

Cerebrum-Lobes, areas, f unctions

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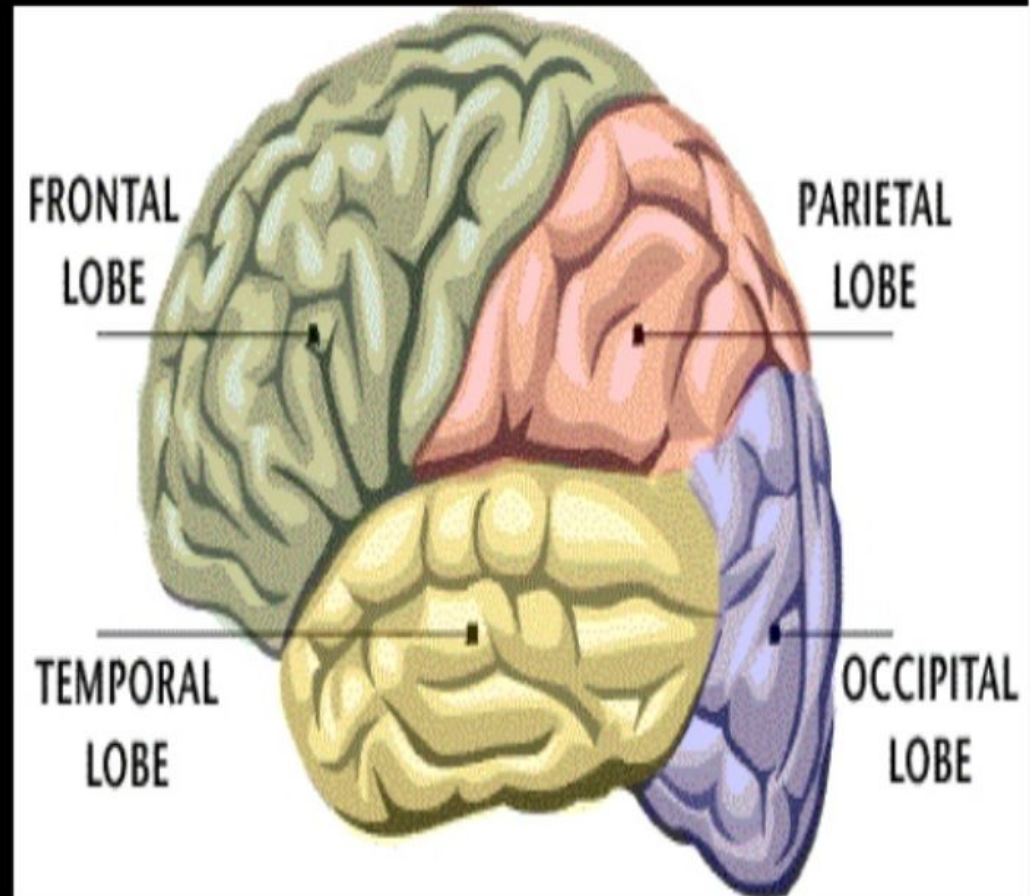
- ▶ **PY10.7 Describe and discuss functions of cerebral cortex, basal ganglia, thalamus, hypothalamus, cerebellum and limbic system and their abnormalities**

Cerebrum- cerebral cortex

- ▶ Lobes, Areas-Broadmans
- ▶ Frontal-Prefrontal, Parietal, Occipital, Temporal, Limbic Lobes
- ▶ Functions
- ▶ Abnormalities

CEREBRAL CORTEX

- ❖ Sulci & Gyri.
 - ❖ Surface area of cortex–
 2200cm^2
- ❖ Lobes of cerebral hemispheres.
 - ❖ Frontal – Motor.
 - ❖ Parietal – Sensory.
 - ❖ Temporal – Auditory.
 - ❖ Occipital – Vision.



Functional Areas of the Cerebral Cortex

Motor areas

Primary motor cortex

Premotor cortex

Frontal
eye field

Broca's area
(outlined by dashes)

Prefrontal cortex

Central sulcus

Sensory areas and related association areas

Primary somatosensory
cortex

Somatosensory
association cortex

Somatic
sensation

Gustatory cortex
(in insula on roof
of lateral sulcus)

Taste

Wernicke's area
(outlined by dashes)

Primary visual
cortex

Visual
association
area

Vision

Auditory
association area

Primary
auditory cortex

Hearing

(a) Lateral view, left cerebral hemisphere



Primary motor cortex



Motor association cortex



Primary sensory cortex



Sensory association cortex



Multimodal association cortex

Frontal lobe.

