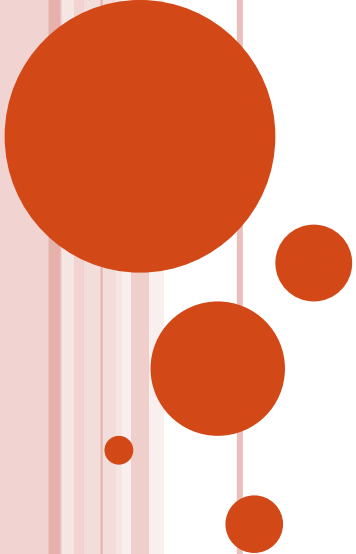




FUNCTIONAL AREAS OF CEREBRAL CORTEX

**15.4.2020
I MBBS
DR. BHAVANA**

COMPETENCIES AND SLOs

AN62. 2		Describe & demonstrate surfaces, sulci, gyri, poles, & functional areas of cerebral hemisphere
	62.2.2	At the end of the session the phase I student shall be able to Describe functional areas of cerebral hemisphere
	62.2.3	At the end of the session the phase I student shall be able to demonstrate surfaces, sulci, gyri, poles, & functional areas of cerebral hemisphere



CONTENTS

- Introduction
- Classification
- Some important areas
- Applied anatomy

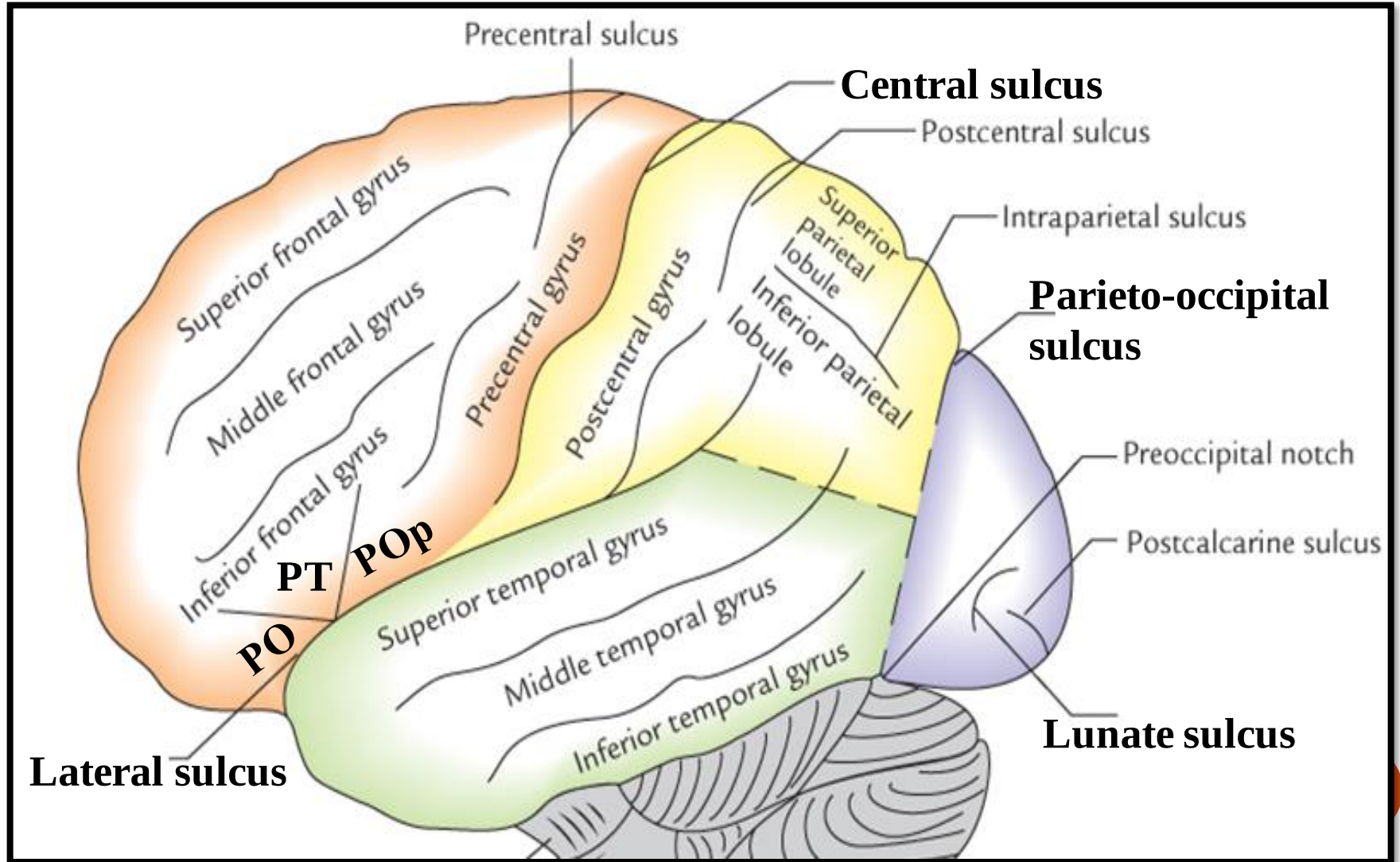


INTRODUCTION

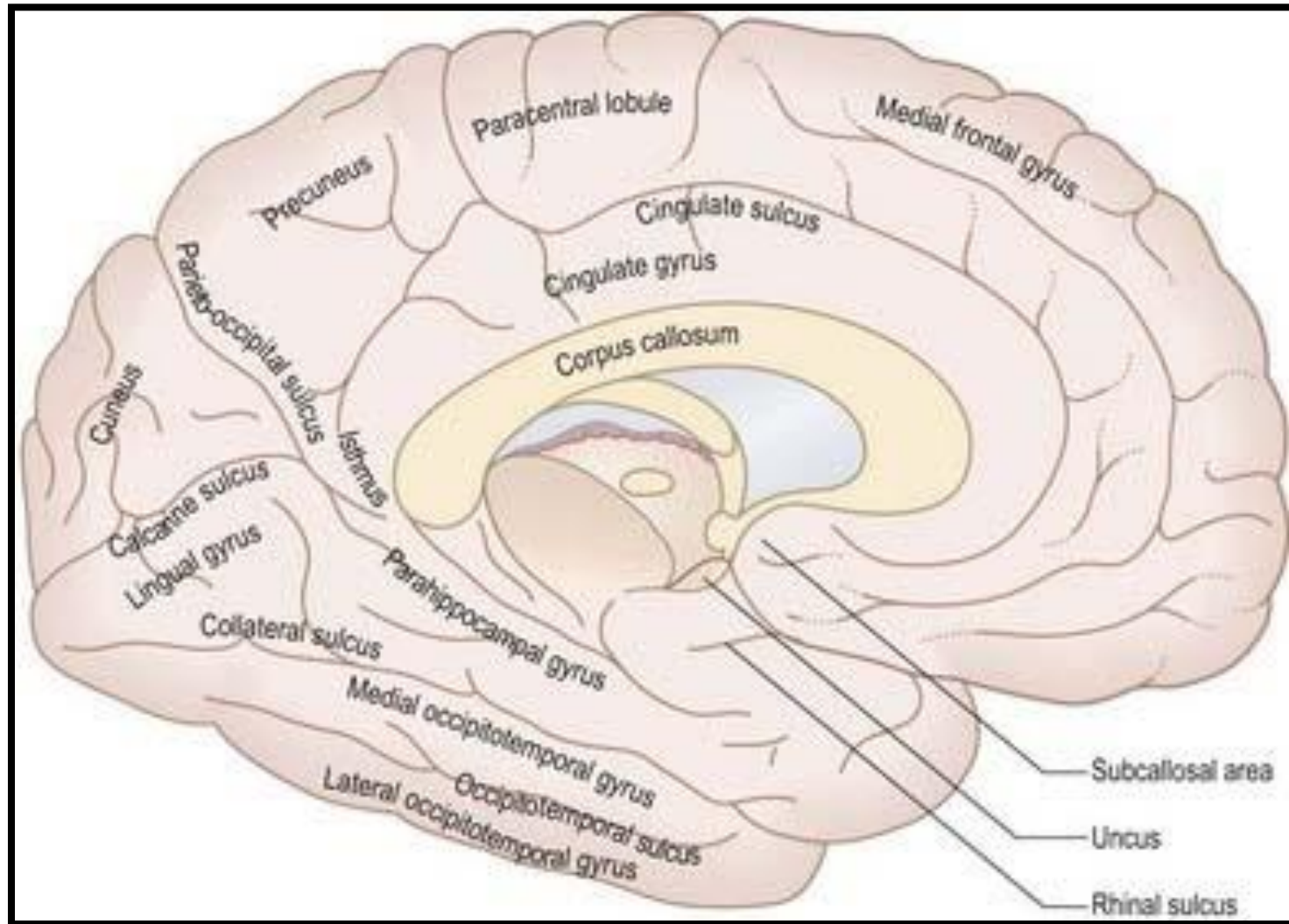
- A young woman after road accident suffered head injury.
 - Discharged from hospital after 1 month with slight weakness of right leg
 - After 4 months developed jerky movements of right leg, spreading on to right arm with eventual episode of unconsciousness.
- This is due to damage to upper part left **precentral gyrus** followed by irritation and scarring of the same area.



