أهلا وسهلا

الأستاذ الدكتور يوسف حسين

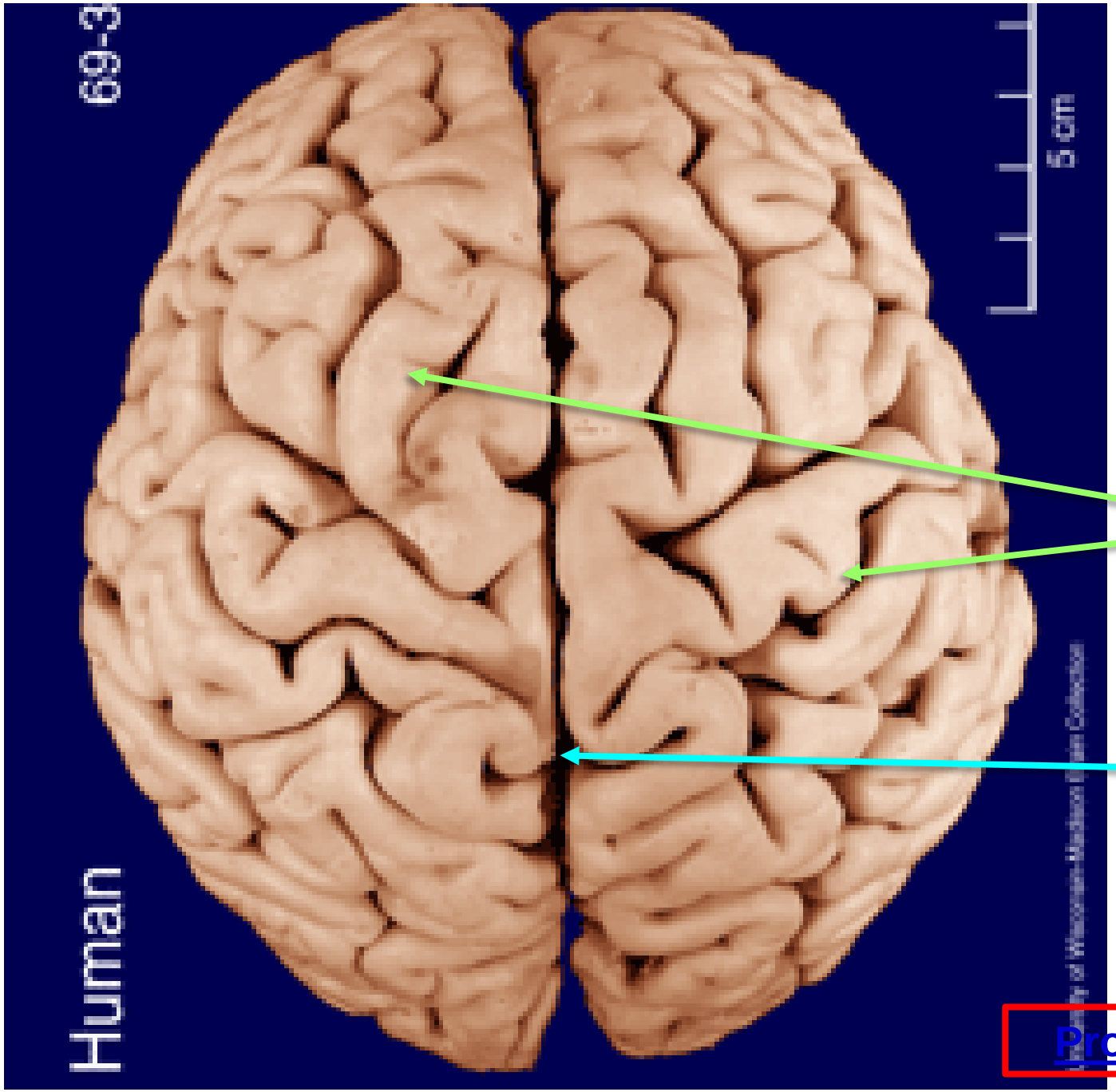
كلية الطب - جامعة مؤتة – الأردن

دكتوراة من جامعة كولونيا المانيا

الواتس (أي استفسار)
00201224904207

Cerebrum

Blood supply



It is divided into two cerebral hemispheres, separated by longitudinal fissure

2 cerebral hemispheres

longitudinal fissure

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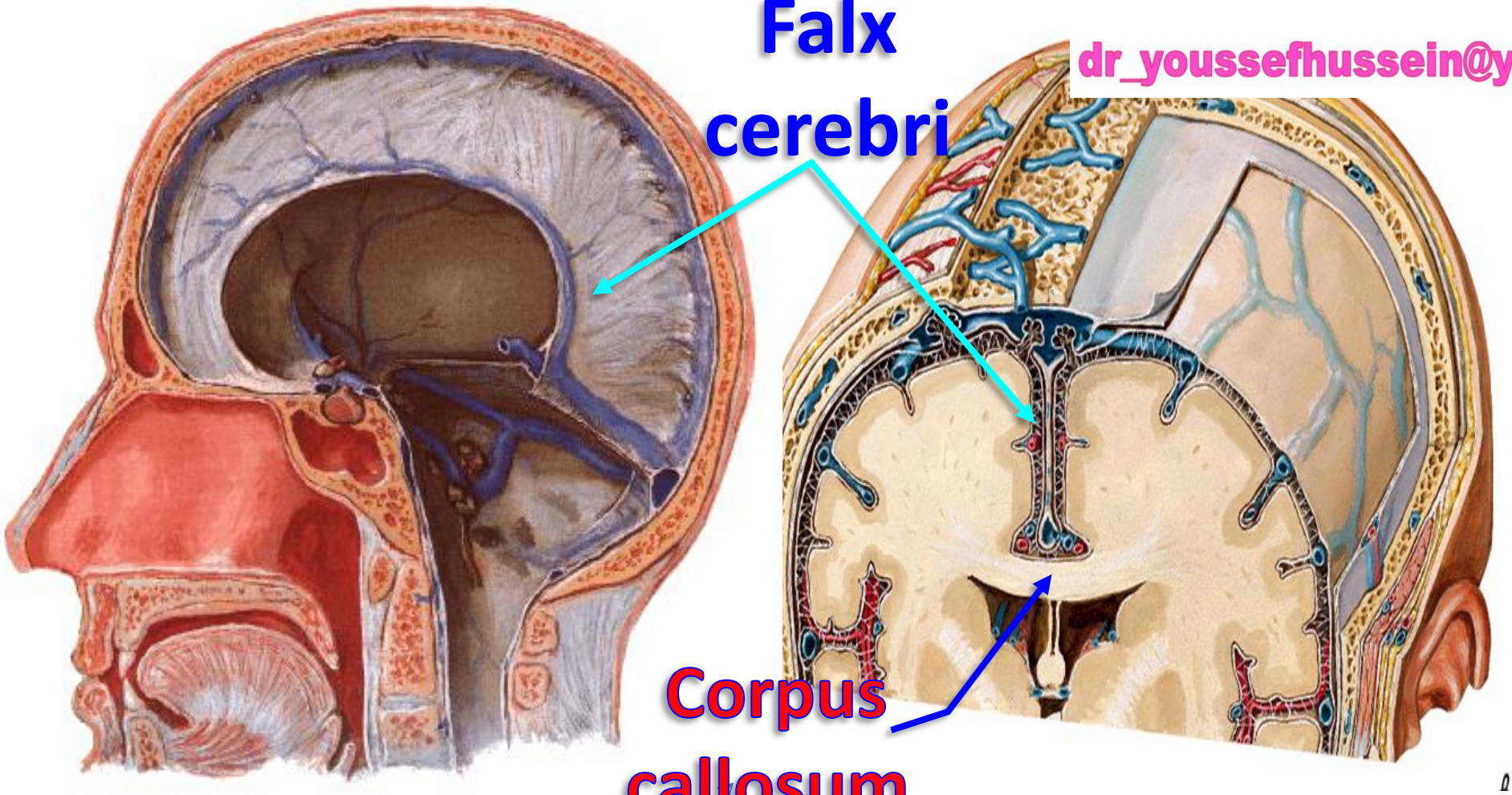