■ **Precentral cortex.**

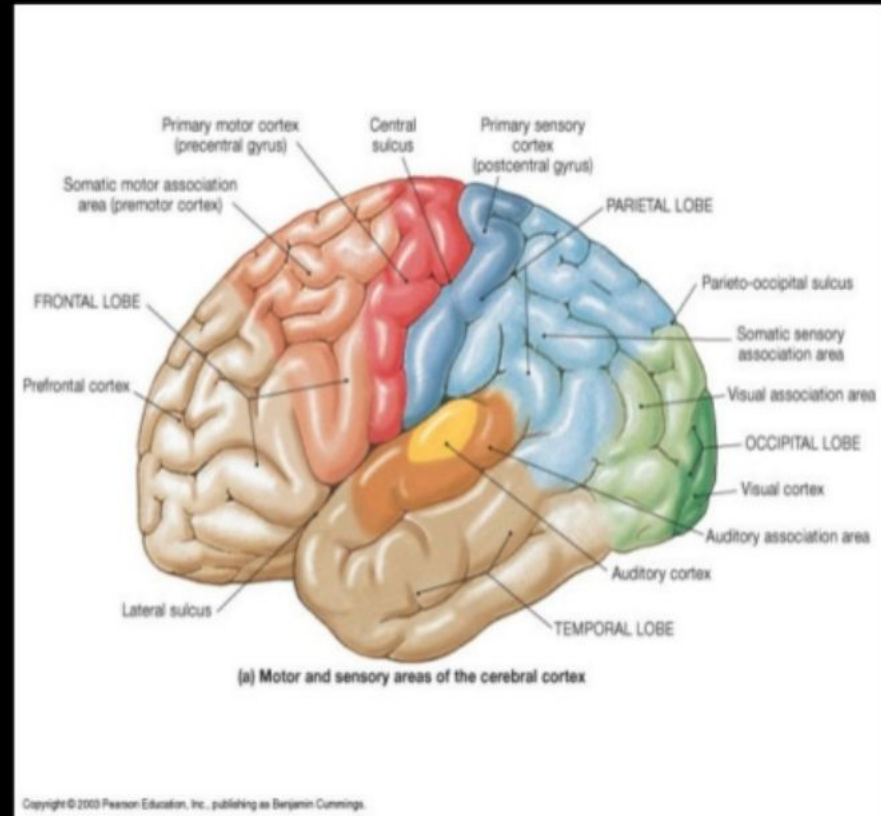
- Also called Excitomotor area of cortex.
- Stimulation causes activity in discrete skeletal muscles
- Sensorimotor cortex.— sensory & motor cortex.

■ **Prefrontal cortex.**

- Also called prefrontal lobe or Orbitofrontal cortex.
- Ant to area 8 & 44.

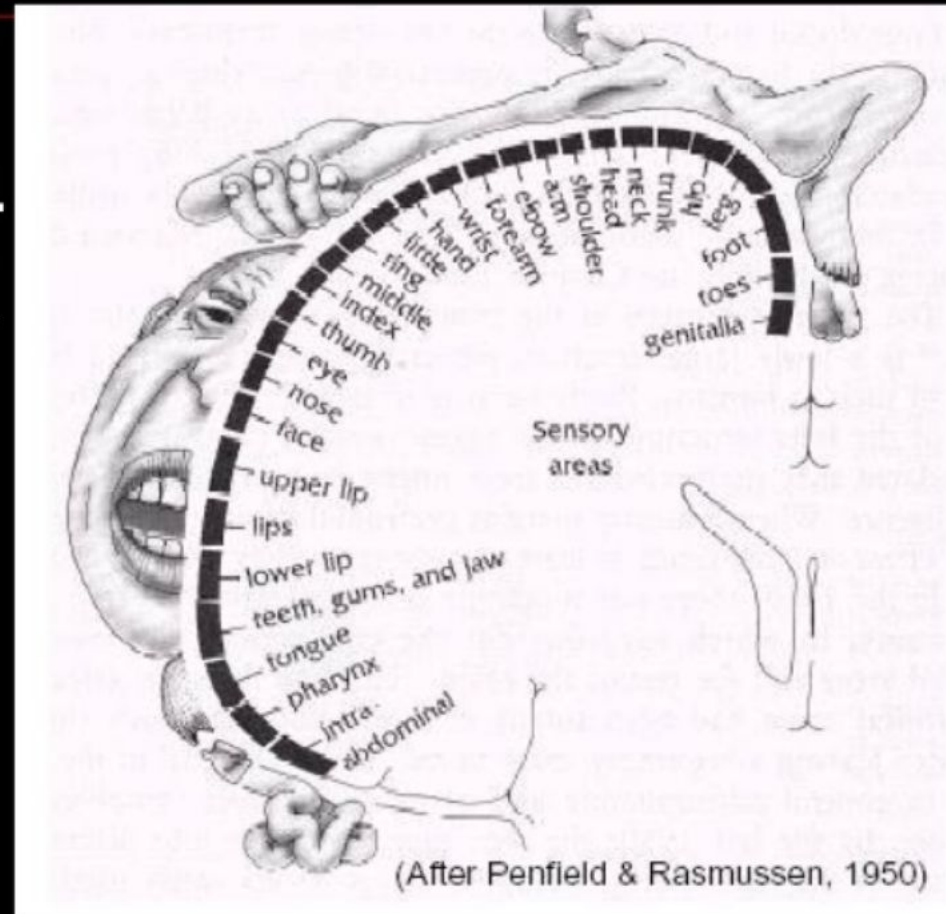
Primary Motor Area (4)