LET'S REVISE - SULCI AND GYRI ON SUPEROLATERAL SURFACE

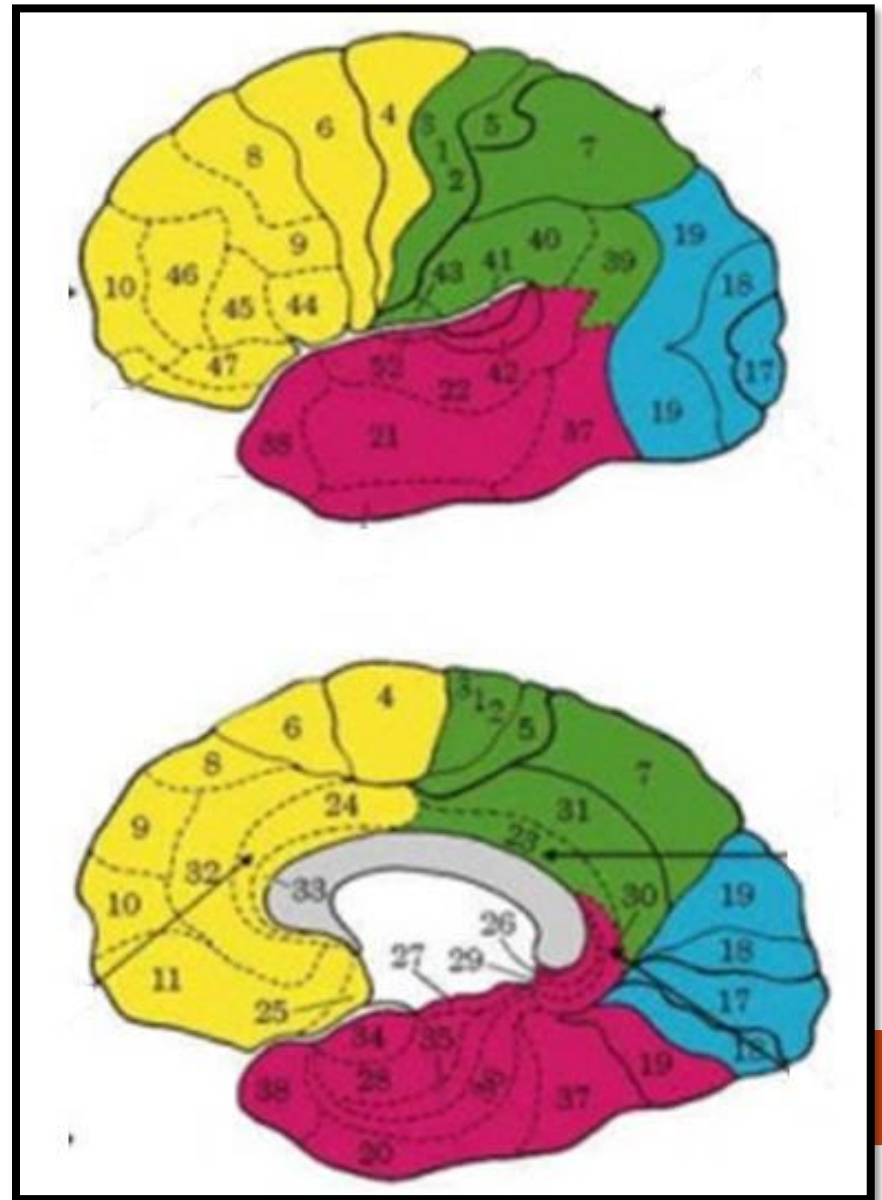


LET'S REVISE - SULCI AND GYRI ON MEDIAL SURFACE



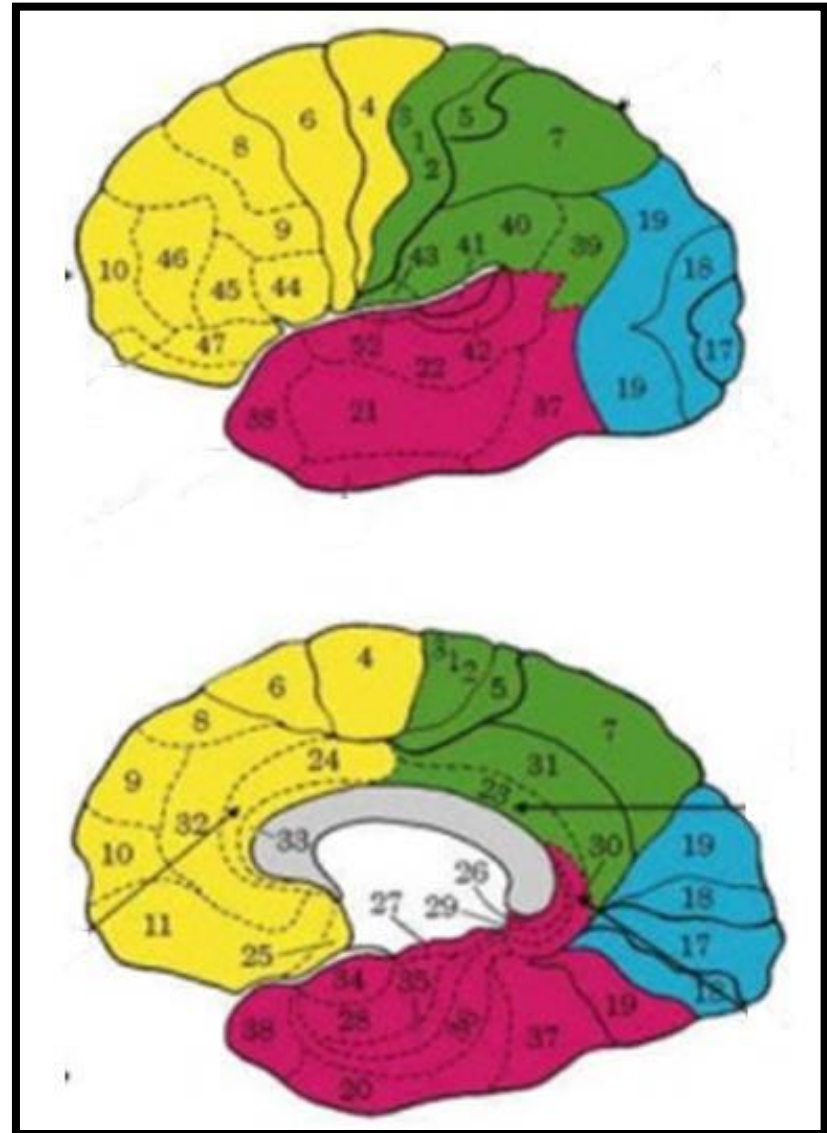
INTRODUCTION

- By MRI, PET and many such studies over years cortex has been mapped into functional areas.
- Many researchers have classified these areas, eg. Cambell, Economo etc.
- Most commonly used and referred one is by Brodmann



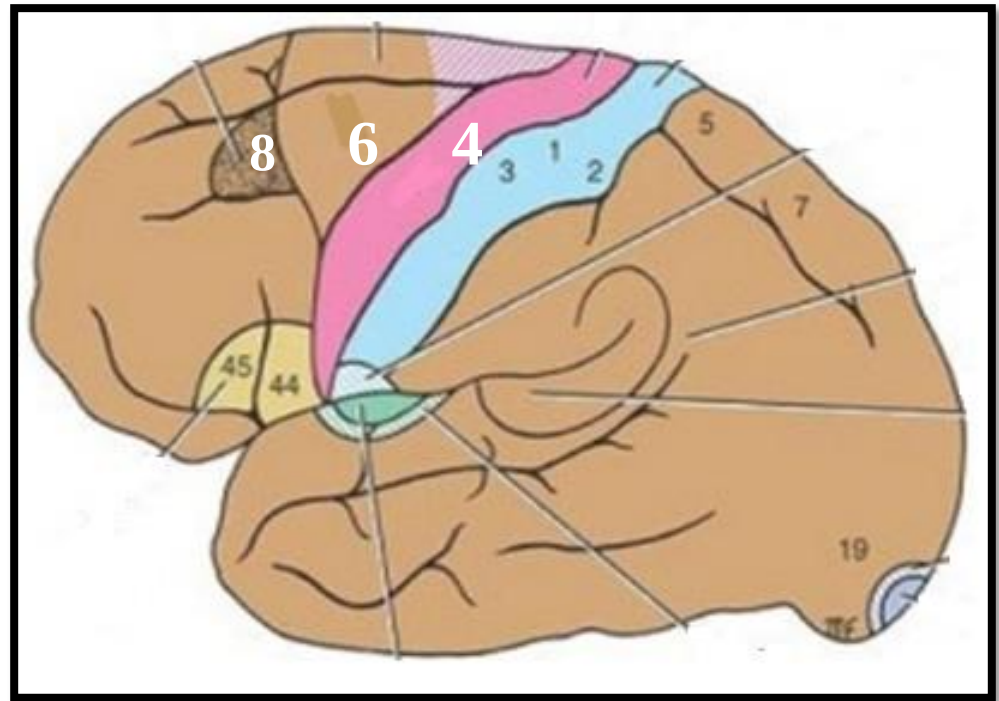
CLASSIFICATION

- Brodmann's cortical areas –
- 52 areas have been mapped by Brodmann
- 3 broad categories –
 - Motor
 - Sensory
 - Psychical



MOTOR AREAS

- Primary motor area – 4
- Premotor area – 6
- Frontal eye field – 8
- Motor speech area – 44,45
- Supplementary motor area
- Prefrontal area