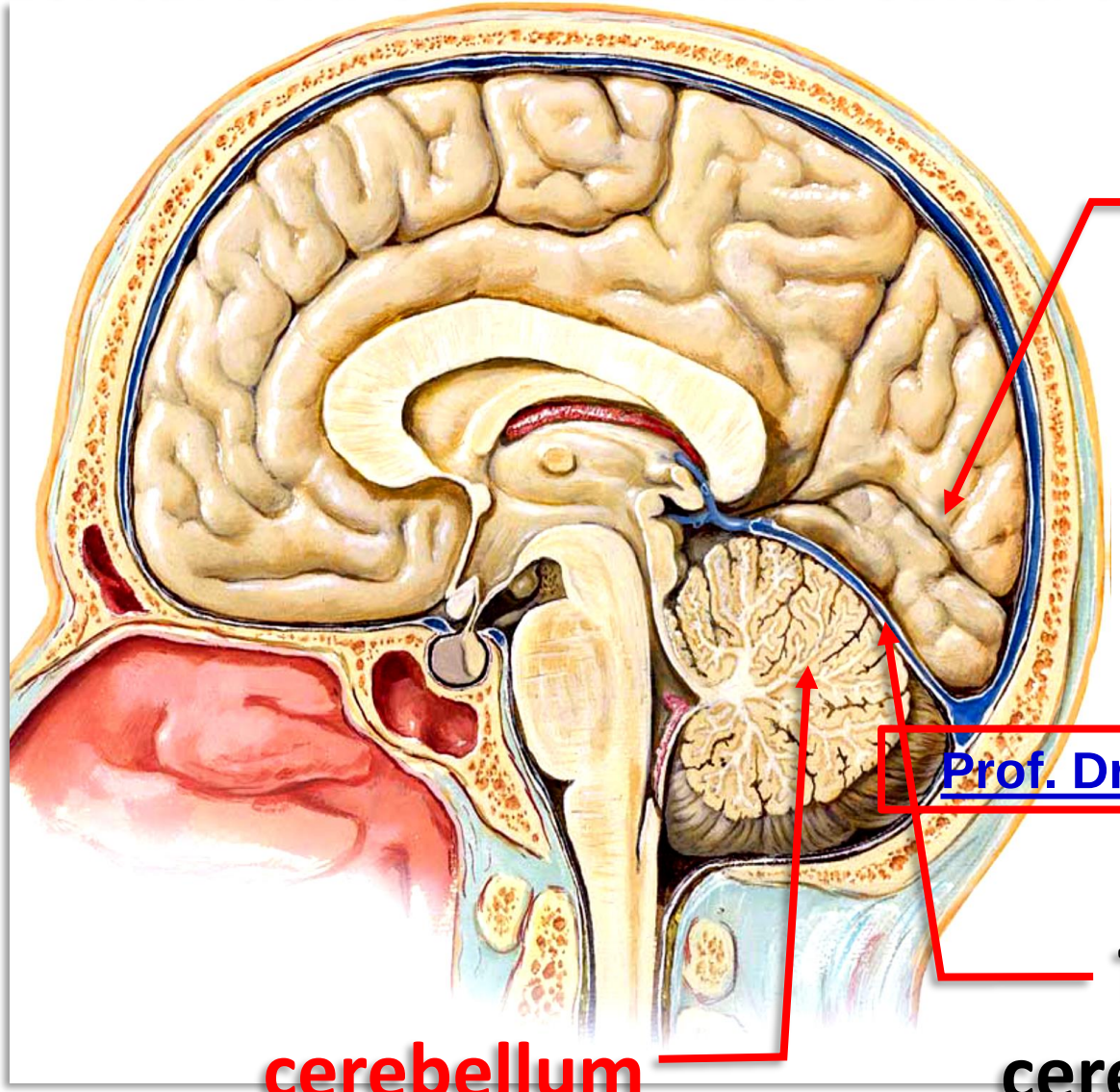


- The longitudinal fissure contains the sickle-shaped fold of dura matter, the falx cerebri and anterior cerebral arteries
- Two hemispheres connected together by CC

The cerebral hemispheres are separated from the cerebellum by a horizontal fold of dura mater called the tentorium cerebelli