- **Extent** – from Precentral gyrus to Paracentral lobule on medial surface.
- **Characteristics** –
 - 6 layers of cortex.
 - Giant pyramidal cells (Betz cells)



Topographic Representation.

- Contra lateral half of body in inverted order.
- Part of body for skilled movements – larger area.
- Body represented **upside down.**

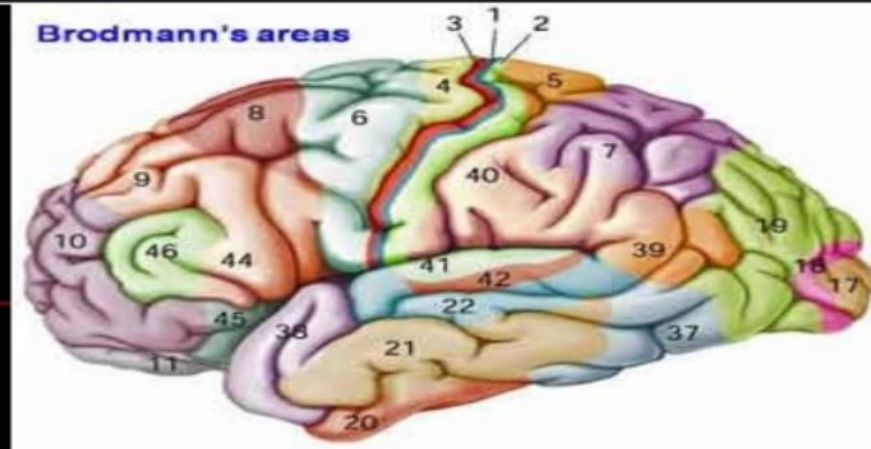


Primary Motor Area (4)

- Electrical stimulation.– Motor homunculus.
- Motor cortex organized in terms of movements.
- Stimulation of points of face, pharynx & vocal cords – bilateral response.
- Functions – Centre for volition. i.e. initiation of movements & speech.
- **Area 45** – suppressor area.
- Inhibits movements initiated by area 4.

Premotor area. (6,8,44,45) area 6

- Structurally similar except Giant Pyramidal Cells.
- 2 parts – Upper 2a, Lower 2b.
- Topographical representation – same.
- Functions – Integration of voluntary movements. Make skilled movements accurate & smooth.
- Lesions – Hemiplegia with Spastic paralysis.

