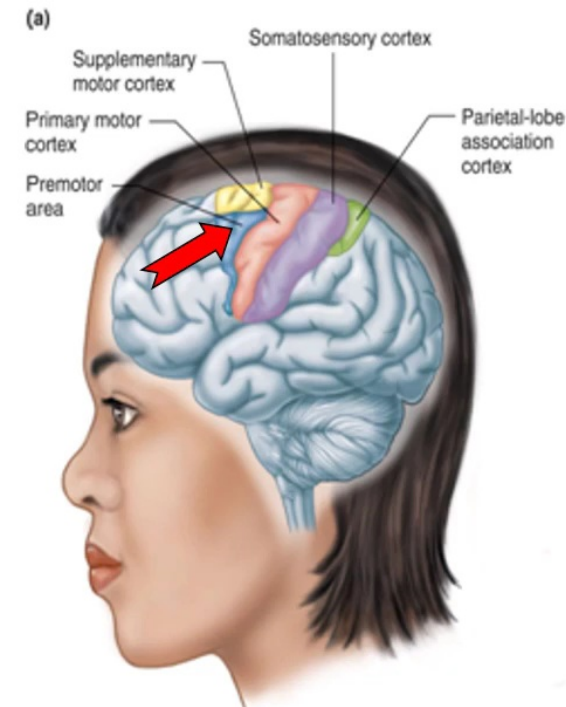
- → Area 4 for execution
  1. Puts & stores programs
  2. Design & plans of learnt skilled movements
  3. Memory of skilled movements stored in area 6



# Premotor Area 6

## Extrapyramidal

- → Main area of the body
  - Except eyes
1. Cortico Reticulo Spinal
  2. Controls postural adjustment of proximal girdle muscles
  3. Semiautomatic movements (walking)
  4. Inhibition of muscle tone

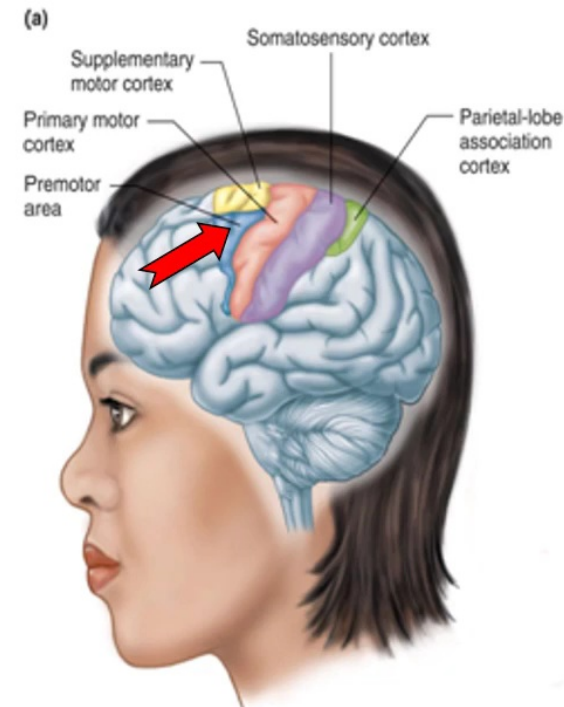


# Premotor Area 6

- **Damage**

- **Motor Apraxia**

1. Impaired voluntary movements
2. Loss of memory store
3. Loss of postural stability of proximal muscles (no paralysis)
4. Reappearance of the Grasp Reflex
5. Muscle spasticity



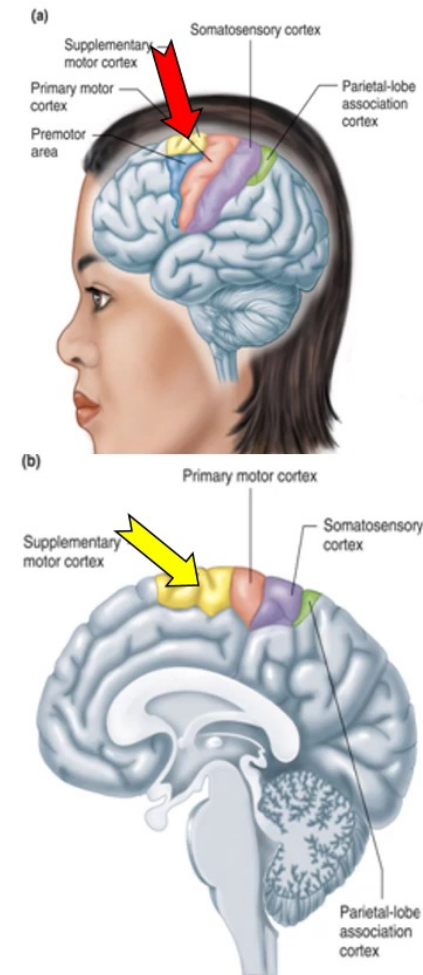
# Supplementary Motor Area

- **Site**

- Part of area 6
- Medial frontal gyrus
- Anterior to the paracentral lobule

- **Representation**

- Face anterior
- Leg posterior



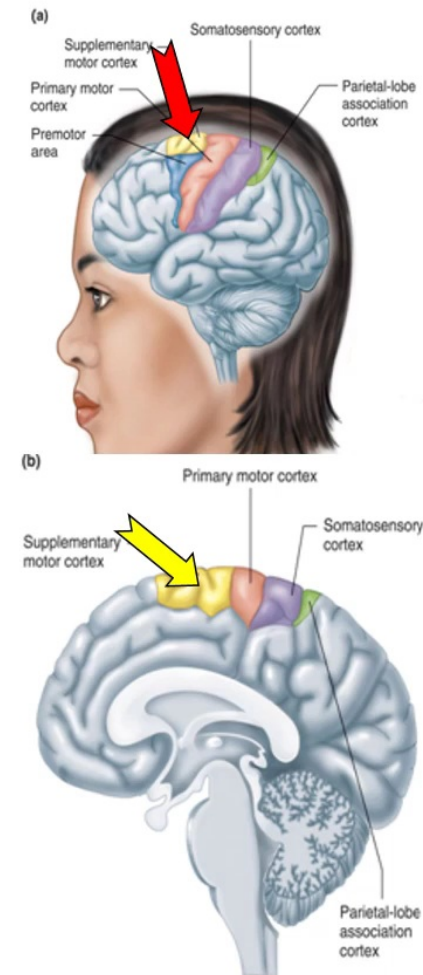
# Supplementary Motor Area

- **Input**

- The decision making area of the prefrontal cortex
- Basal Nuclei through VAN of thalamus

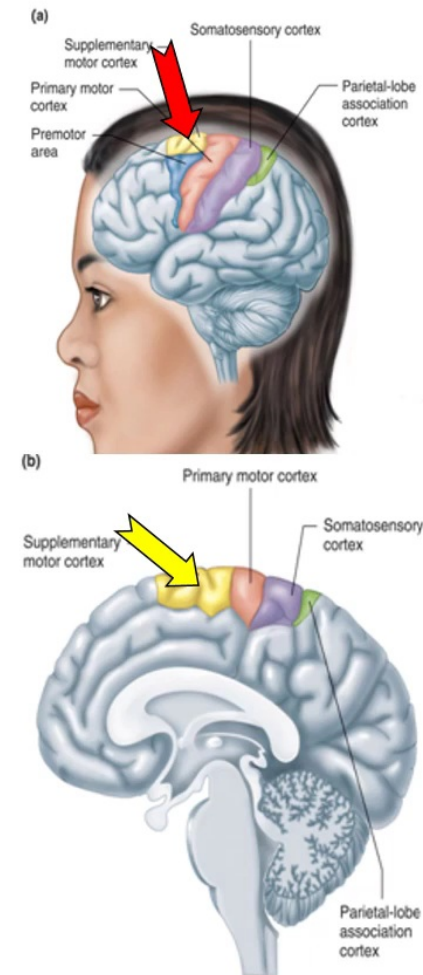
- **Output**

- Area 4 & 6
- Both hemispheres



# Supplementary Motor Area

- **Function**
  - Programming motor sequence
  - Before movement begins
  - Complex bimanual skilled hand movements
  - Program of intended movements
  - → area 4 for execution



