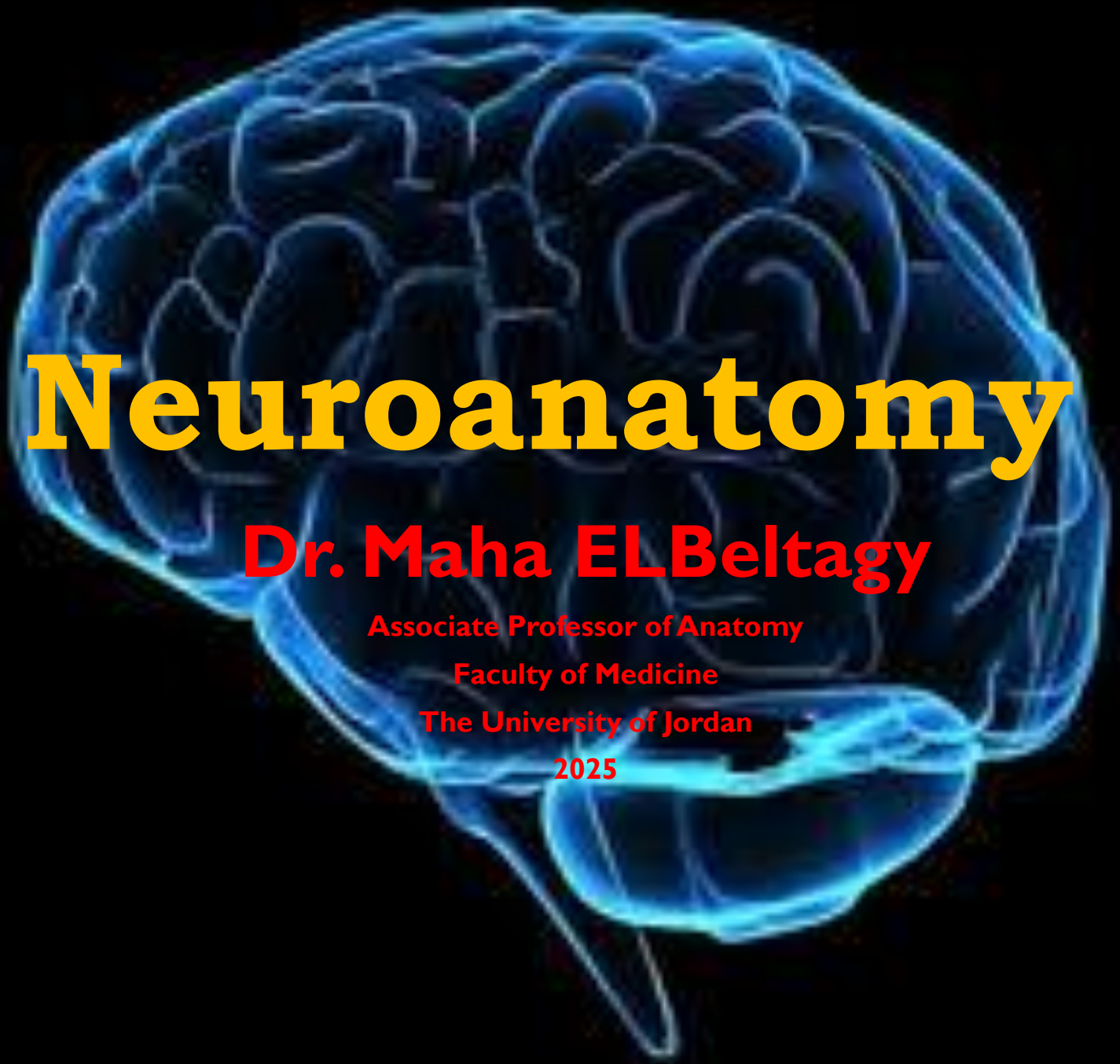


Neuroanatomy

Dr. Maha ELBeltagy

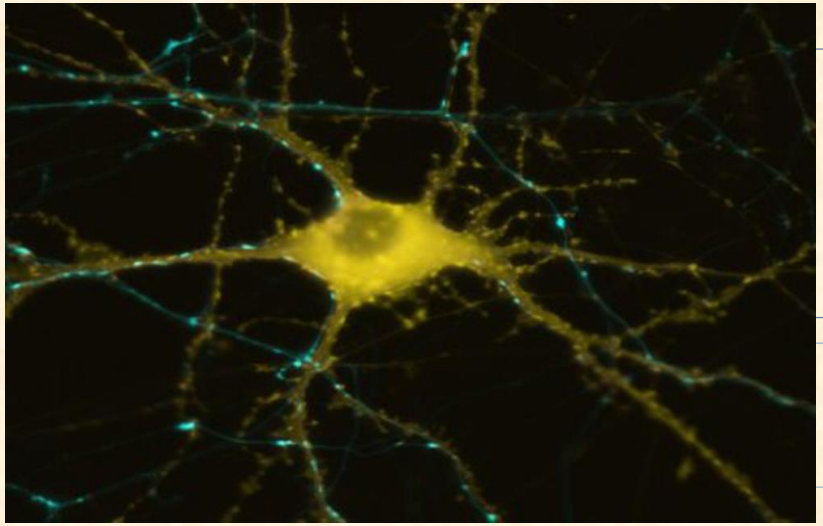
Associate Professor of Anatomy

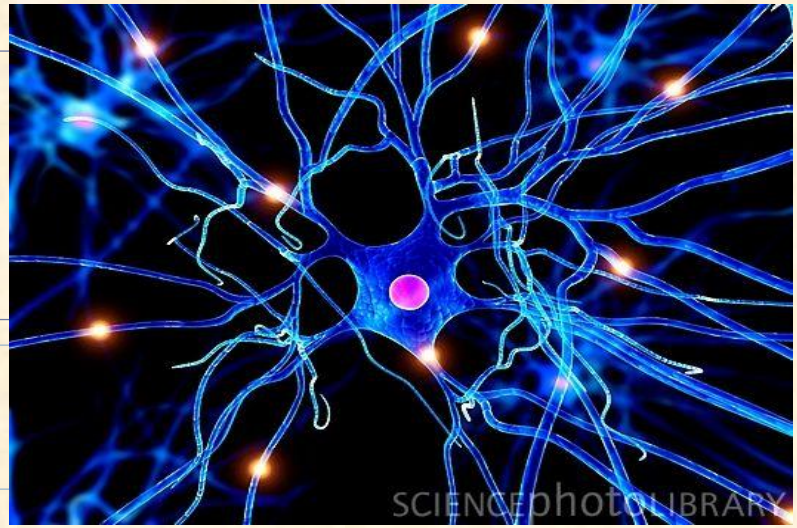
Faculty of Medicine

The University of Jordan

2025

Histology of the Nervous System





Objectives

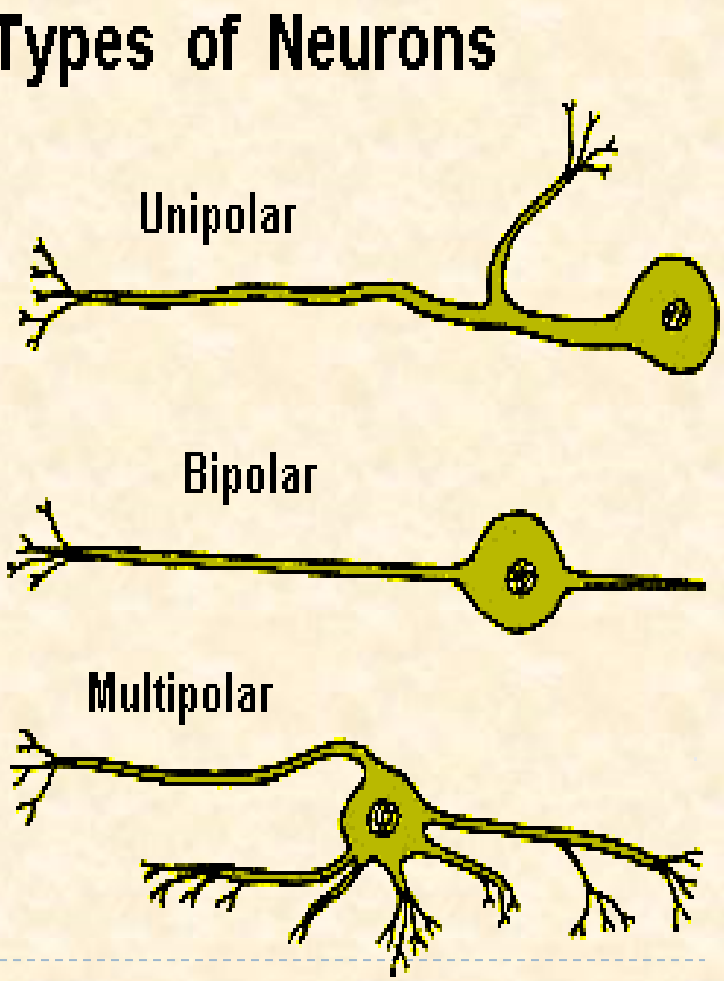
At the end of this lecture, you will be able to:

- 1- Histologically and functionally classify the neuron
- 2- Classify the nerve fiber histologically
- 3- Identify and differentiate types of glial cells
- 4- Generally classify the nervous system
- 5- Identify anatomically different lobes, sulci and gyri of the cerebrum
- 6- Identify major areas of Broadman classifications, Function of each and clinical manifestations of their disorder or lesions.

THE NERVOUS TISSUE

-The functional unit of the nervous tissue is the **neuron** which is formed of cell body + its processes (an axon & dendrites)

- In addition to neurons the nervous tissue contains **Glial cells**



The Neuron

Shape:

1)Unipolar or pseudounipolar Unipolar:

dendrite and axon emerge from same point.

1)Bipolar: axon and single dendrite on opposite ends of a spindle shaped body

2)Multipolar: with one axon & many dendrites

Functional Classification of Neurons:

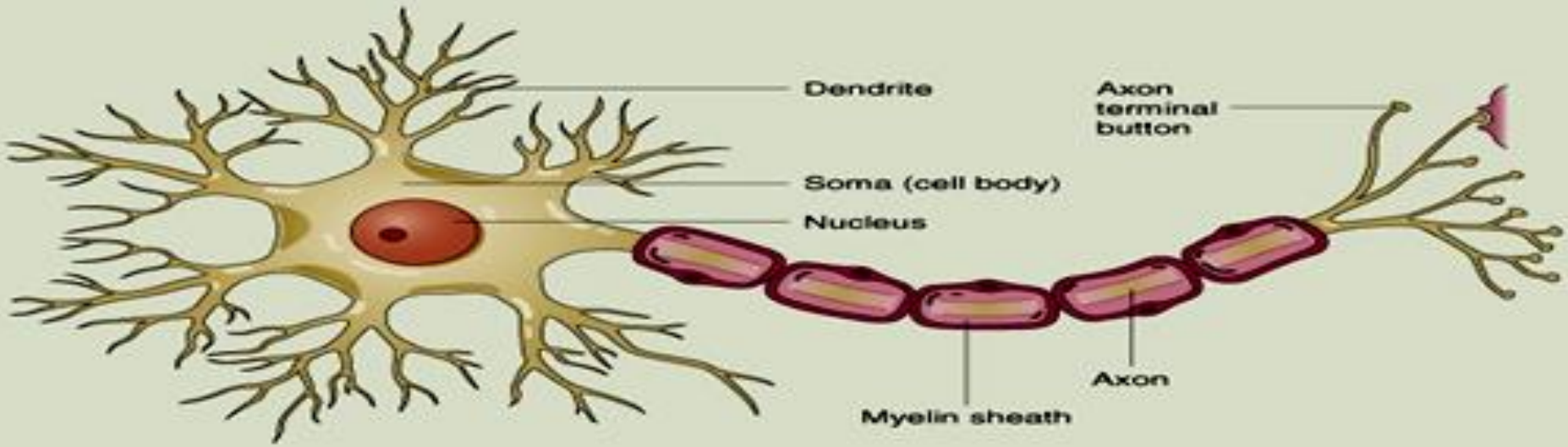
1) **Afferent (sensory) neurons:** convey information from tissues and organs into the central nervous system (CNS).
2) **Efferent (motor)neurons:** transmit signals from the CNS to the effector organs (muscles & glands).
3) **Interneurons:** connect neurons within specific regions of the CNS.

The body of neuron contains:

The nucleus: Large, round with prominent nucleolus

The cytoplasm: contains the usual organelles + neurofibrils. There is **NO centrioles** and adult neurons can't divide.

Dendrites	axon
-Multiple -Carry impulse to the cell body (afferent fibers) -With wide base & tapering end -Give many branches -Contain neurofibrils & Nissl granules	-Single -Carries impulse from the cell body (efferent fiber) -With the same diameter in all parts -Give few collaterals -Contains neurofibrils but No Nissl granules



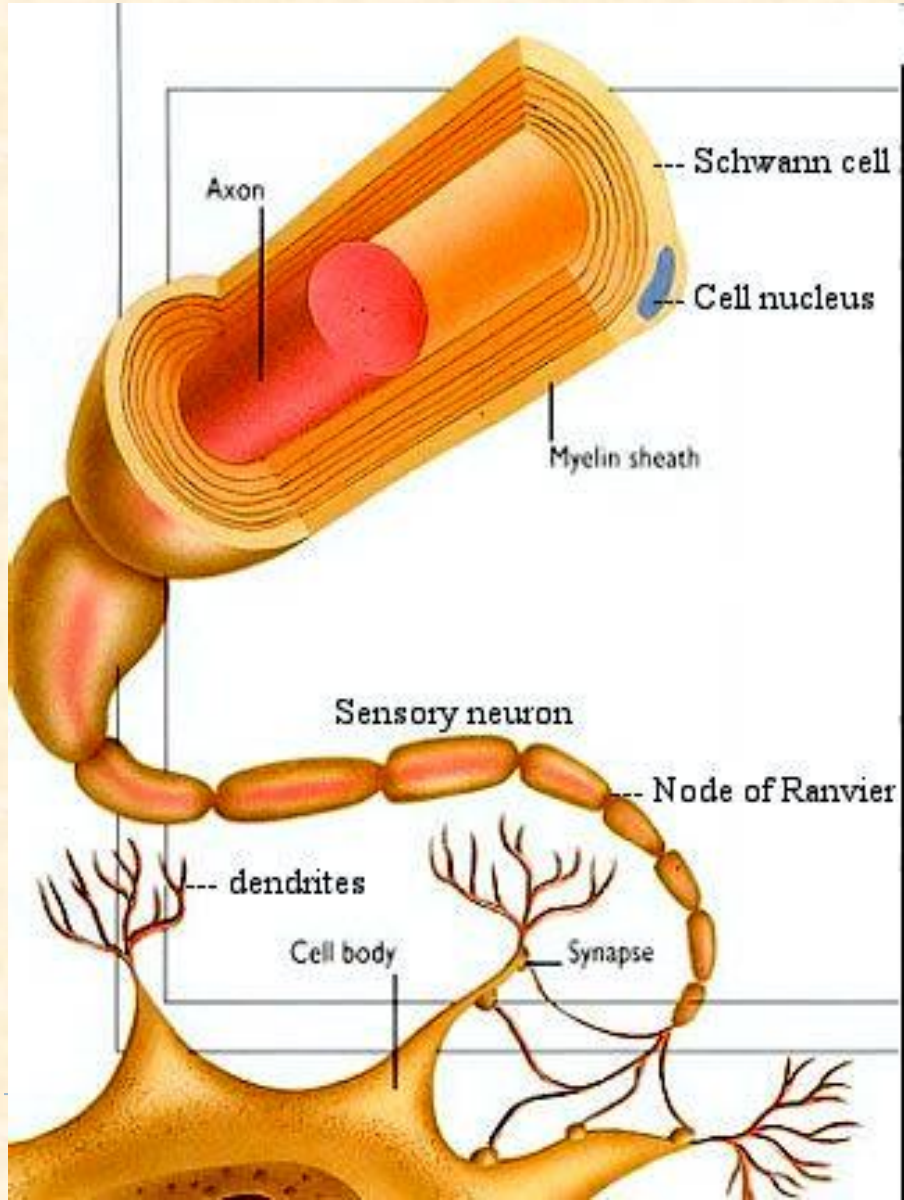
The nerve fibers

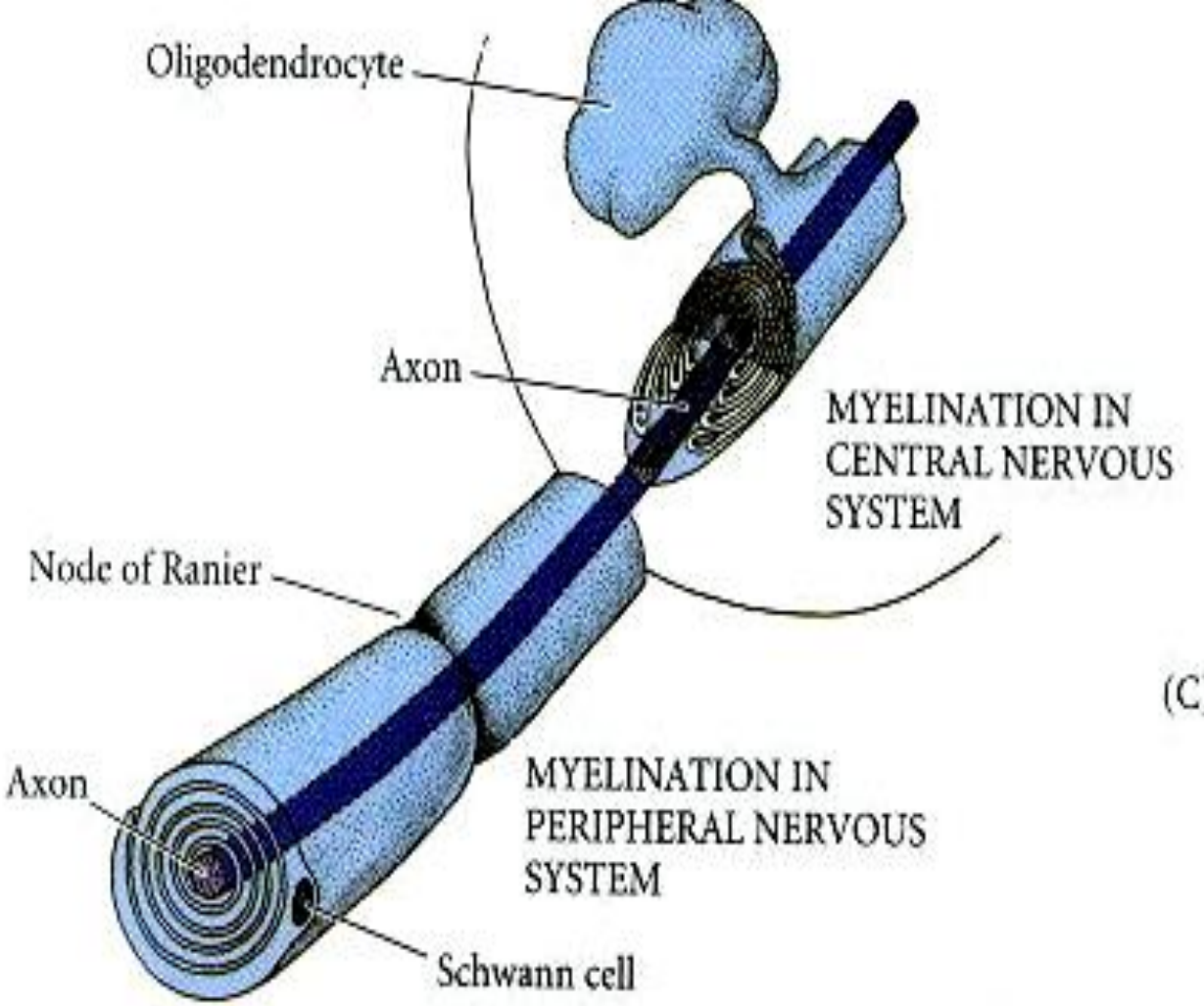
This name is applied to the axons of all nerve cells & to the dendrite of unipolar cells

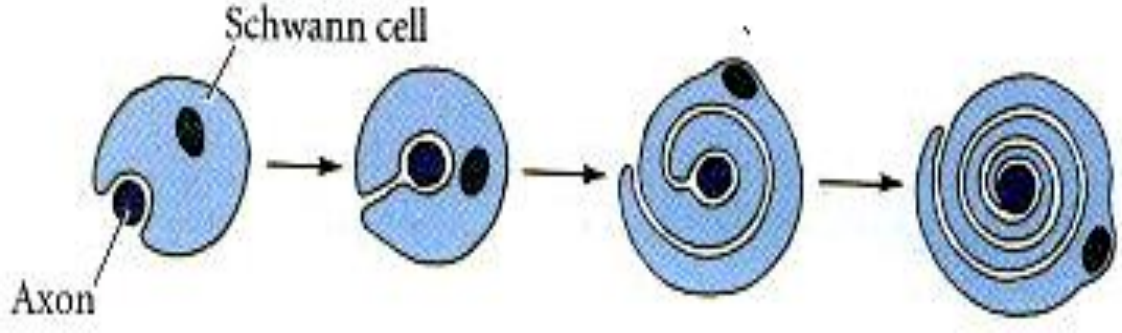
Sheaths of nerve fibers

A) **Myelin sheath:** It is a thin layer of lipoprotein which is interrupted at nodes of Ranvier. It is formed by the neurilemma cells outside the CNS & by oligodendrocytes inside the CNS. Thickly myelinated fibers transmits impulses faster. It has an **insulator** or **nutritive** function

B) **Neurilemma (Schwann) sheath:** It looks like tubes. In myelinated nerve fibers it forms & envelops myelin segments. It is important for nerve regeneration after injury.




Oligodendrocyte
Axon
MYELINATION IN CENTRAL NERVOUS SYSTEM
Node of Ranier
Axon
MYELINATION IN PERIPHERAL NERVOUS SYSTEM
Schwann cell


Schwann cell
Axon

(C)

Classification of nerve fibers:

1)**Naked fibers:**

In the grey matter of the CNS

2) **Myelinated without neurilemma:**

In the white matter of the CNS

3) **Myelinated with neurilemma:**

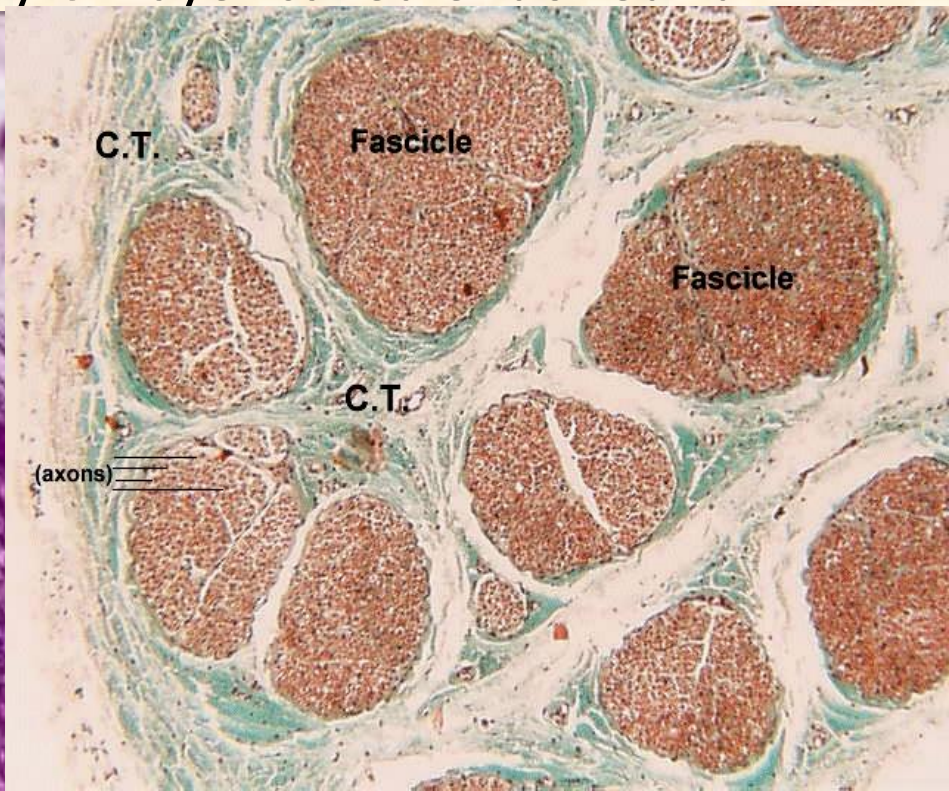
In all peripheral nerves

4) **Unmyelinated with neurilemma:**

In post-ganglionic sympathetic fibers.