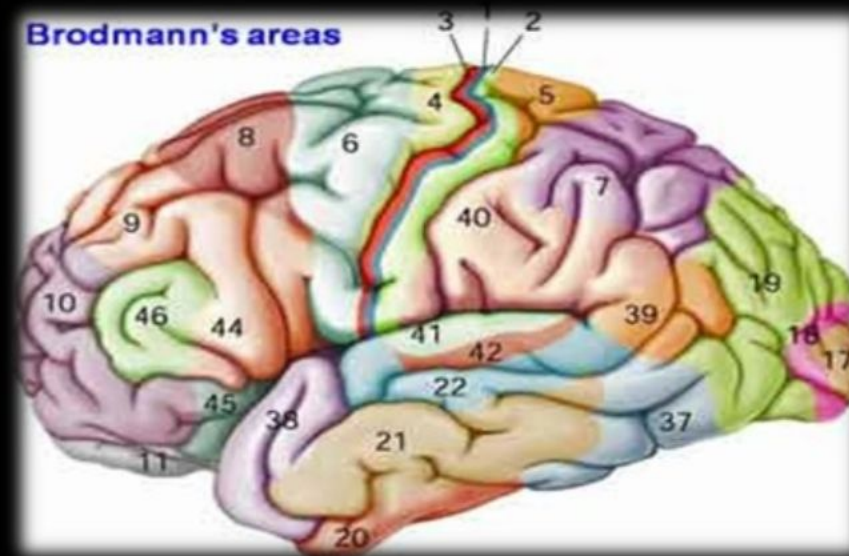


Area 8

- Frontal Eye field.
- Location – ant to area 6.
- Function – control eye movements.
- Lesions – turn eye to opposite side.
- Conjugate movements -- lost

■ **Afferent** – occipital lobe & Dorsomedial N. of Thalamus.

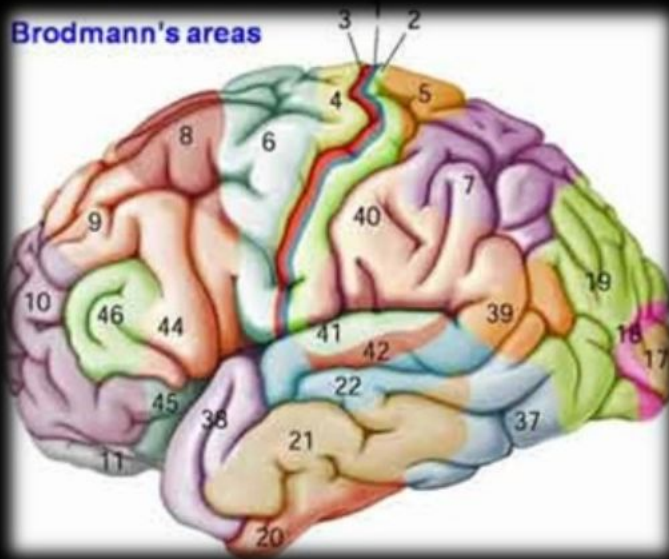
■ **Efferents** – N. of III, IV & VI Cranial nerves.



- **Broca's motor speech area.**

- **Area 44** – pars Triangularis.

- **Area 45** – pars Opercularis.

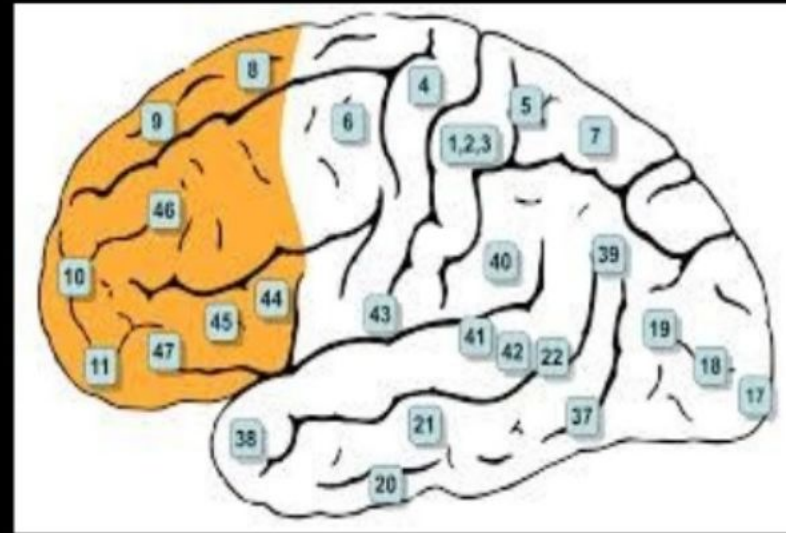


Area 44 & 45.

- **Functions** – in **Dominant Hemisphere** concerned with movements responsible for production of voice & articulation of speech.

Prefrontal cortex.

- Major areas. (9-14, 23,24,29,32, 44-47.



Prefrontal cortex.

■ Afferents

- Dorsomedial nucleus of thalamus.
- Anterior nuclei of thalamus.

■ Form Papez circuit– close circuit connection with thalamus.