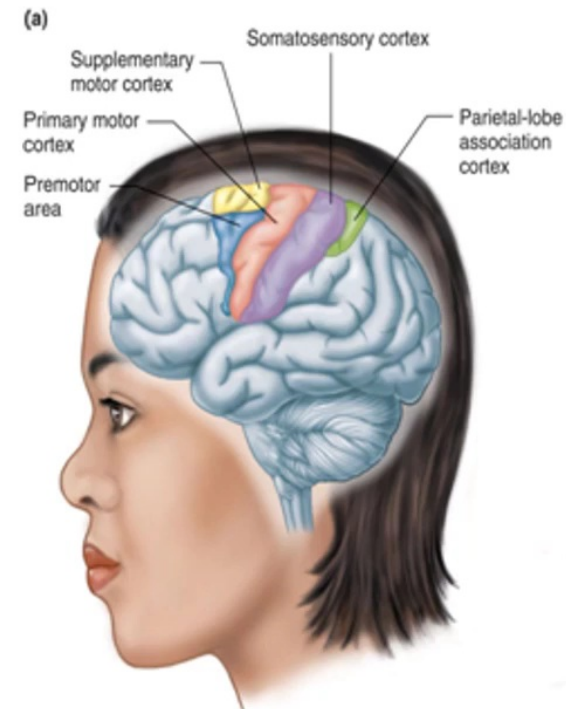
# The Specific Motor Areas

1. Frontal eye field 8
2. Broca's speech area
3. Exner's writing centre



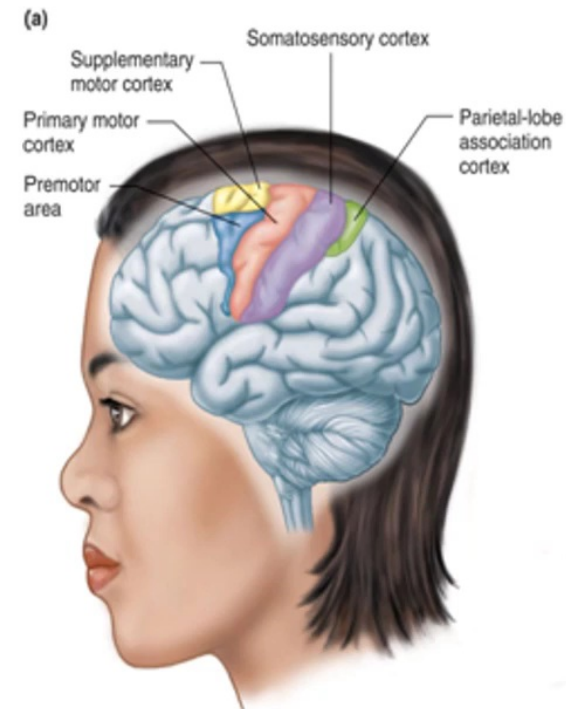
# Exner's writing centre

- **Site**
  - Frontal lobe
  - Anterior to hand area (4)
  - Usually left side
- **Input**
  - Arcuate fasciculus from Wernick's area
- **Output**
  - Hand Motor area (4)



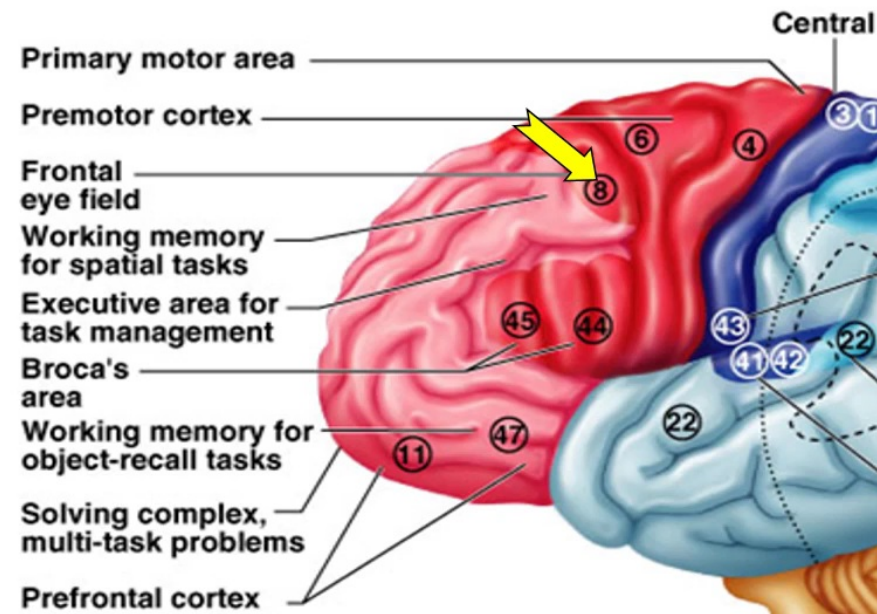
# Exner's writing centre

- **Function**
  - Stores motor programs
    - Writing
    - Drawing
- **Damage**
  - Agraphia



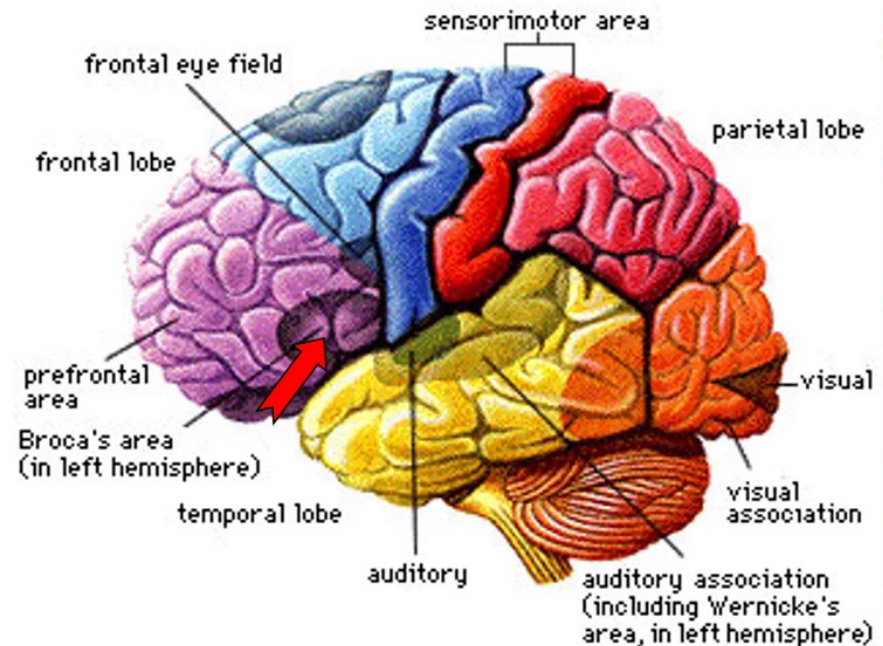
# Frontal Eye Field: Area 8

- Pyramidal motor area for the EYES
- Posterior end of the middle frontal gyrus
- Medial Corticobulbar fibers



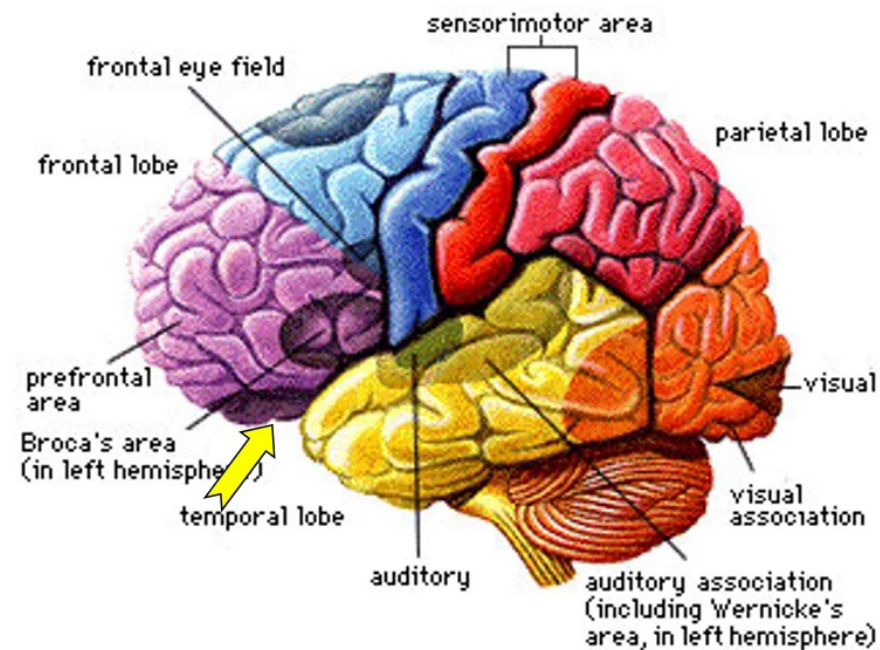
# Broca's Motor Speech Area

- Posterior part of Inferior Frontal Gyrus
- LEFT Hemisphere
- Area 44
- Near motor area for the
- larynx,
- tongue and
- lips