The nerve trunk

- It is formed of bundles of nerve fibers
- The whole nerve is surrounded by CT layer called epineurium
- Each nerve is divided into separate bundles (fascicles)
- Each bundle is surrounded by CT layer called perineurium
- Each nerve fiber is surrounded by CT layer called endoneurium



NERVE GANGLIA

A ganglion is a collection of nerve cells & nerve fibers surrounded by a CT capsule **outside the CNS**. It is found along the course of a nerve.

Types:

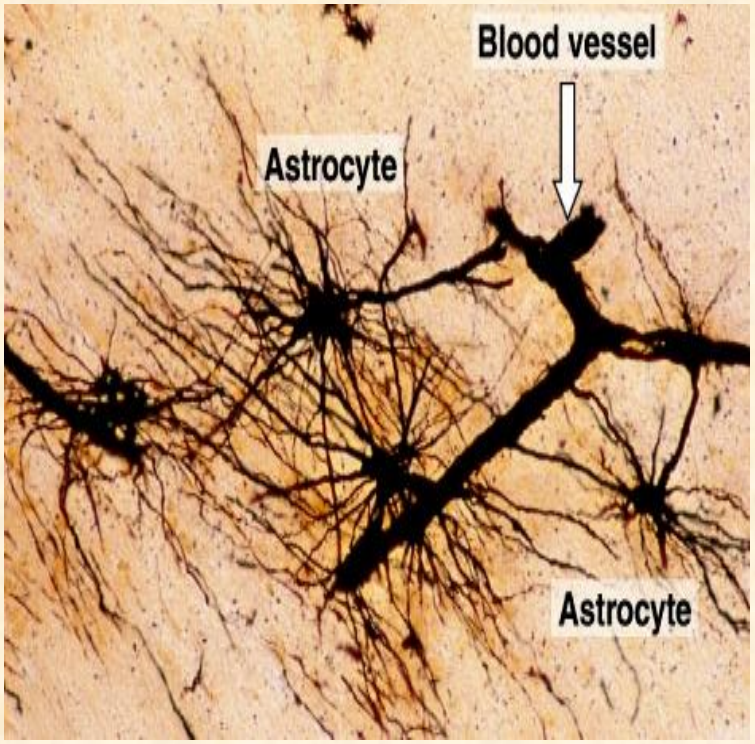
- Spinal ganglia
- Autonomic ganglia: sympathetic & parasympathetic
- Cranial ganglia

Glial cells

Type	Origin	Location	Main Functions
Oligodendrocyte	Neural tube	CNS	Myelin production, electric insulation
Schwann cell	Neural tube	Peripheral nerves	Myelin production, electric insulation
Astrocyte	Neural tube	CNS	Structural support, repair processes
			Blood–brain barrier, metabolic exchanges
Ependymal cell	Neural tube	CNS	Lining cavities of central nervous system
Microglia	Bone marrow	CNS	Phagocytic cells

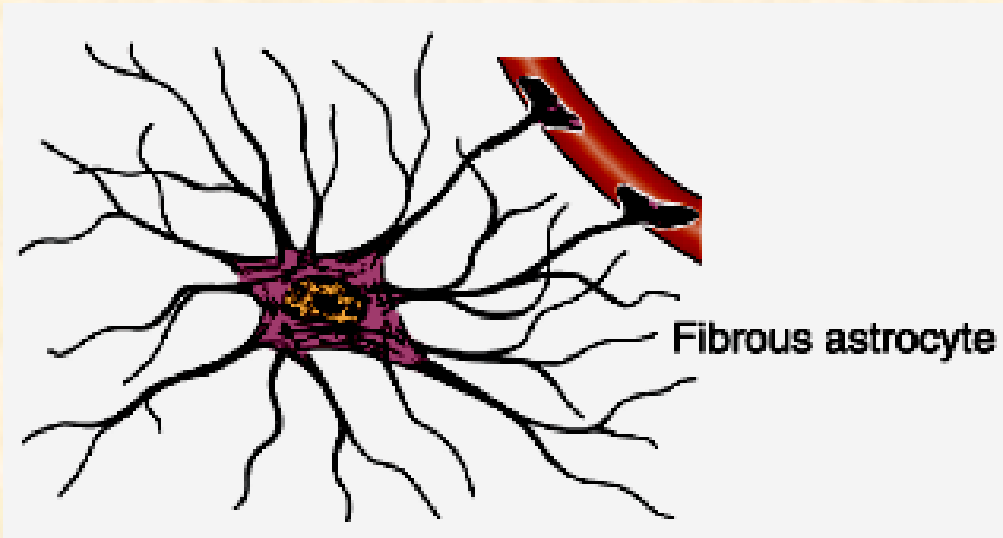
Astrocytes (*astron* = star)

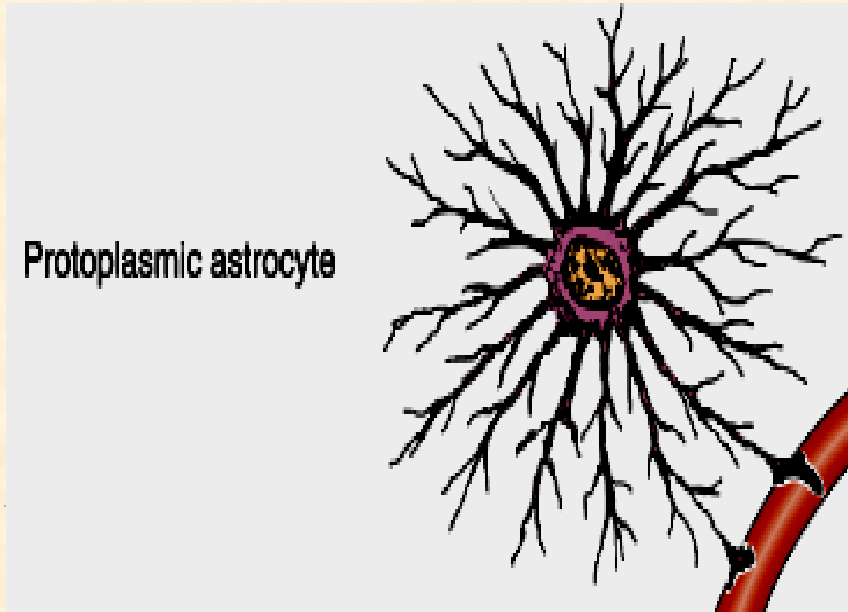
- They are star-shaped cells with multiple radiating processes that bind neurons to capillaries and to the pia mater.
- Astrocytes with few long processes are called **fibrous astrocytes** and are located in the white matter; **protoplasmic astrocytes,** with many short-branched processes, are found in the gray matter.



Functions:

- Structural support, repair processes
- Blood–brain barrier, metabolic exchanges





THE NERVOUS SYSTEM (NS)

It is divided into 2 major divisions:

1) Central Nervous System (CNS): found within bones & consists of:

*** The Brain: within the skull**

*** The spinal cord: within the vertebral canal.**

2) Peripheral Nervous System (PNS): Consists of:

A) Autonomic nervous system: which is divided into:

*** Sympathetic nervous system.**

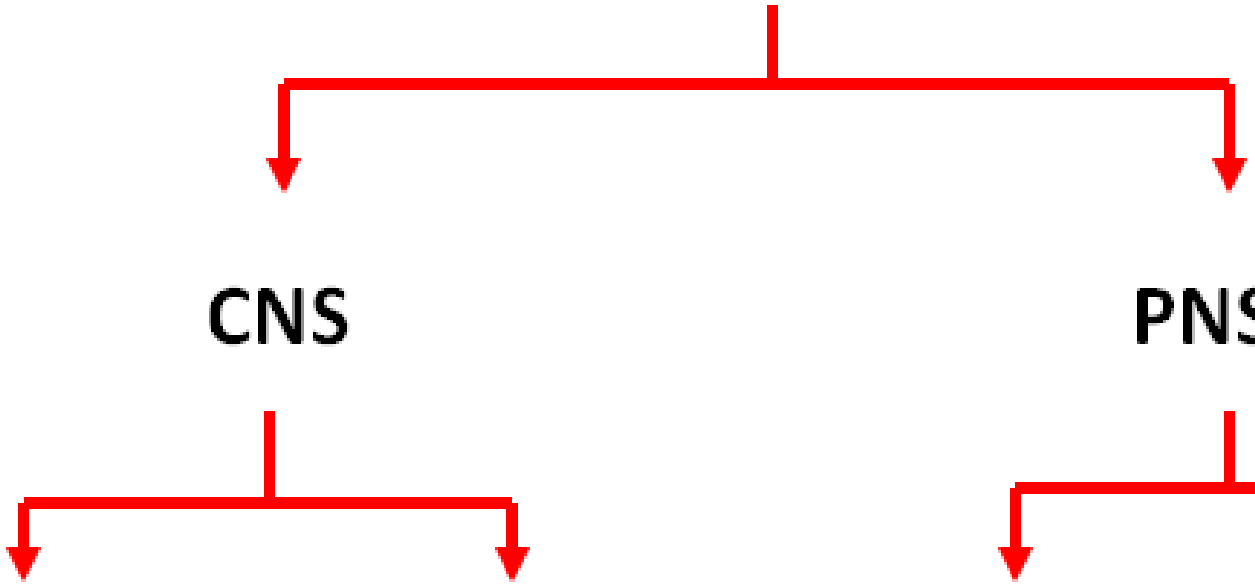
*** Parasympathetic nervous system.**

B) Somatic nerves:

*** Cranial nerves (12 pairs): Connected to the brain.**

*** Spinal nerves (31 pairs): Connected to the spinal cord.**

THE NERVOUS SYSTEM



CNS

BRAIN

Cerebrum

Cerebellum

Brain Stem

SPINAL CORD

31 spinal segments

- 8 cervical
- 12 Thoracic
- 5 Lumbar
- 5 Sacral
- 1 Coccygeal

PNS

ANS

Sympathetic

Parasympathetic

SNS

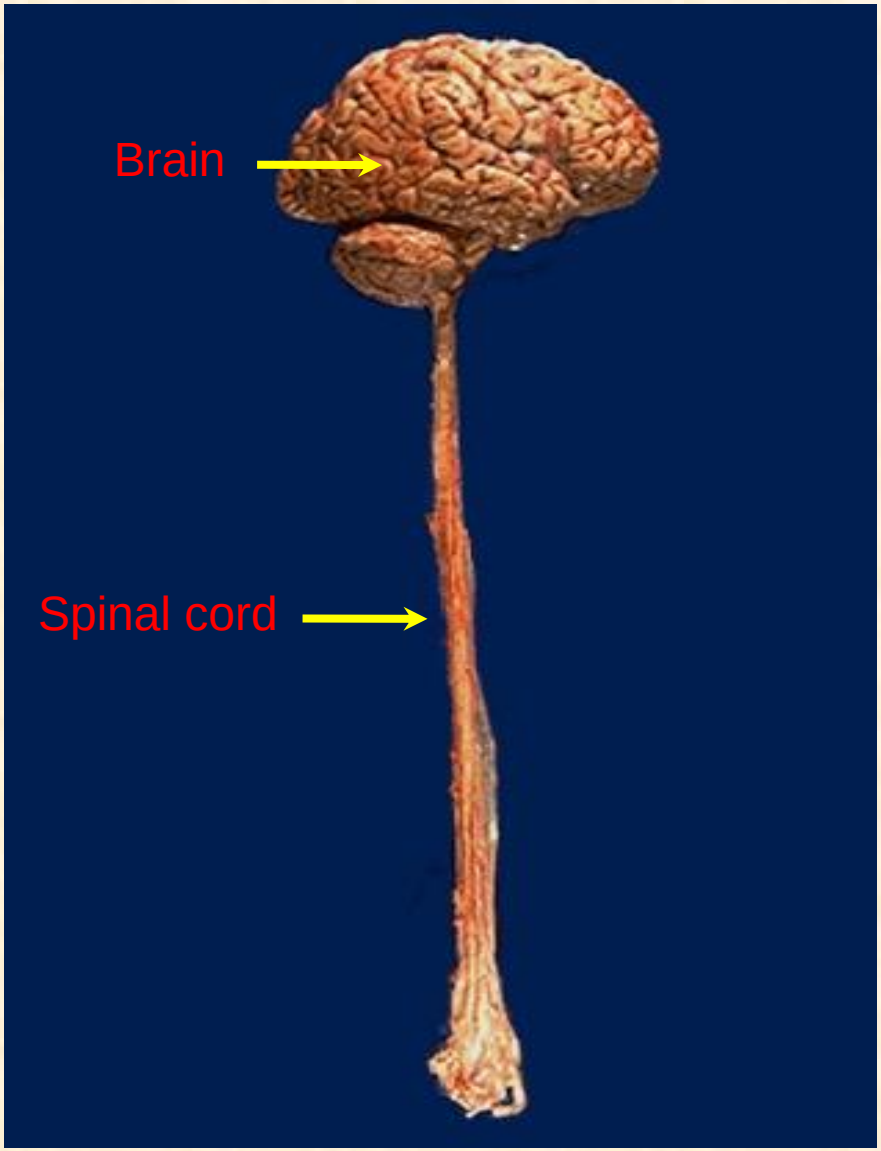
Spinal nerves

Cranial nerves

THE CENTRAL NERVOUS SYSTEM

It consists of:

1) **The brain: Within the skull.**
2) **The spinal cord: Within the vertebral canal.**



THE BRAIN

<u>It consists of</u>:

1) **Cerebrum:**

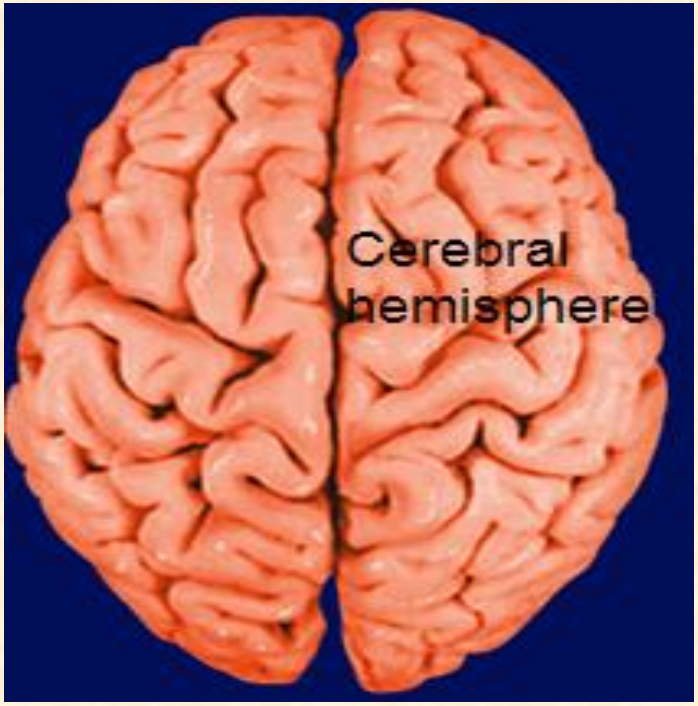
- 2 Cerebral hemispheres separated from each other by median fissure
- Diencephalon.

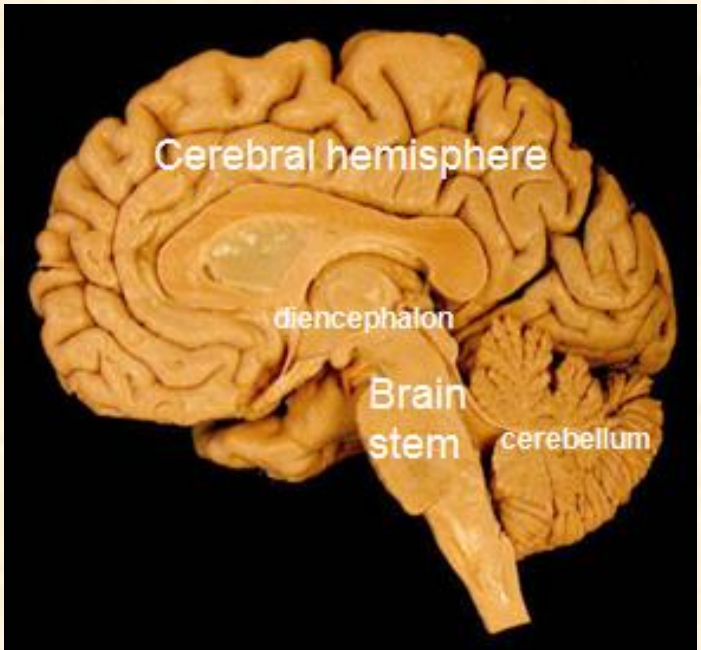
2) **Brain Stem:**

- Midbrain
- Pons
- Medulla

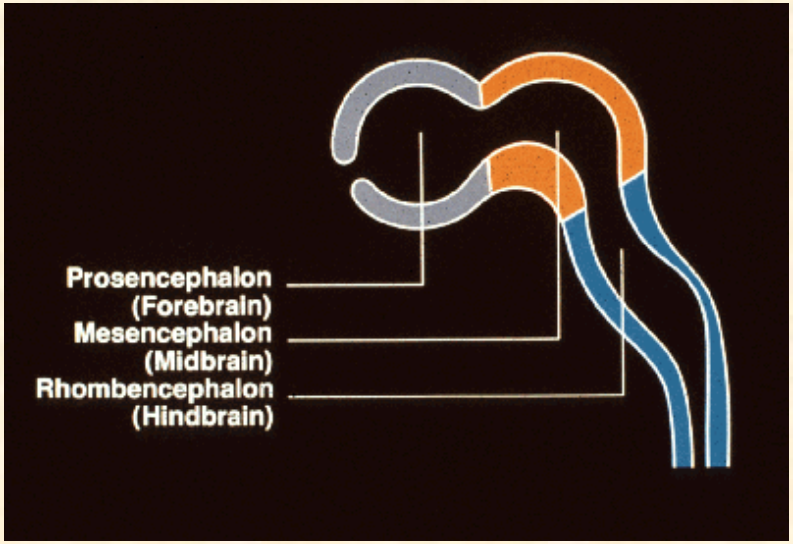
3**) Cerebellum:**

- 2 cerebellar hemispheres
- Vermis





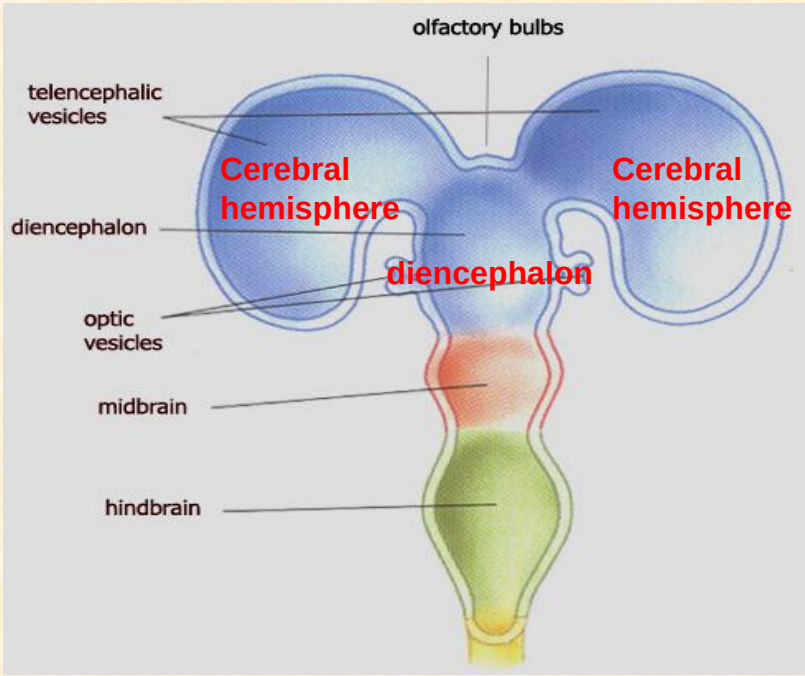
On embryological basis the brain is divided into:

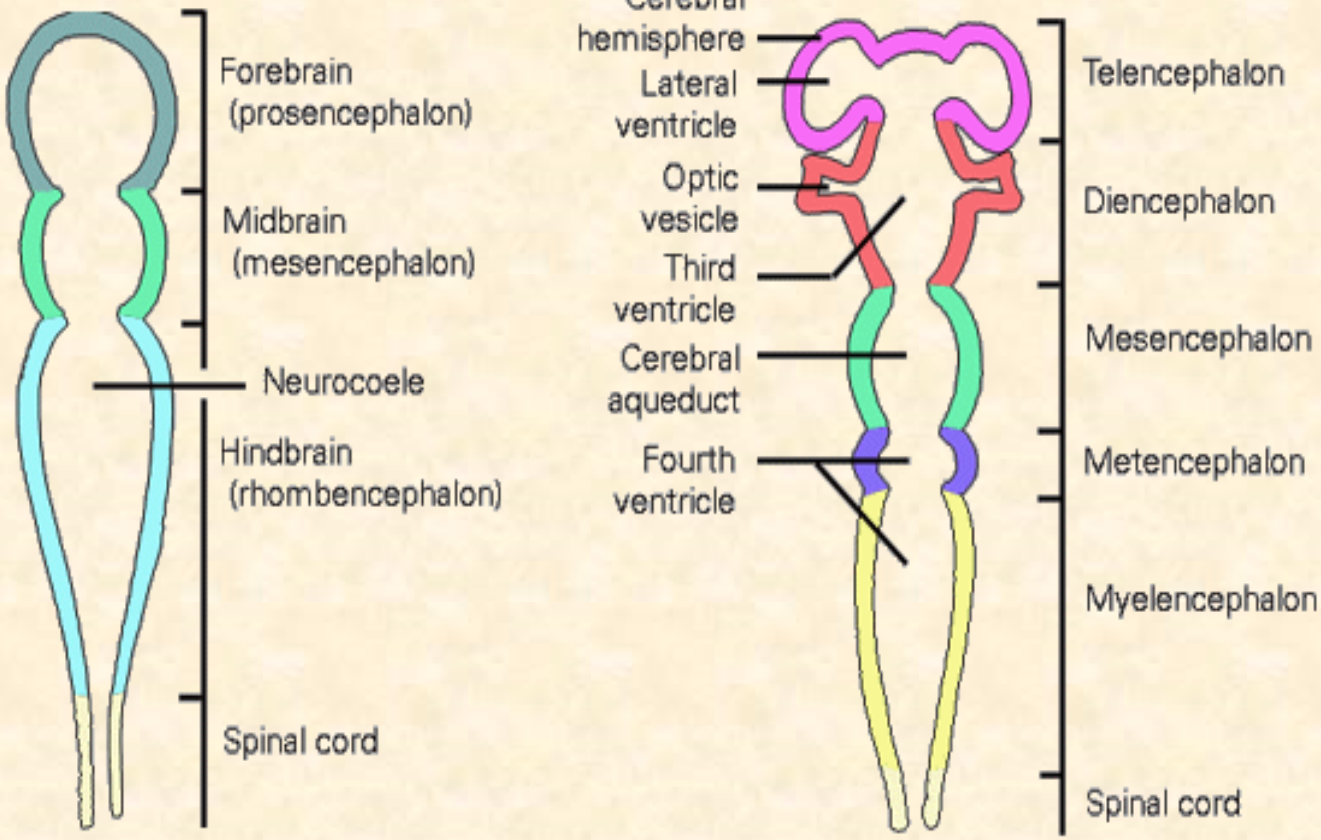


1) **Forebrain**: Consists of
   * 2 Cerebral hemispheres.
   * Diencephalon.

2) **Midbrain.**

3) **Hindbrain**: Consists of:
   * Pons.
   * Medulla Oblongata.
   * Cerebellum.