Cerebral hemisphere

Posteriorly

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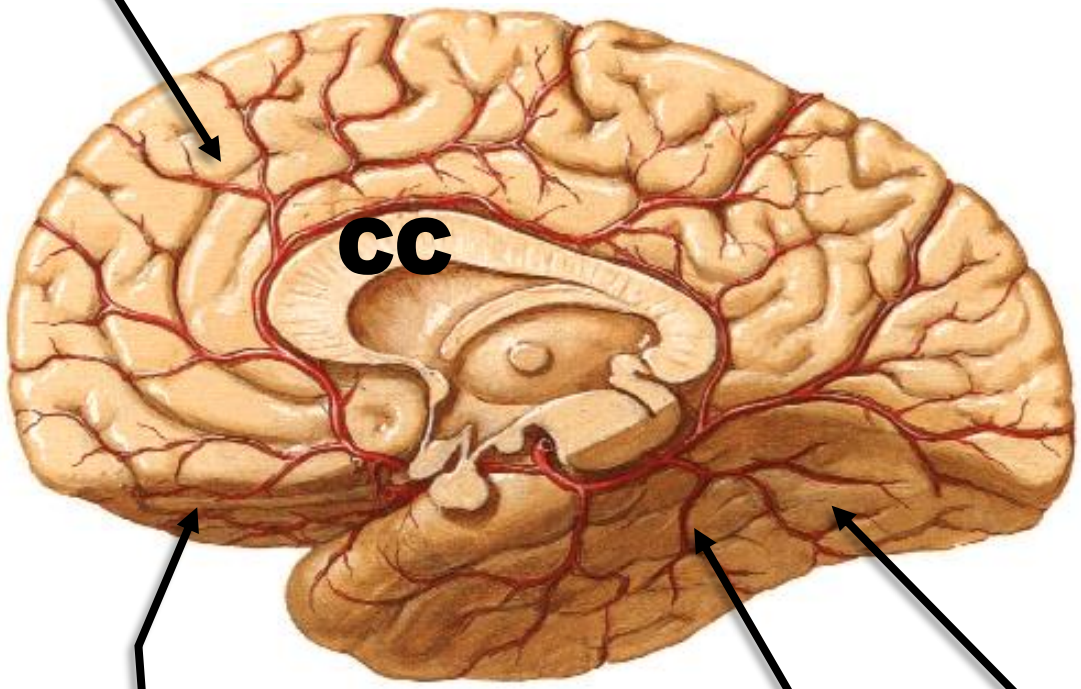
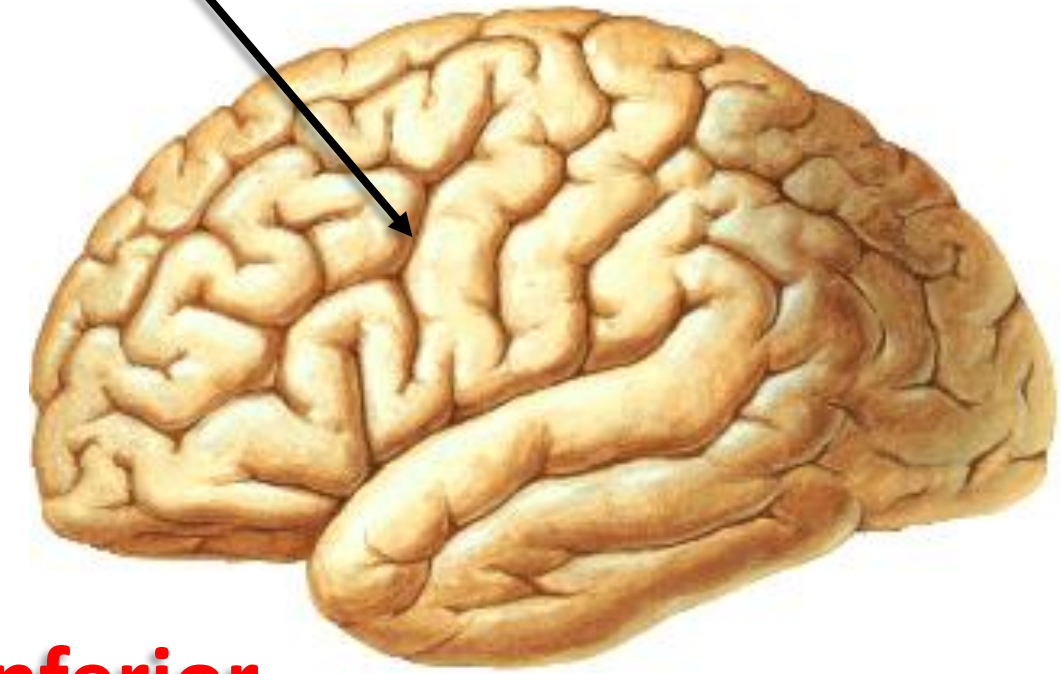
Tentorium cerebelli (cut)

cerebellum





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Each cerebral hemisphere has 3 surfaces

• Surfaces of the Cerebral Hemisphere

1- Superolateral surface: the widest surface of the hemisphere.

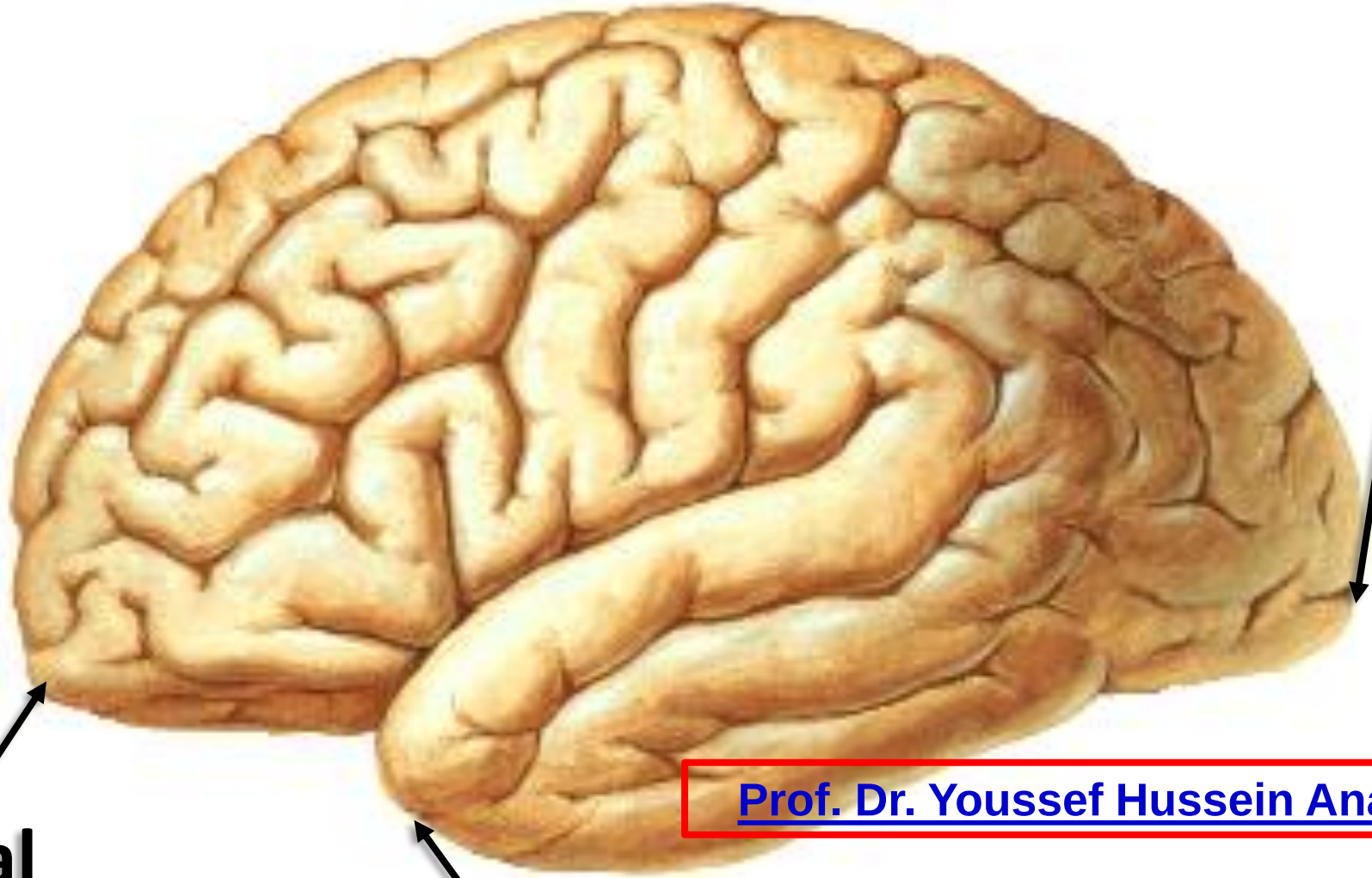
- This is a convex surface which is directed upward and laterally.

2- Medial surface: is a flat surface which is separated from the opposite side by the longitudinal fissure which lodges the falx cerebri. It contains the **corpus callosum** which connects the two cerebral hemispheres.

3- Inferior surface: is directed inferiorly and is divided by the stem of the lateral sulcus into two parts:

a- Anterior (orbital surface) rests on the roof of the orbit.

b- Posterior (tentorial surface) rests on the tentorium cerebelli.