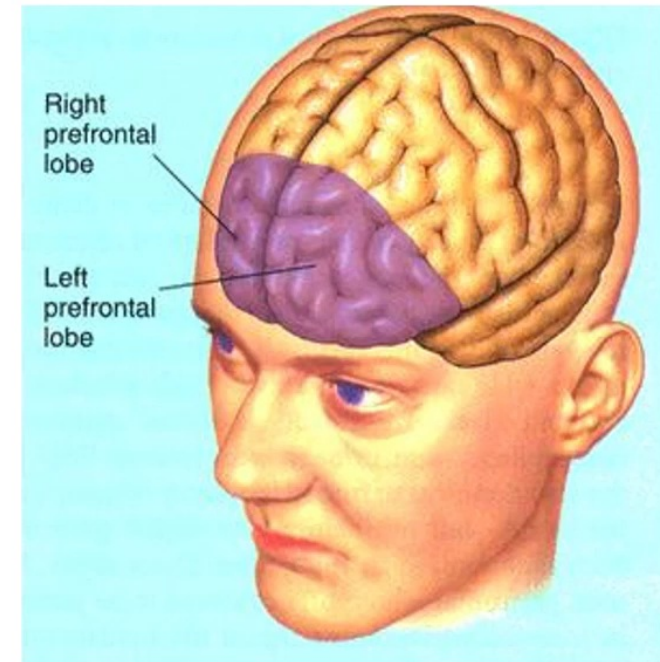
# Frontal Lobe Functional Areas

- Medial surface
  - Emotional behaviour
- Orbital surface
  - Autonomic activity control



# Prefrontal Cortex

- Anterior frontal lobes
  - Anterior to area 6
  - As far as the frontal pole
- Connection
  - Parietal, temporal & occipital association areas
  - Thalamic medial nuclei
  - Amygdala



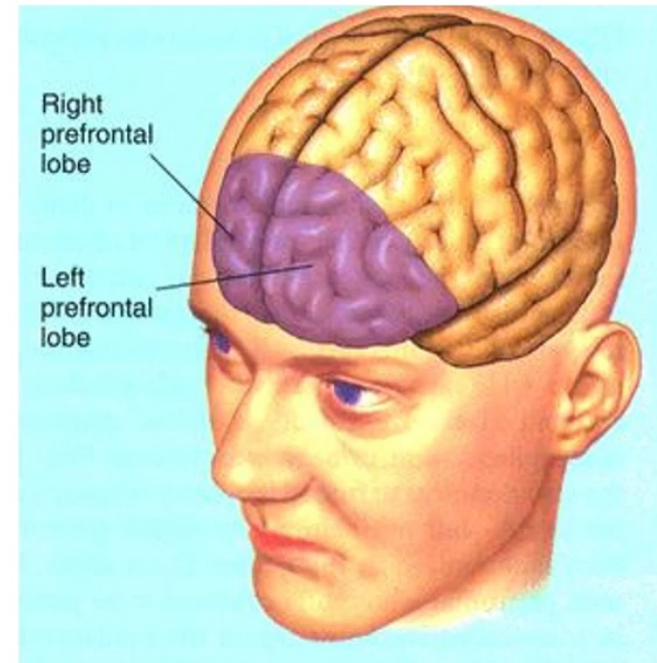
# Prefrontal Cortex

- **Function**

- Decision making area (dorsolateral)
- Cortical area for higher mental functions
  - Intellectual abilities
  - Judgement
  - Foresight 27

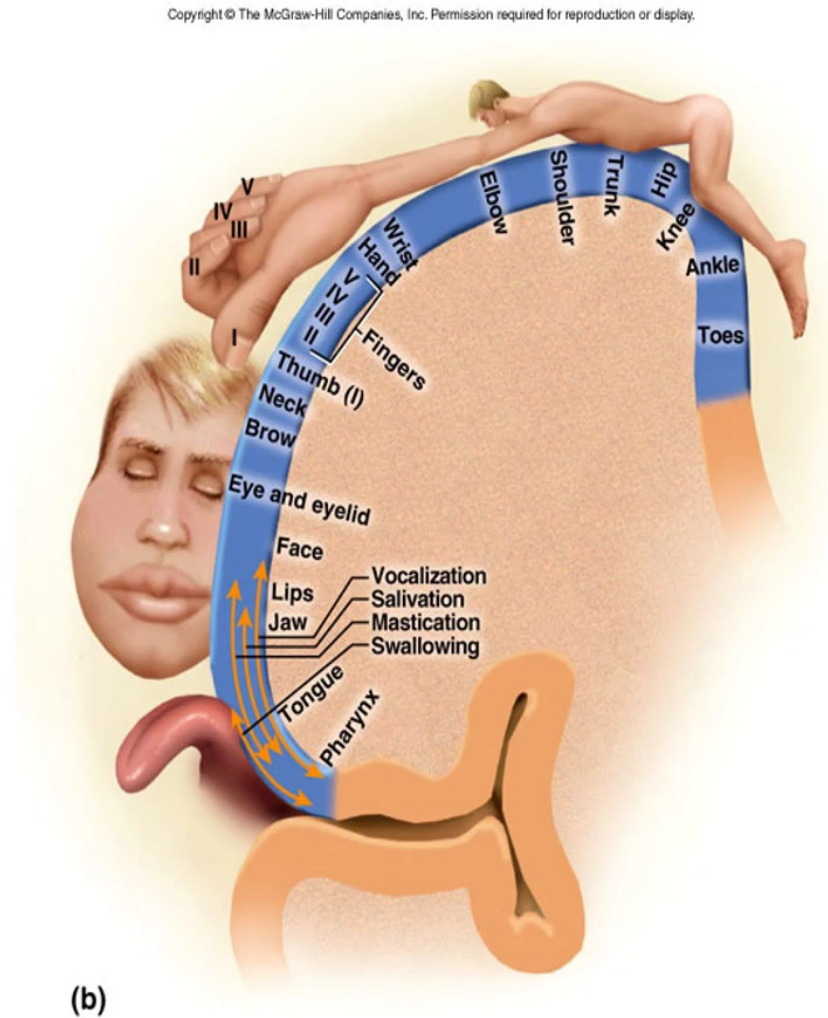
- **Involved in**

- Analysis,
- Cognition,
- Thinking,
- Personality,
- Conscience,
- & much more.



# Motor Control

- Motor homunculus
  - proportional to
  - number of
  - muscle motor units
  - in a region