■ Responsible for resting EEG & genesis of Emotions.

■ Efferents

- Thalamus. (V & M)
- Tegmental reticular formation.
- Pontine nuclei
- Caudate nucleus.
- Mammillary bodies.

Functions.

- Centre of planned actions
- Centre for higher functions.
 - Emotions, learning, memory & social behaviour.
 - Causes autonomic changes during emotional conditions
- Seat of intelligence.
 - Register short term memory
 - Called An organ of mind.
- Control of intellectual activities.

Control of Intellectual Activities.

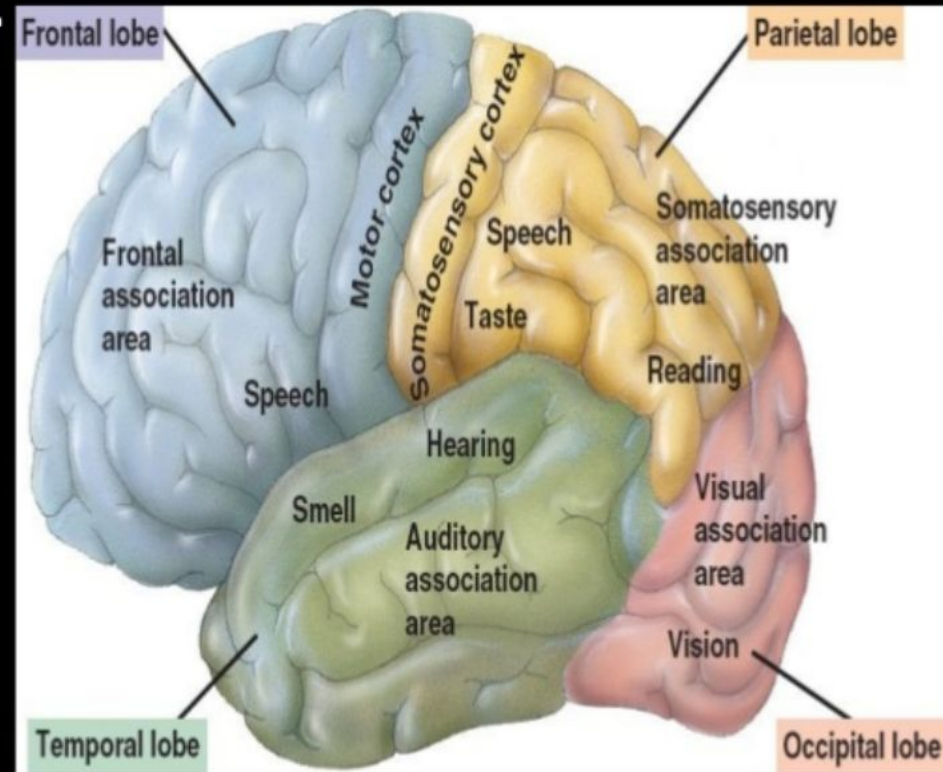
- To prognosticate.
- Plan future.
- Concentrate – Central theme of thought.
- Delay actions in response to sensory signals.
- Consequences of motor action before it.
- Solution of complicated mathematical & philosophical problems.
- Controls one's activity according to moral laws.

Applied aspects. Frontal lobe syndrome.

- **Cause** – ablation of prefrontal cortex.
- **Features.** (**FEEL – FILL**)
 - Flight of ideas.
 - Emotional instability.
 - Euphoria.
 - Loss of moral & social sense.
- Functional abnormal—
 - Hyperphagia.
 - Sphincters control loss.
 - Disorientation & tremors.
- Impairment of memory.
- Lack of attention & concentration.
- Lack of initiative & decreased intellectual activity.

Parietal lobe

- Primary sensory area. (3,1,& 2)
- Secondary sensory area.
- Sensory association areas. (5, 7)



Primary sensory area. (3,1,& 2)