Forebrain
(prosencephalon)
Midbrain
(mesencephalon)
Neurocoele
Hindbrain
(rhombencephalon)
Spinal cord
Cerebral
hemisphere
Lateral
ventricle
Optic
vesicle
Third
ventricle
Cerebral
aqueduct
Fourth
ventricle
Telencephalon
Diencephalon
Mesencephalon
Metencephalon
Myelencephalon
Spinal cord

Embryonic (developmental) divisions of the Brain

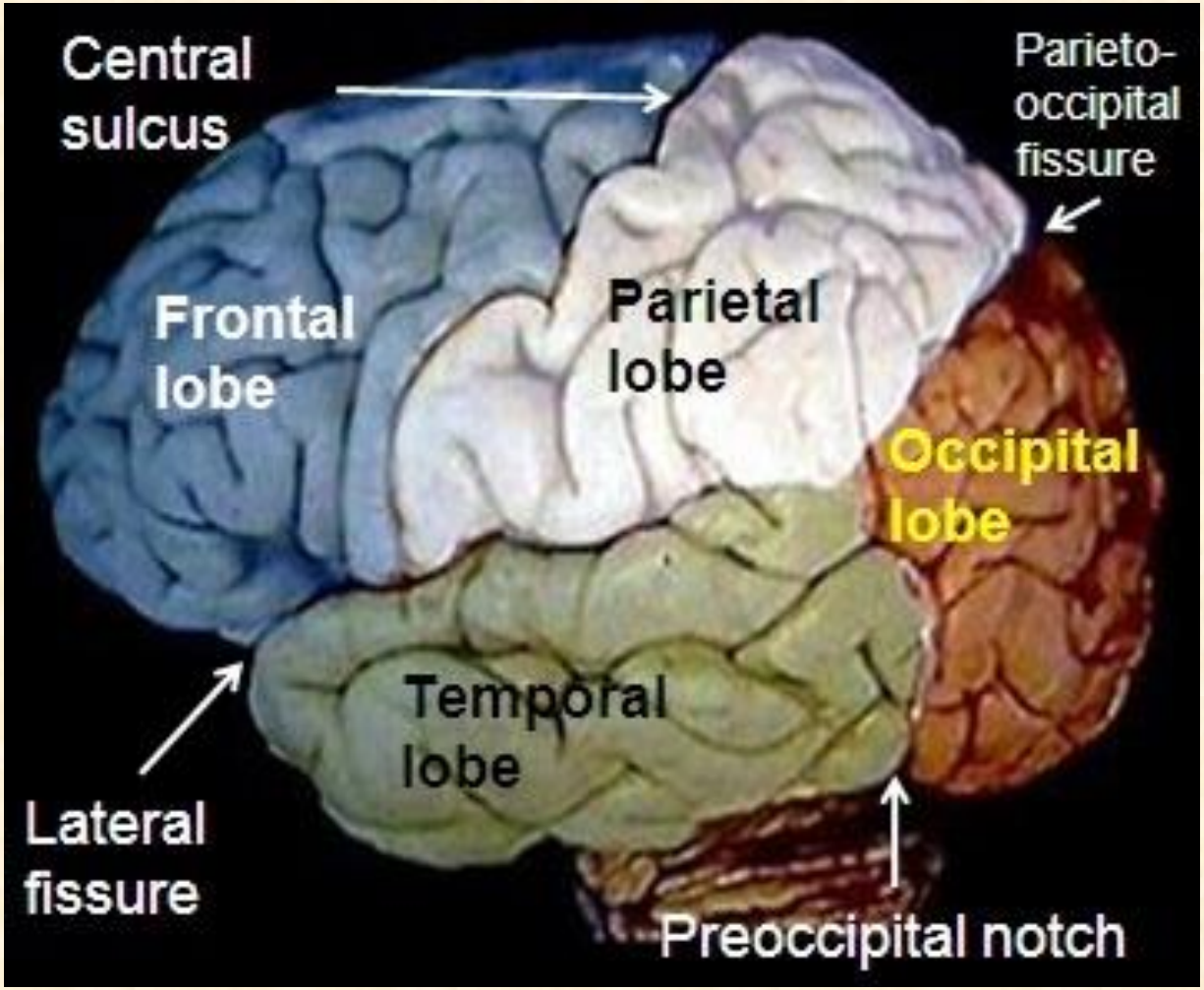
Primary vesicle	Secondary vesicle	Derivatives
Prosencephalon	telencephalon	Cerebral cortex Cerebral white matter Basal ganglia
	diencephalon	Thalamus Hypothalamus Subthalamus Epithalamus
Mesencephalon	mesencephalon	Midbrain
Rhombencephalon	metencephalon	Cerebellum Pons
	myelencephalon	Medulla oblongata

THE CEREBRAL HEMISPHERES

- **4 lines divide each hemisphere into 4 lobes:**
- **The central sulcus.**
- **Posterior ramus of lateral fissure.**

- **Imaginary line between Parieto-occipital fissure & Preoccipital notch.**
- **Imaginary line connecting the posterior ramus of lateral fissure to the previous line.**

- **Each hemisphere is divided into 4 lobes:**
  - **Frontal lobe.**
  - **Parietal lobe.**
  - **Temporal lobe.**
  - **Occipital lobe.**



Components of the cerebral hemisphere

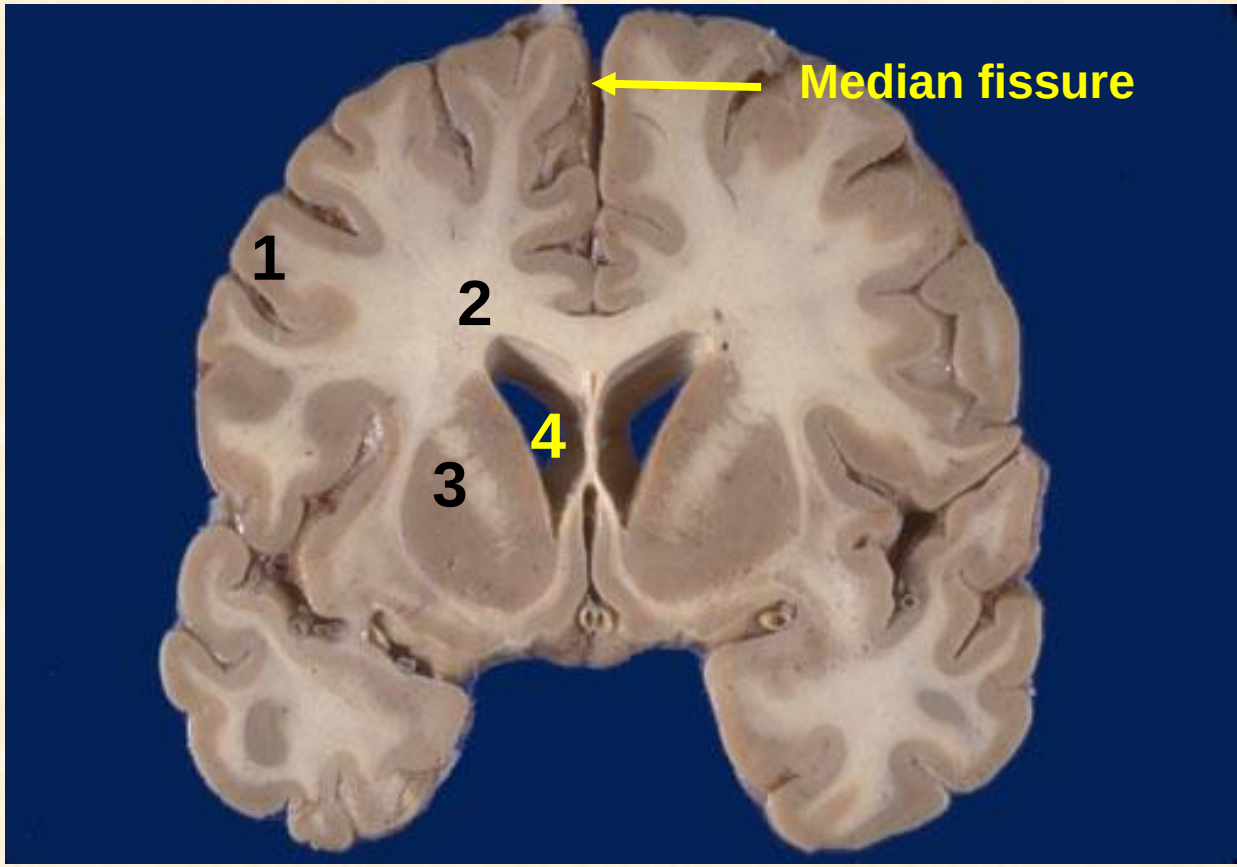
It consists of:

1- Outer grey matter (cerebral cortex)

2- white matter.

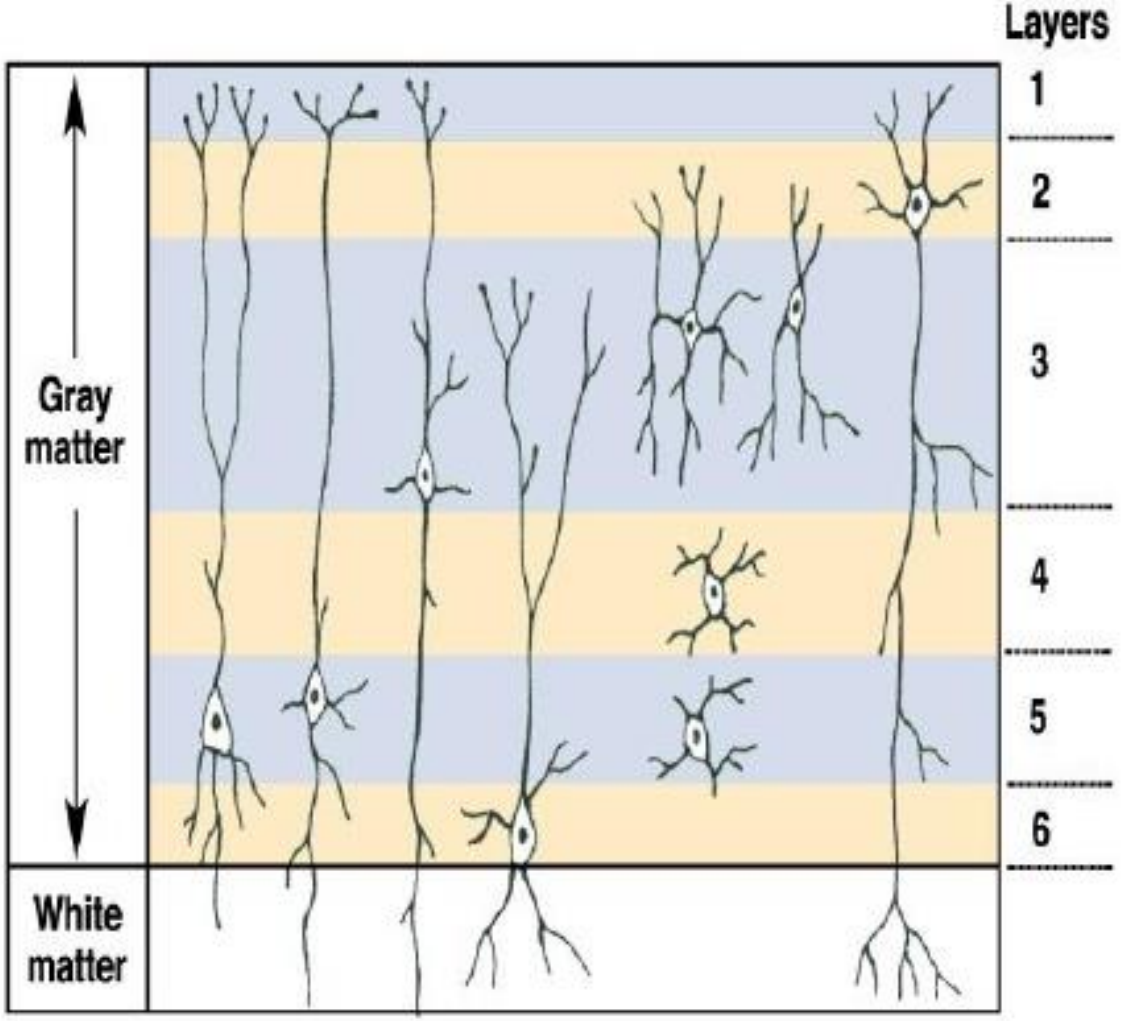
1) Basal nuclei (inner grey matter)

4- Lateral ventricle.



Cerebral Cortex

- Allows for sensation, voluntary movement, self-awareness, communication, recognition, and more.
- Gray matter!
- 40% of brain mass, but only 2-3 mm thick.
- Each cerebral hemisphere is concerned with the sensory and motor functions of the opposite side (contralateral side) of the body.



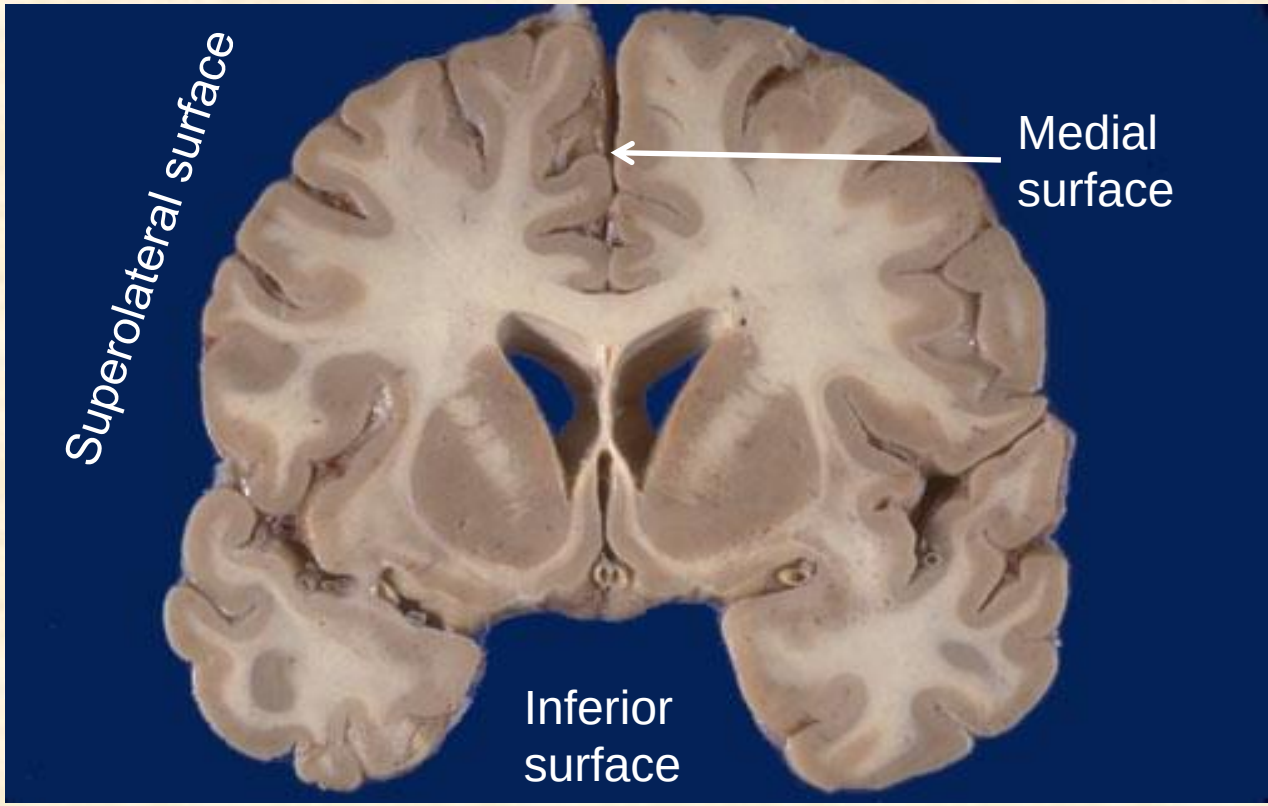
More about cerebral cortex layers
Not an exam material

Layers	Components	Schematic	Afferents		Efferents
I – Molecular	Axons and Dendrites (Cell processes)		From other regions of Cortex and Brainstem	Epomedicine.com	To other regions of cortex (Intra-cortical Association functions)
II - External granular	Densely packed Stellate cells + Small pyramidal cells				
III – External pyramidal	Loosely packed Stellate cells + Medium pyramidal cells				
IV – Internal granular	Densely packed Stellate cells only			+ From Thalamus	
V – Internal pyramidal	Large pyramidal cells only (few stellate cells) – Giant Pyramidal cells of Betz			+ From Brain stem	To Brain stem & Spinal cord (Projection fibers)
VI - Multiform	Multiple sized pyramidal cells + Loosely packed stellate cells				To Thalamus

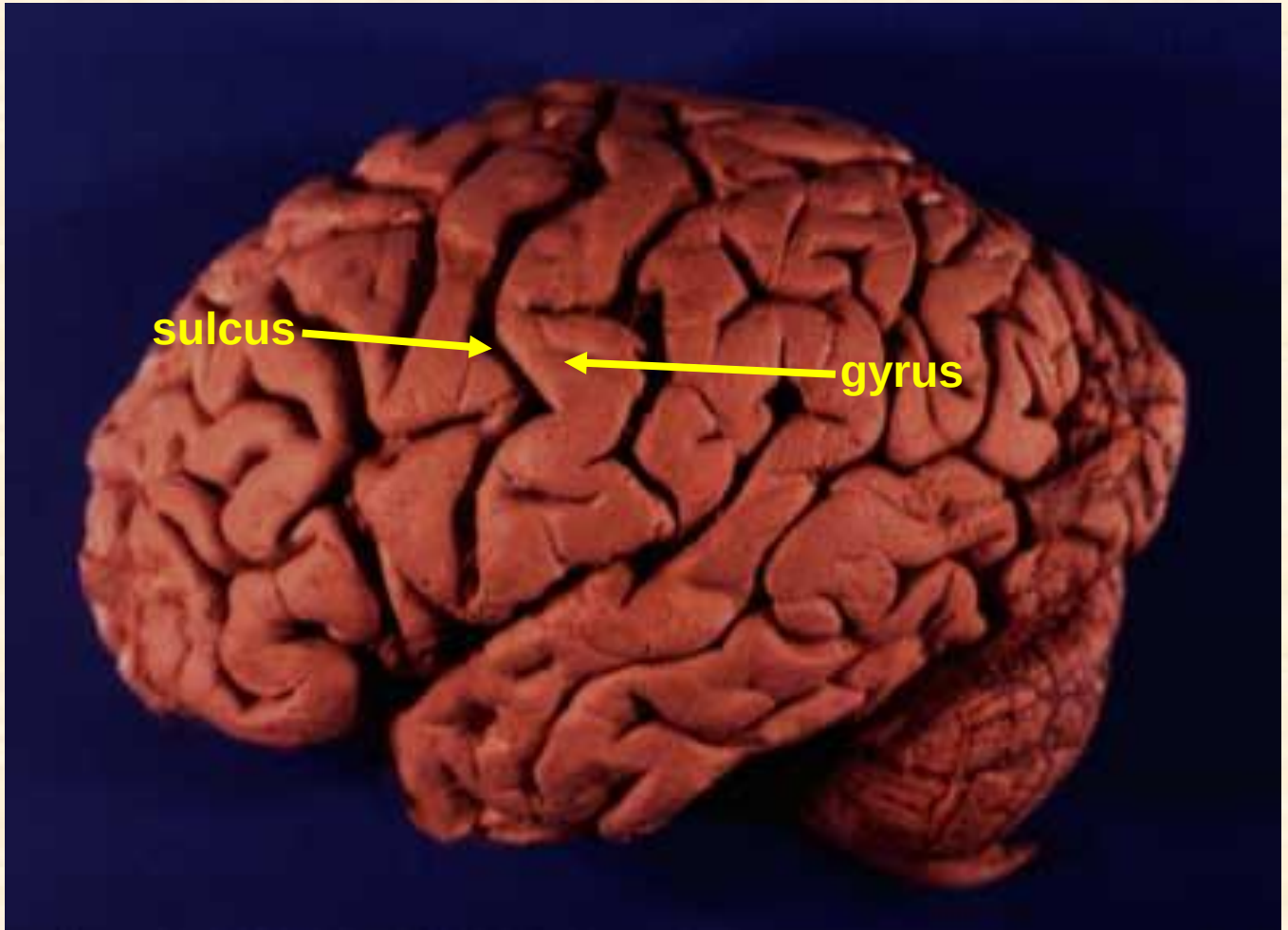
SURFACES OF THE CEREBRAL HEMEISPHERE

Each hemisphere has 3 surfaces:

- Superolateral surface.
- Medial surface.
- Inferior surface.



- The surfaces of the cerebral hemisphere show elevations called **GYRI** & grooves called **SULCI.**
- Deep sulci are called fissures.
- The surface of the hemisphere is divided into different areas.
- Each area contains a group of cells that perform a specific function.



THE SUPEROLATERAL SURFACE

Important sulci & gyri:

Central sulcus (of Rolando):

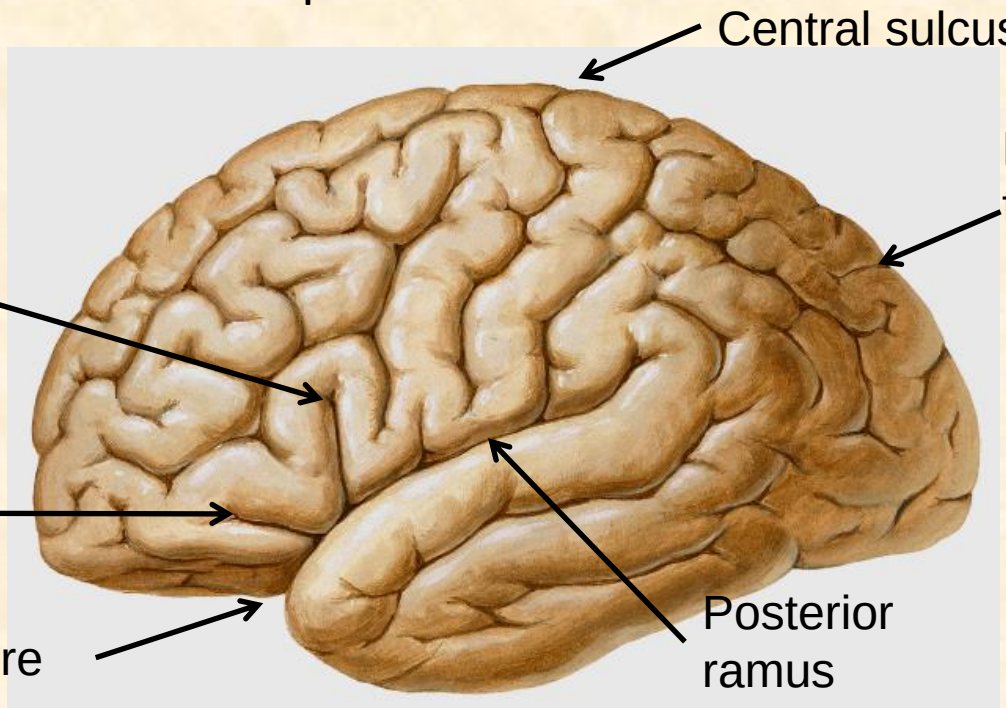
- **Extends from the superomedial border at a point a little behind the midpoint between the frontal & occipital poles. It ends slightly above the middle of the posterior ramus of lateral fissure. Begins on medial surface**

Lateral fissure (of Sylvius):

It begins on the inferior surface (stem) lateral to the anterior perforated substance & extends laterally to reach the lateral surface where it divides into 3 branches:

- **Anterior ramus: Runs forwards in the inferior frontal gyrus**
- **Ascending ramus: Ascends in the inferior frontal gyrus.**
- **Posterior ramus: Runs backwards & ends by turning upwards in the parietal lobe.**

Parieto – occipital fissure: Between Parietal & occipital lobes.