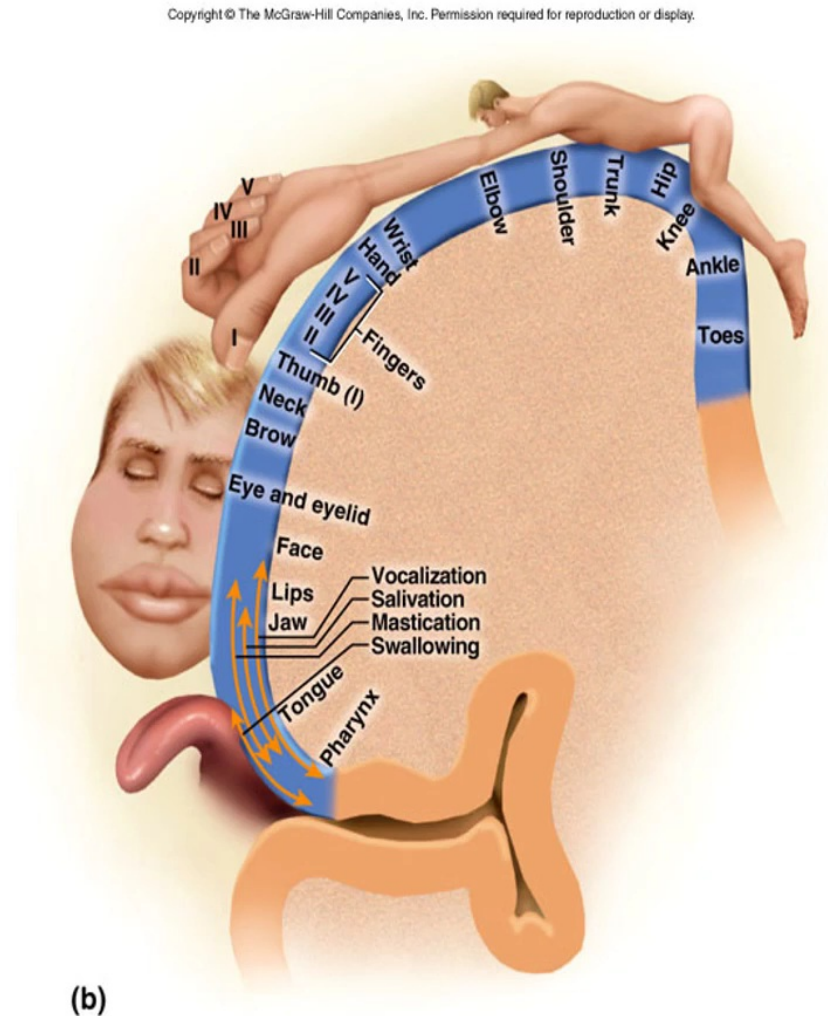


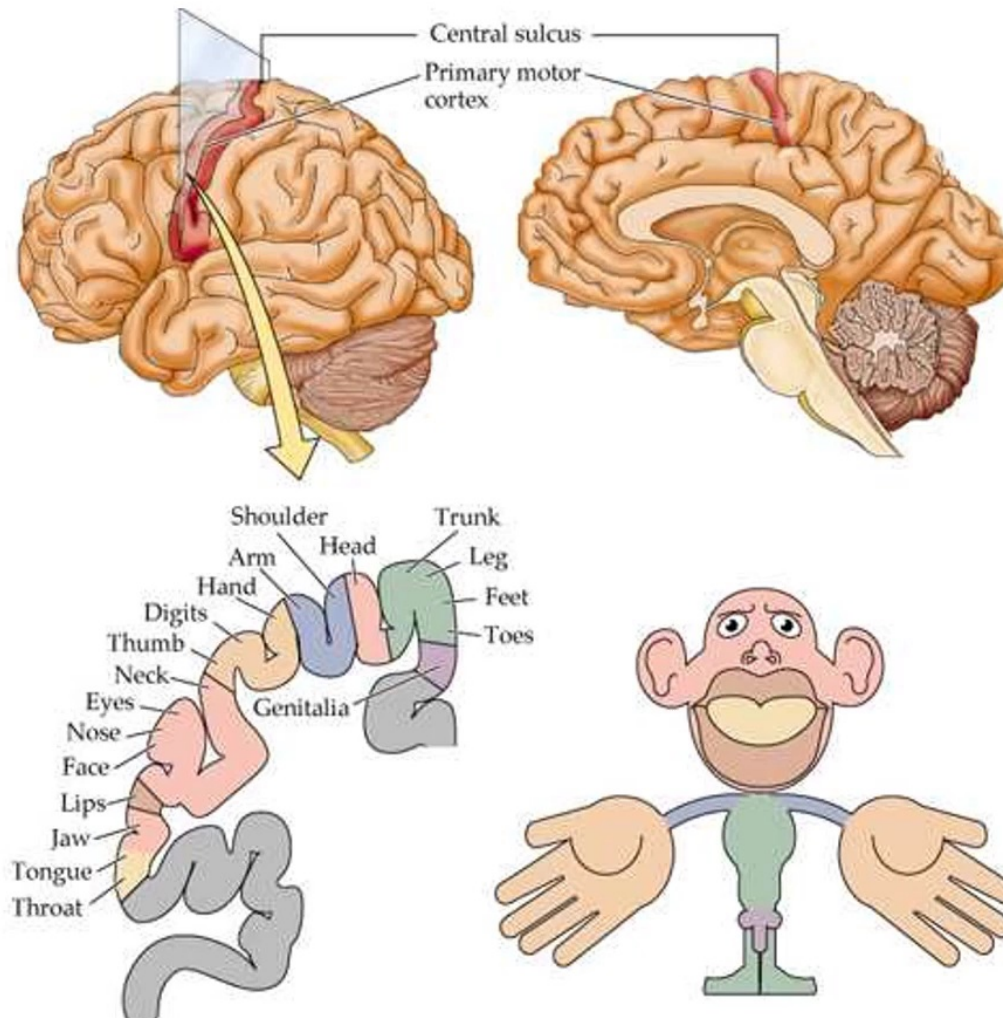
# Motor Control

Greater # of motor units

- allows for
- fine movement patterns

- Face,
- mouth,
- hands,
- feet



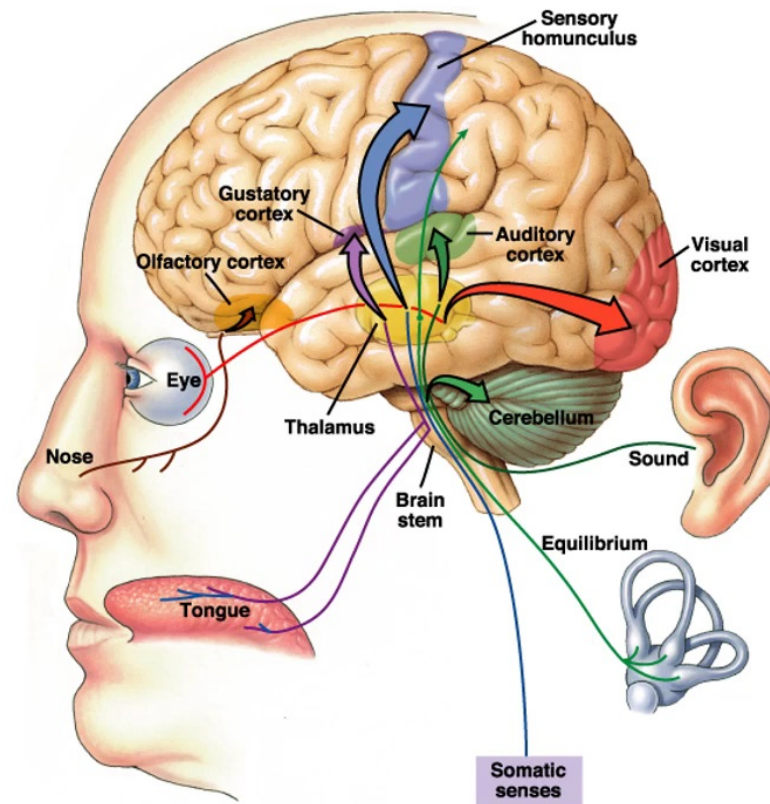


# Parietal lobe

- Principle sensory area
  - Touch
  - Proprioception
- Involvement in cognition

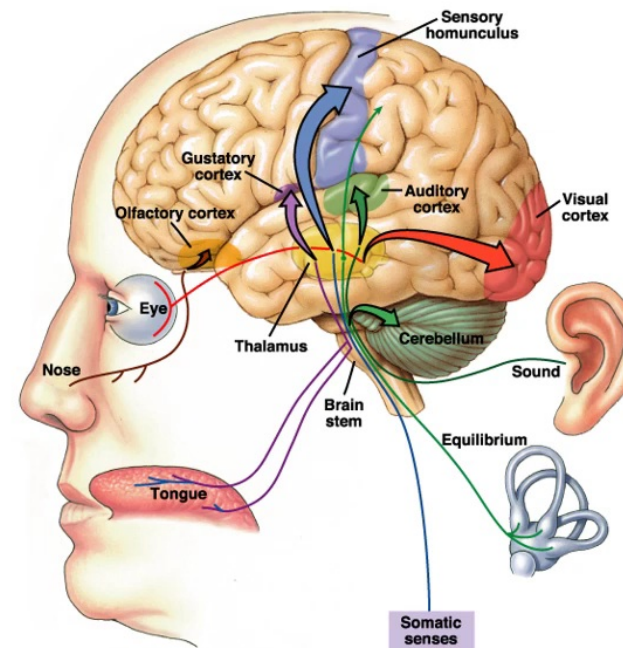
Lesions cause

- Sensory losses
- Receptive speech loss



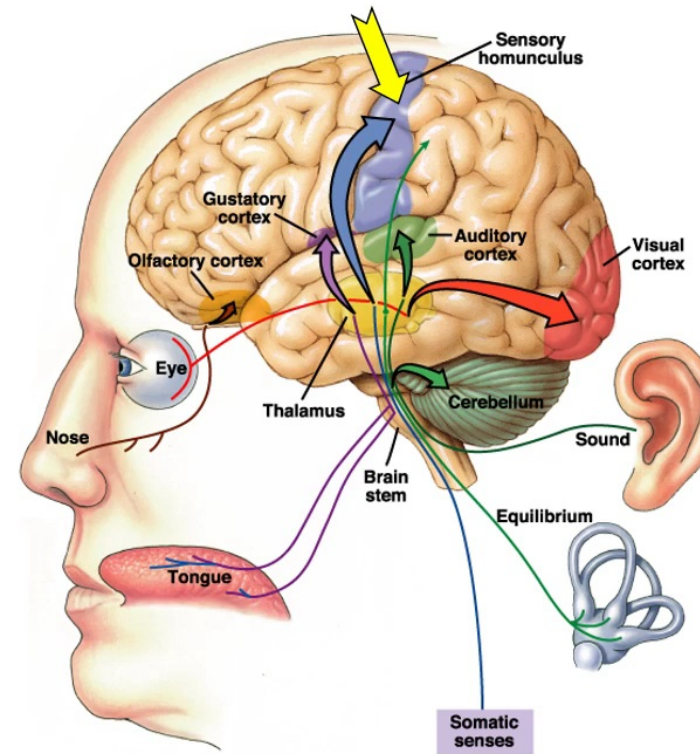
# Parietal lobe

- 3 Somatosensory Areas
  - First Somatosensory Area
    - The Main Sensory Area
    - S I
    - Area 3, 1 & 2
  - Second Somatosensory Area
    - S II
  - Somatosensory Association Cortex
    - Areas 5, 7
    - Areas 40, 39