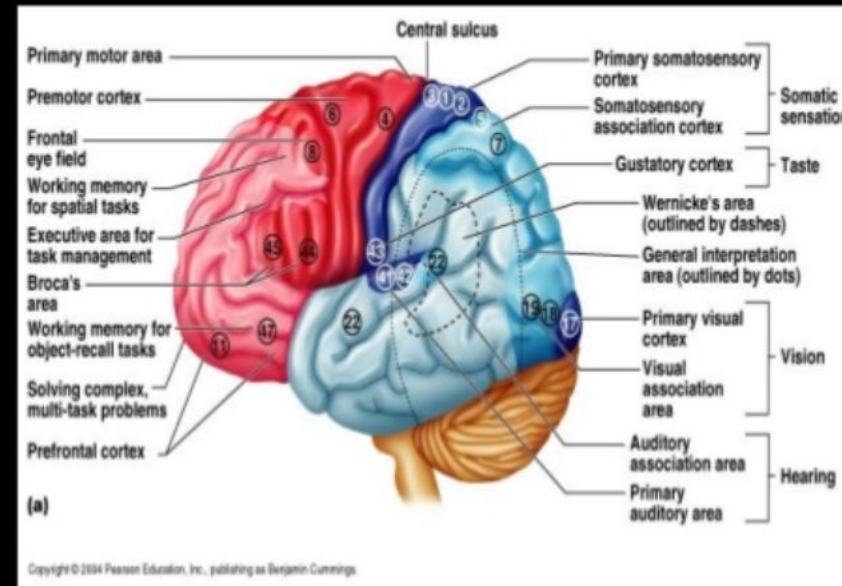
- **Location** – Post central Gyrus & Post wall of Central sulcus.
- **Histo** – dense stellate cells , few pyramidal cells.
- **Topographical representations.** – Sensory Homunculus.
- **Lesion** – without thalamus only discriminative functions lost
- With thalamus – all sensation from opp half of body.

Primary sensory area. (3,1,& 2)

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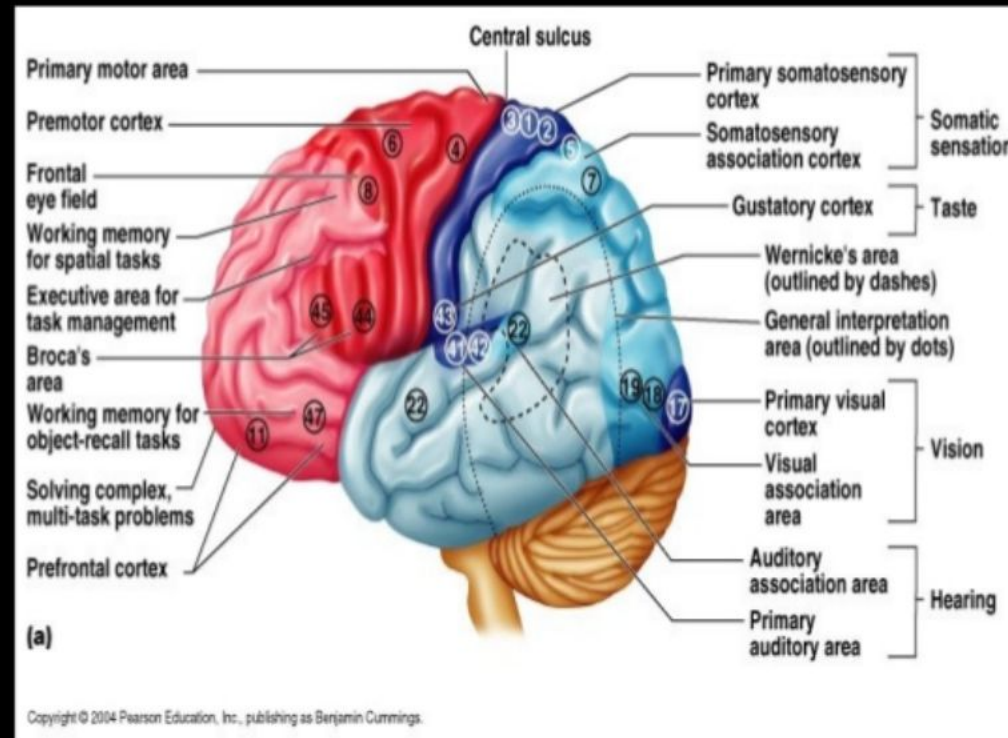
Secondary sensory area.

- **Location** – post central Gyrus below 1st somatic sensory area.
- **Topographical representation** – body represented twice in area I & area II.
- **Lesion** – discriminative power lost.