Sulci & Gyri of the frontal lobe

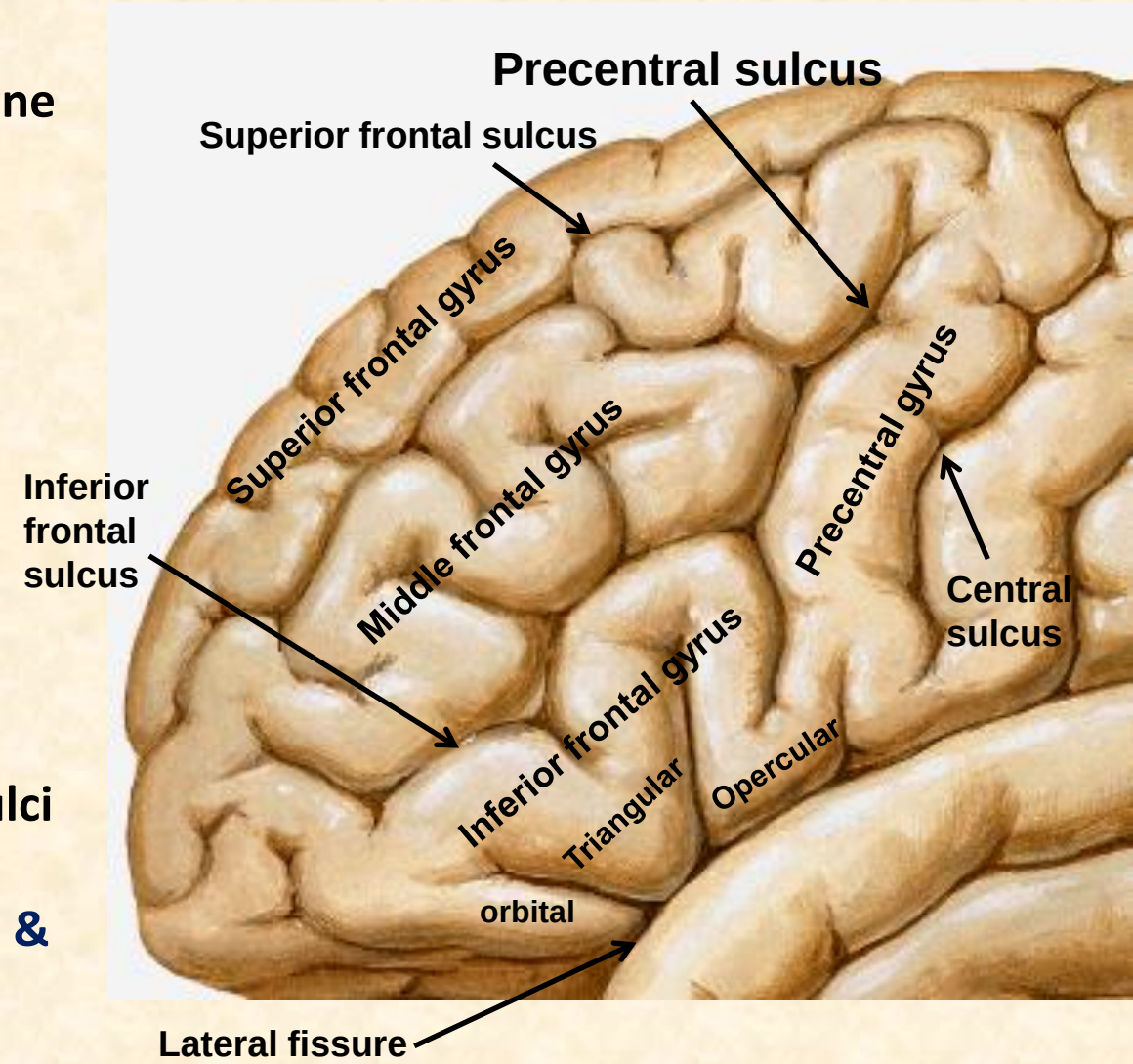
- **Precentral sulcus:** Parallel to & one finger in front of the central sulcus.
- **Superior Frnontal sulcus**
- **Inferior frontal sulcus**

Gyri of the Frontal lobe:

It is divided by the sulci of the frontal lobe into:

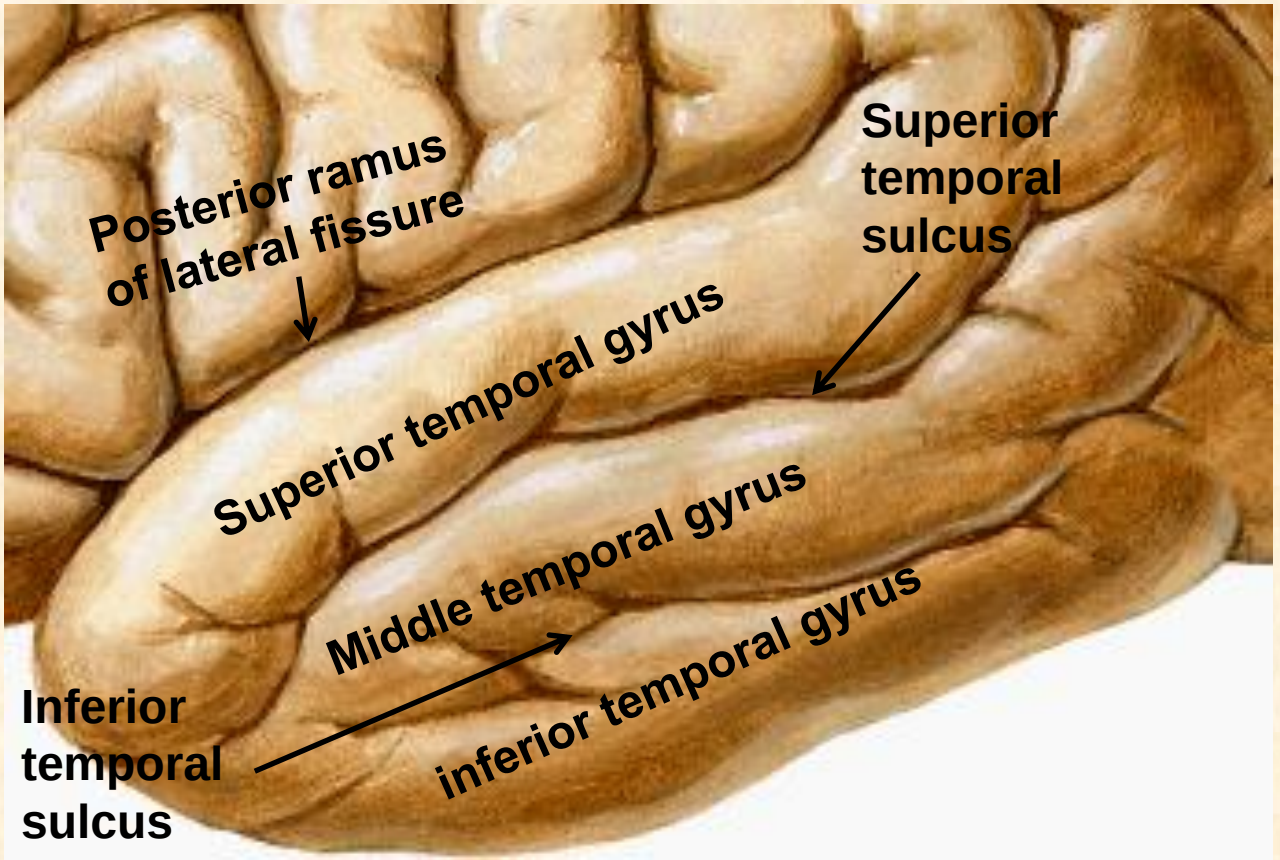
A) **Precentral gyrus:** Between central & precentral sulci.

B) Superior & inferior frontal sulci divide the remaining part equally into **superior, middle & inferior frontal gyri**



Sulci & Gyri of the Temporal lobe

- It contains 2 sulci : Superior & inferior temporal sulci.
- The 2 sulci divide the temporal lobe into 3 gyri: superior, middle & inferior temporal gyri.



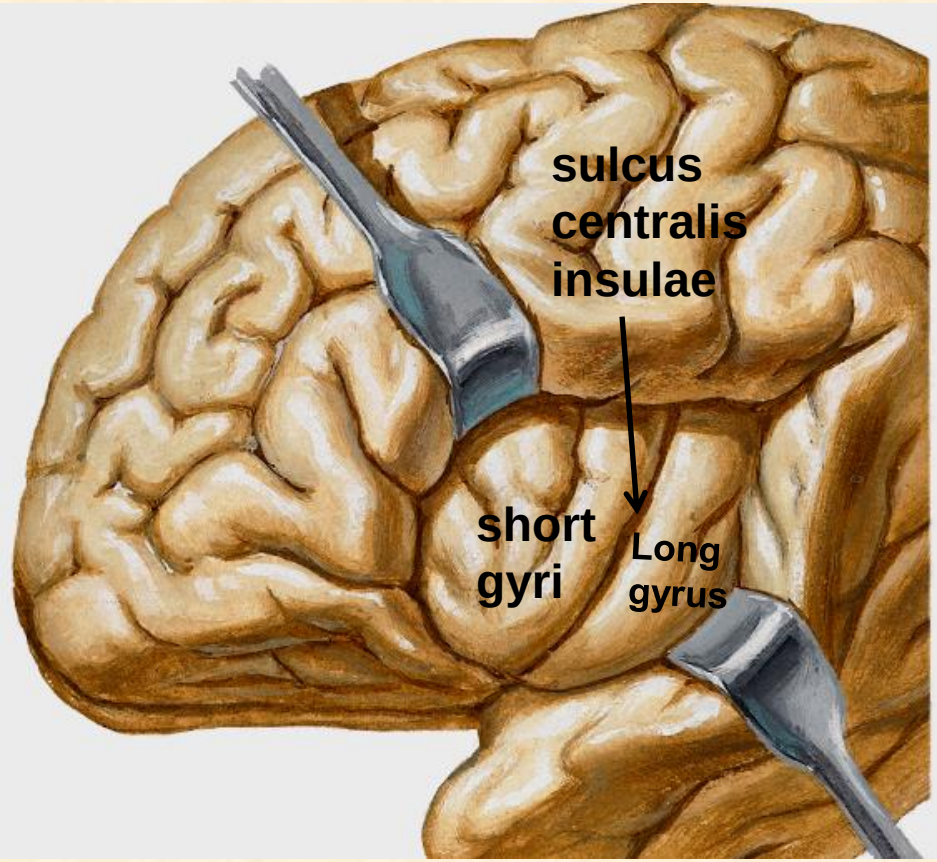
The insula (Island of Reil)

- It lies at the bottom of the lateral fissure. It is conical in shape having a base (surrounded by circular sulcus) & an apex directed inferiorly towards the anterior perforated substance.

- It is divided by sulcus centralis insulae into:

  - Anterior part divided into 3-4 short gyri.

  - Posterior part with one long gyrus which is usually divided near its upper part.



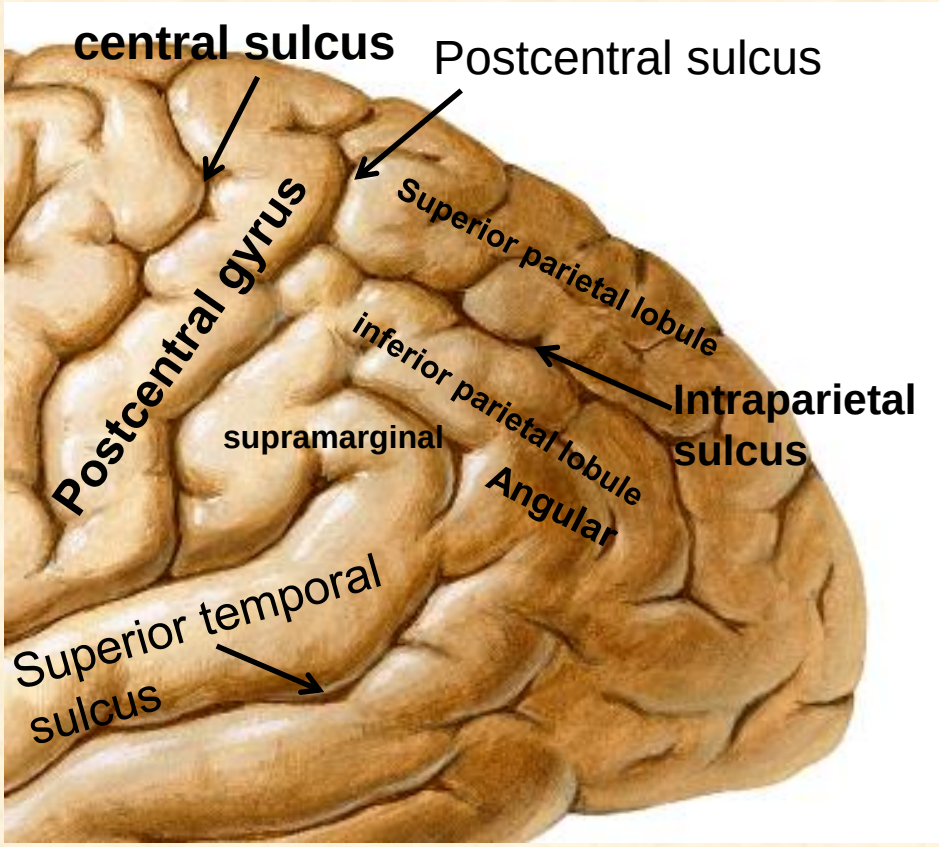
-Its function is related to taste (gustatory area)

Sulci & Gyri of the Parietal lobe

- **Postcentral sulcus**: parallel to & one finger behind the central sulcus.
- **Postcentral gyrus**: Between the central & postcentral sulci.
- **Intraparietal sulcus**: Begins at the middle of the postcentral sulcus & divides the remaining part of the parietal lobe into:

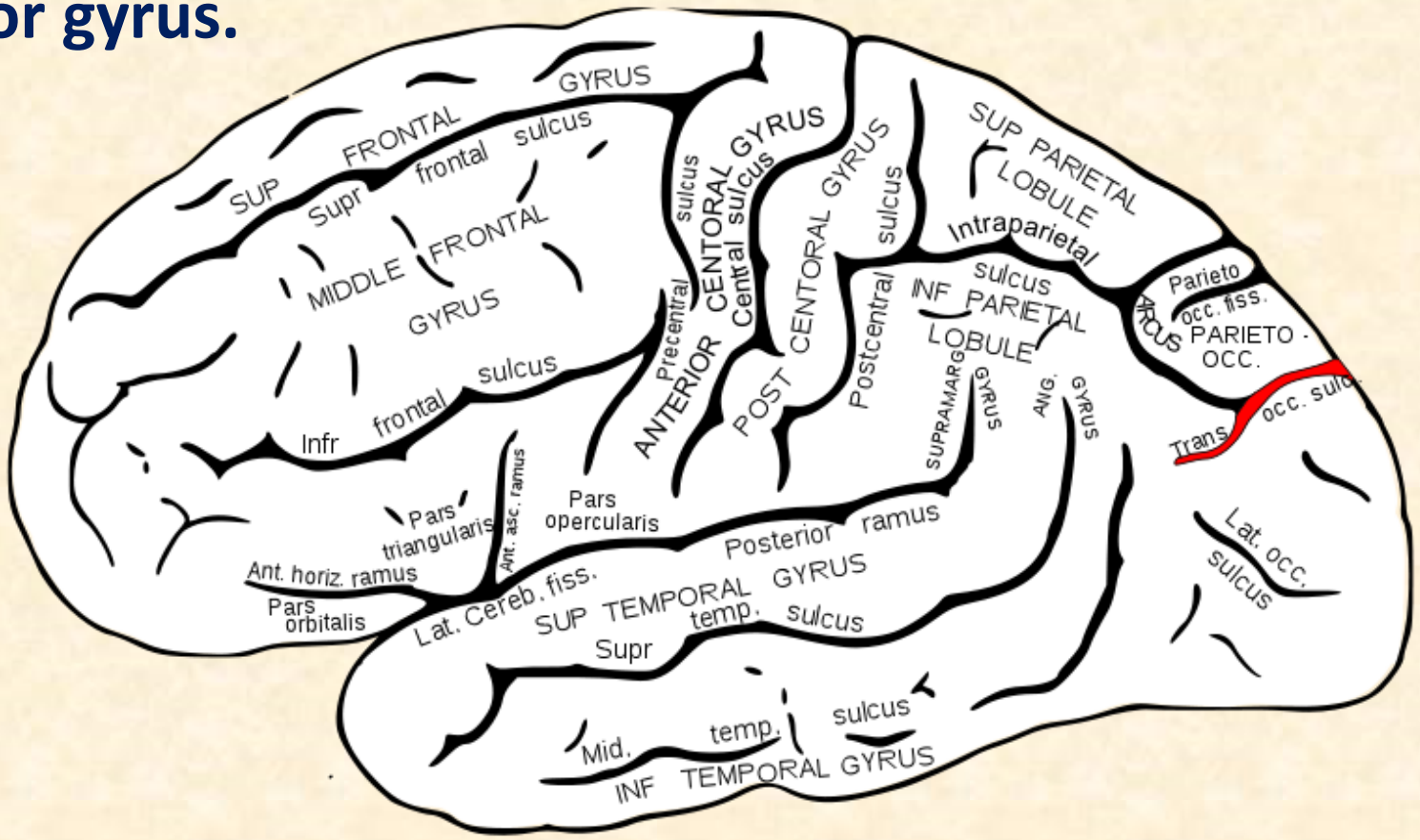
- **Superior parietal lobule**.
- **Inferior parietal lobule**: Is further divided into:

- **Supramarginal gyrus**: Above the upturned end of the post ramus of lateral fissure.
- **Angular gurus**: Above the upturned end of superior temporal sulcus area 39



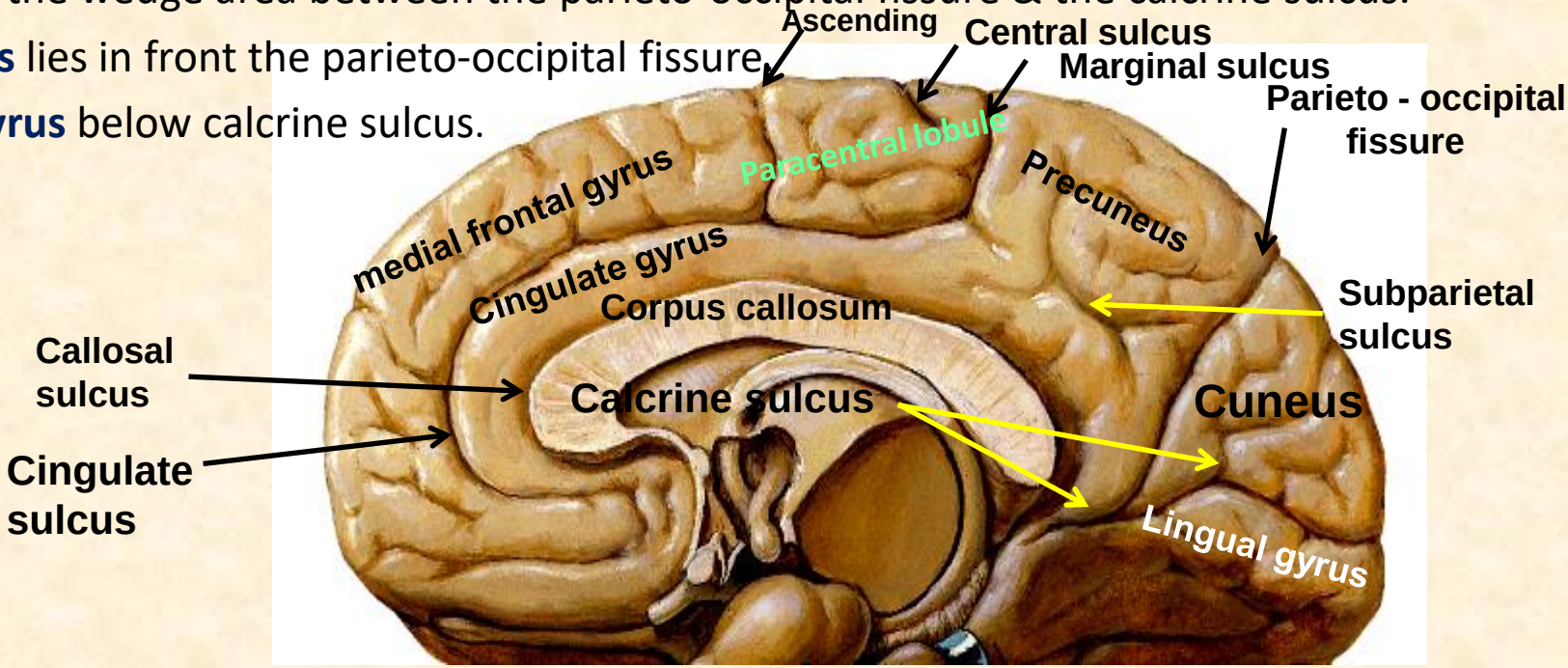
The Occipital Lobe

- Transverse occipital sulcus (lunate)
- Lateral occipital sulcus (horizontal): divides the lateral surface of the occipital lobe into a **superior** and an **inferior gyrus.**

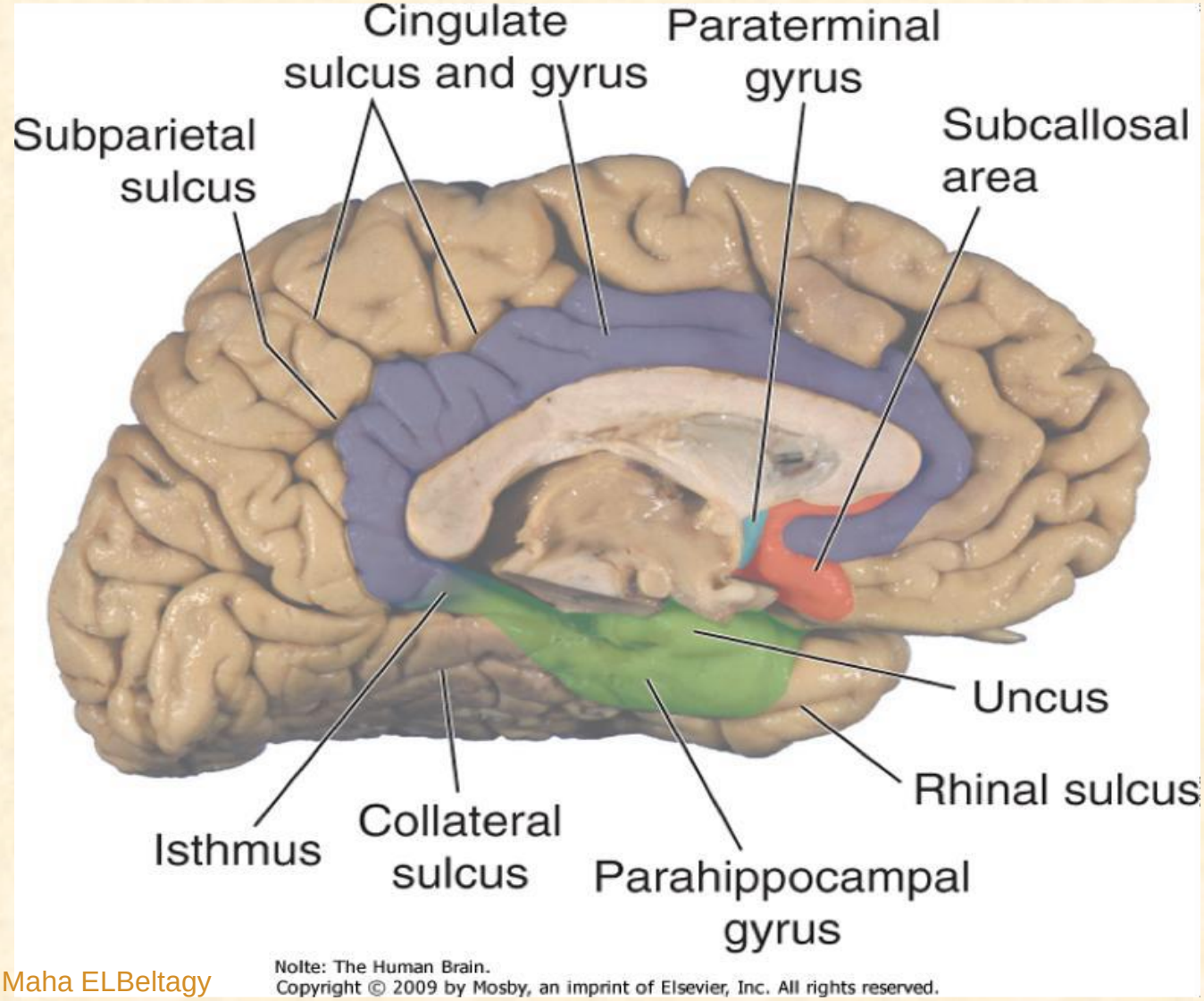


Sulci & Gyri of the medial surface

- **Callosal sulcus** surrounds CC.
- **Cingulate sulcus** runs parallel to CC & terminates by turning upwards to meet the superomedial border. It gives ascending branch above the middle of the body of CC which divides the area above cingulate sulcus into anterior part: medial frontal gyrus & **paracentral lobule** (around central sulcus). Ends above as marginal sulcus.
- **Cingulate gyrus** lies between CC & cingulate sulcus.
- **Subparietal (suprasplenial) sulcus** appears as a continuation of cingulate sulcus.
- **Parieto-occipital fissure** between the parietal & occipital lobes.
- **Calcrine sulcus** begins near the occipital pole.
- **Cuneus** is the wedge area between the parieto-occipital fissure & the calcrine sulcus.
- **Precuneus** lies in front the parieto-occipital fissure.
- **Lingual gyrus** below calcrine sulcus.