# First Somatosensory Area

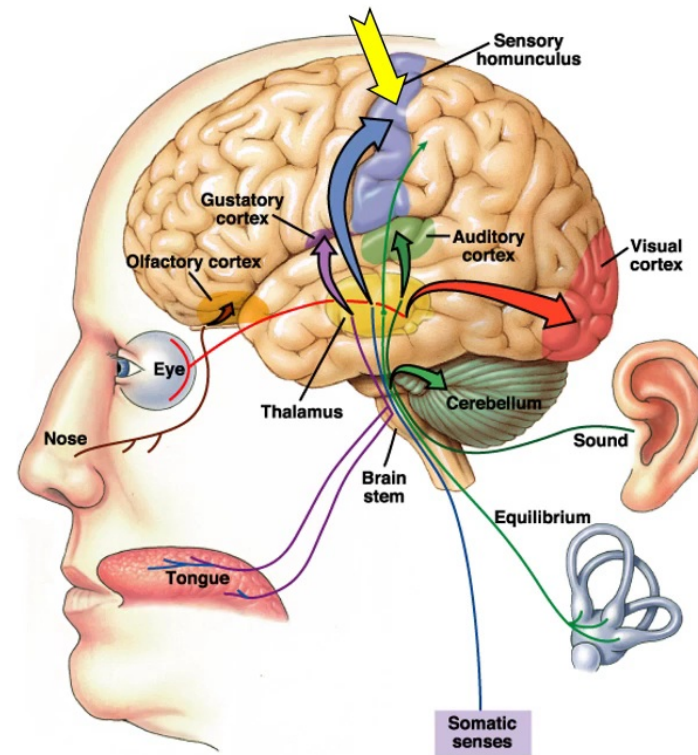
- The Main Sensory Area
  - Areas 3,1 & 2
  - Post-central gyrus + its medial extension in the posterior part of the paracentral lobule



# First Somatosensory Area

Represents

- Inverted
- Contralateral  $\frac{1}{2}$
- of the body
  - Face → down on the lateral surface
  - LL → medial surface



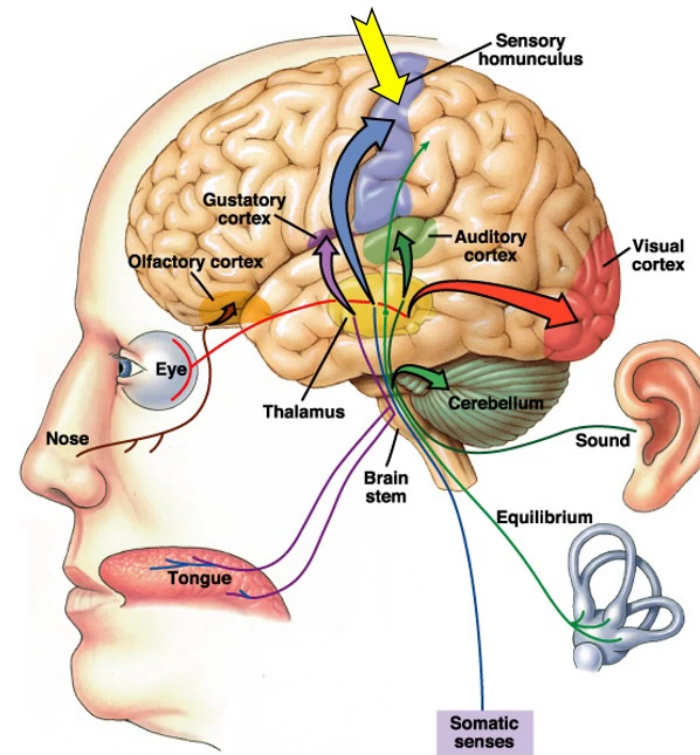
# First Somatosensory Area

- **Input**

Nucleus Ventralis Posterior of the Thalamus

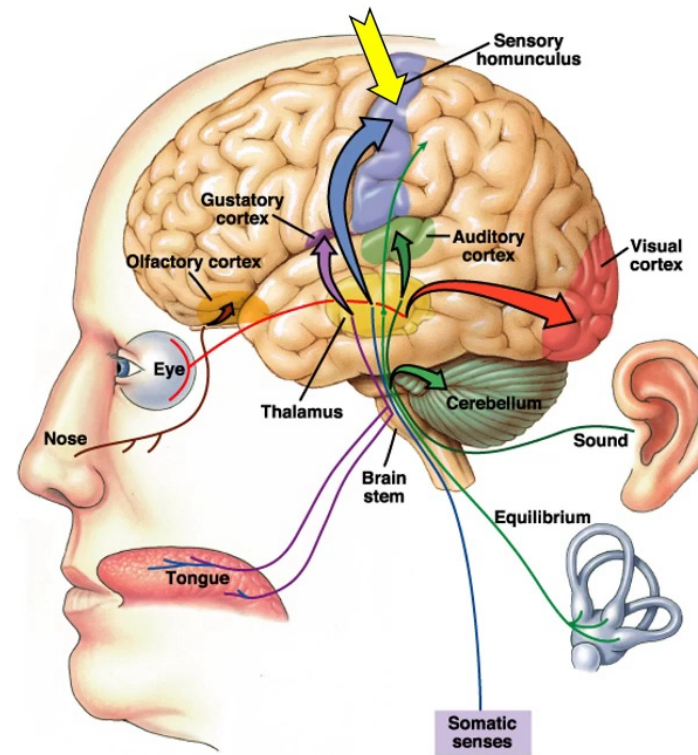
Lemnisci

1. Medial,
2. Spinal &
3. Trigeminal



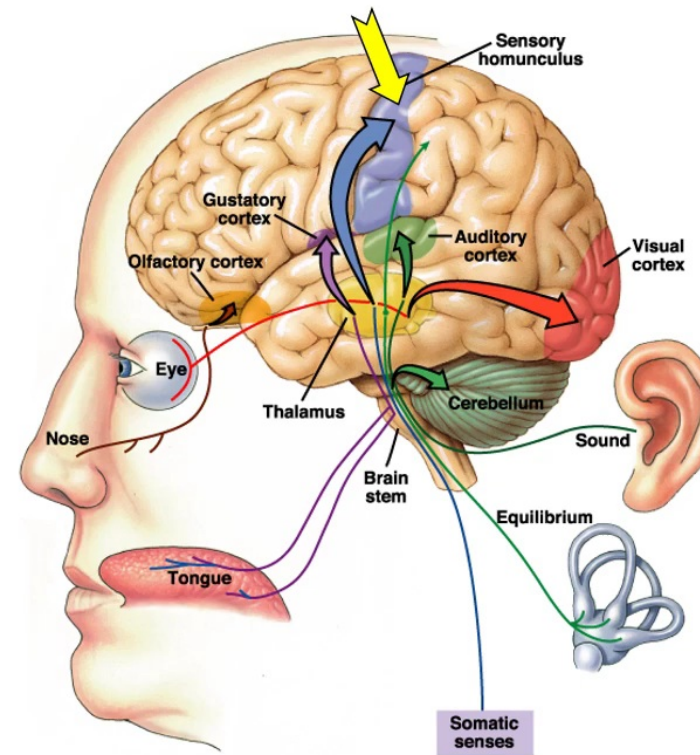
# First Somatosensory Area

- Receives
  1. Pain
  2. Temp
  3. Touch
  4. Proprioception
- Upper 2/3
  - Body below the Head
- Lower 1/3
  - Head +
  - Taste