Occipital pole

Frontal pole

Temporal pole

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Each cerebral hemisphere has 3 poles

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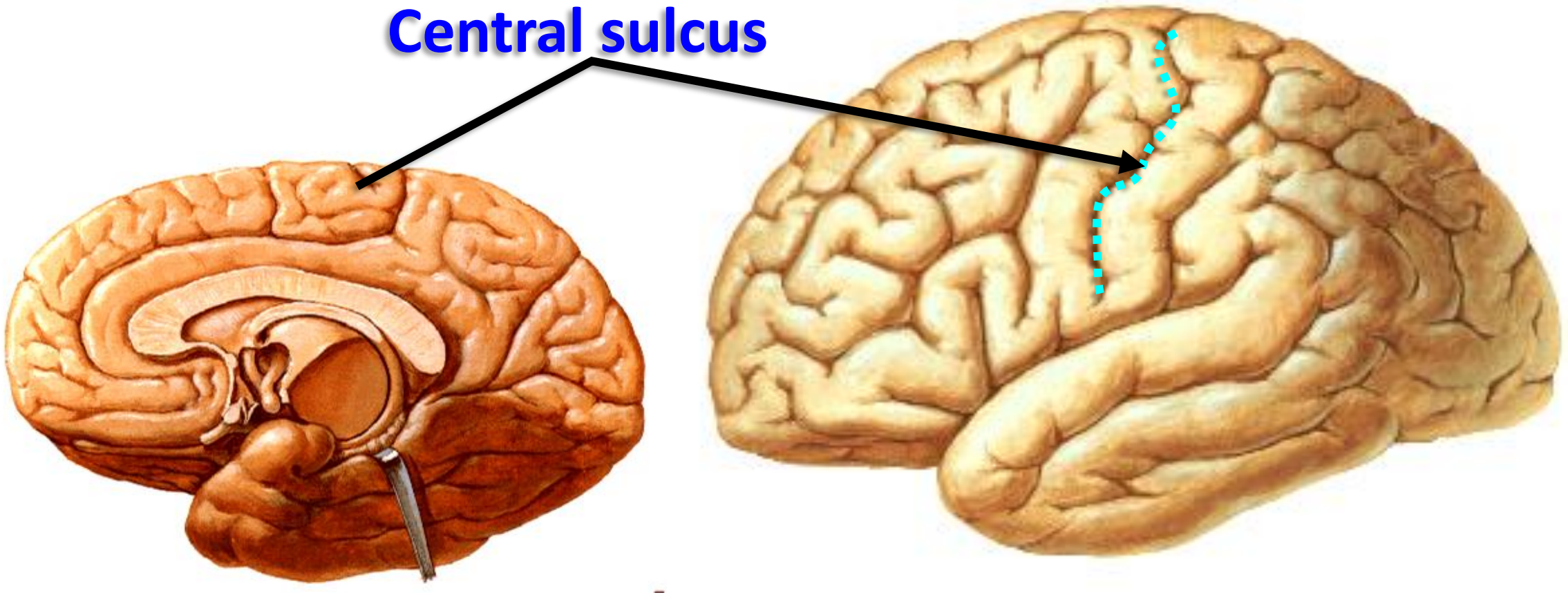
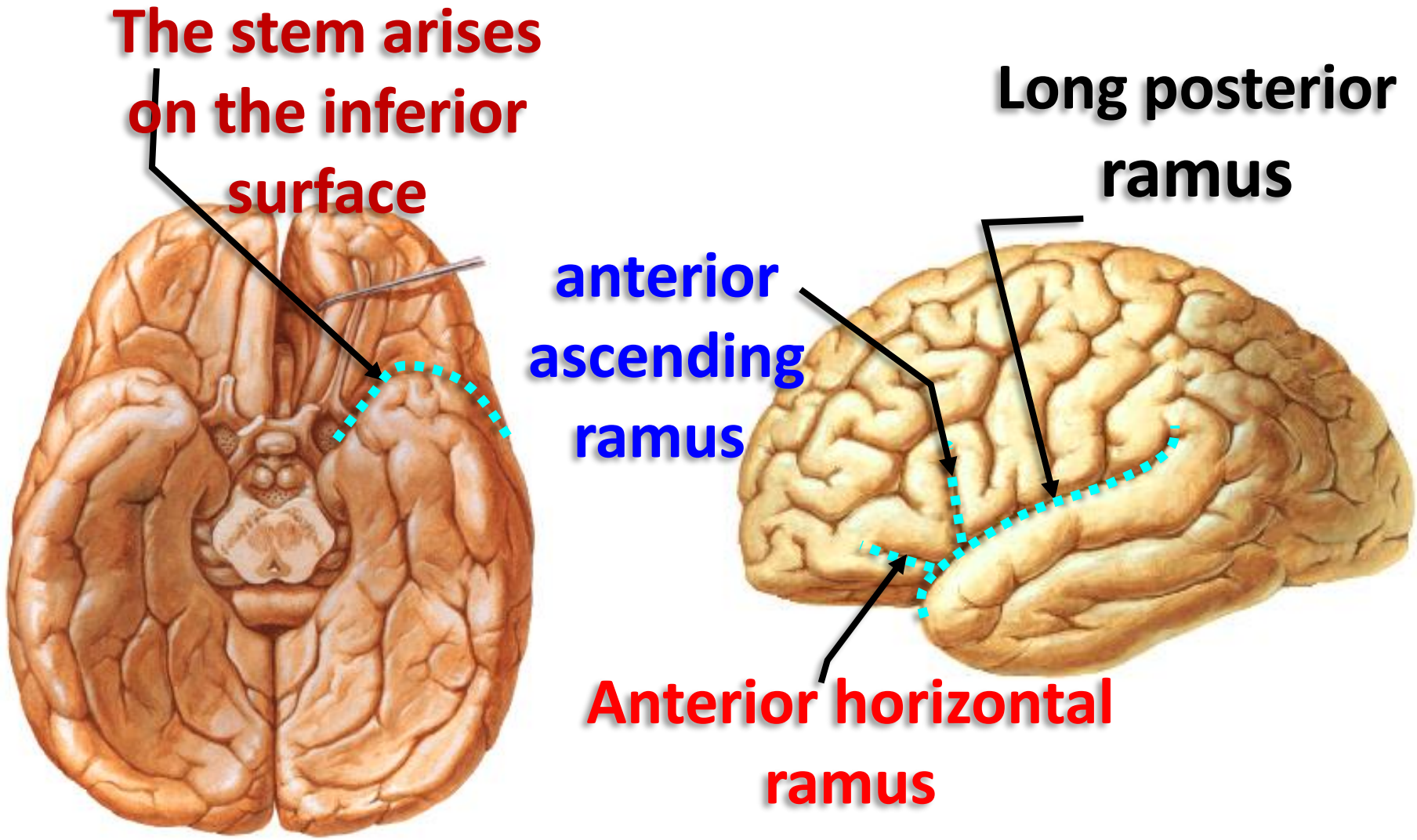
Main Sulci and Lobes of the cerebral hemisphere



1- Central sulcus (Fissure of Rolando) a deep sulcus about **1/2 inch** behind the midpoint between frontal and occipital poles.

- It extends obliquely downwards and forwards and ends slightly above the lateral sulcus.
- It extends a little on the medial surface



2- Lateral sulcus (fissure of Sylvius) consists of a short stem (inferior surface) that divides into three rami (superolateral surface).