PRIMARY MOTOR AREA - AREA 4

○ Location –

- Precentral gyrus, anterior part of paracentral lobule

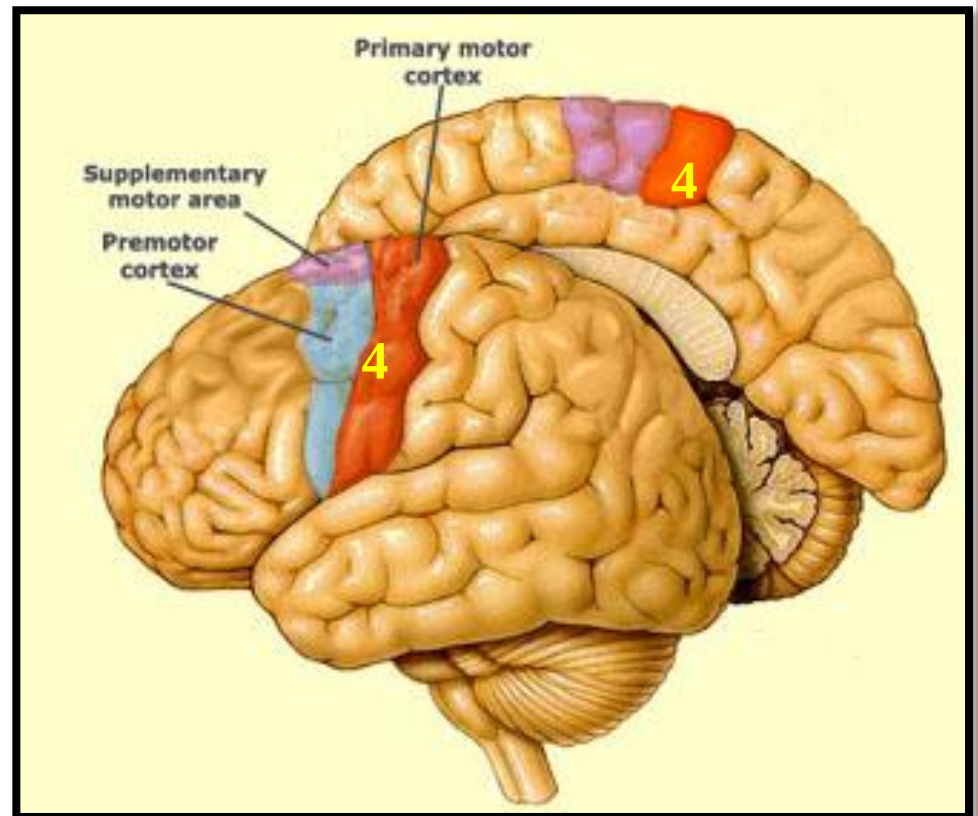
○ Connections –

○ Afferent –

- Basal ganglia and cerebellum via thalamus

○ Efferent –

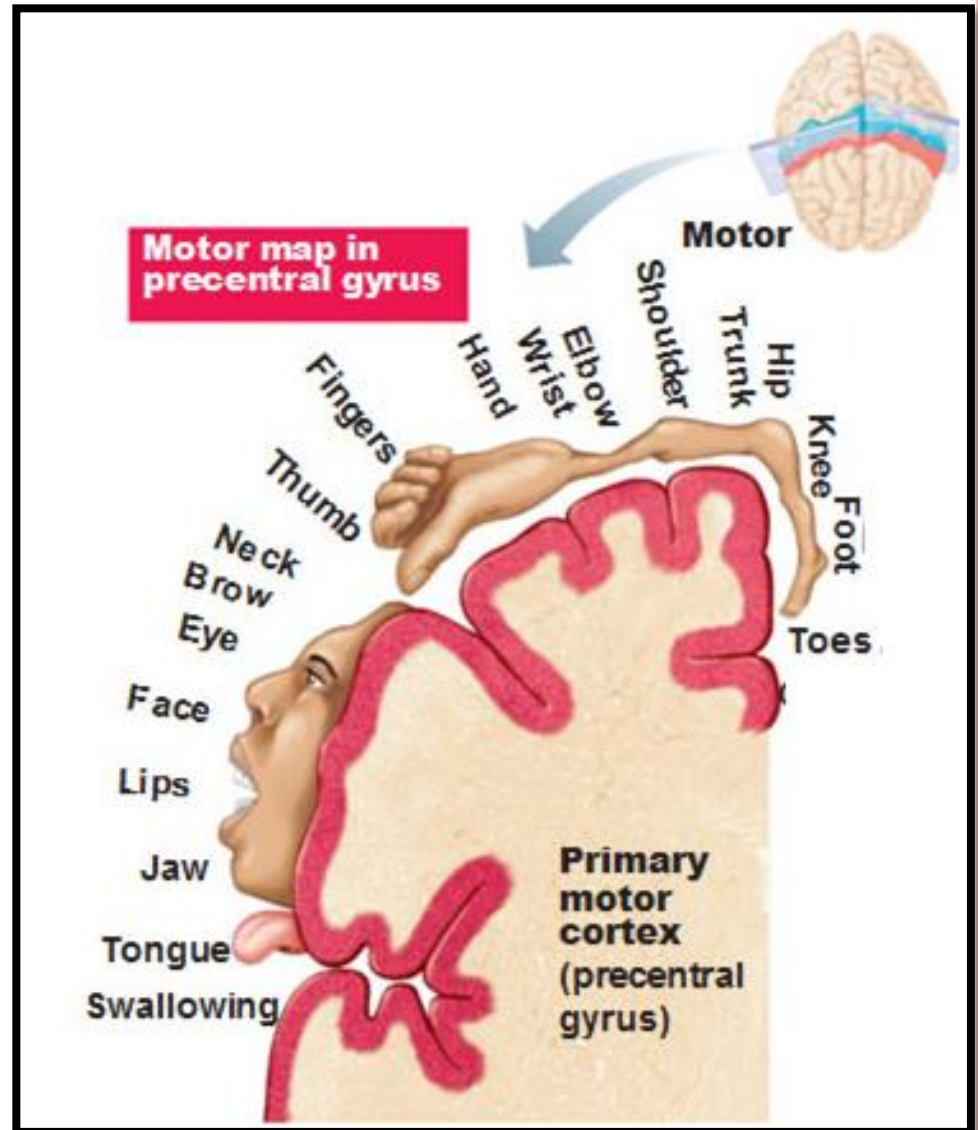
- Cortico-spinal, cortico-nuclear and cortico-pontine fibres
- Basal ganglia





AREA - 4

- **Functions** –
- **Homunculus** – inverted
 - Lower limb below knee and micturition, defaecation centers are in paracentral lobule
 - Controls movements of muscles of contralateral side of the body



PRE-MOTOR AREA - AREA 6

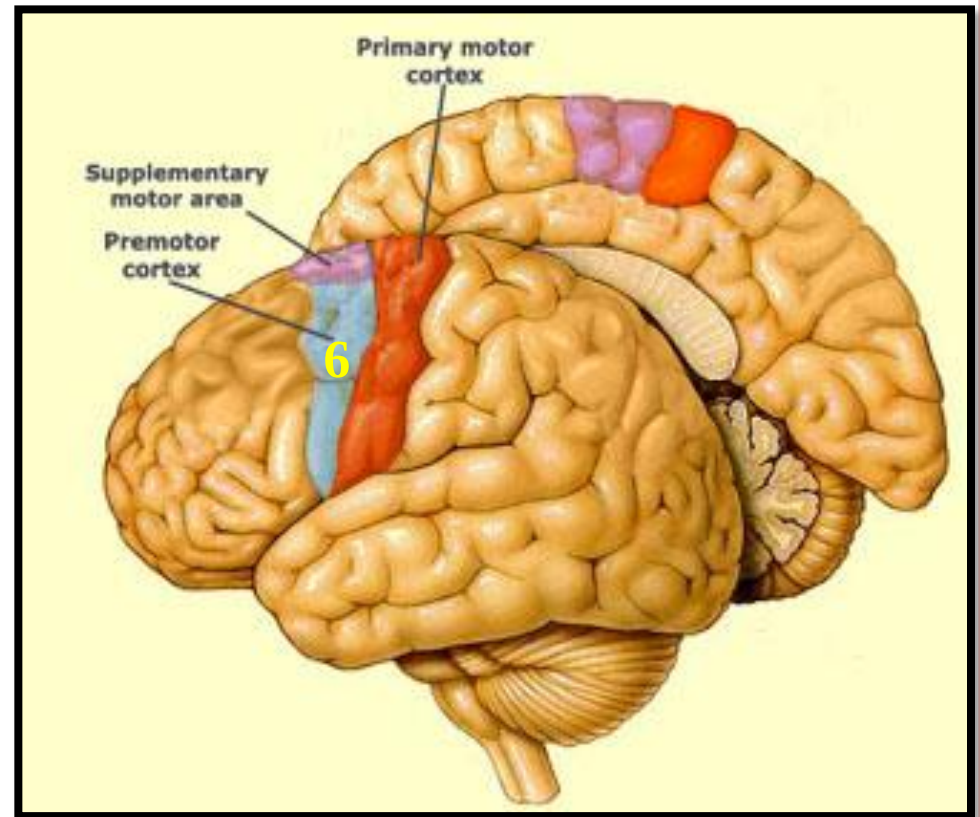
○ Location –

- Posterior parts of superior, middle and inferior frontal gyri and in front of area 4 on medial surface

○ Connections –

○ Afferent –

- Basal ganglia and cerebellum via thalamus



- Connections –

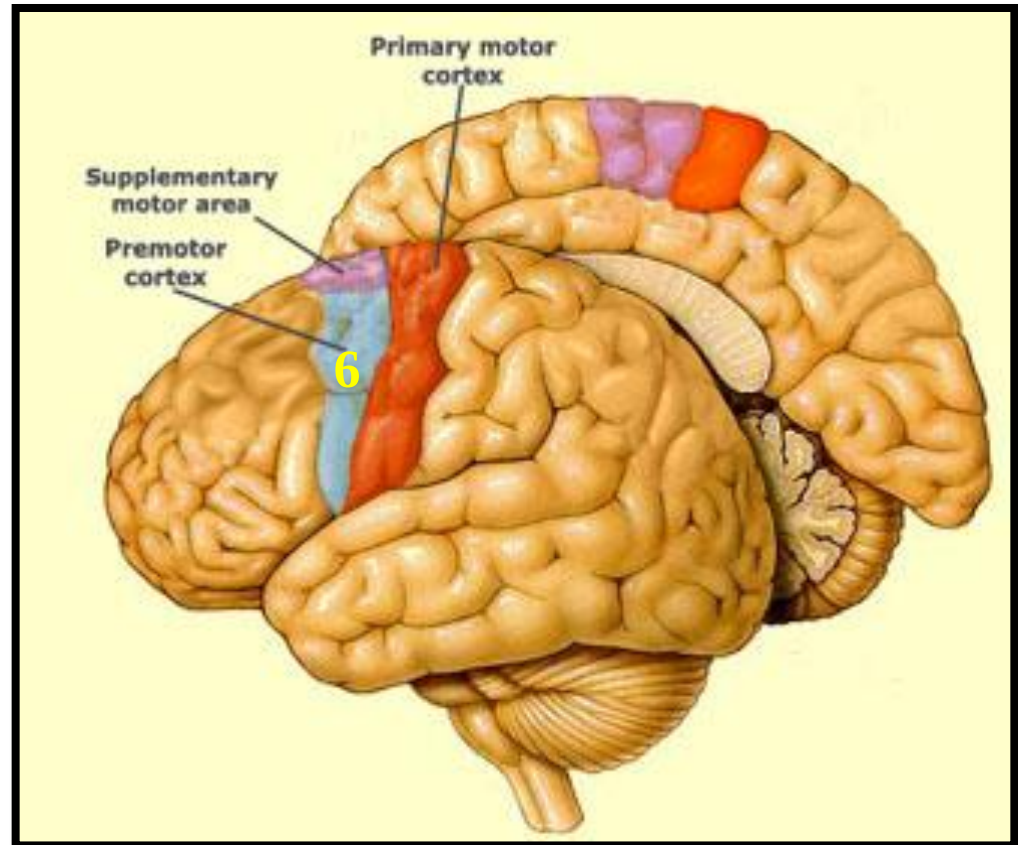
- Efferent –

- Cortico-spinal, cortico-nuclear and cortico-pontine fibres
- Basal ganglia

- Functions –

- Can do functions of area 4 but requires stronger stimulus
- Programs movements which will be executed by area 4

PRE-MOTOR AREA



BROCA'S MOTOR SPEECH AREA - AREA 44,45

○ Location –

- Inferior frontal gyrus of dominant hemisphere

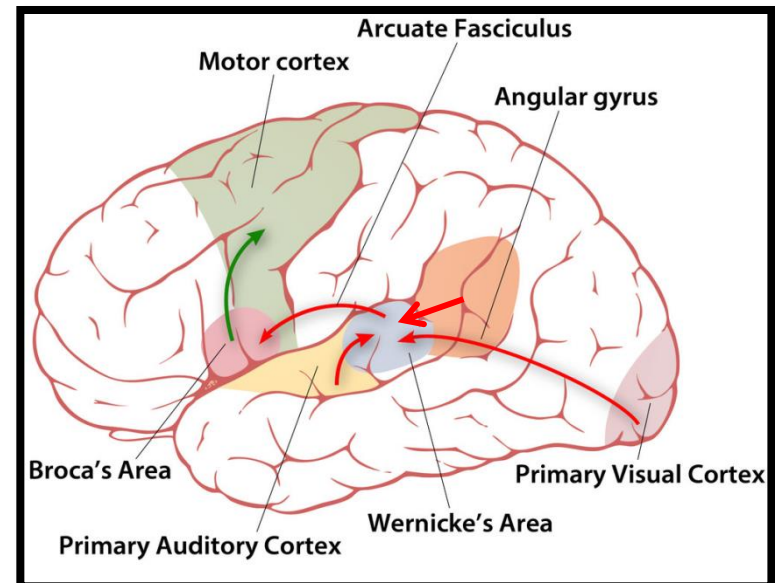
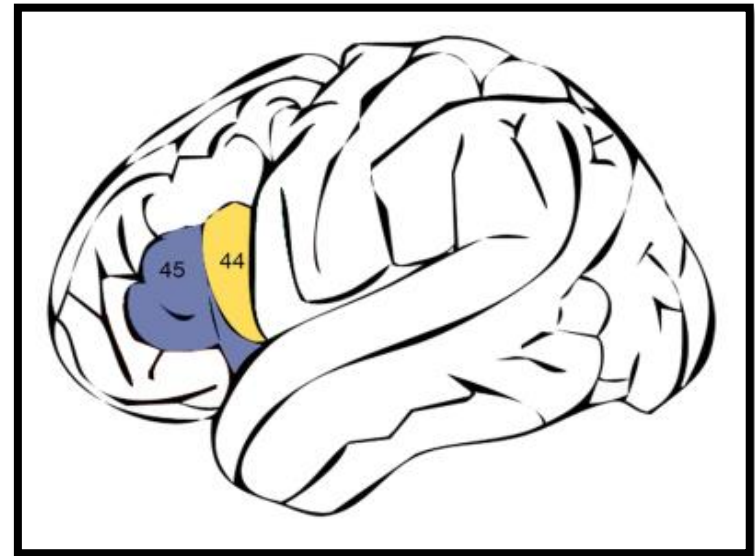
○ Connections –