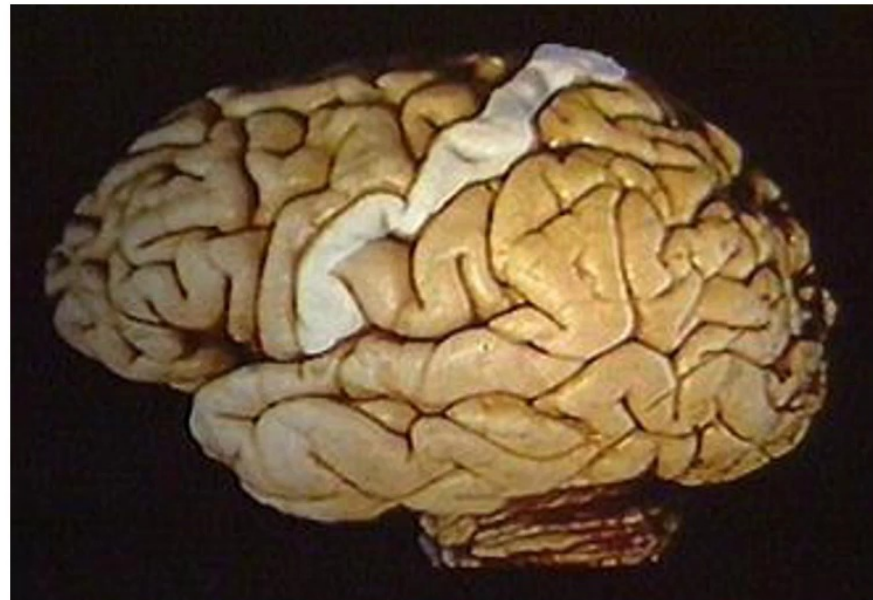
# First Somatosensory Area

- Output
  - → sensory association cortex
  - 5 & 7



# First Somatosensory Area

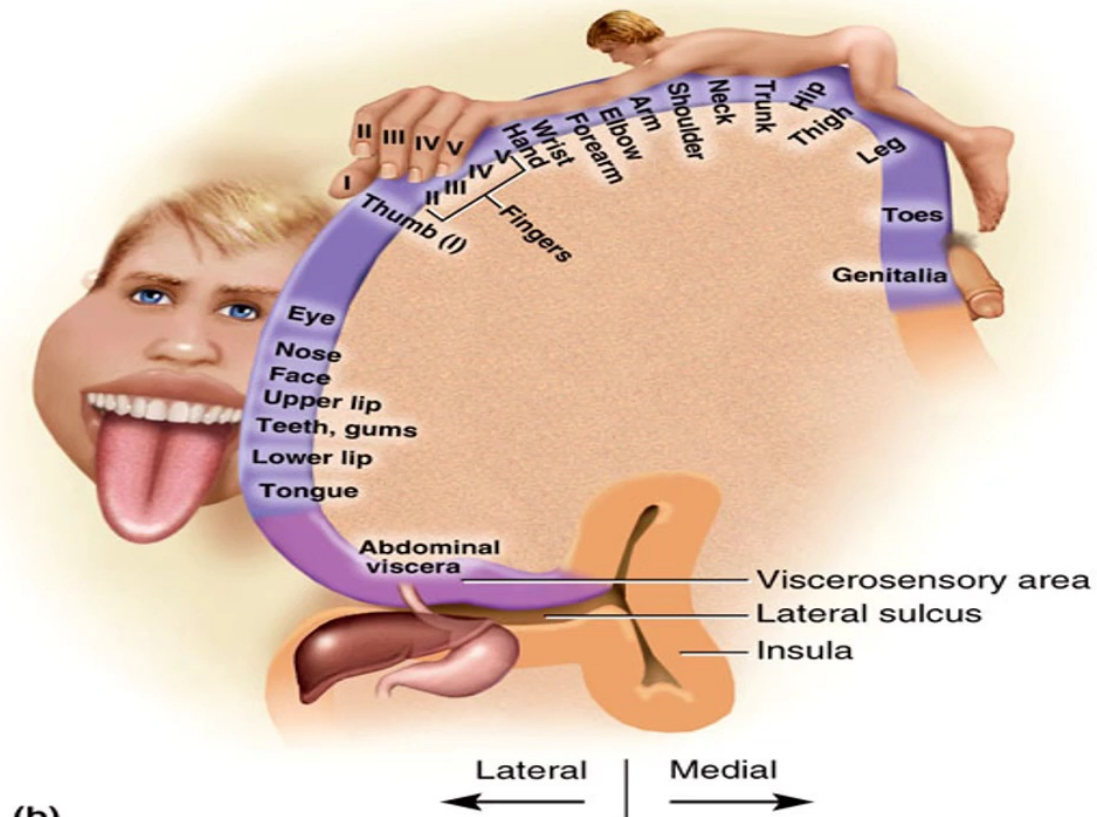
- Neurons in this cortical area receive info from
  1. Sensory neurons in the skin
  2. Proprioceptors which monitor joint position
- Contralateral input



# Sensory Homunculus

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- Area of cortex
  - Dedicated to
  - sensations of
  - body parts
- Proportional to the
- sensitivity of
- that body part



(b)