Sensory Association Areas. (5, 7)

- Post to area S1.
- Point to point representation.
- Lesion – Tactile Agnosia. (Astereognosis & Tactile Aphasia)



Connections of Parietal Lobe

■ **Afferents.**

- SI – Thalamus
(VPM,VPL)
Exteroceptive &
Proprioceptive from opp
side & both sides of face.
- SII – from SI & thalamus
- Sensory Association
area. – SI & SII

■ **Efferents.**

- Corticospinal
- Corticobulbar

Functions of Parietal Lobe

- **First somatic sensory area. (SI)**
 - Localize, analyze & Discriminate Cutaneous & Proprioceptive senses.
 - Area 3 – touch, pressure, position & vibrations.
 - Area 1 – Cutaneous & joint sense.
 - Area 2 – deep sense from muscles & joints.

Parietal Lobe

- **Second somatic sensory area. (SII)**
 - From S1 & thalamus directly.
 - Perception of sensation.
- **Sensory association area. (5,7)**
 - Discriminate stimuli related to intensity.
 - Warm, warmer, cold, colder

Temporal lobe.

Primary auditory area.

- 41, 42 Audio sensory Area.
- HEARING CENTRE.
- Middle of superior temporal gyrus.
- From – MGB, Thalamus.
- To – MGB, Superior colliculus.
- Perceives – loudness, pitch, source & direction of sound.

Auditory association area

- 22, 21 & 20
- 22- Wernicke's area, also called sensory speech area in dominant hemisphere.
- Interpretation of meaning, comprehension of spoken language & formation of ideas.
- 21, 20 – interpretation & integration of auditory impulses.

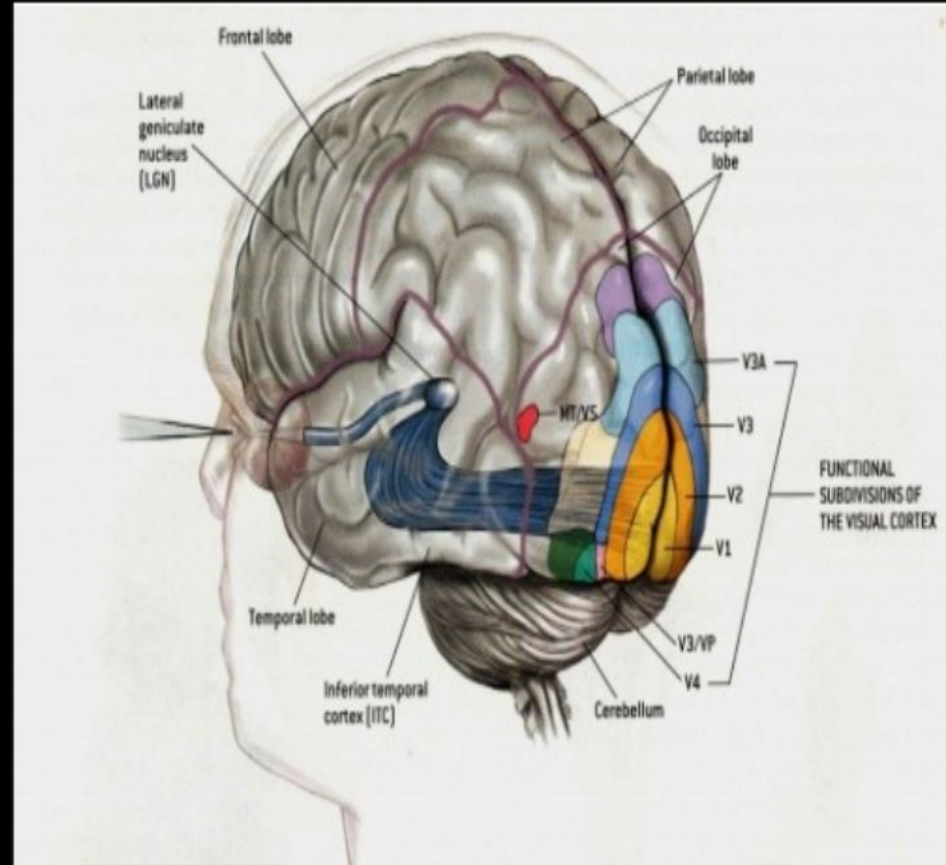
Temporal lobe syndrome. (Kluver-Bucy syndrome)

- Features. (HHH-VADIA)
- Hyperphagia & omniphagia.
- Hyper sexuality.
- Hyper metamorphosis.
- Visual Agnosia.
- Aphasia.
- Dreaming states.
- Increased oral activity.
- Auditory disturbances.



Occipital lobe

- Primary visual cortex. (17)
- Visual association area. (18)
- Visual association area or occipital eye field. (19)



Connections & functions.

■ **Afferents.**

- LGB via optic radiations.