The limbic loop
6th loop

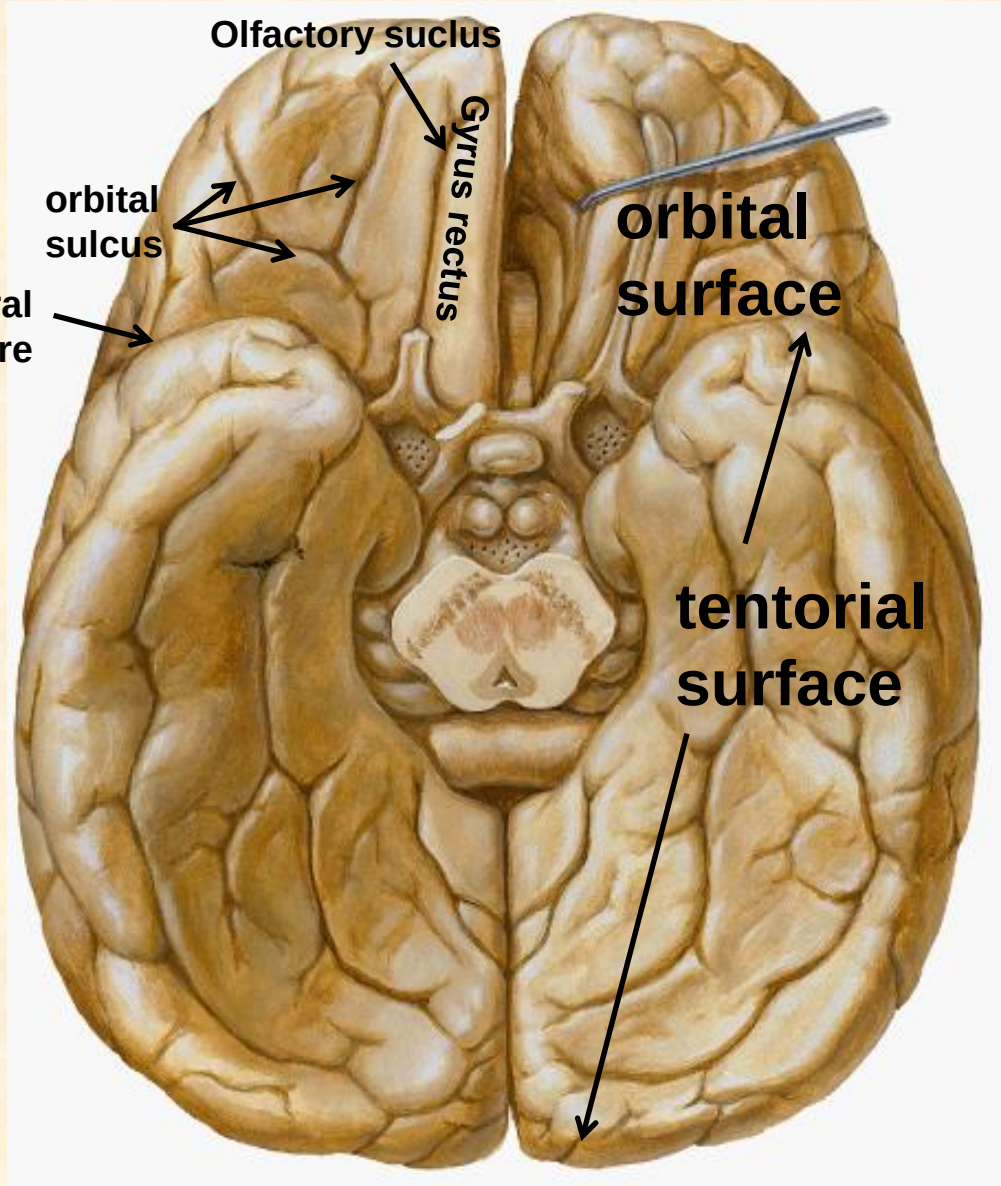


Sulci & Gyri of the inferior surface of the brain

The inferior surface is divided by the stem of the lateral fissure into a smaller anterior part known as the **orbital surface** & a posterior part known as the **tentorial surface**.

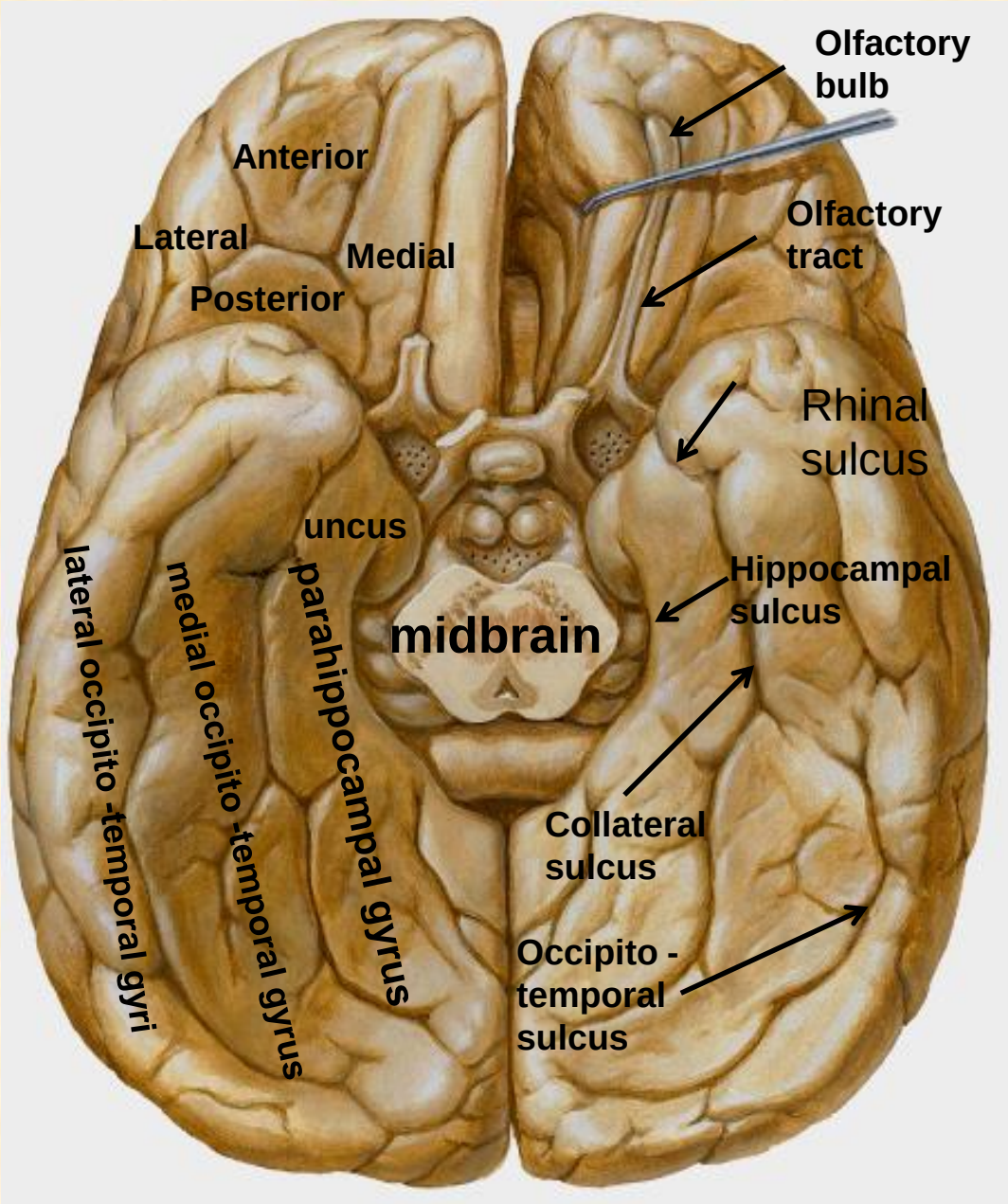
The orbital surface:

- **Olfactory suclus**; near & parallel to the median fissure. It is overlapped by the olfactory bulb & tract.
- **Gyrus rectus** lies medial to the olfactory suclus. continuous with superior frontal gyrus. Has a role in sexual behaviour.
- H-shaped **orbital sulcus** divide the remaining part into anterior, posterior, lateral & medial orbital gyri.
- Orbital gyri are connected with limbic system especially nucleus accumbens (reward reinforcement)



The tentorial surface:

- **Hippocampal sulcus** separates the parahippocampal gyrus from the midbrain.
- **Collateral sulcus**: below & parallel to the calcrine sulcus.
- **Rhinal sulcus** separates the temporal pole from the uncus.
- **Occipito -temporal** sulcus lies between the medial occipitotemopral or fusiform gyrus which is involved in face recognition & lateral occipito - temporal or inferior temporal gyrus. which is involved in location recognition memory



Morphological Classification of Cortical Areas

- based on cytoarchitectonic studies
- Campbell (1905) -------- about 20 areas
- **Brodmann (1909) ------ 47 areas**
  - most popular
- Vogt and Vogt (1919) - over 200 areas
- von Economo (1929) -- 109 areas

Functional Localization of Cerebral Cortex

Sensory areas

primary sensory area (post centeral gyrus)

secondary sensory area

Motor areas

primary motor area 4 (precenteral gyrus)

secondary (pre) motor area 6

supplementary motor area (SMA)

Association areas

parietal, occipital and temporal cortex

prefrontal (frontal) cortex

Motor Areas

primary Motor Area (M I) area 4

Premotor Area (PM) area 6

Supplementary Motor Area SMA

Frontal Eye Field area 8

Broca's area of speech area 44,45

Primary Motor Area

M I (area 4)

precentral gyrus of lateral surface

anterior part of paracentral lobule

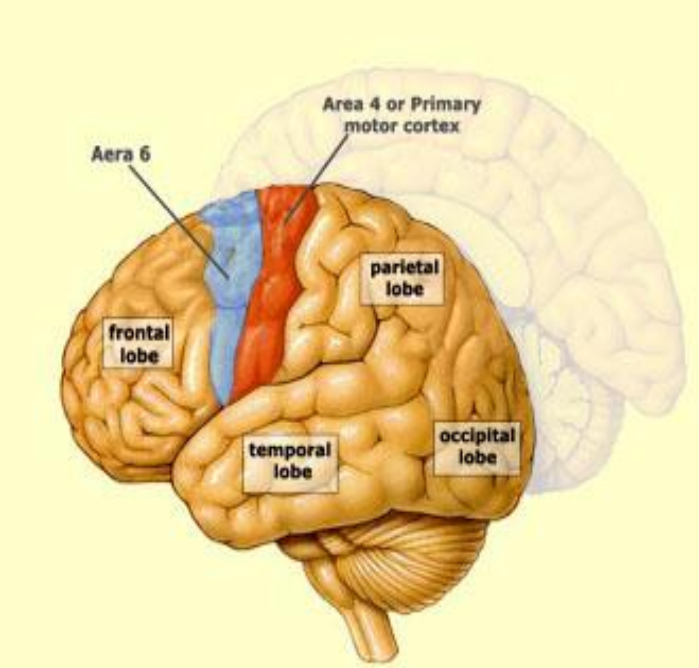
giant pyramidal cell of Betz (5th layer)

afferents: premotor area (40%), SMA, parietal sensory, thalamus

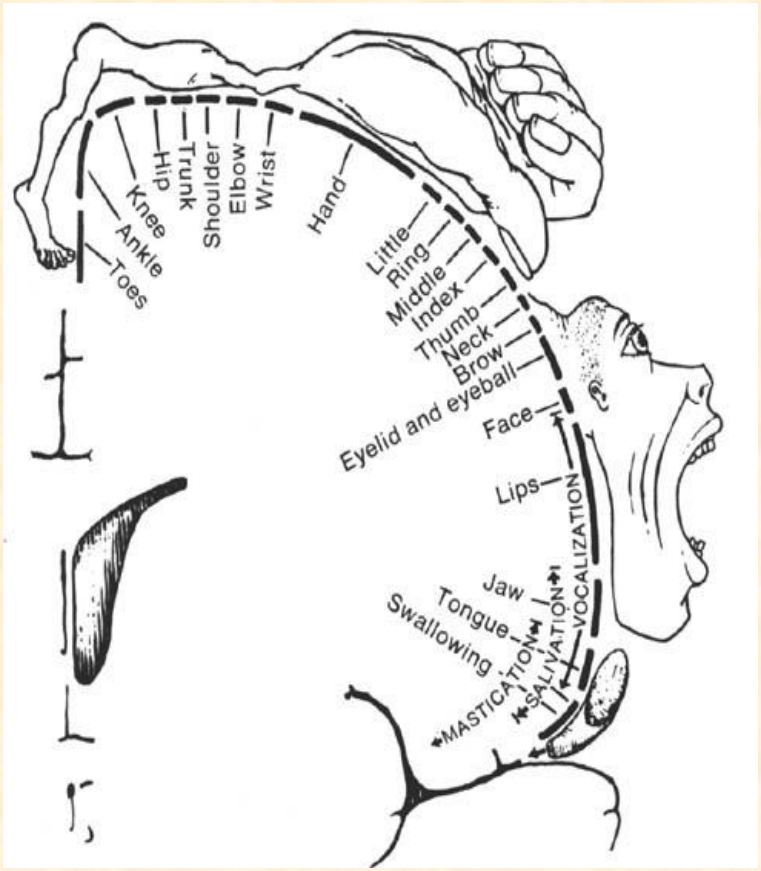
Motor Homunculus

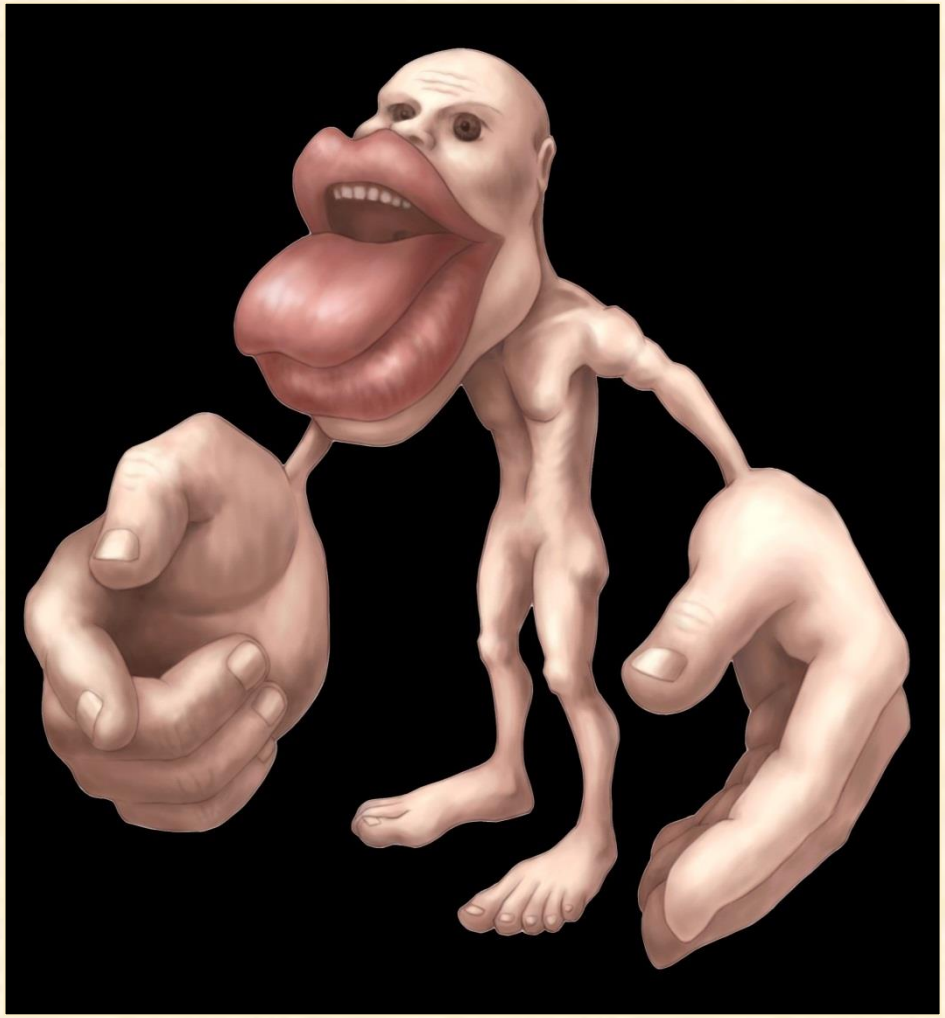
Function: fine specific discrete movement mainly extremities

lesion Upper Motor Neuron (UMN) syndrome (contra lateral hemiplagia)



Motor Homunculus





Other Motor Areas

Premotor Area (PM) ------ area 6

(Extrapyramidal center)

afferents: thalamus ,from cerebellum, basal ganglia

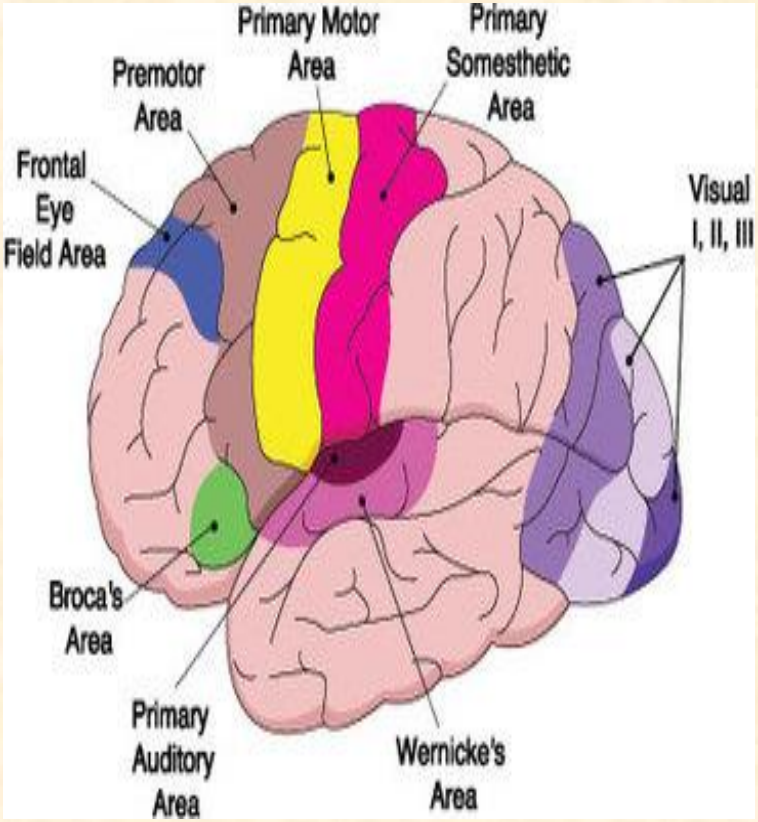
Site: in front of area 4 broad above narrow below

Function: storing motor programs ,coordination of coarse movement mainly trunk, shoulders and hip muscles.

Inhibitory to muscle tone

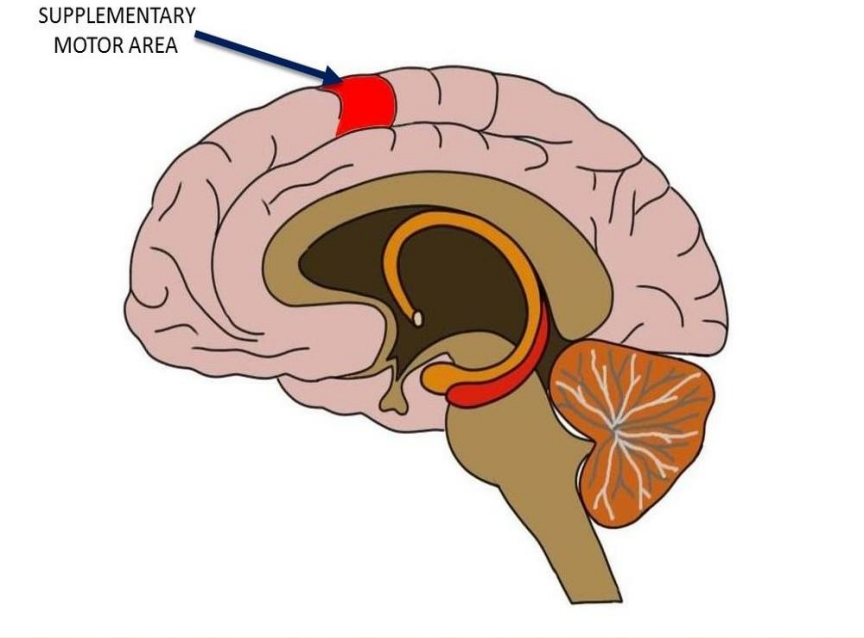
Send inputs to M4

Lesion: motor apraxia, spasticity, loss of postural stability



Supplementary Motor Area (SMA)

Extrapyramidal centre



afferents: thalamus, from basal ganglia

Site: (moslty on the medial frontal gyrus anterior to paracenteral lobule)

Function: postural stabilization of the body, the coordination of both sides of the body and the control of sequences of movements.

Lesion: not definite

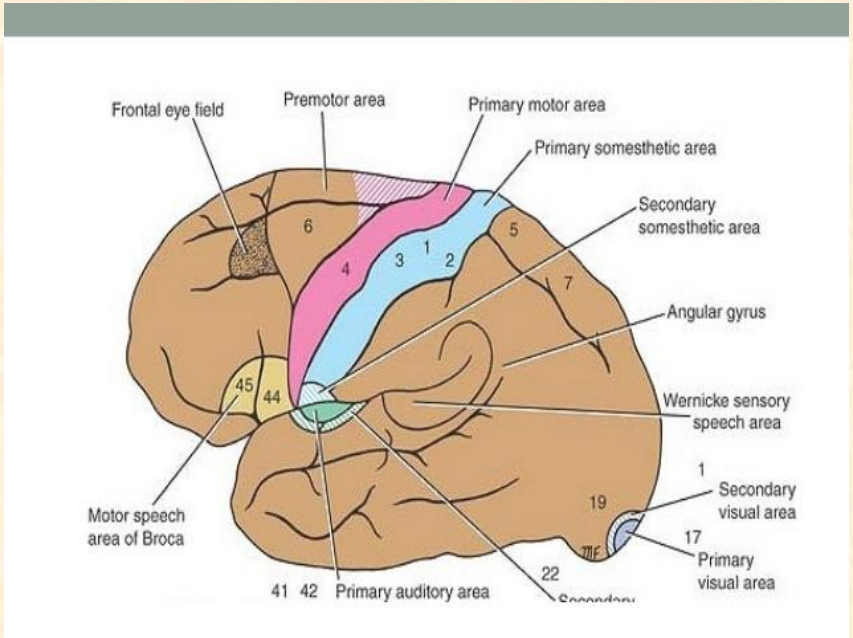
Frontal Eye Field ----------8

Site: in front of premotor area

mainly middle frontal gyrus

Connected to visual area in

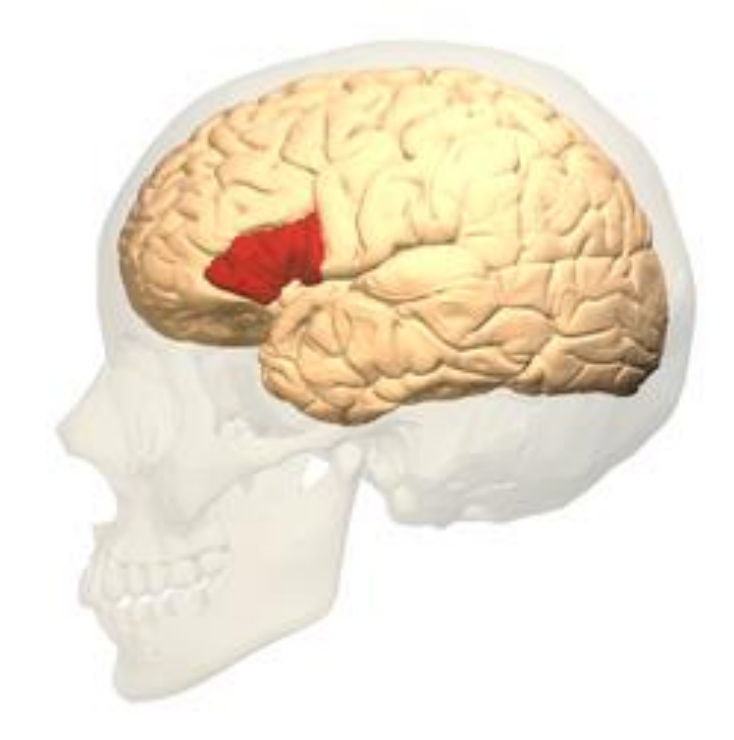
occipital lobe.



Function: voluntary tracking movement (conjugate movement) to the opposite side

lesion :(deviation of both eyes to same side of lesion)

Motor (Broca's) area of speech 44



Site: inferior frontal gyrus

Mainly on the left dominant hemisphere

Function: coordination of muscles of larynx, mouth, tongue and palate.