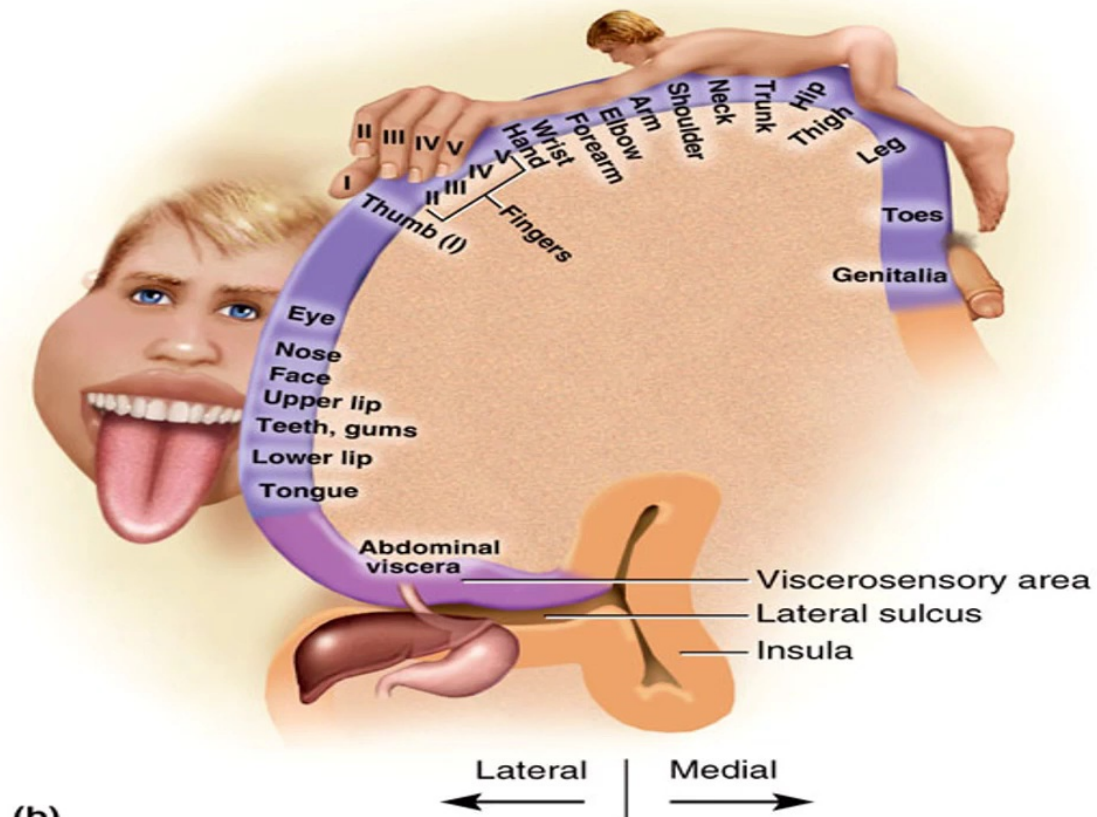
# Sensory Homunculus

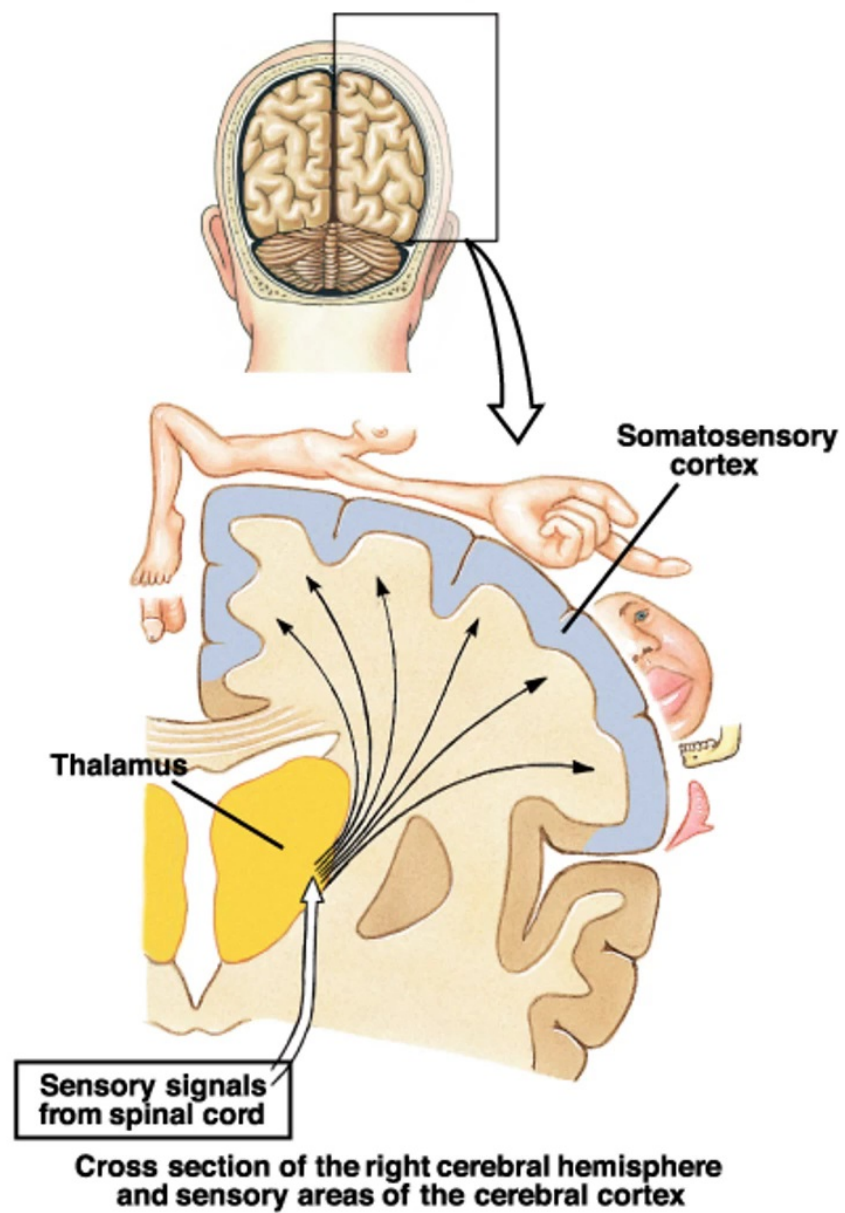
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- (# of receptors)

The face mouth ,hands and fee

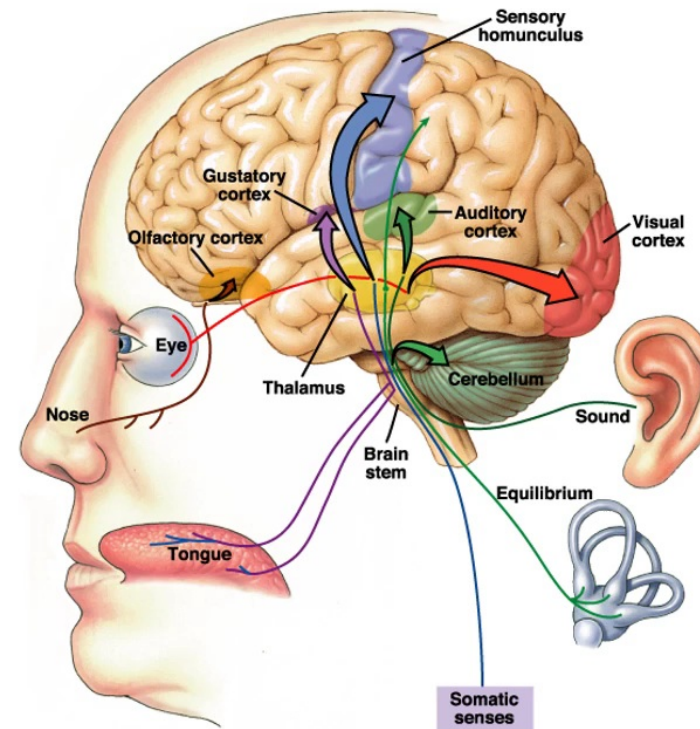
- Have the greatest amount of receptors
- Allows the greatest discrimination of touch





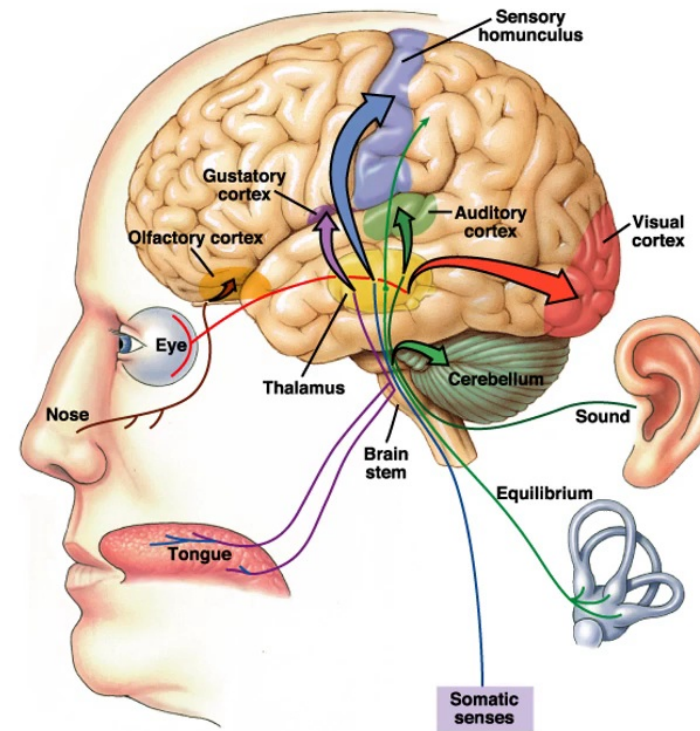
# Secondary Somatosensory Area

- S II
- Site
  - The Superior lip of the
  - Posterior Ramus of the
  - Lateral Sulcus
  - below S I
- Body representation
  - Head most anterior
  - Leg most posterior