○ Afferent –

- Sensory speech area via arcuate bundle

○ Efferent –

- Through motor cortex for speech, stimulates concerned muscles of speech
- Articulation of speech



PREFRONTAL AREA - 9,10,11,12

○ Location –

- Frontal lobe in front of premotor cortex

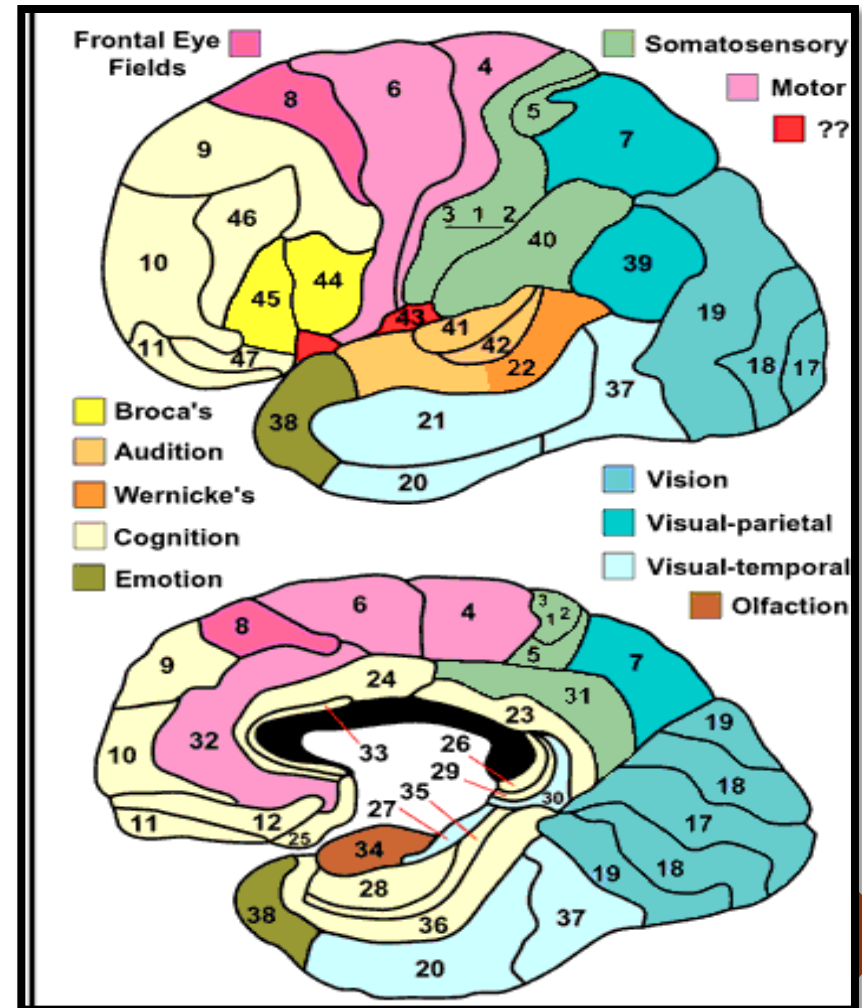
○ Connections –

○ Afferent –

- All areas of cortex and thalamus, hypothalamus and limbic system

○ Efferent –

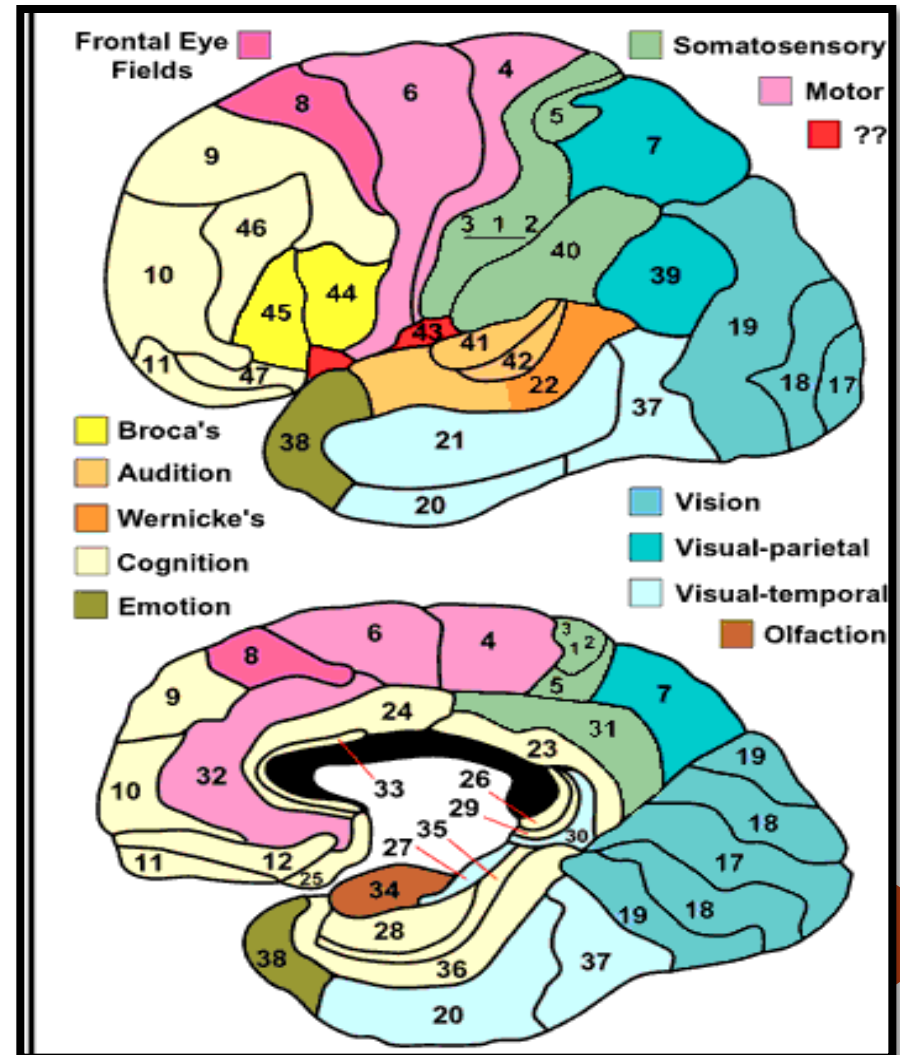
- Thalamus, hypothalamus and limbic system



PREFRONTAL AREA - 9,10,11,12

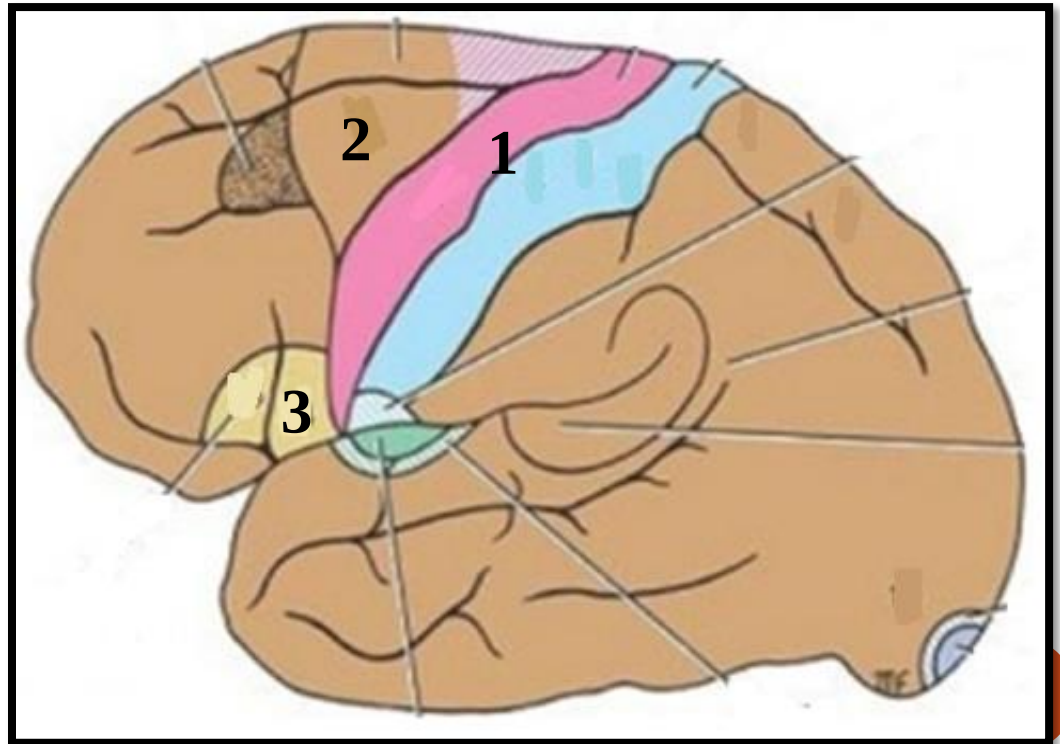
○ Functions –

- Abstract thinking
- Judgement
- Regulation of depth of feeling



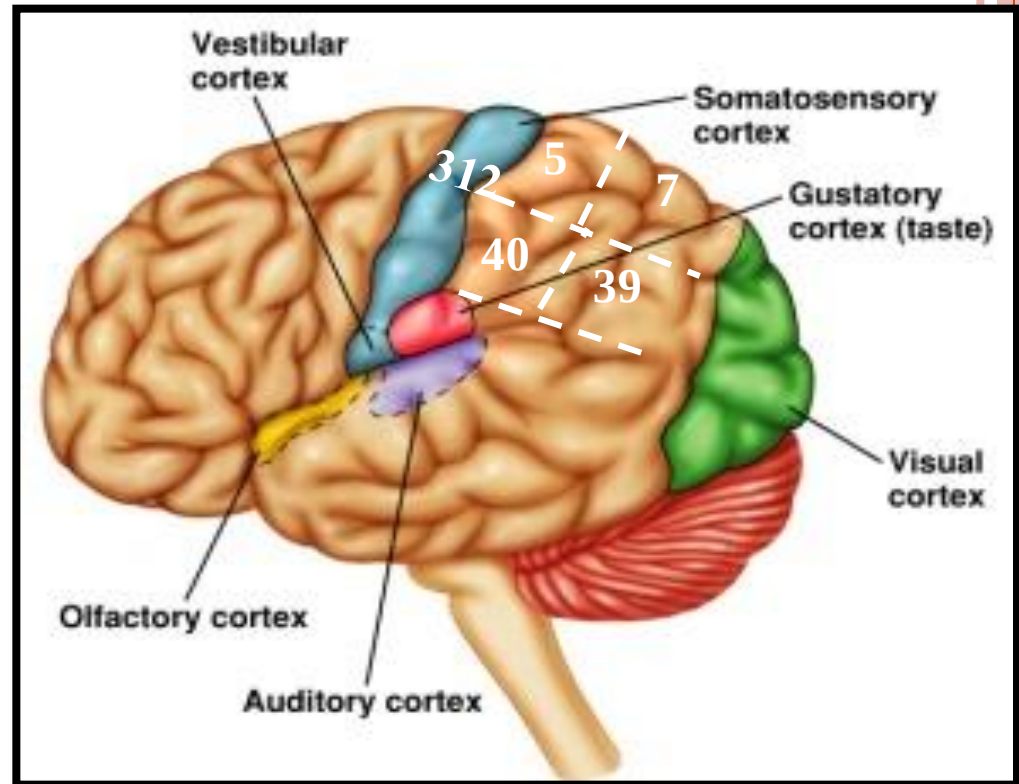
LET'S REVISE

1. 4 Primary Motor
2. 6 Premotor
3. 44,45 - Broca's motor speech area



SENSORY AREAS

- Somesthetic areas –
 - Primary (3,1,2), association (5,7)
- Visual areas –
 - Primary (17), association (18,19)
- Auditory areas –
 - Primary (41), association (42)
- Sensory speech areas –
 - Wernicke's (22), 39 and 40