Connected to wernicke's area through arcuate fasiculus

Lesion: (motor aphasia) non fluent aphasia

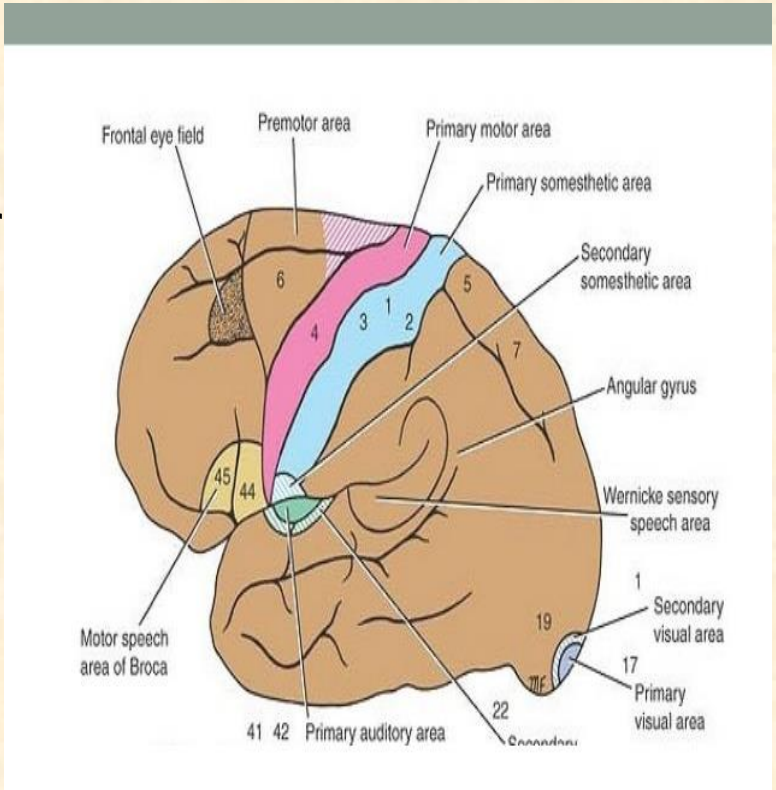
Sensory areas

Primary sensory area (3,1,2)

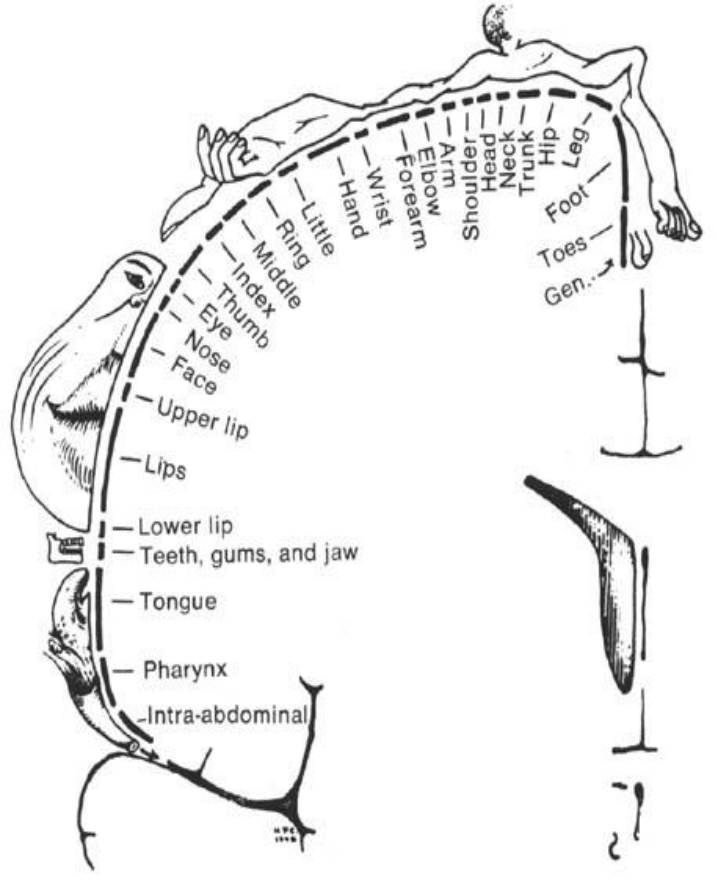
Site: post centeral gyrus
Extends on the paracenteral lobule
Representation of the body as motor area.
Function: localize, discriminates different sensations.
Gives 20% of pyramidal tract
Lesion: contralateral hemianathesia

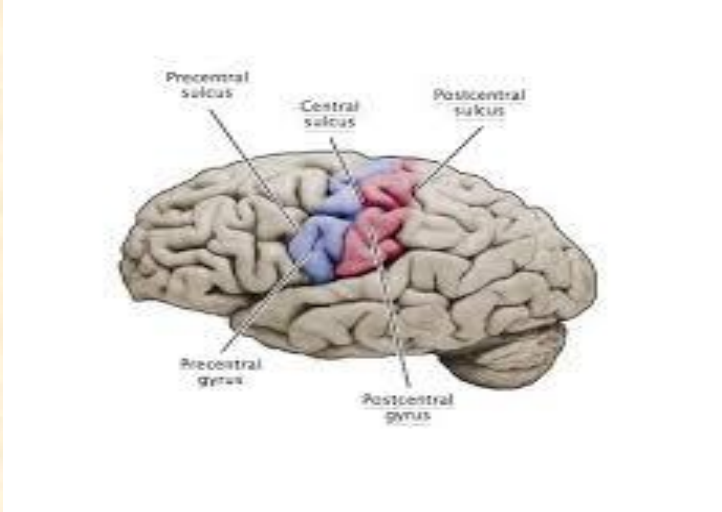
Secondary sensory area

Lowermost part of postcenteral gyrus (depth of lateral sulcus)



Primary sensory area (3.1.2)
Sensory Homnculus





Postcenteral gyrus

Lesion: contralateral hemianathesia

Other Sensory Areas

Visual Area (vision)

Auditory Area (Hearing)

Vestibular Area (Equilibrium)

Gustatory Area (Taste)

Olfactory Area (Smell)

Visual Cortex

V I ----- 17

site: around calcarine sulcus lips (cuneus above and lingual below)

receive visual radiations from LGB

Function: visual perception

lesion: contralateral homonymous hemianopia with macular sparing.

V II ---- 18, 19 (visual association area)

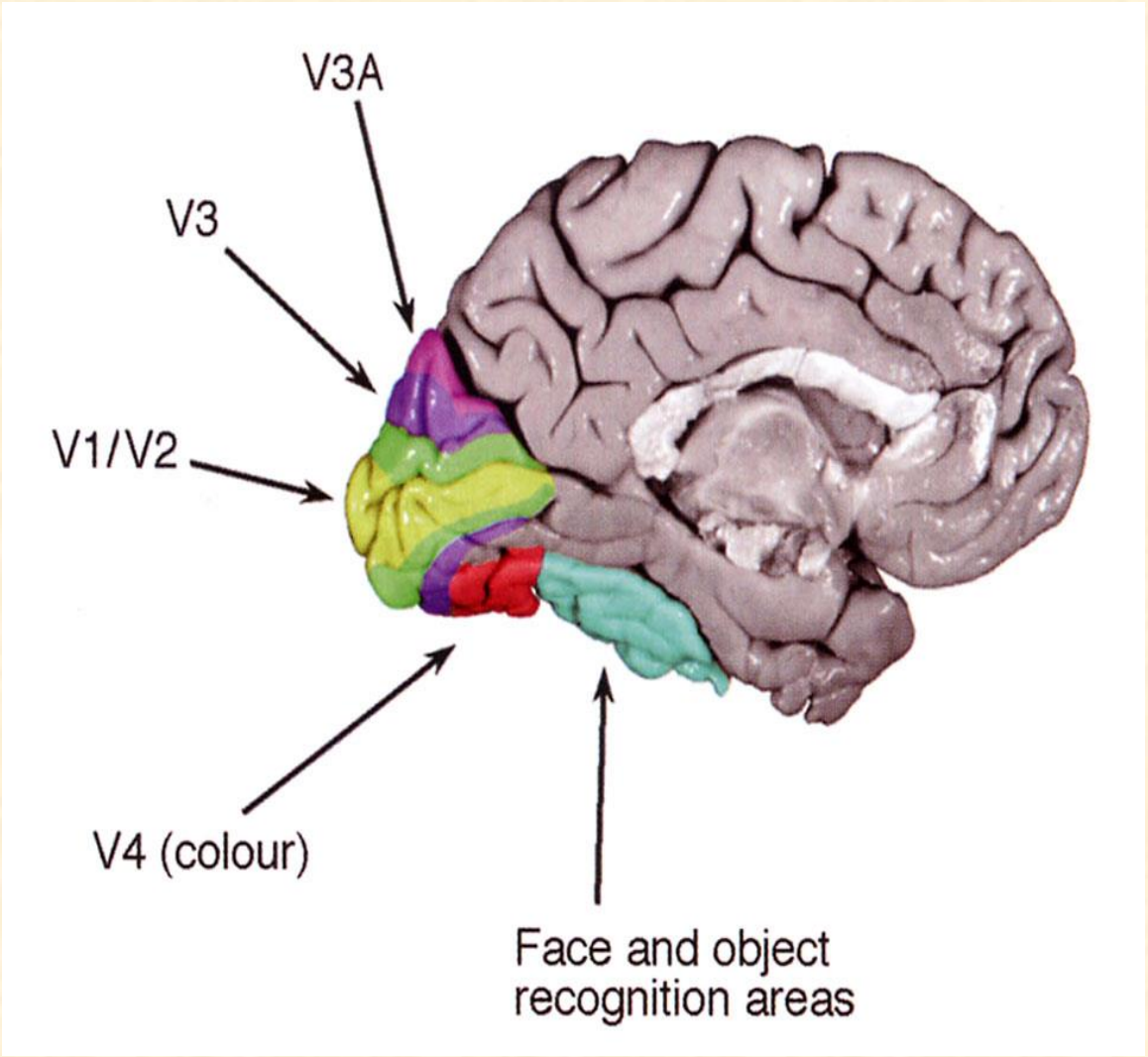
Site: remainder of cuneus and lingual gyri

Function: Interpretation of visual stimulus with past experience

lesion: visual agnosia and colour blindness

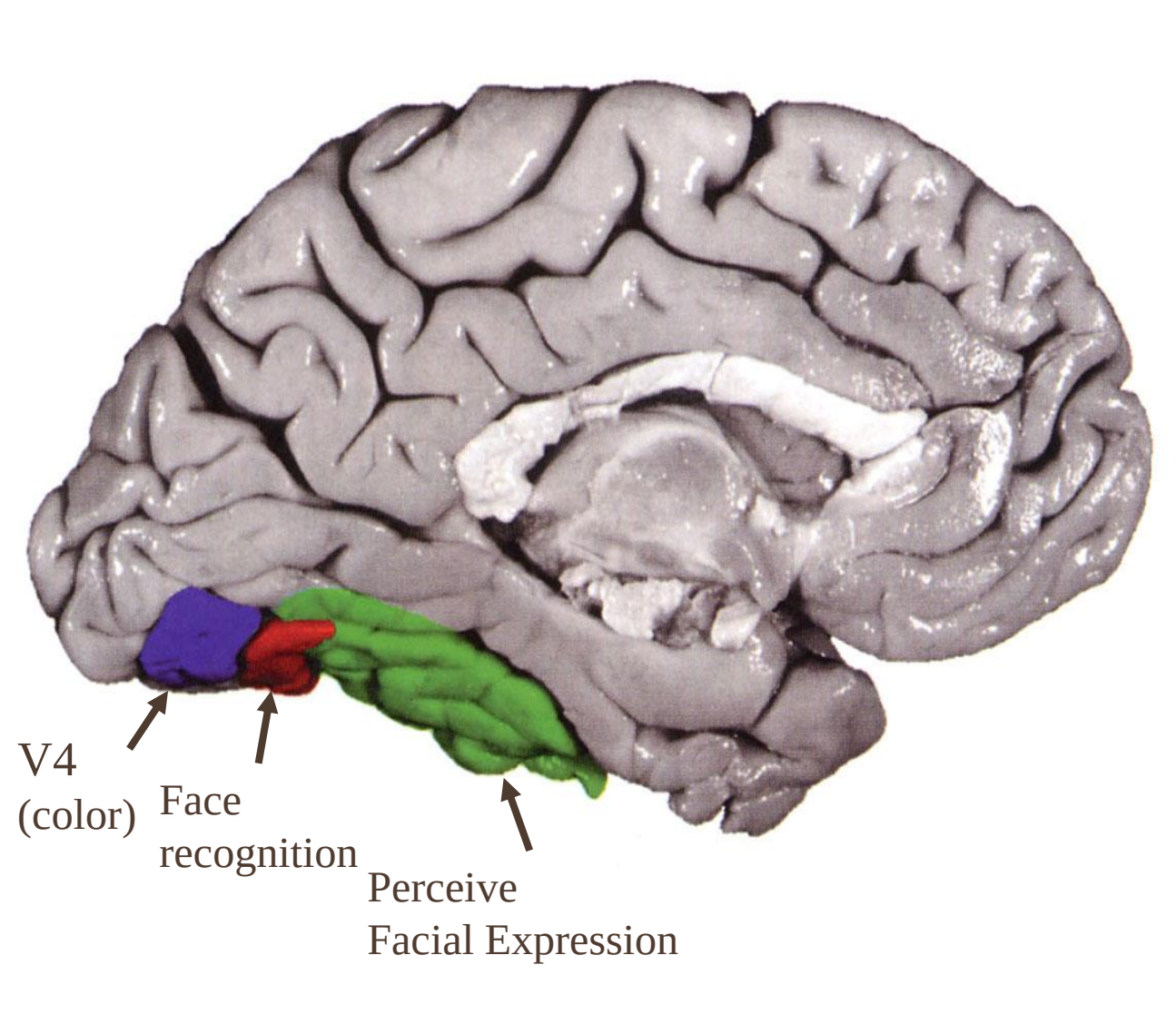
Occipital eye field area (rest of occipital lobe)

Function: reflex conjugate movement of both eyes to opposite side

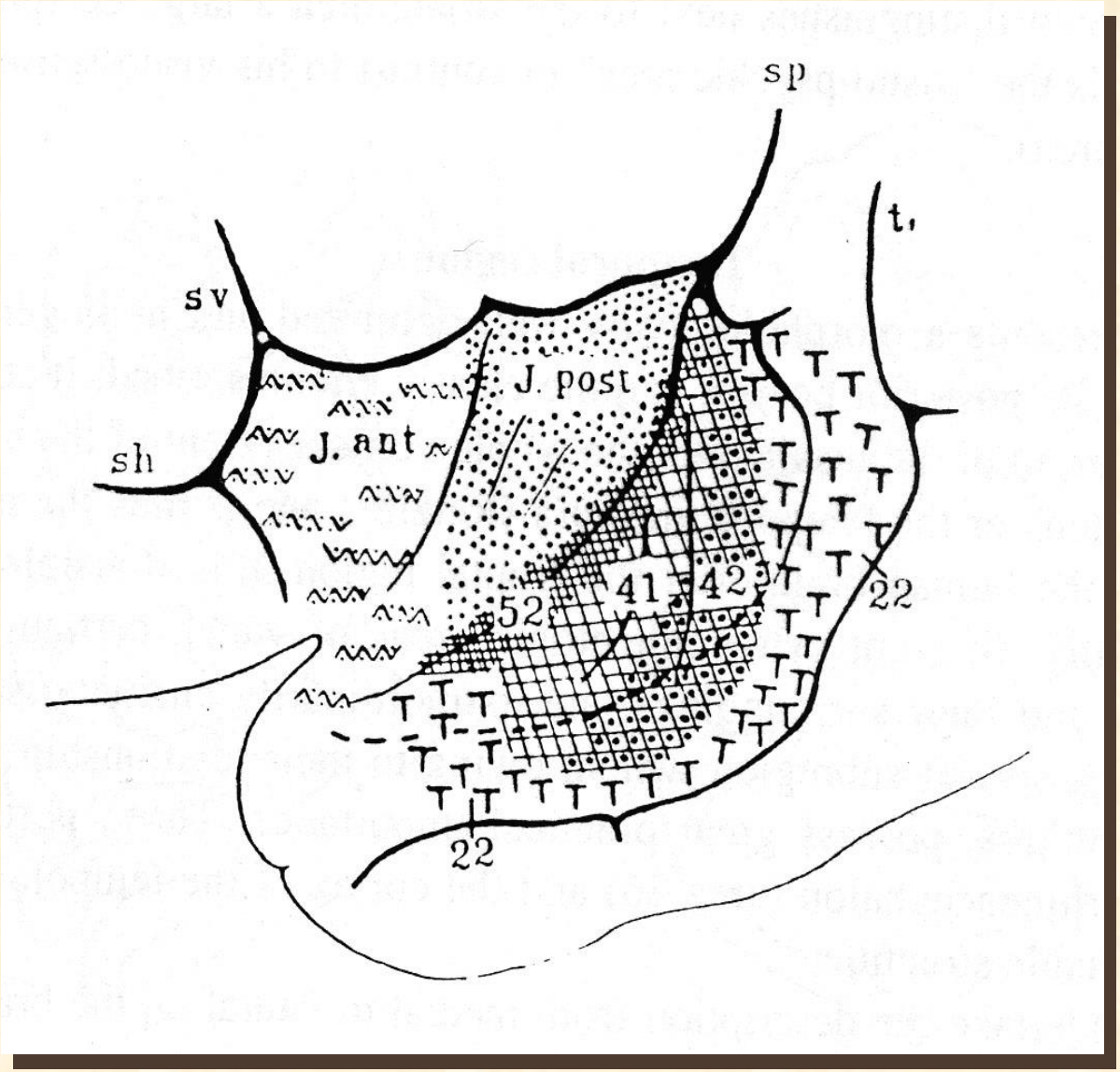


Visual Areas

Visual association areas



Auditory Areas (SUPERIOR TEMPORAL GYRUS)



A I primary auditory ----- 41, 42

Lesion: hearing defect

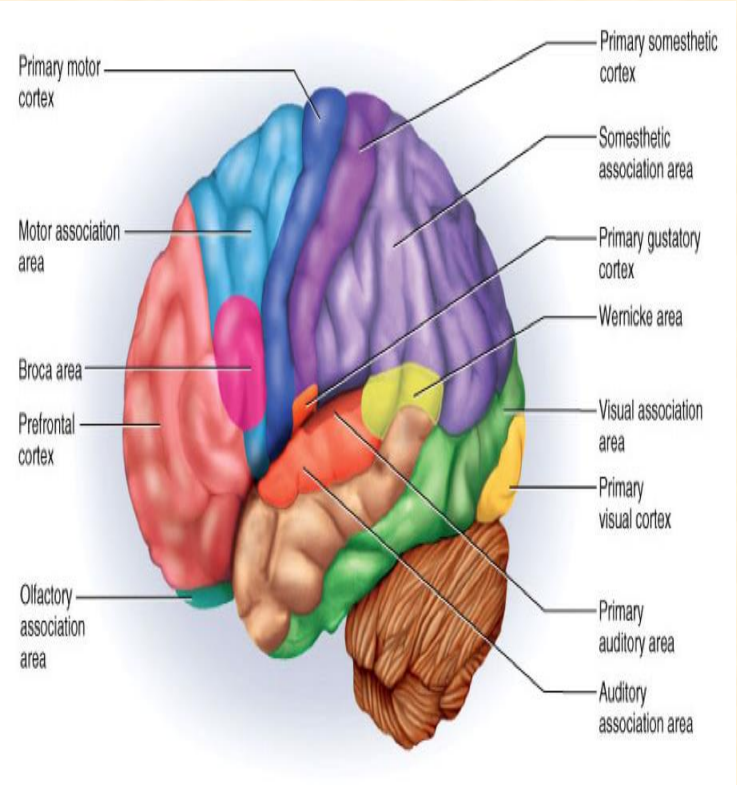
A II auditory association---- 22

Lesion : auditory agnosia

Auditory Areas (SUPERIOR TEMPORAL GYRUS)

Primary auditory area 41,42

Site: middle of the superior temporal gyrus
Function: perception, analysis of pitch, intensity of sound
Lesion: reduction of hearing acuity on both ears mainly on opposite side.



auditory association---- 22

Site: back of superior temporal gyrus along with wernicke's area
Function: interpretation of auditory stimulus
Lesion: auditory agnosia

Rest of temporal lobe ------memory

Other Primary Sensory Areas

Vestibular Area

[superior temporal gyrus posterior part?]

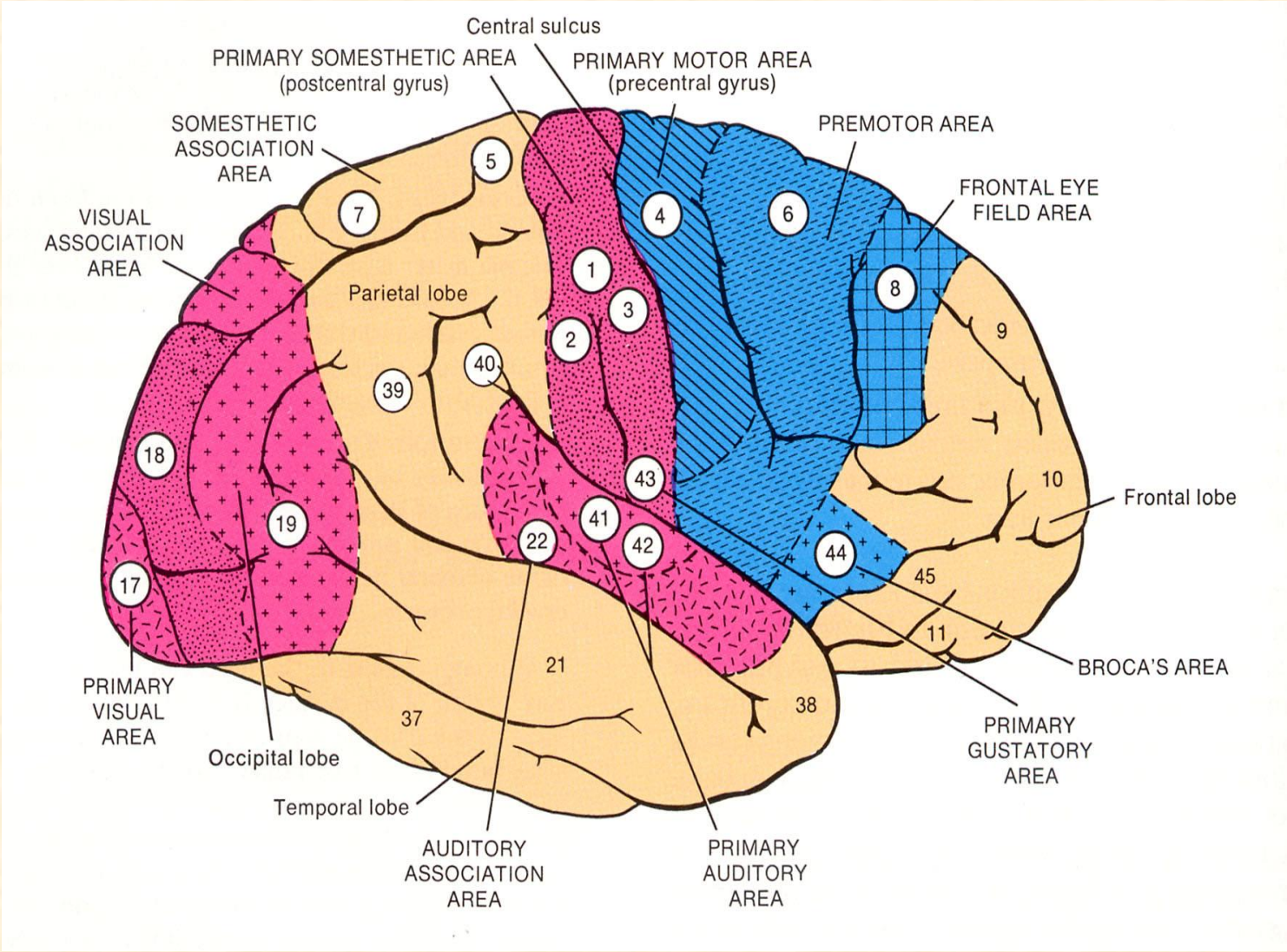
Gustatory Area

Area 43 (inferior end of postcentral gyrus)

+Insula

Olfactory Area

Uncus- piriform area= uncus and adjoining hippocampal gyrus (rhincephalon), smell center


Central sulcus
PRIMARY SOMESTHETIC AREA
(postcentral gyrus)
PRIMARY MOTOR AREA
(precentral gyrus)
SOMESTHETIC
ASSOCIATION
AREA
PREMOTOR AREA
FRONTAL EYE
FIELD AREA
VISUAL
ASSOCIATION
AREA
Parietal lobe
Frontal lobe
PRIMARY
VISUAL
AREA
Occipital lobe
Temporal lobe
AUDITORY
ASSOCIATION
AREA
PRIMARY
AUDITORY
AREA
BROCA'S AREA
PRIMARY
GUSTATORY
AREA
1
2
3
4
5
6
7
8
9
10
11
17
18
19
21
22
37
38
39
40
41
42
43
44
45

Association Areas

1- Language Areas ----- 22, 39, 40, 44, 45 (next slide)

2- Posterior Parietal Association Area (5, 7)

works with supramarginal and angular gyri (39, 40)

body image know object by feeling it **lesion (Asterognosis)**

3- Temporal Association Area (22)

Superior temporal gyrus around primary audiotory area

lesion (acoustic or verbal agnosia)

4- Visual association area occipital lobe (18 ,19)

lesion visual agnosia

5- Prefrontal Association Area (9, 10, 11, 12)

Site: greater part of frontal cortex

Function: judgment, foresight, personality

(Alzheimer) amyloid degeneration and schizophrenia (low dopamine)

Language Areas

Motor Language Area (Broca's area) --- 44, 45

lesion Motor Apahsia (non-fluent aphasia)

good comprehension, poor speech

Sensory Language Area (Wernicke's area) ---- 22, 39,40

Site: **left dominant hemisphere of superior temporal gyrus extending into posterior end of lateral sulcus into parietal lobe**

Connected to broca's area by arcuate fasciculus

Receives fibers from visual and auditory areas.