# Secondary Somatosensory Area

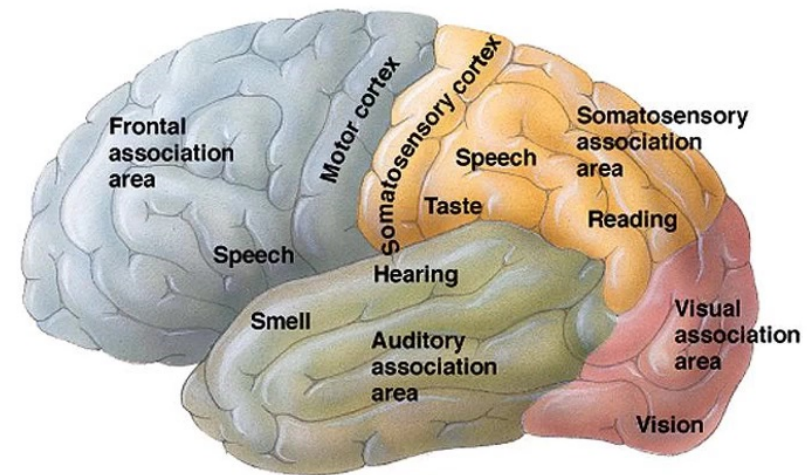
- Input
  - From S I
- Function
  - ? Perception of Pain
    - Chronic
    - Slow
    - Poor discriminated



# Somatosensory Association Cortex

Found

- posterior to the
- primary somatosensory cortex
- Neurally tied to it



Synthesizes

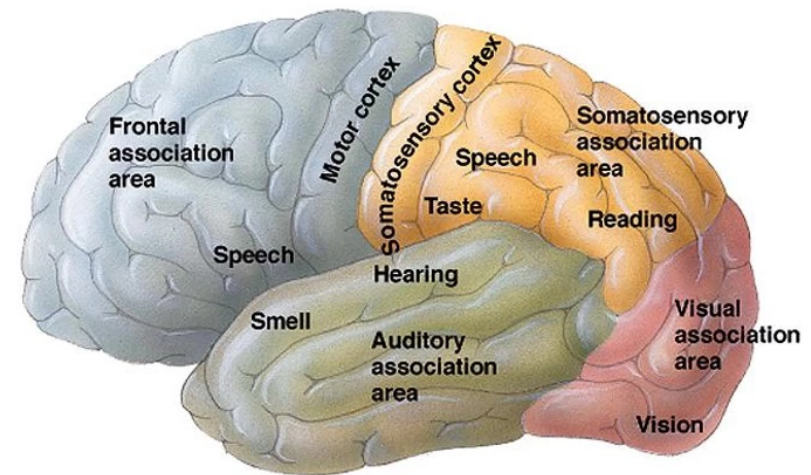
- multiple
- sensory inputs



# Somatosensory Association Cortex

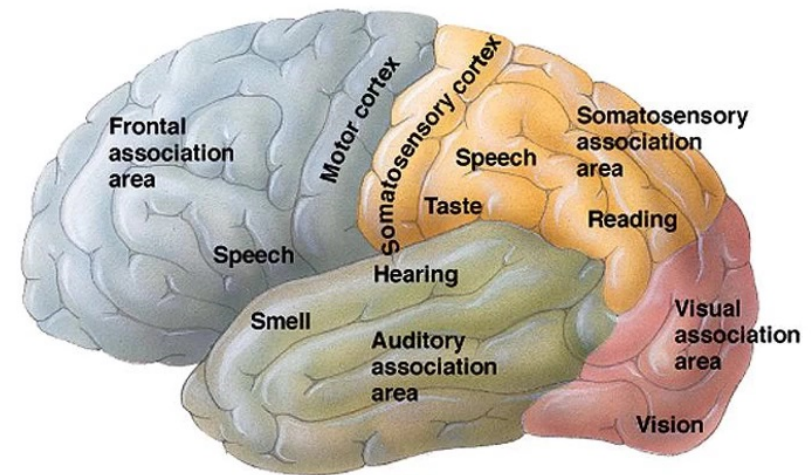
Creates a

- complete
- comprehension of the
- object
- being felt



# Somatosensory Association Cortex

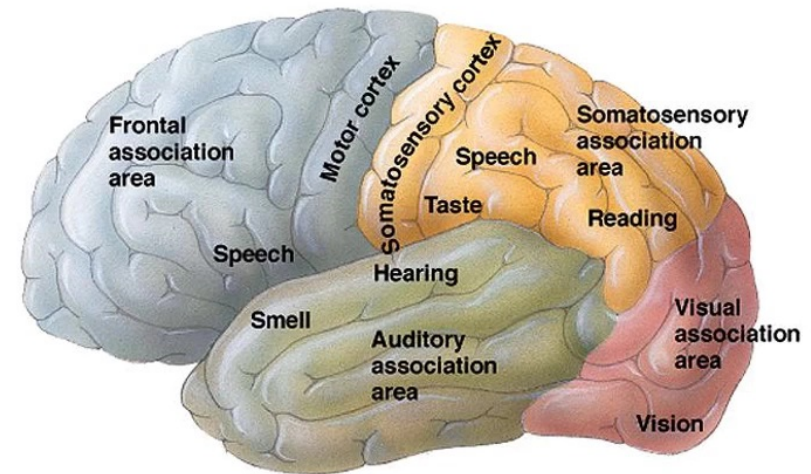
- Know the
  - meaning of the
  - sensation
  - we feel
- 
- Damage →
    - Agnosia
    - Disturbed body image



# Somatosensory Association Cortex

1. The Superior Parietal Lobule + Precuneas

2. Inferior Parietal Lobule



# Somatosensory Association Cortex

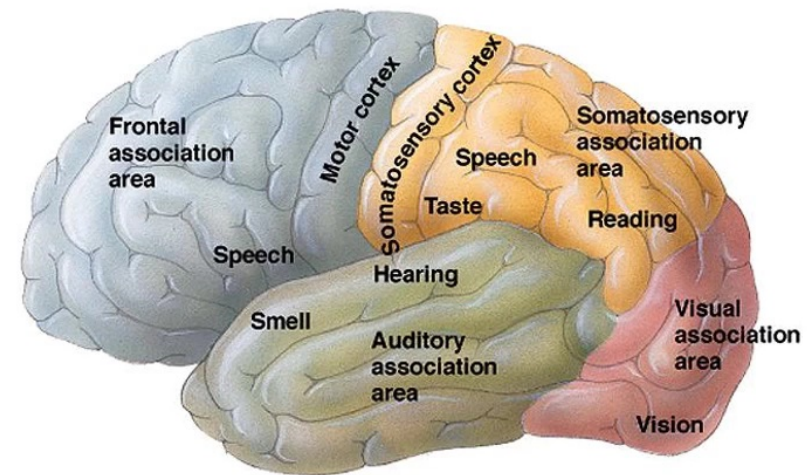
- The Superior Parietal Lobule + Precuneas

- Area 5, 7

- Input from S I

- Function

- Stereognosis
      - X → astereognosis
    - Stores sensory memory
      - Based on past experience



# Somatosensory Association Cortex

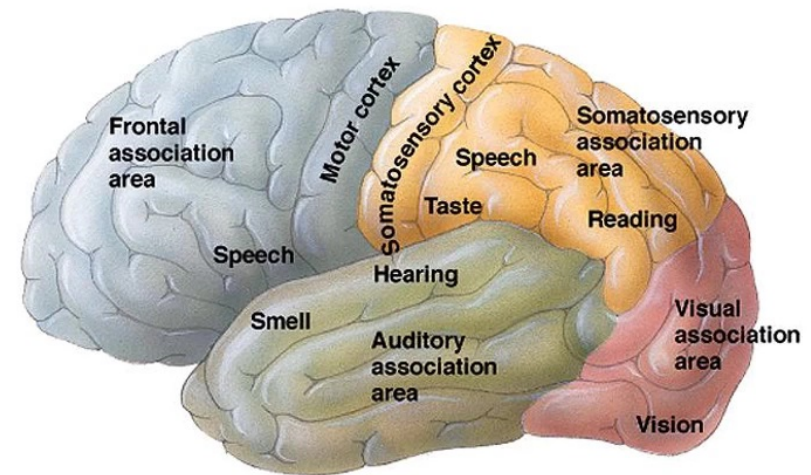
- Inferior Parietal Lobule

- Area 40

- Supramarginal G
    - Surrounds upturned end of the posterior ramus of the lateral sulcus

- Area 39

- Angular G
    - Surrounds upturned end of the superior temporal sulcus



# Somatosensory Association Cortex

- Input from
  - S I
  - Visual input from area 19
  - Auditory input from 2ry auditory area
- Function
  - General interpretive area
  - Integrates
    - Somatosensory
    - Vision
    - Hearing
  - Stores it in Memory