- **Location** –

- Postcentral gyrus, posterior part of paracentral lobule

- **Connections** –

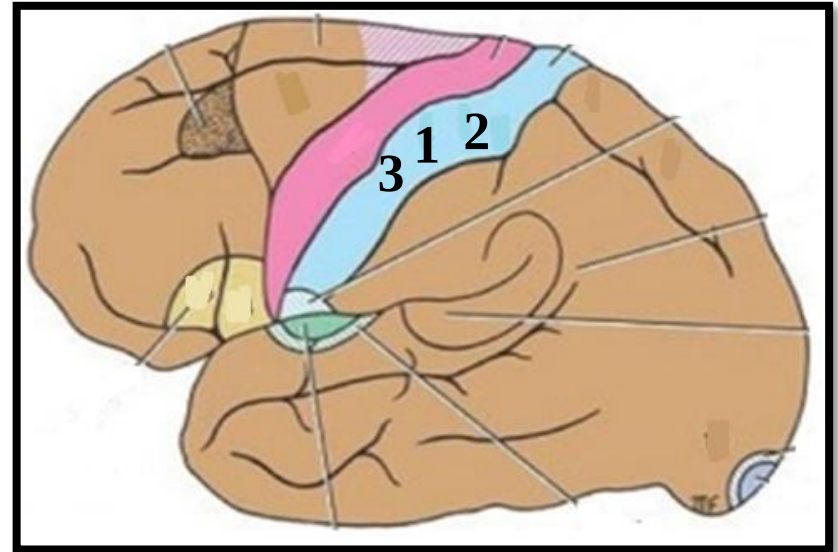
- **Afferent** –

- From gracilis and cuneatus tracts, spinothalamic tracts and sensations from face via thalamus

- **Efferent** –

- Connects to other cortical areas eg. Motor area
 - Also contributes to pyramidal tract

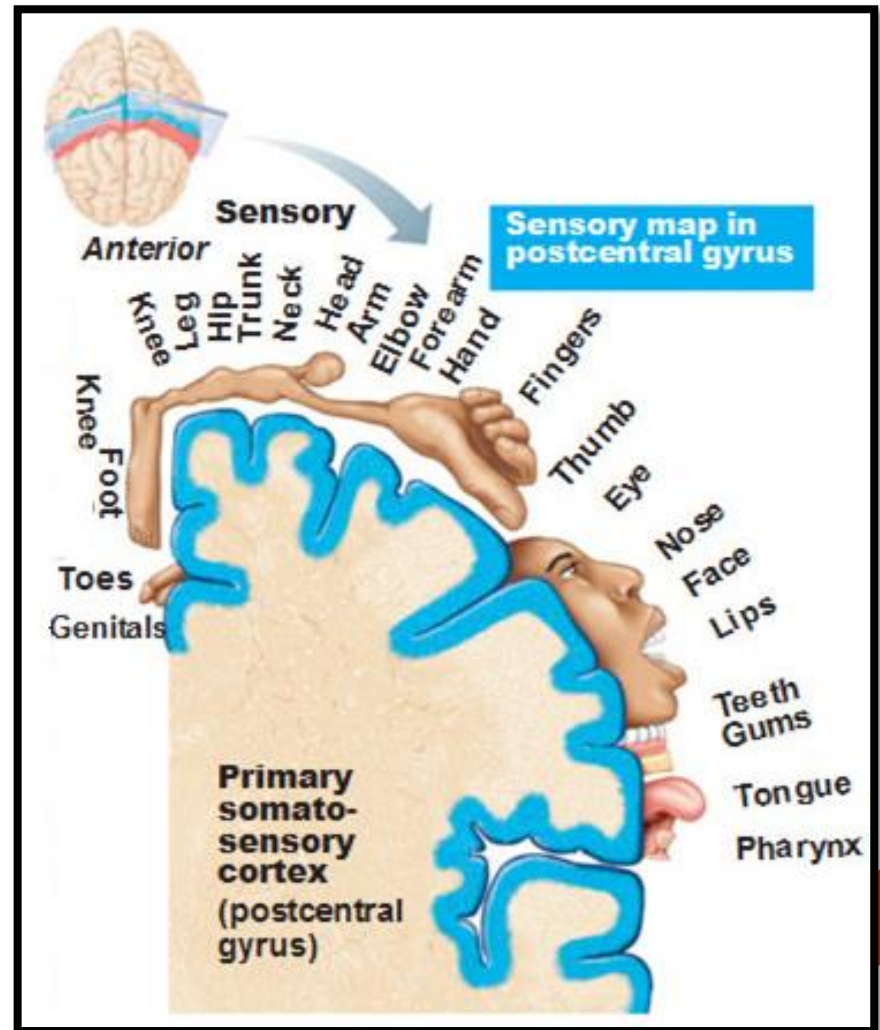
PRIMARY SOMESTHETIC AREA - 3,1,2



PRIMARY SOMESTHETIC AREA

○ Functions –

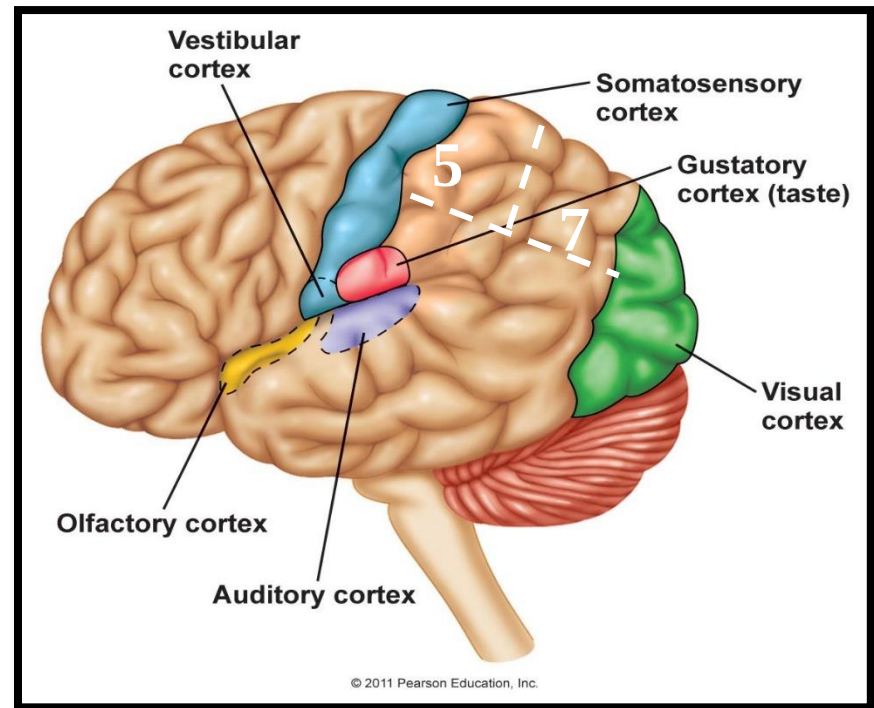
- Inverted homunculus
- Localization, analysis and discrimination of various cutaneous and proprioceptive senses from contralateral half of the body
- Lower part of the postcentral gyrus (43) receives taste sensation



SOMESTHETIC ASSOCIATION AREA - 5,7



- **Location** –
 - Behind postcentral gyrus in superior parietal lobule
- **Connections** –
- **Afferent and Efferent**
 - Thalamus (pulvinar), area 3,1,2
- **Functions** –
 - Further processing of somesthetic input, stereognosis