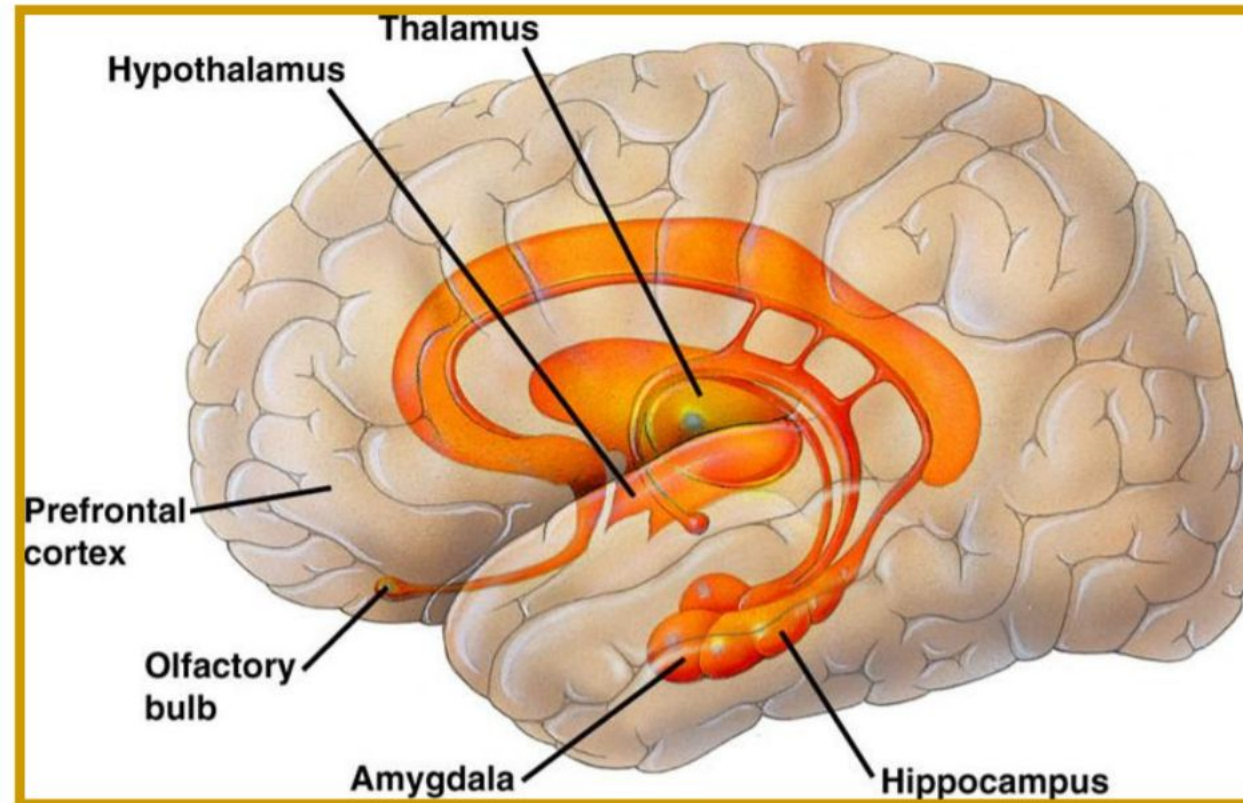
■ **Efferents.**

- Frontal eye field for eye movements.
- Superior colliculus.
- Cortico geniculate projections.
- Thalamus.

■ **Functions**

- Area 17– perception of visual impulses.
- Area 18, 19 – interpretation , recognition & identification from memory.
- occipital eye field area.– movement of eye ball.

Schematic Diagram of principal limbic areas



Limbic System (not a true lobe)
involves with cingulate gyrus and the

- Hippocampus- short term memory
- Amygdala- fear, aggression, mating
- Fornix pathway to hypothalamus
- Hypothalamus- ANS control
- Prefrontal Cortex- appropriate behavior

Applied Physiology Clinical Aspects

- ▶ UMN lesions
- ▶ Head injury
- ▶ CVA-Stroke
- ▶ Seizures
- ▶ Increased ICP
- ▶ Alzheimer's Disease
- ▶ Psychological & Behavioural symptoms

Acknowledgement

- ▶ MCI documents
- ▶ Internet resources for content, images, videos
- ▶ IPR remains with original creators
- ▶ This material is used only for educational purpose
- ▶ Students are advised to read from standard textbooks