Function: **Understanding written and spoken words enables person to read and understand**

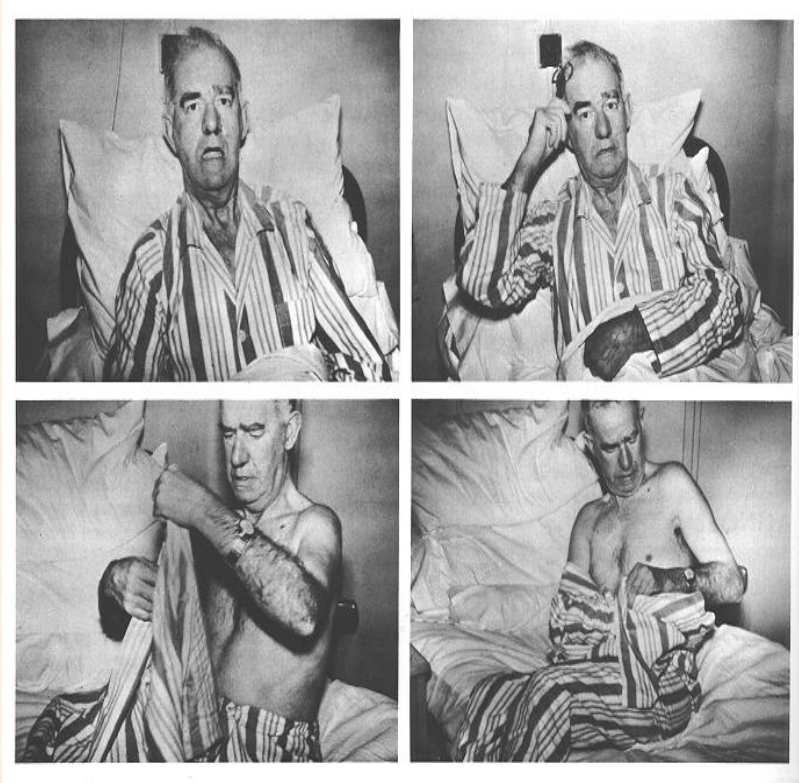
Works in coordination with angular gyrus (39) and supra marginal gyrus (40)

Lesion: Sensory or sensory aphasia (fluent)

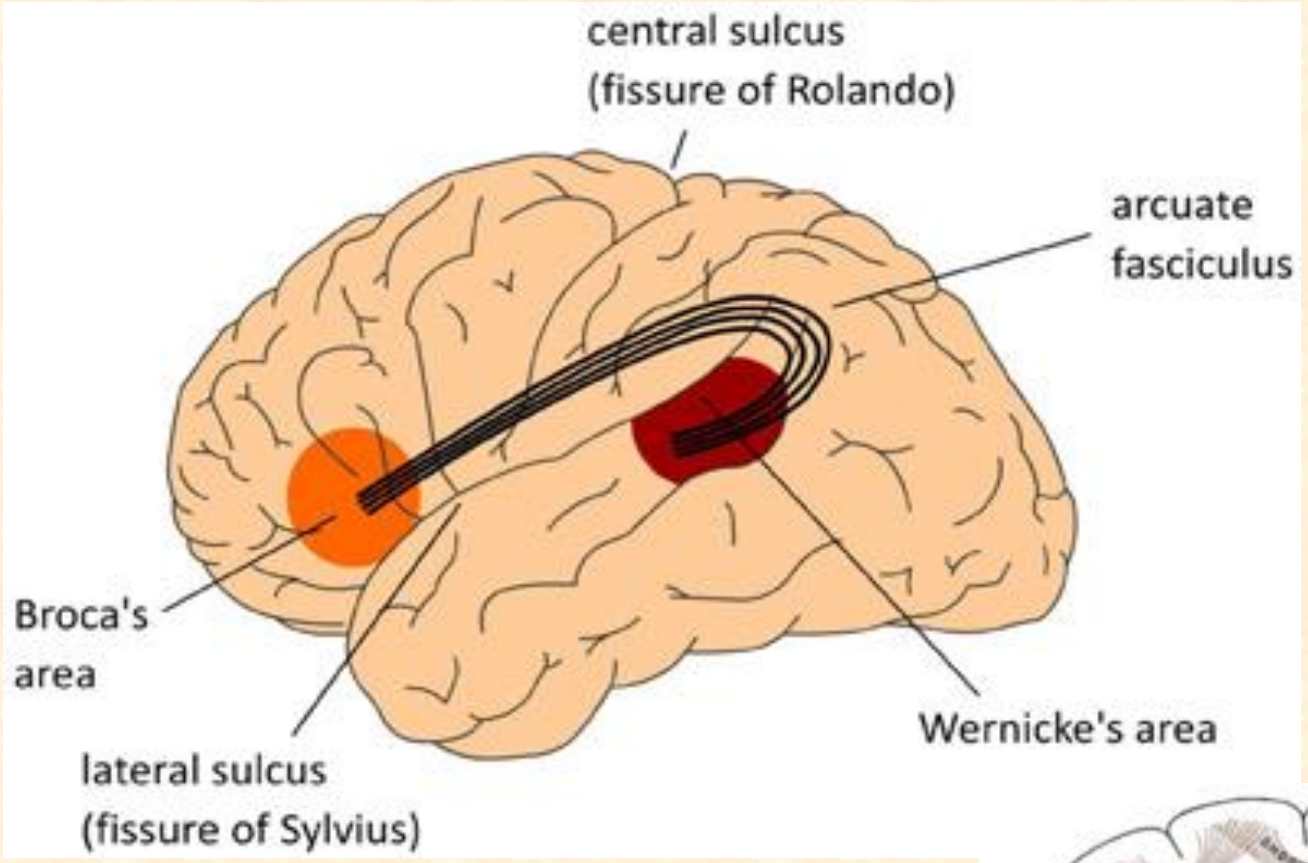
Summary of disorders of Association Cortex

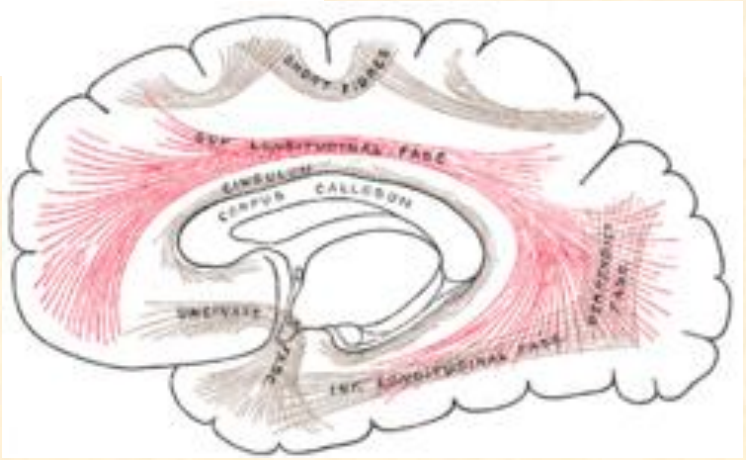
- Agnosia
  - Tactile agnosia (Asterognosis) site? …….
  - Visual agnosia ? ……..
  - Auditory agnosia ?……..
- Apraxia (posterior parietal damage and or premotor area 6), CC
- Aphasia (types)
  - 1- Wernicke's (sensory or receptive) aphasia
  - → 2- Broca's (Motor) aphasia (expressive)
  - 1+2 global aphasia
  - 3- Conduction aphasia

Apraxia



The inability to execute a voluntary motor movement despite being able to demonstrate normal muscle function .Lesion is mainly due to injury of posterior parietal area or the split brain syndrome due to corpus callosum injury.


central sulcus
(fissure of Rolando)
arcuate
fasciculus
Broca's
area
Wernicke's area
lateral sulcus
(fissure of Sylvius)



More about aphasia……..Read only

(Fluent aphasia)

Receptive Aphasia - area 22 defect in comprehension, good spontaneous speech (inability to understand spoken, written

Anomic Aphasia - word finding difficulty

Jargon aphasia - fluent, but unintelligible not understood

Global aphasia: both broca's and wernicke's.

Superior Longitudinal Fasciculus

lesion: Conduction Aphasia

good comprehension, good spontaneous speech poor repetition, poor response

Angular gyrus (39)

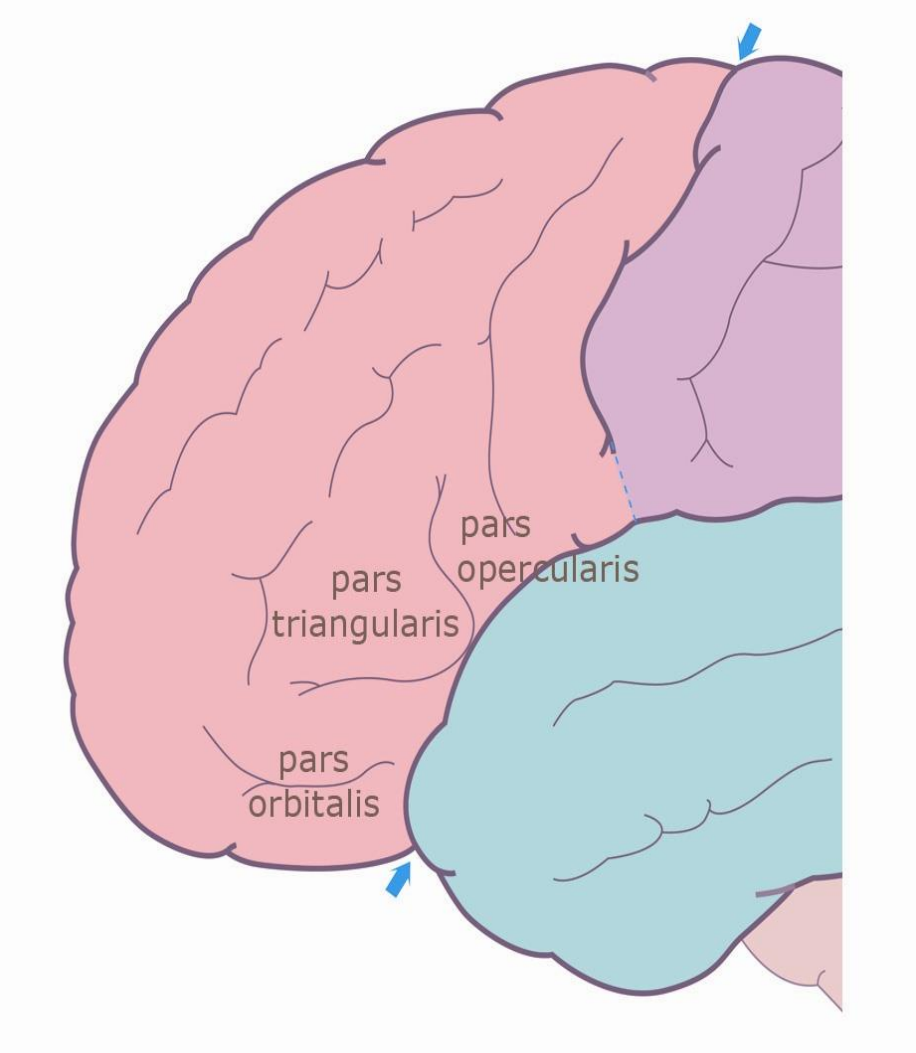
Site: around posterior end of superior temporal gyrus

Lesion: Agraphia : inability to write or identify drawn objects

Alexia: inability to read

Acalculia: inability to solve small calculations

Speech area

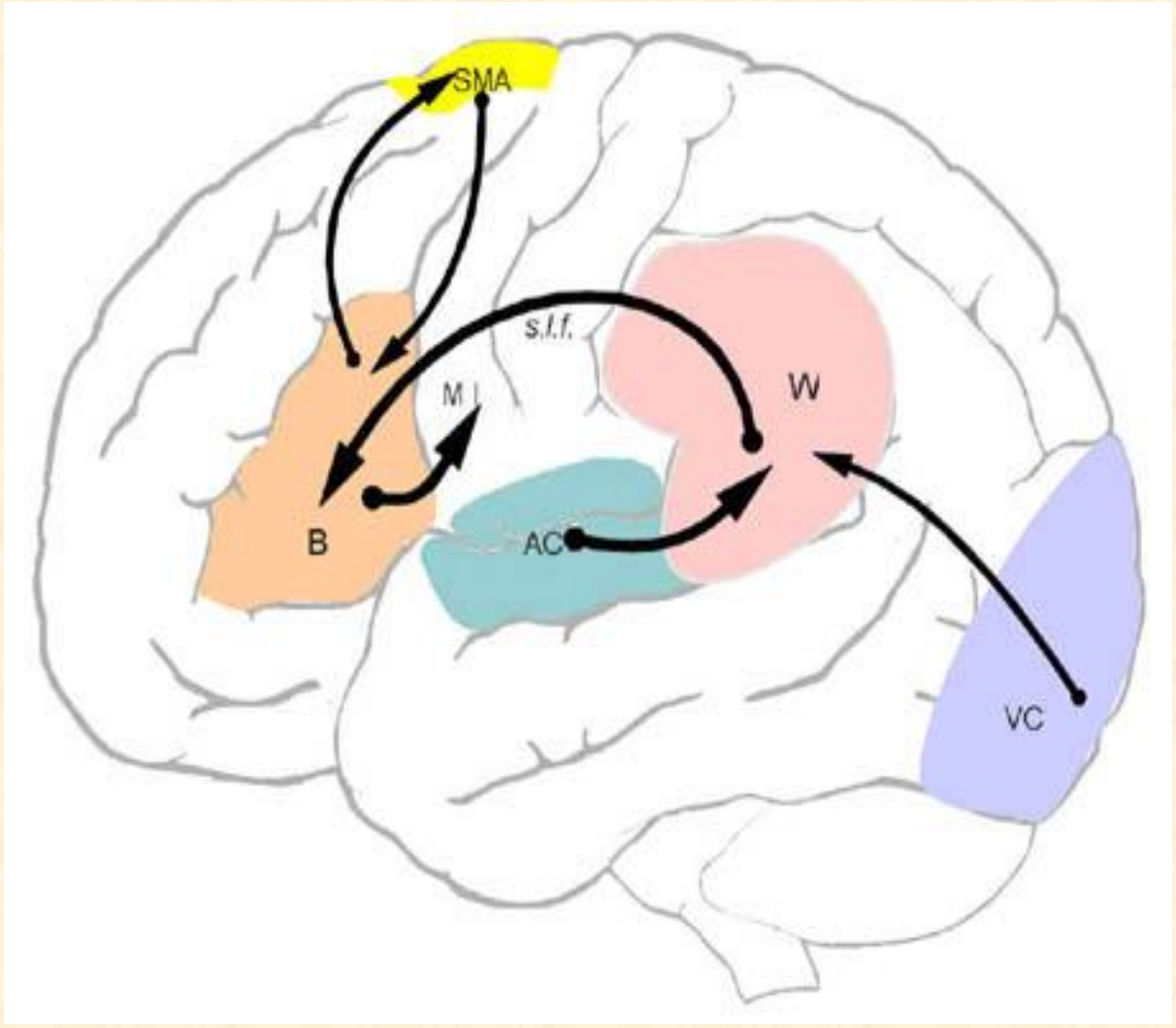


Broca's area

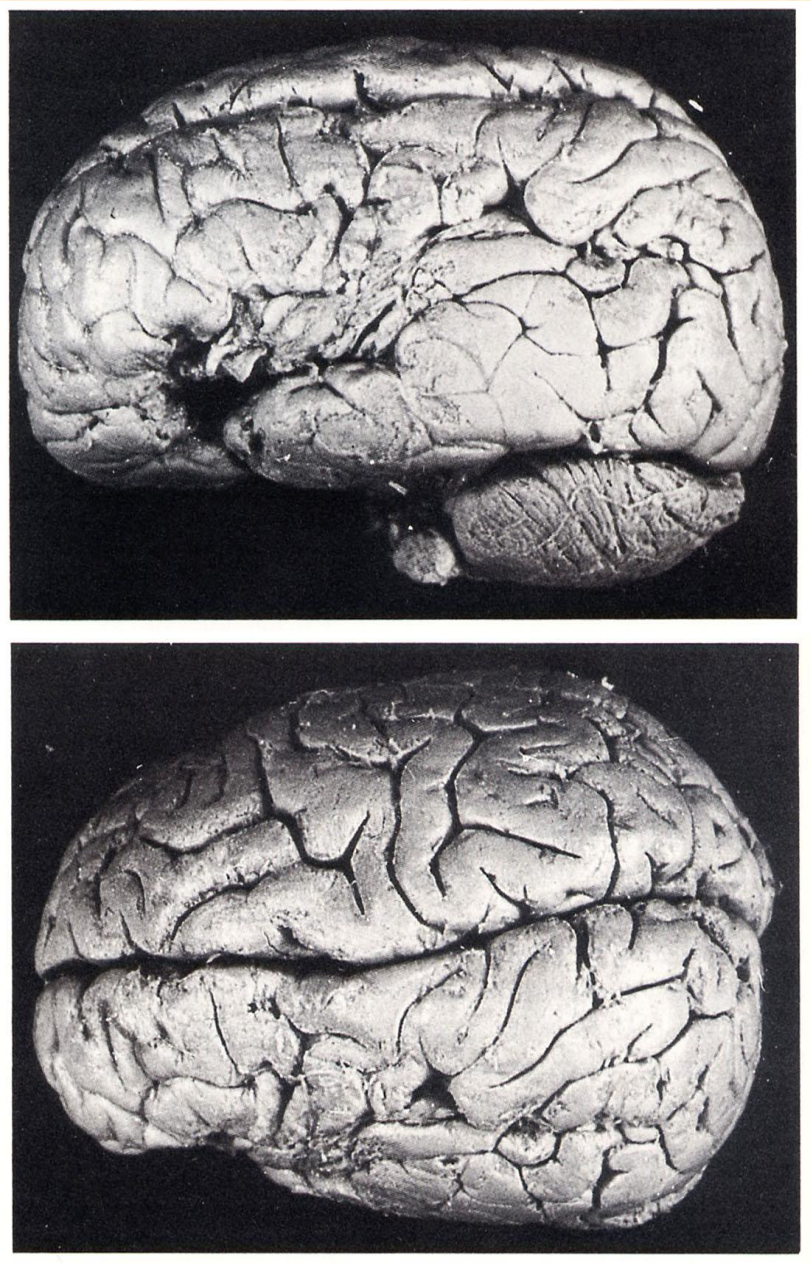
Pars Opercularis

Pars Triangularis

Pars Orbitalis



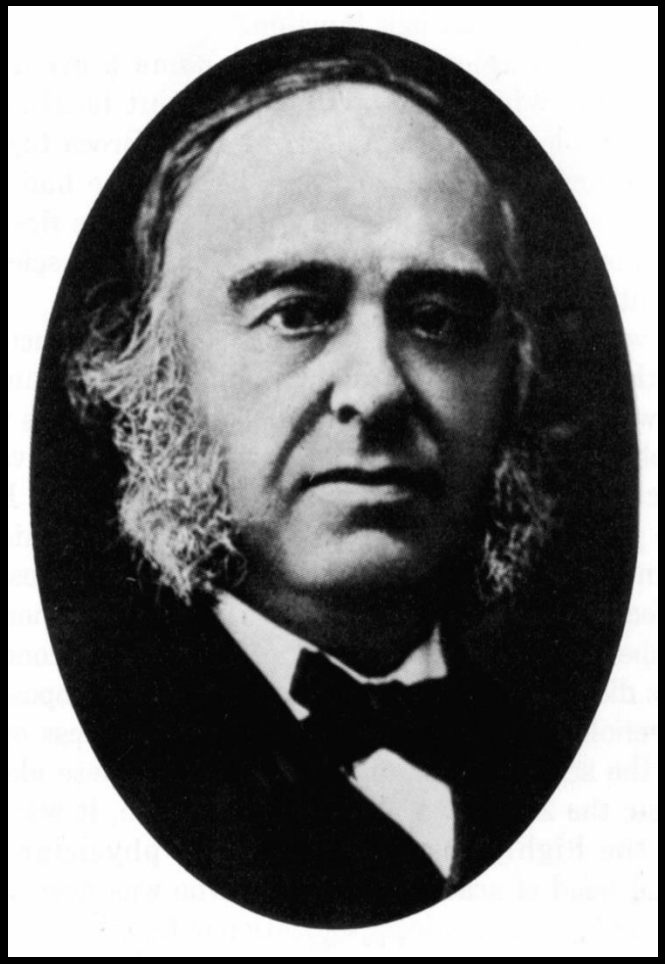
Language Areas



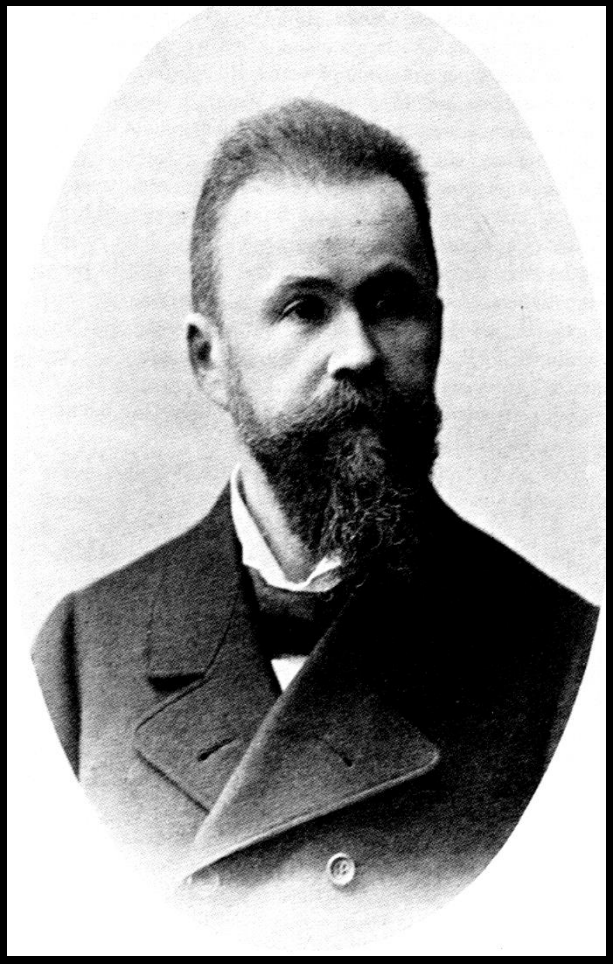
Broca's Area

Pars triangularis and pars opercularis of the inferior frontal gyrus of dominant hemisphere.

Photograph of the brain of Broca's patient.