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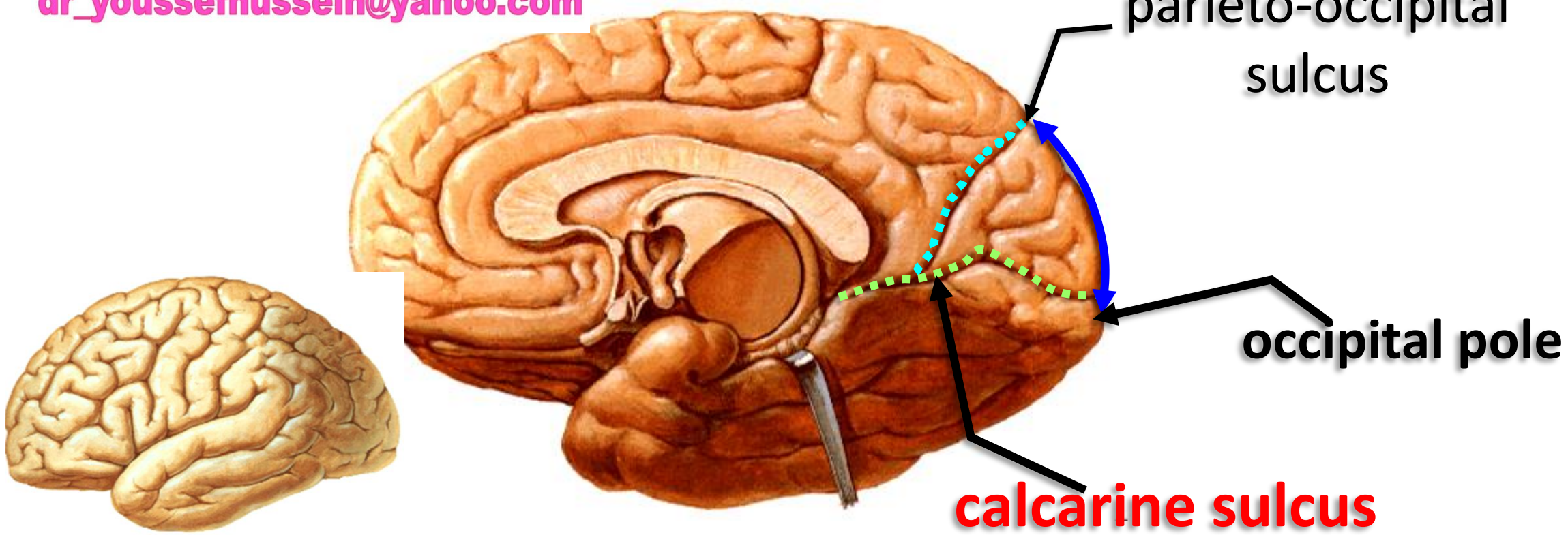
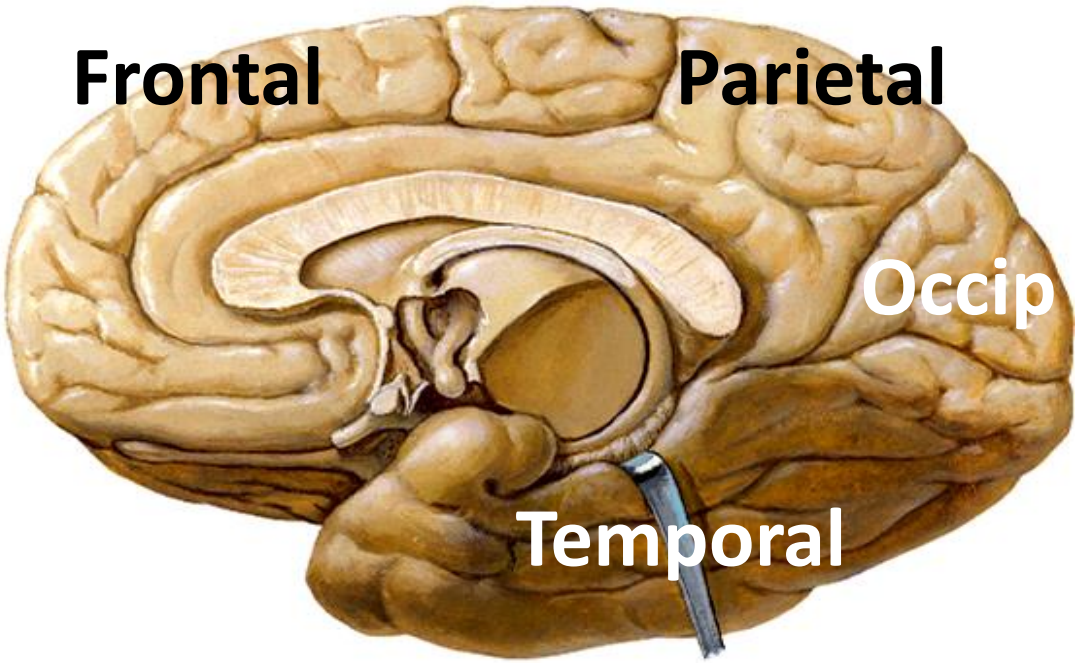


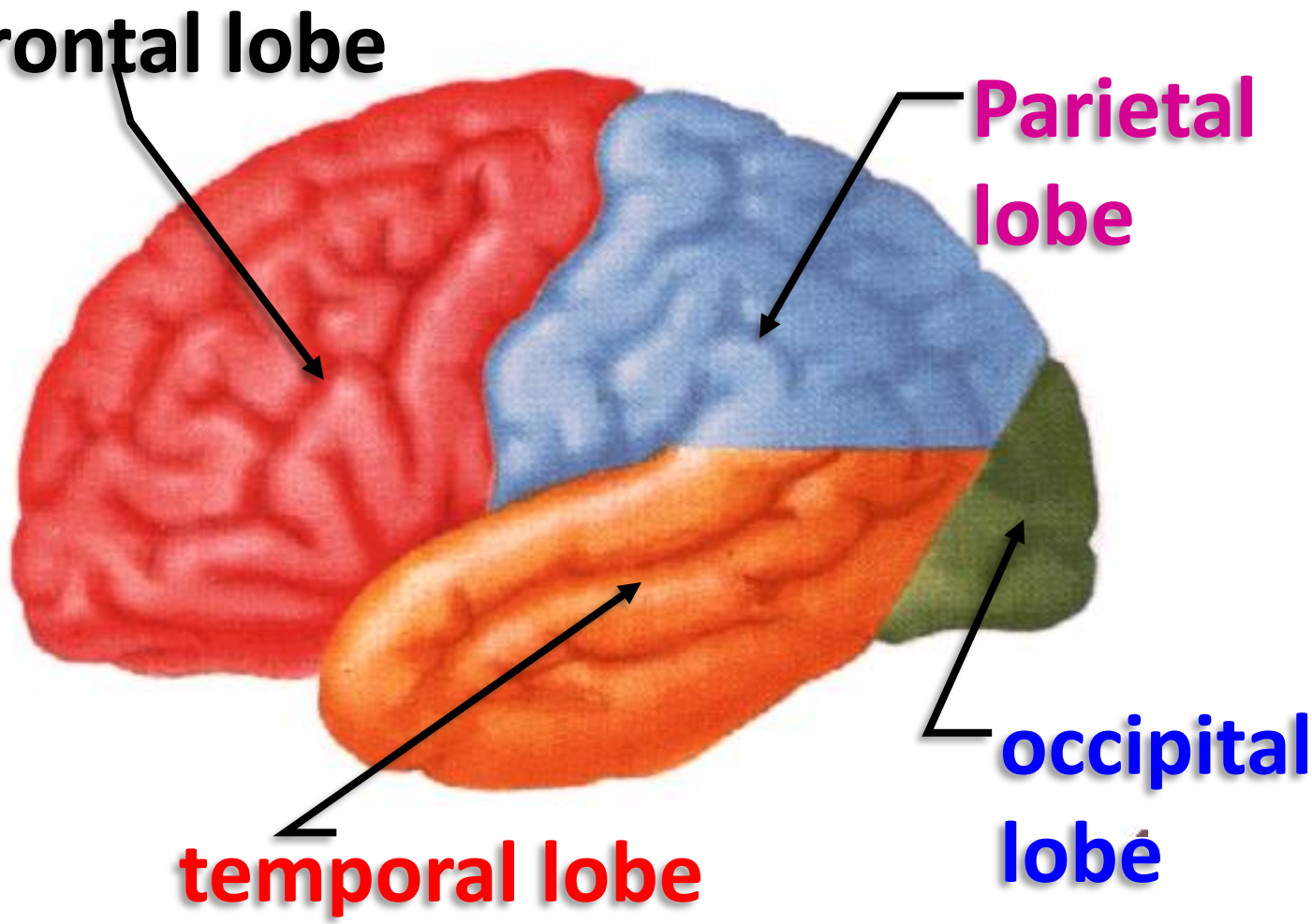
3- Parieto-occipital sulcus begins on the medial margin of the hemisphere about 2 inches (5 cm) anterior to the occipital pole, extends downward & forward