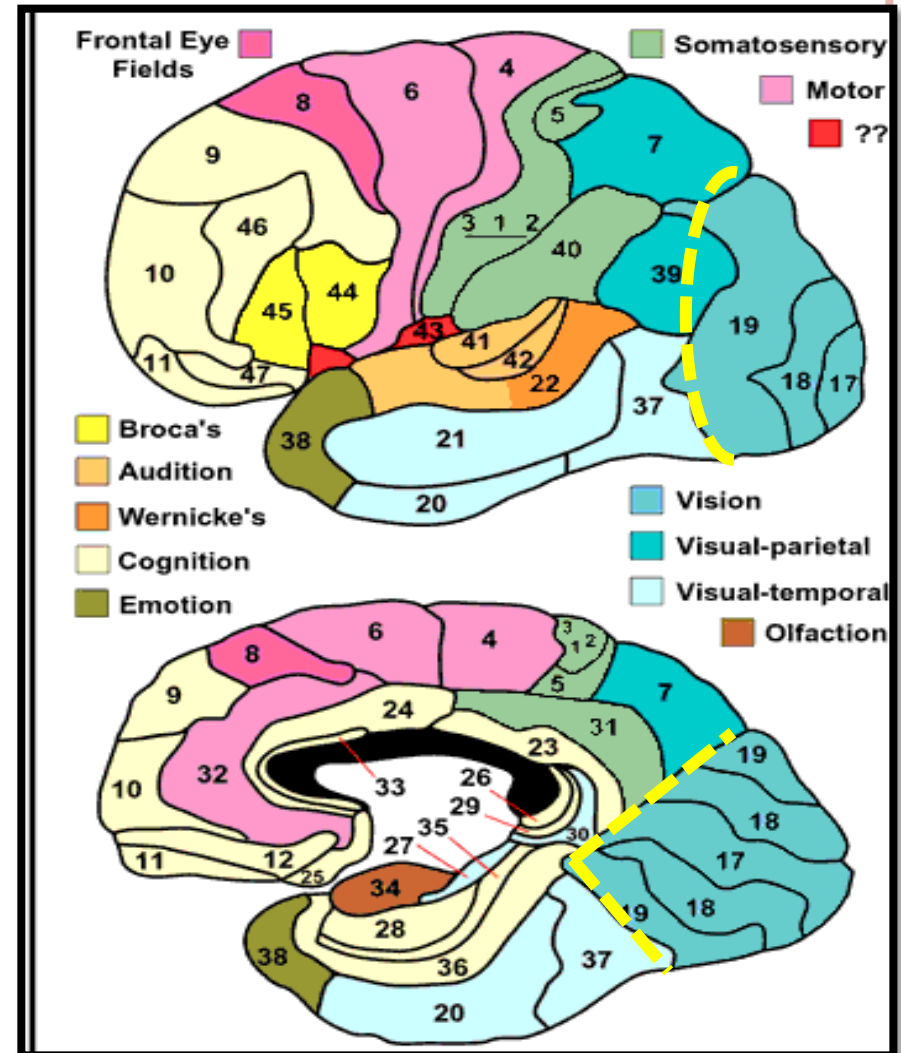


VISUAL AREAS -

○ Primary – 17

○ Location –

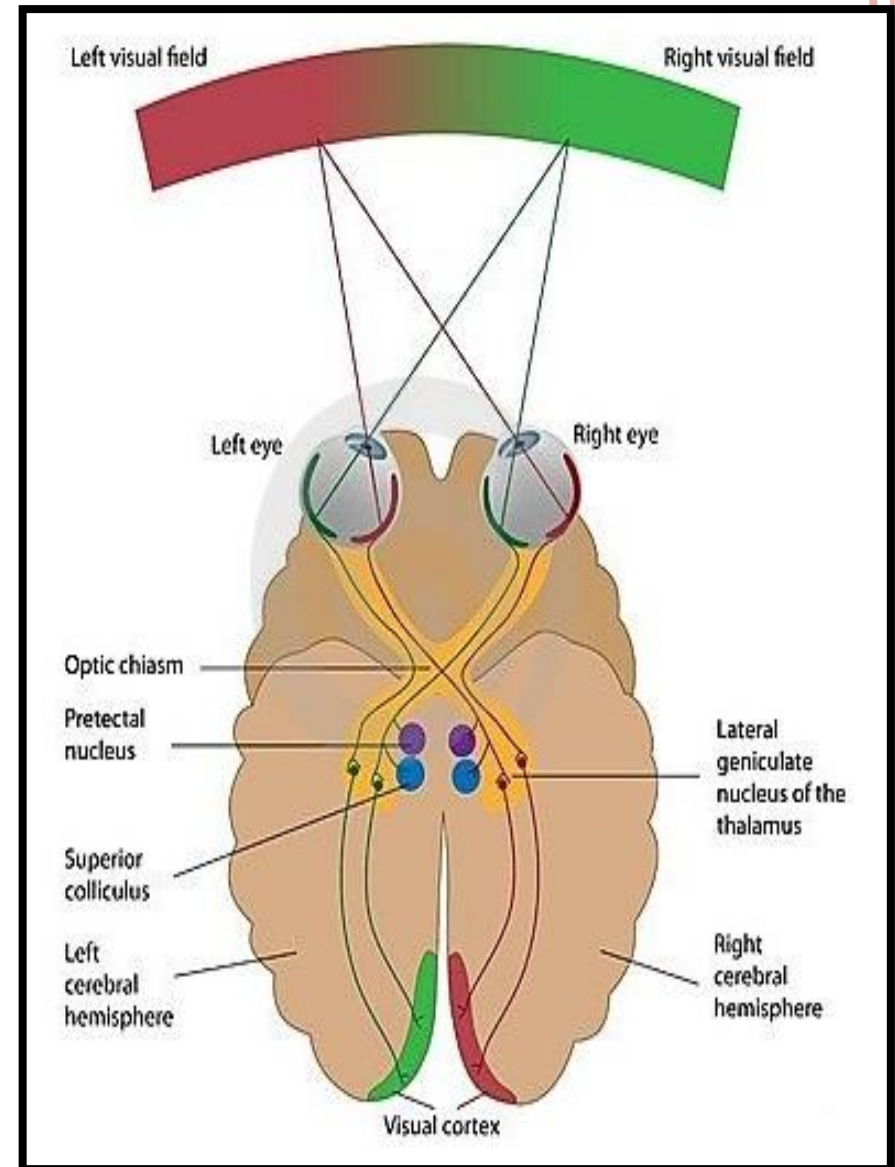
- Along lips and walls of posterior part of calcarine sulcus
- Limited by lunate sulcus on superolateral surface





PRIMARY VISUAL AREA - 17

- **Connections** –
- **Afferent** –
 - Optic radiation from lateral geniculate body - receives opposite field of vision
- **Efferent** –
 - Projects to area 18,19
- **Functions** –
 - Receives visual information from opposite field of vision somatotopically





○ Location –

- Surround area 17 on medial and superolateral surfaces in occipital lobe

○ Connections –

○ Afferent – From area 17

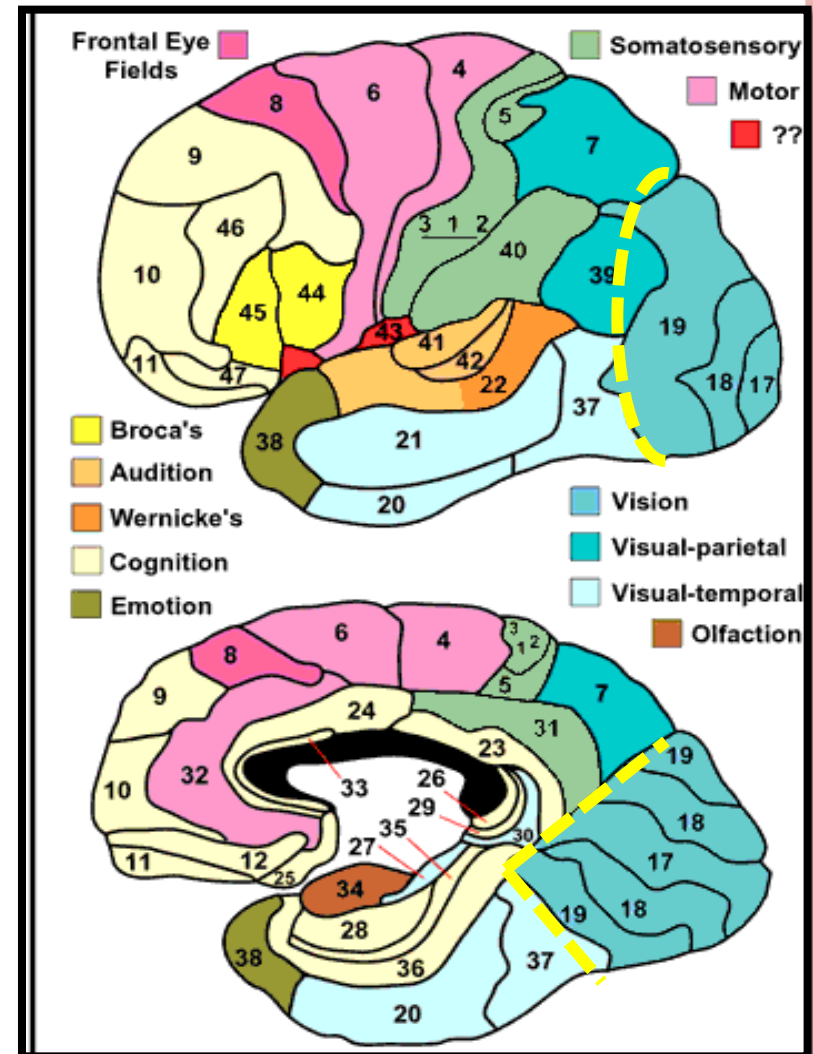
○ Efferent –

- Thalamus(pulvinar)
- Extraocular muscles

○ Functions –

- Analyze and recognize objects with the help of memory
- Help in accommodation reflex

VISUAL ASSOCIATION AREAS - 18,19

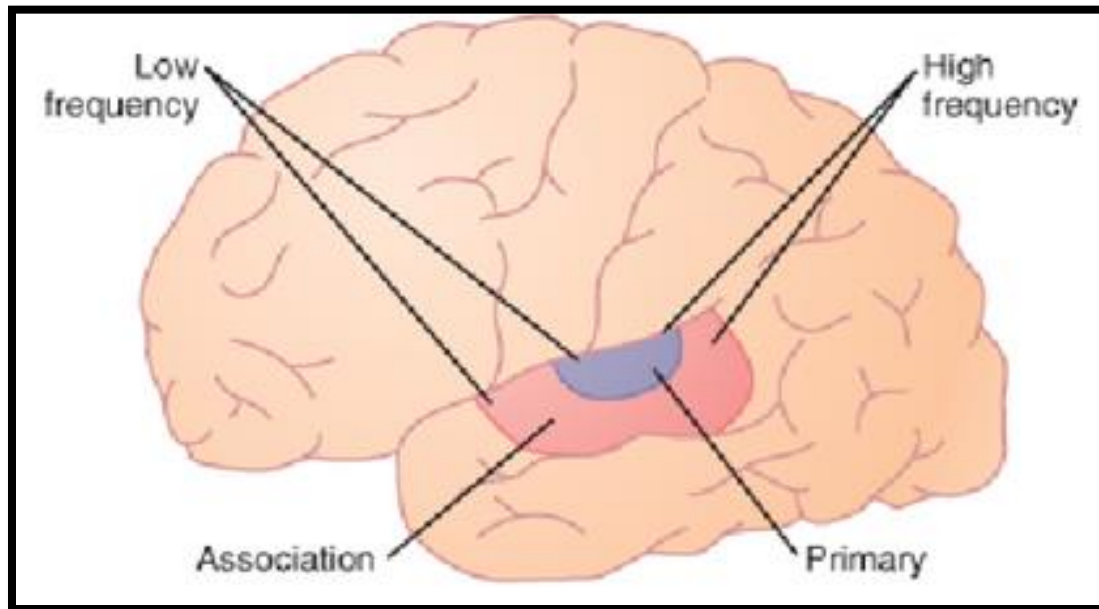


AUDITORY AREAS

- Primary – 41

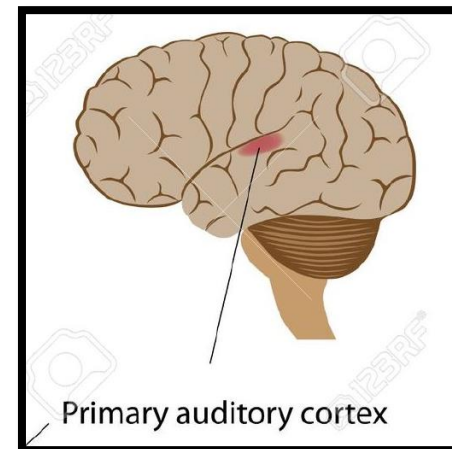
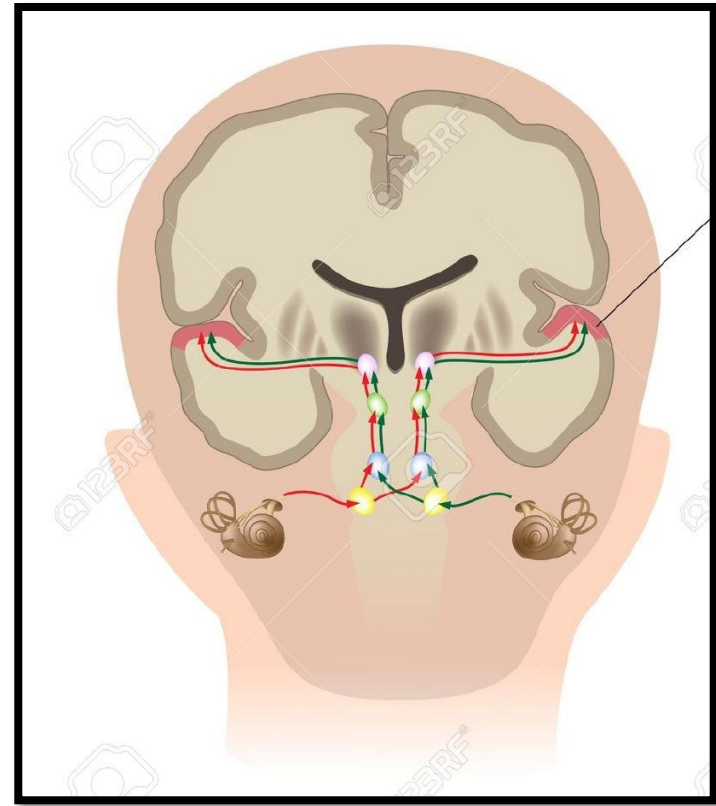
- Location –