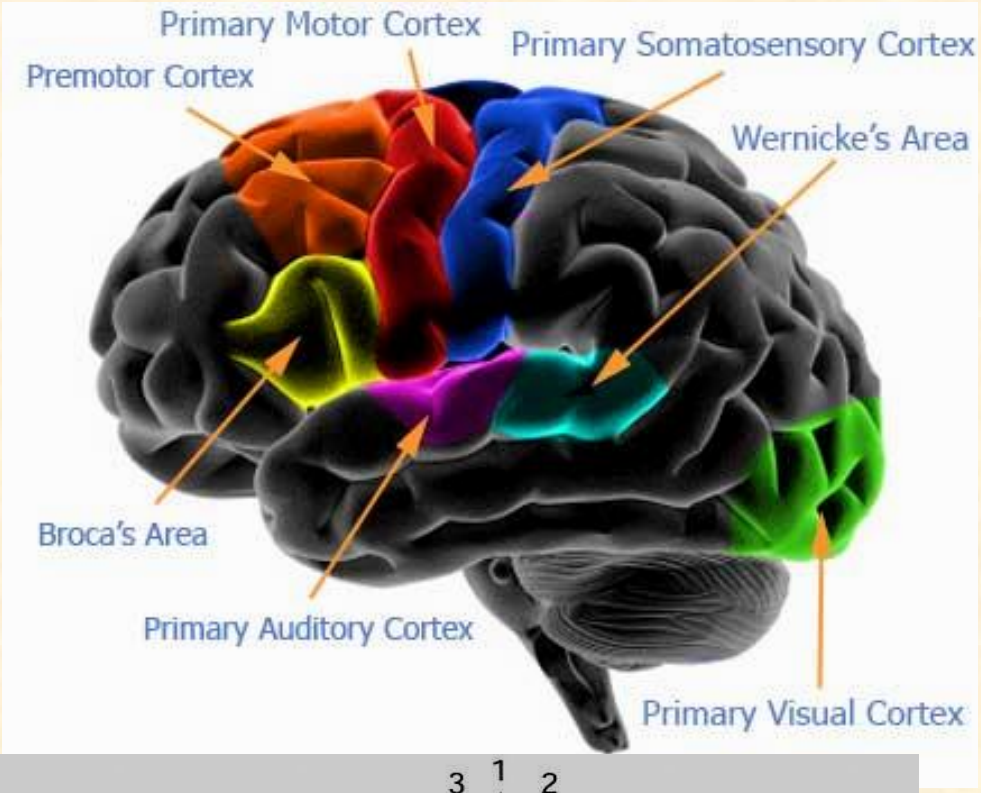


Paul Broca (1824-1880)



Carl Wernicke (1848-1905)

SUMMARY OF THE MAIN FUNCTIONAL AREAS OF THE DIFFERENT LOBES OF THE BRAIN



The Frontal lobe:

- **Contains motor area (4) which controls muscles of the opposite half of the body. Premotor area (6), Frontal eye field (8) & Broca's (motor)area for speech (44,45)**

The parietal lobe:

- Contains the sensory area (3,1,2) for the opposite half of the body.

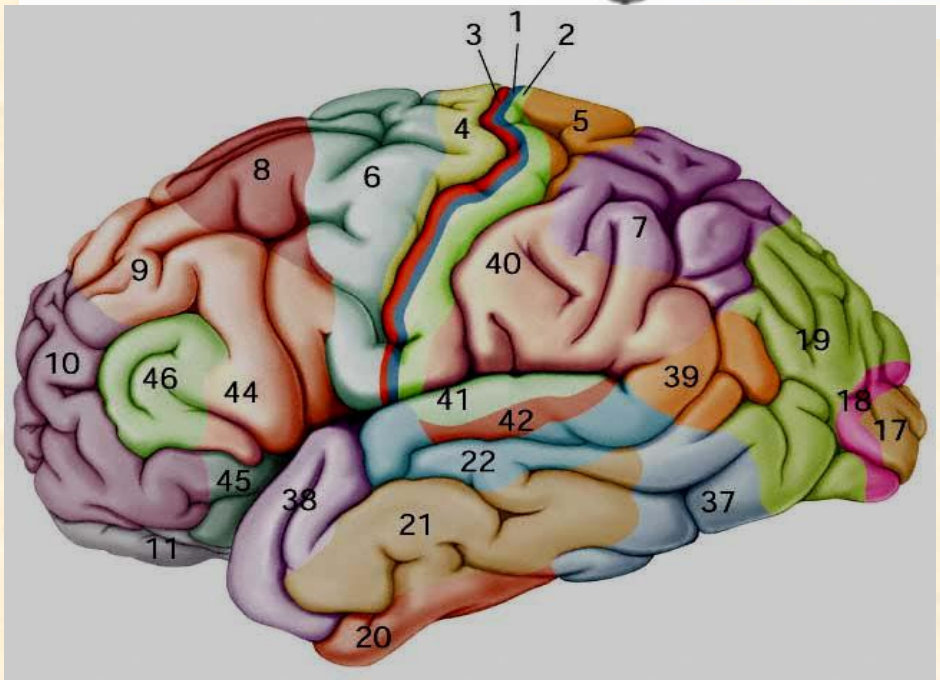
- Wernicke's area (39,40,22)

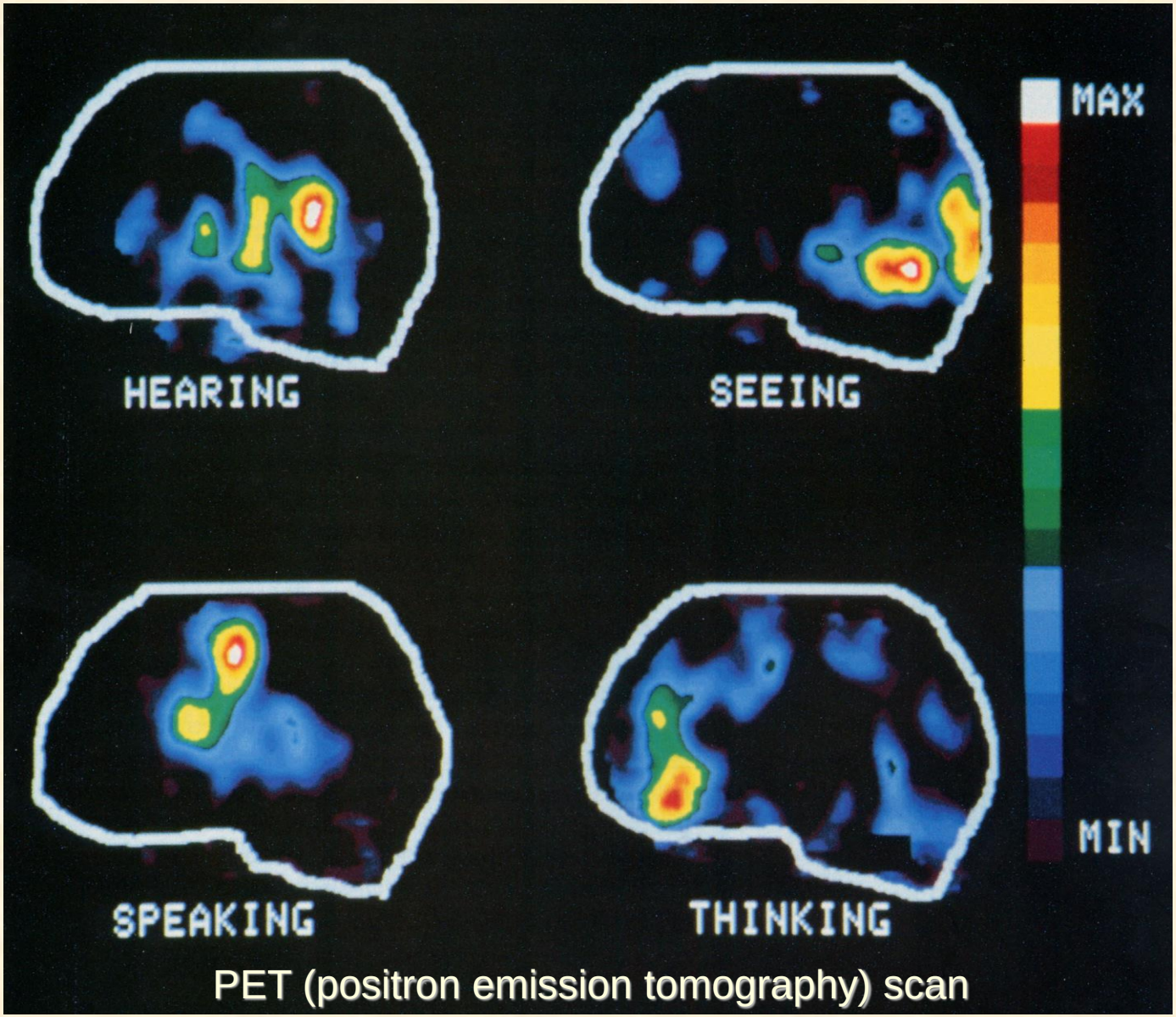
The temporal lobe:

Contains hearing center (41,42,22).

The occipital lobe:

Contains center for vision (17,18,19).





PET (positron emission tomography) scan

Cerebral Dominance (Lateralization, Asymmetry)

Dominant Hemisphere

Language

speech, writing

Calculation

Non-dominant Hemisphere

Spatial Perception (3D subject)

Singing

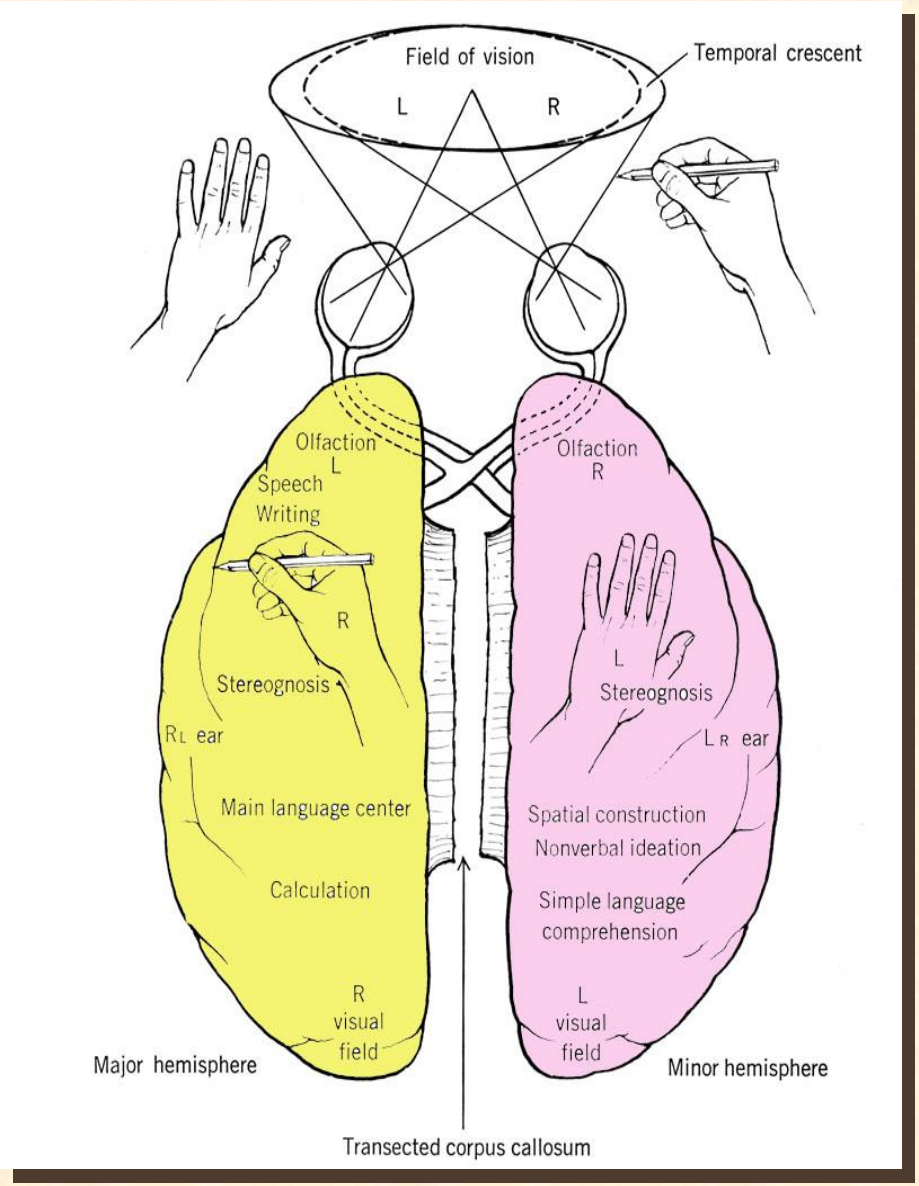
Playing musical instrument

Language

Speech

Writing

Calculation

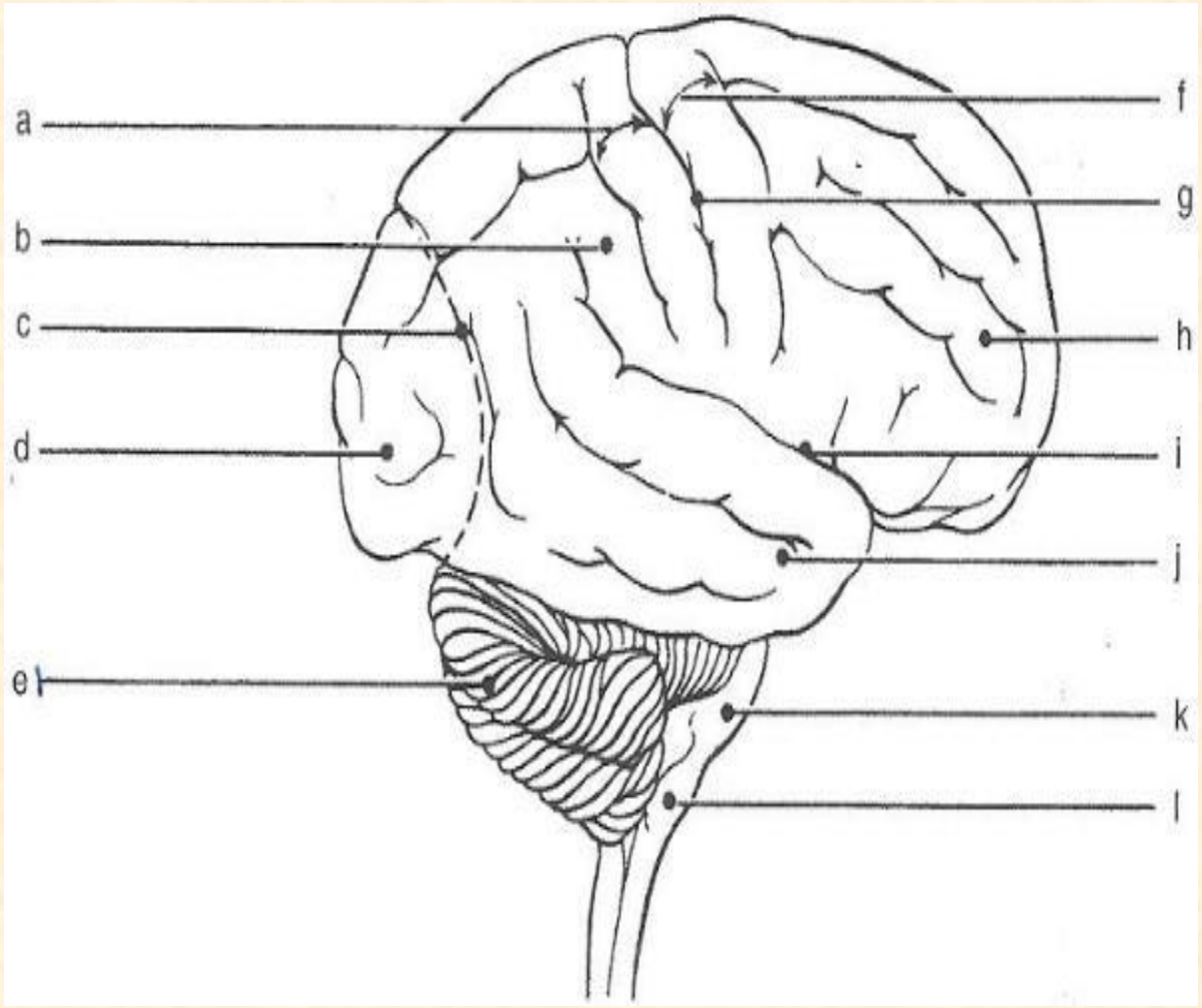


3D perception

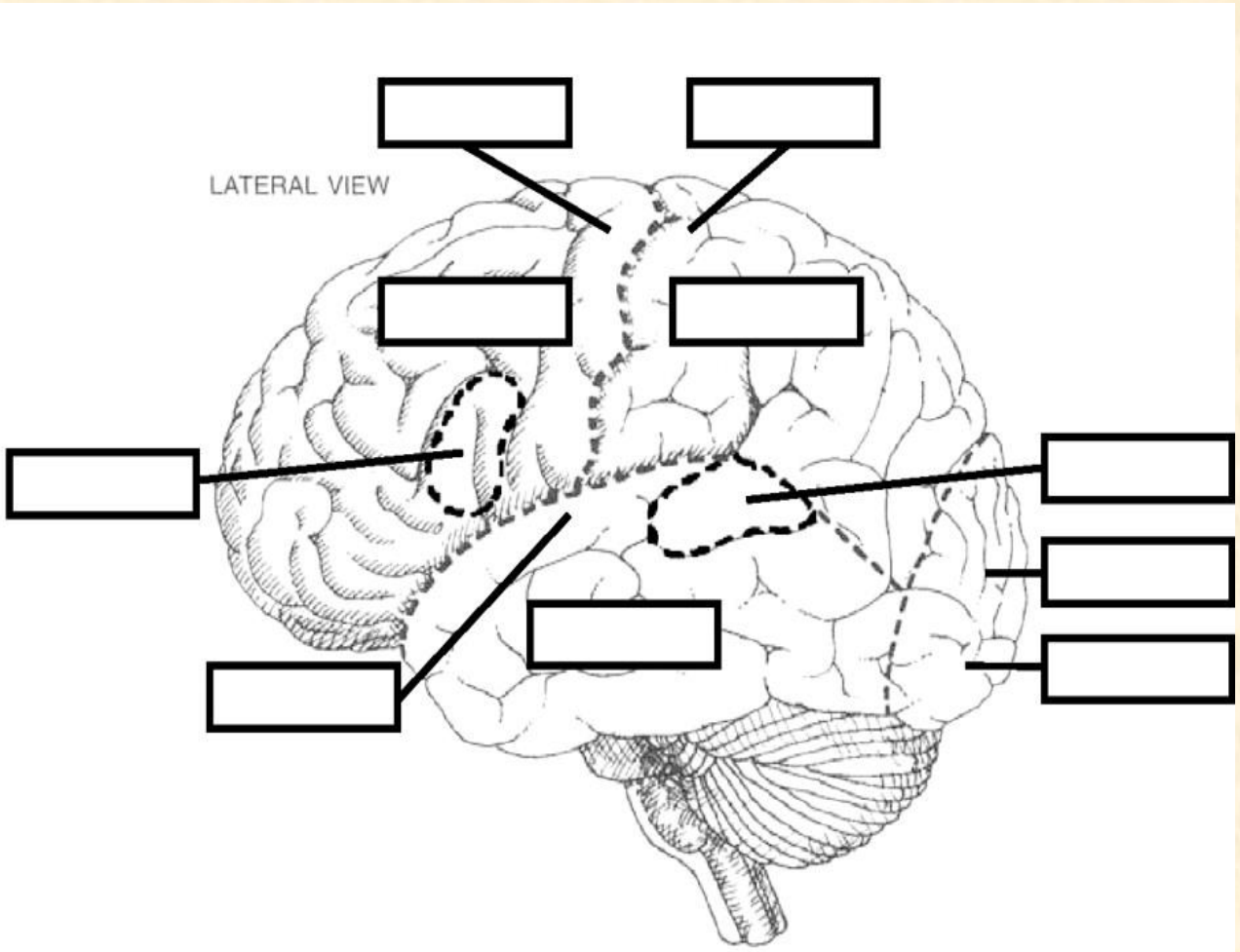
Singing

Playing Musical instrument

Now test yourself



A- post centeral gyrus
B- inferior parietal lobule
C- immaginary line
D- occipital lobe
E- cerebellum
F- precenteral gyrus
G- centeral sulcus
H- inferior frontal gyrus
I- posterir ramus (lateral fissur
J- middle temporal gyrus
K- pons
L- medulla oblongata



Brain diagram adapted from Pinel, J. P. J. & Edwards, M. (2008, p.113). *A colorful introduction to the anatomy of the human brain: A brain and psychology coloring book*. Boston, Massachusetts: Pearson Education.

Label Key: Insert the correct brain term into the picture's label boxes.

...

LOBE TERMS

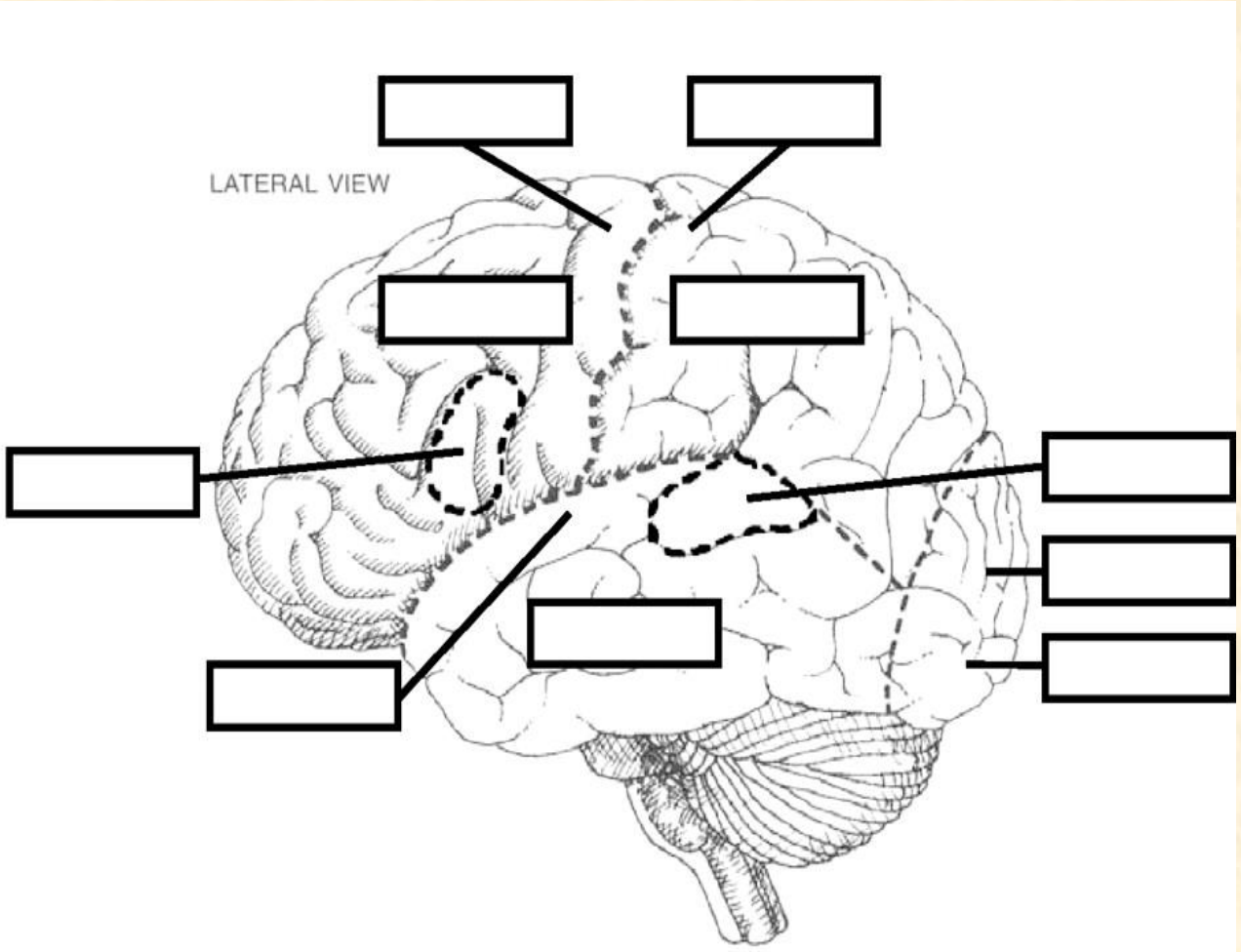
1. **Occipital Lobe**
2. **Parietal Lobe**
3. **Temporal Lobe**
4. **Frontal Lobe**

SENSORY CORTEX TERMS

7. **Visual Cortex**
8. **Auditory Cortex**
9. **Somatosensory Cortex**
10. **Motor Cortex**

SPECIAL FEATURE TERMS

5. **Wernicke's Area**
6. **Broca's Area**



Brain diagram adapted from Pinel, J. P. J. & Edwards, M. (2008, p.113). *A colorful introduction to the anatomy of the human brain: A brain and psychology coloring book*. Boston, Massachusetts: Pearson Education.

THANK YOU