4- Calcarine sulcus; begins below the splenium of the corpus callosum to the occipital pole.

- It is divided by parieto-occipital sulcus into precalcarine and postcalcarine sulcus.

Medial





Superolateral

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Each cerebral hemisphere has 4 lobes

Sulci & Gyri of the supero-lateral surface

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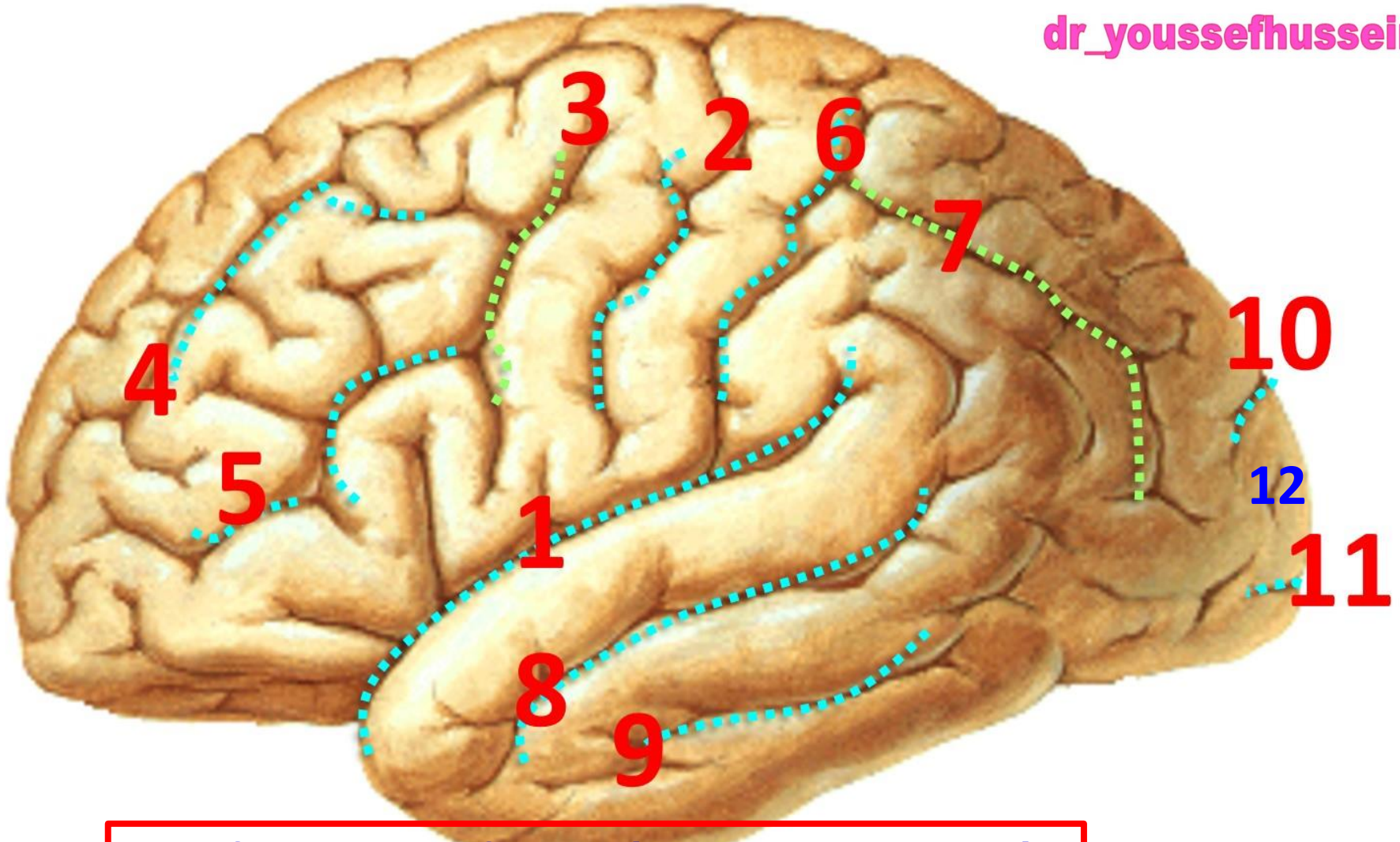

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Important Sulci on the superolateral surface

• Sulci on the Supero-lateral surface

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1- Lateral sulcus (fissure of sylvius**):**

2- Central sulcus (Fissure of Rolando**):**

3- Precentral sulcus: about 1 cm (finger's breadth) infront central sulcus.

4 & 5- Superior and inferior frontal sulci: begin close to the precentral sulcus and extend forwards.

6- Postcentral sulcus: about 1 cm (finger's breadth) behind central sulcus.