- Anterior transverse temporal gyrus of Heschl, superior temporal gyrus



PRIMARY AUDITORY AREA

- Connections –
- Afferent –
 - From medial geniculate body via auditory radiation
- Functions –
 - Detection of changes in frequency and direction of origin of sound

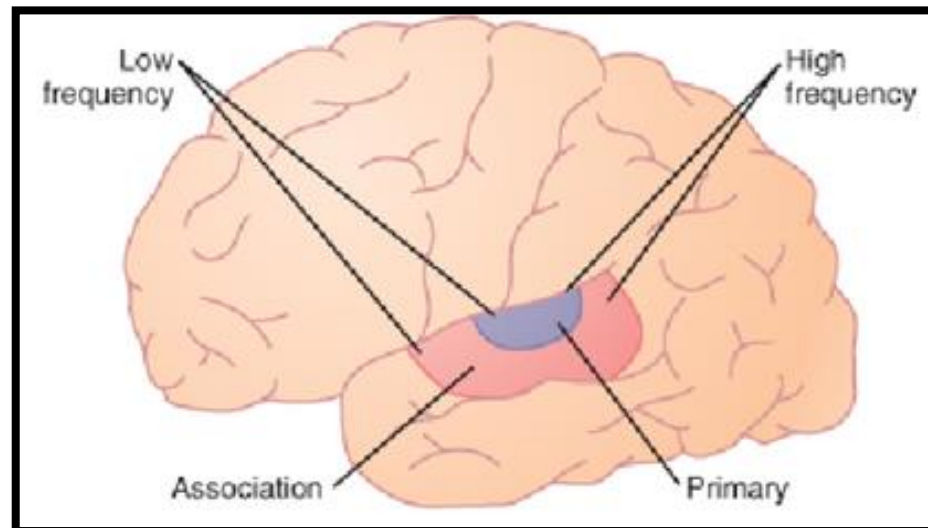


AUDITORY AREAS

- Secondary – 42

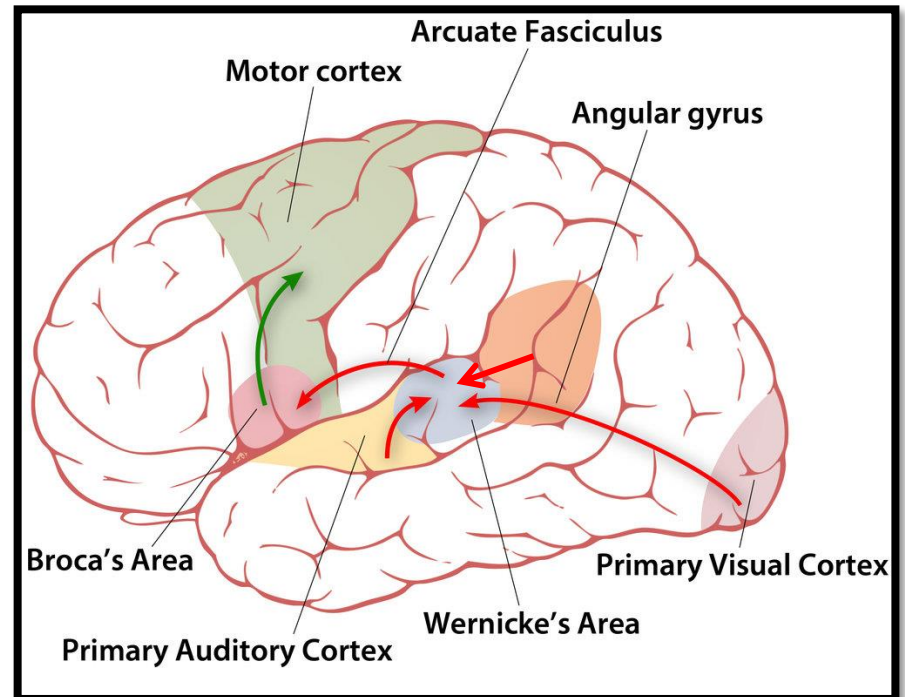
- Location –

- Posterior transverse temporal gyrus, superior temporal gyrus



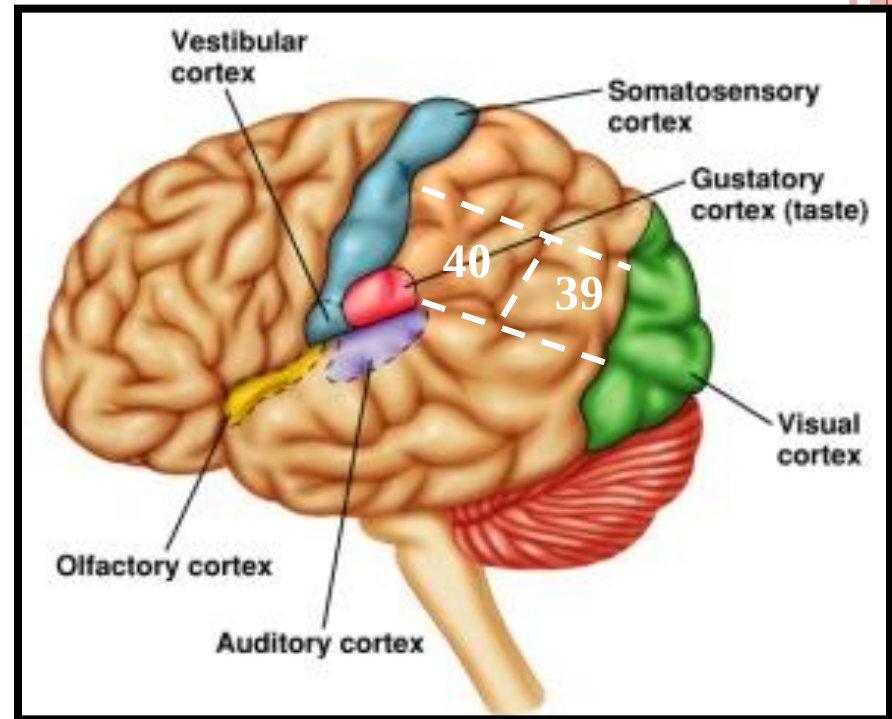
SENSORY SPEECH AREA - WERNICKE'S AREA - 22

- **Location** –
 - Posterior part of superior temporal gyrus behind 41,42 in dominant hemisphere
- **Connections**
- **Afferent** –
 - From auditory + visual cortex and 39
- **Efferent** –
 - Broca's area via arcuate fasciculus
- **Functions** –
 - Understands spoken word



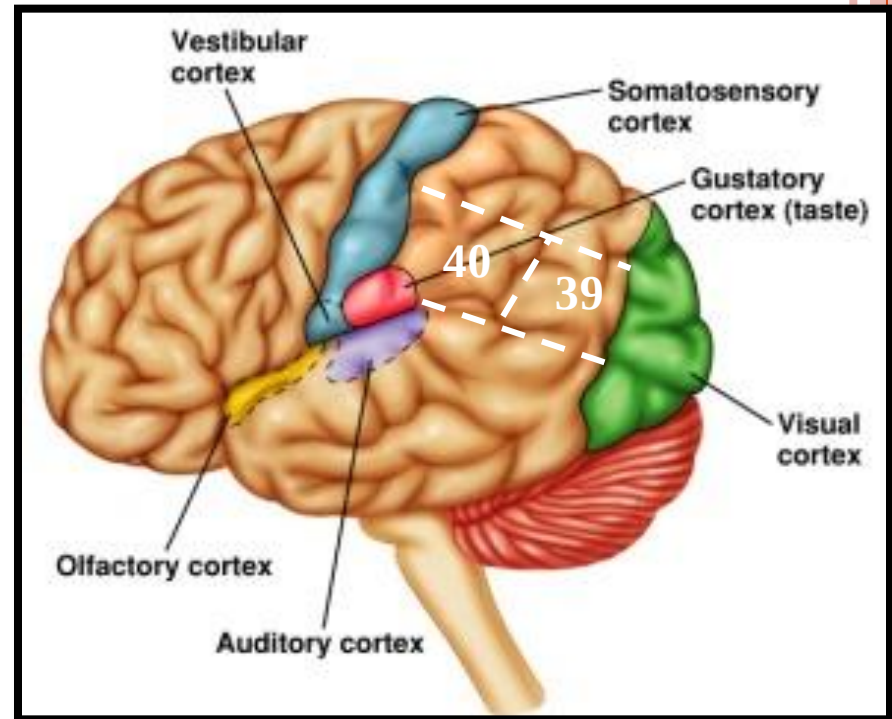
AREA 39

- **Area 39** –
- **Location** –
 - Angular gyrus, In inferior parietal lobule
- **Connections**
- **Afferent** - From 19
- **Efferent** – Wernicke's
- **Functions** –
 - Has dictionary of words, numbers, symbols and can convert them to phonemes