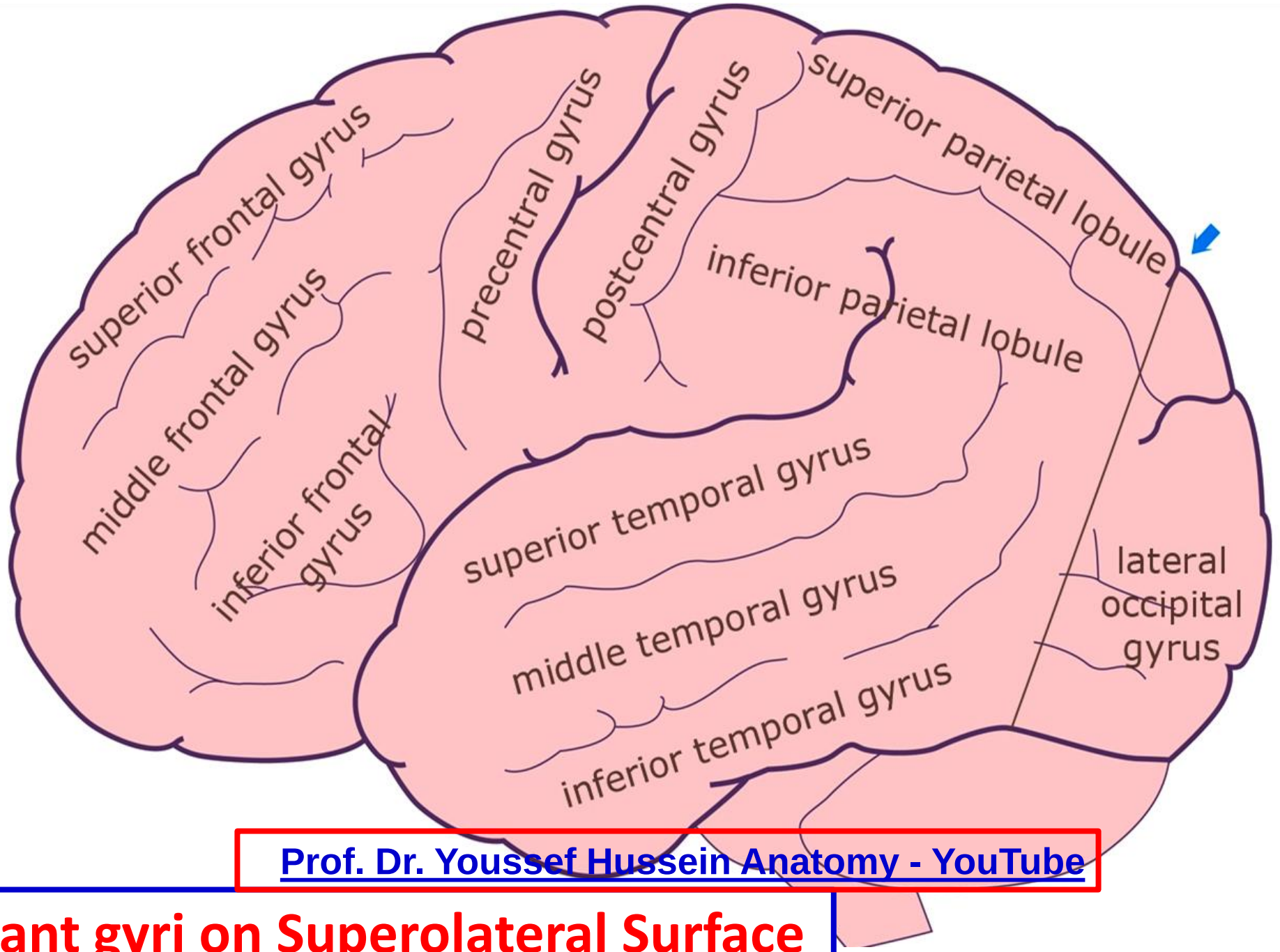
7- Intraparietal sulcus: extends backwards from the middle of the postcentral sulcus.

8 & 9- Superior and inferior temporal sulci: on the temporal lobe parallel to the lateral sulcus.

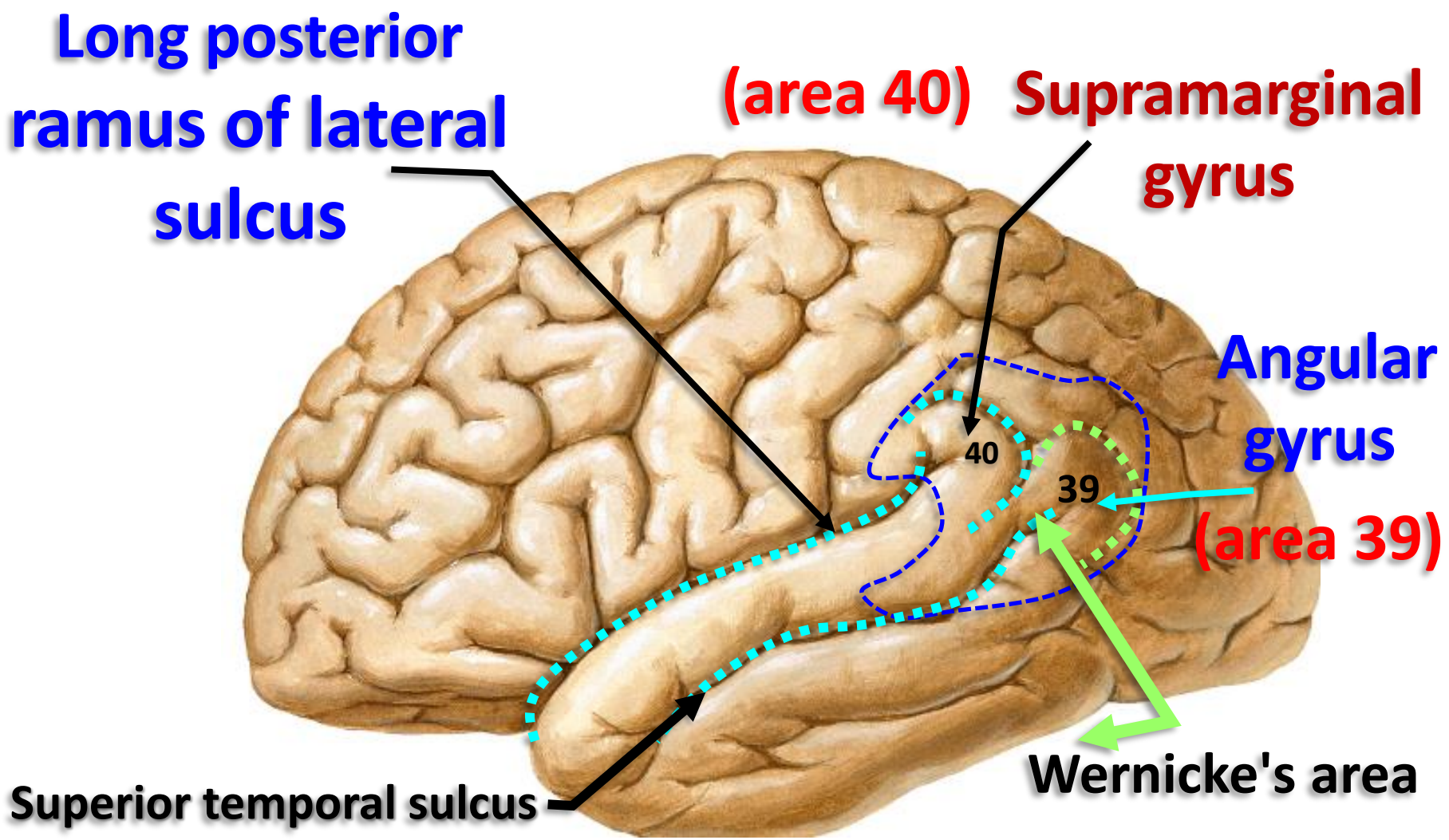
10- Parieto-occipital sulcus: 5 cm infront the occipital pole.

11- Calcarine sulcus: its posterior end reaches to the occipital pole.