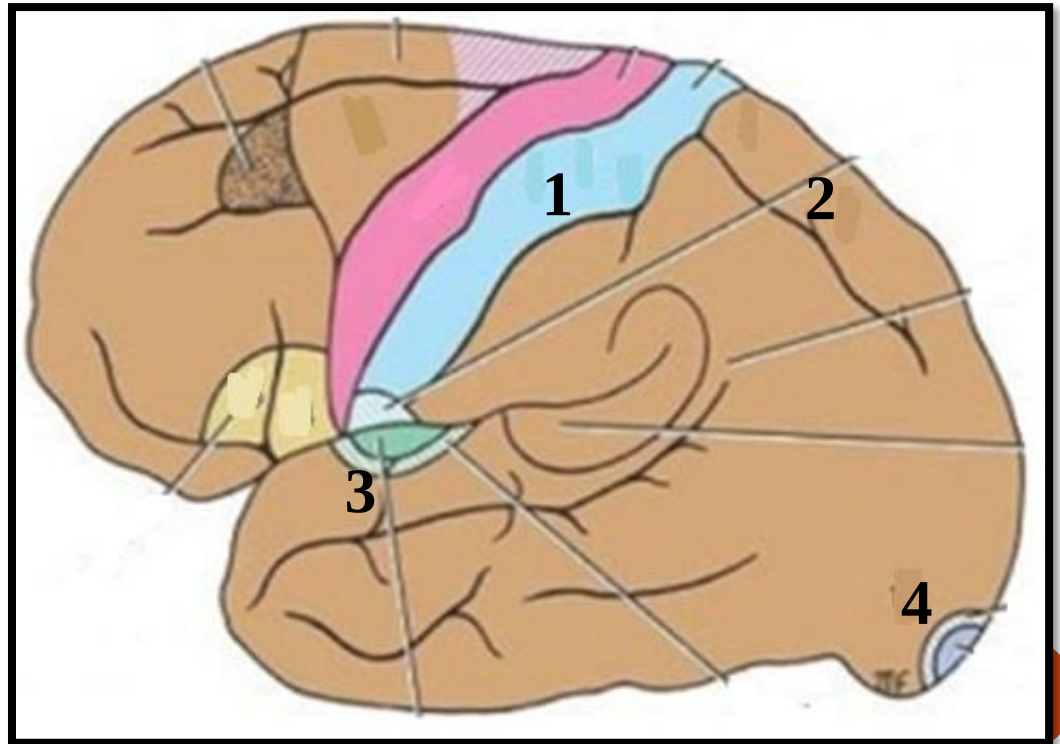
AREA 40

- Area 40 –
- Location –
 - Supramarginal gyrus, In inferior parietal lobule
- Functions –
 - From spoken and written cues can find meaning of words and sentences by memory search



LET'S REVISE

1. 3,1,2 Primary somesthetic
2. 5,7 somesthetic association
3. 41,42 Auditory
4. 17,18,19 Visual



PSYCHICAL CORTEX

- **Anterior part of temporal lobe** –
 - Concerned with recall of auditory and visual memories



GYRI AND AREAS ON SUPEROLATERAL SURFACE

No.	Gyri	Area	Lobe
1	Precentral	4	Frontal
	Postcentral	3,1,2	Parietal
2	Superior frontal	6	Frontal
	Middle frontal	6	
3	Inferior frontal - Pars triangularis	45	Frontal
	Pars opercularis	44	



GYRI AND AREAS ON SUPEROLATERAL SURFACE

No	Gyri	Area	Lobe
4	Superior parietal lobule	5,7	Parietal
	Inferior parietal lobule	40,39	
5	Superior & Inferior occipital	17,18,19	Occipital
6	Superior temporal	41,42,22	Temporal



GYRI AND AREAS ON MEDIAL SURFACE

No.	Gyri	Area	Lobe
1	Paracentral lobule	4 & 3,2,1	
2	Precuneus	5,7	Parietal
3	Cuneus	17,18,19	Occipital
	Lingual		

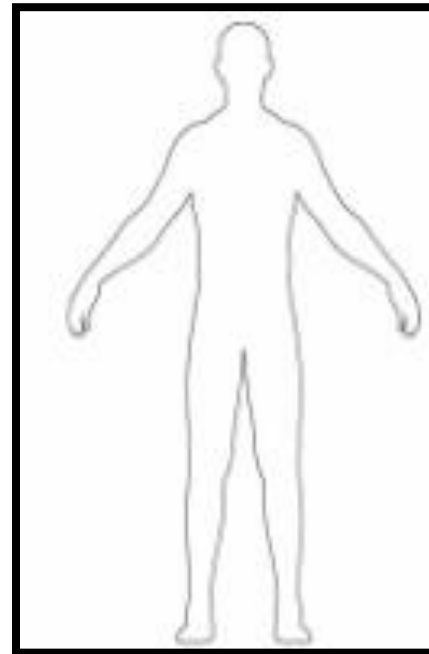


APPLIED ANATOMY

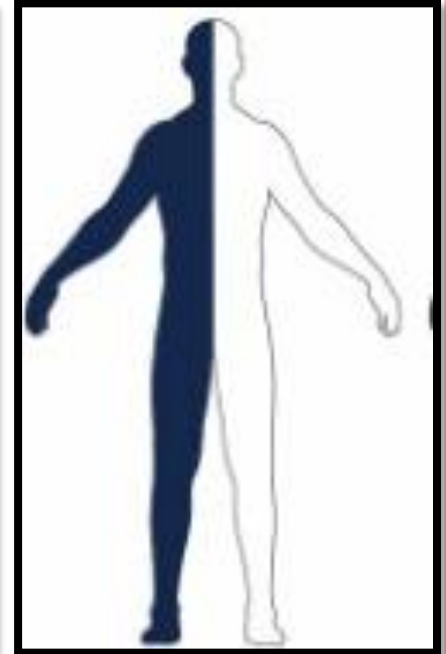


- **Lesions of motor cortex** –
 - Contralateral loss of fine skilled movements corresponding with the affected area
 - Spastic paralysis

Normal

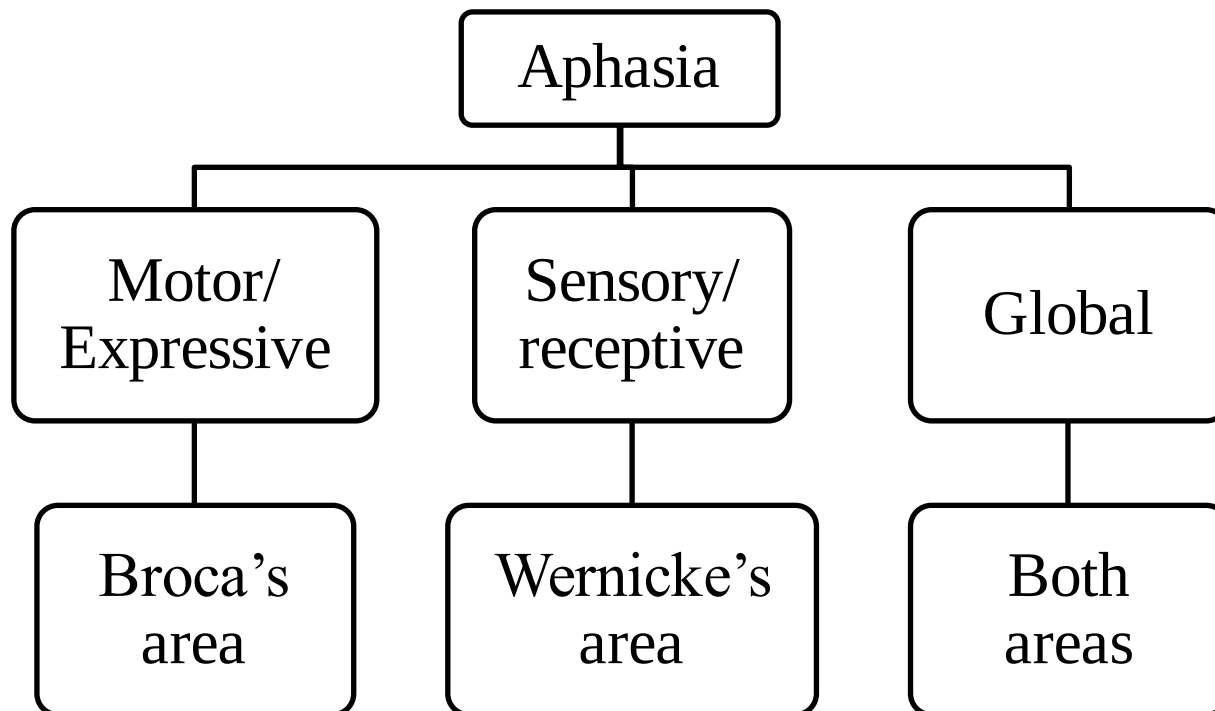


Hemiplegia



APPLIED ANATOMY

- **Aphasia** – lesions related to speech



APHASIA

○ Sensory/ Receptive –

- Loss of ability to understand spoken or written word
- But can speak fluently even though meaningless
- May use paraphrasia –
 - Knife and fork ↔ Bife and dork
- May use completely garbled speech
- Patient is unaware of mistakes



APHASIA

○ Motor / Expressive –

- Loss of ability to produce speech / express
- Slow, laboured speech
- But know what they want to say and are aware of their inability

○ Global –

- Both combined



APPLIED ANATOMY

○ Astereognosis –

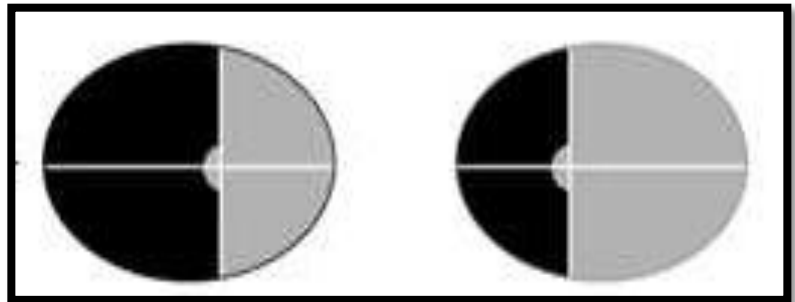
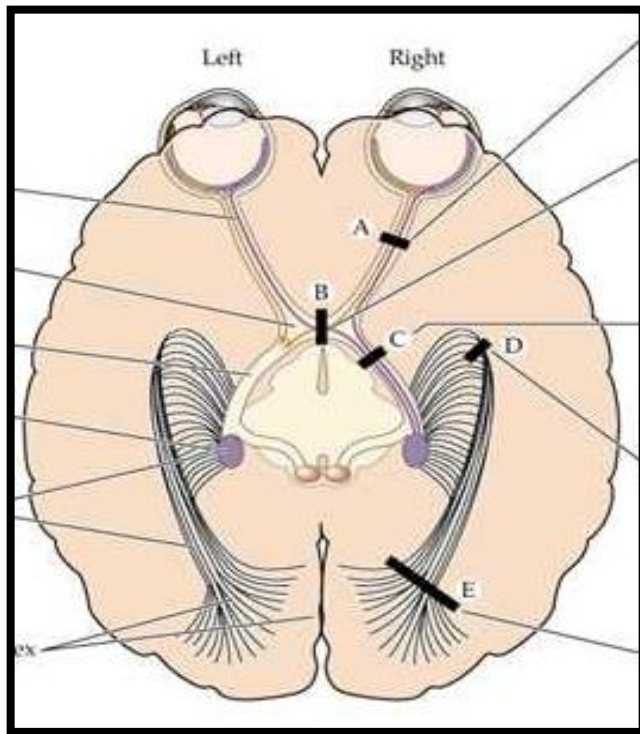
- Area 5,7 – superior parietal lobule
- Inability to combine various sensations to understand texture, size, form etc
- Eg. Inability to recognize key placed in the hand



APPLIED ANATOMY

○ Contralateral homonymous hemianopia –

- Visual cortex
- Loss of sight in opposite visual field



ASSIGNMENT

- SAQs
- Broca's motor speech area
- Draw and label functional areas on superolateral surface of cerebrum





Its over