12- Lunate sulcus (Simian) at the occipital lobe



Important gyri on Superolateral Surface



- **Supramarginal gyrus (area 40)** is gyrus around the posterior end of the lateral sulcus
- **Angular gyrus (area 39):** is gyrus around the posterior end of the superior temporal sulcus

- **Gyri On the supero-lateral surface**

A- Frontal lobe;

I- Precentral gyrus between the central and precentral sulci.

2- Superior frontal gyrus; lies above the superior frontal sulcus.

3- Middle frontal gyrus lies between the superior and inferior frontal sulci.

4- Inferior frontal gyrus; below inferior frontal sulcus, from anterior to posterior:

a- Orbital part below the anterior horizontal ramus.

b- Triangular between the horizontal, and ascending rami.

c- Opercular part behind the anterior ascending ramus.

B- Parietal lobe;

1- Postcentral gyrus: between the central and postcentral sulci.

2- Superior parietal gyrus (lobule**)** above the intraparietal sulcus.

3- Inferior parietal gyrus (lobule**)** below the intraparietal sulcus.

4- Supra**marginal gyrus** around the posterior end of the lateral sulcus.

C- Temporal lobe;

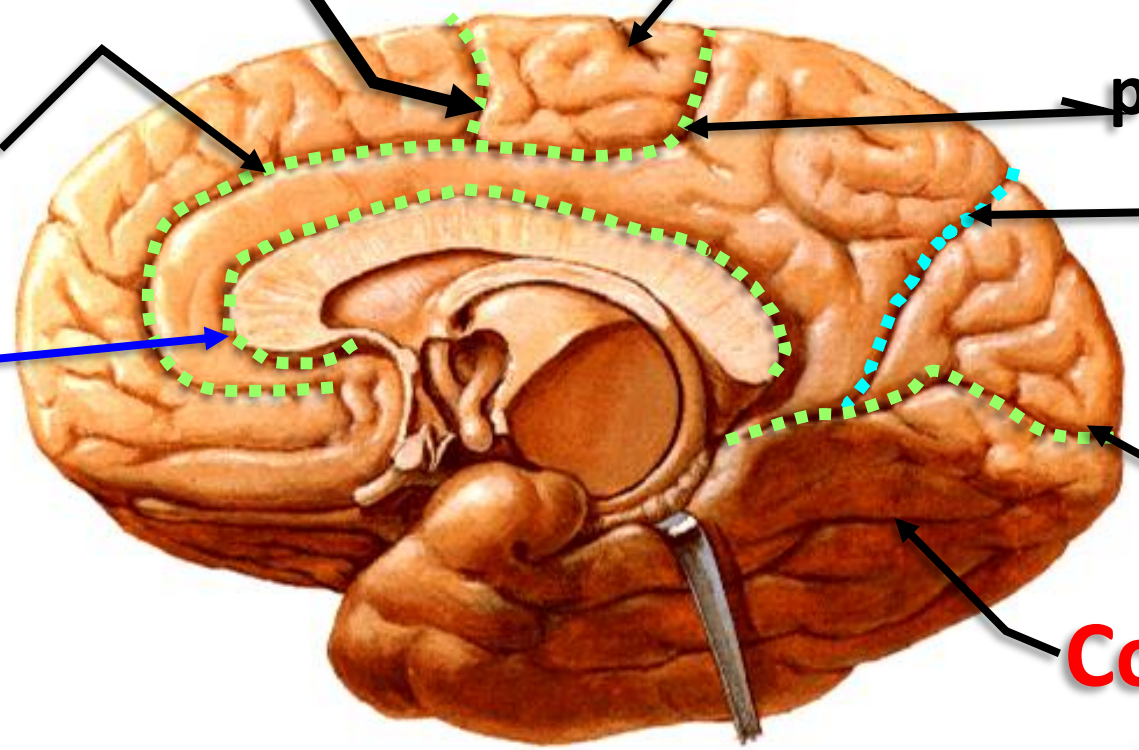
1- Superior temporal gyrus between lateral sulcus and superior temporal sulcus.

2- Middle temporal gyrus lies between the superior and inferior temporal sulci.

3- Inferior temporal gyri: lies below the inferior temporal sulcus.

4- Angular gyrus around the posterior end of the superior temporal sulcus.

Sulci & Gyri of the medial surface



- **Sulci on the Medial Surface**

1- Callosal sulcus: close to the upper surface of the corpus callosum.

2- Cingulate sulcus; about finger's breadth above and parallel to the callosal sulcus.

- It **ends** by dividing into two rami in front and behind the central sulcus.

3- Central sulcus: between the two branches of the cingulate sulcus.

4- Parieto-occipital sulcus.

5- Calcarine sulcus.

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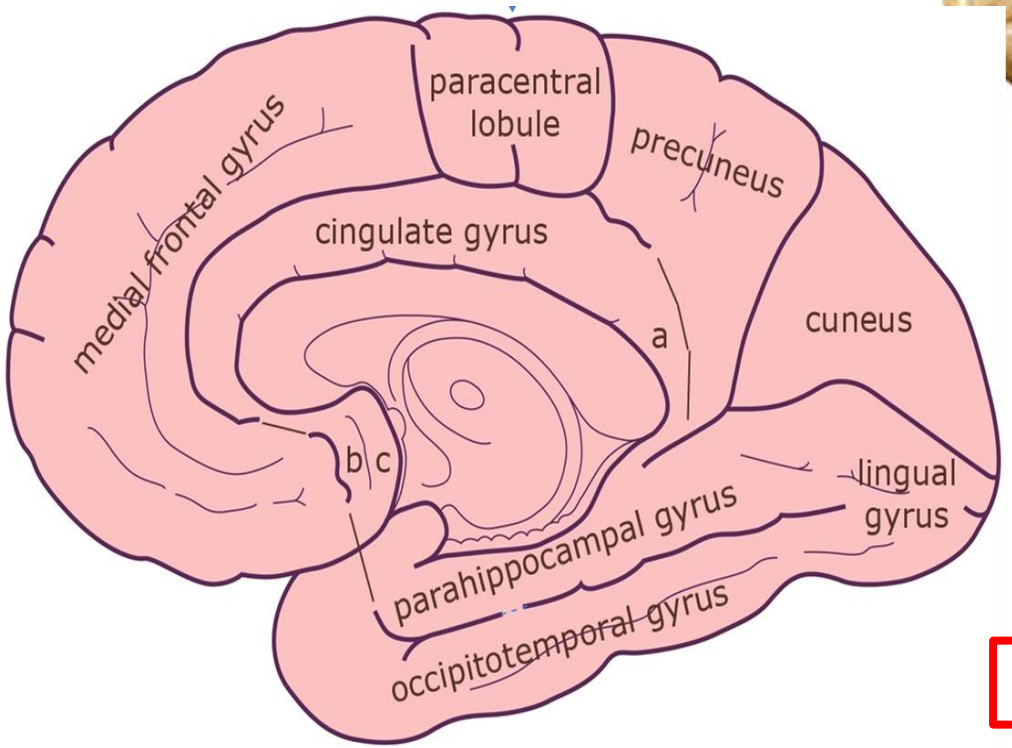

cingulate gyrus

medial frontal gyrus

paracentral lobule

precuneus

cuneus

Lingual gyrus

Parahippocamus

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- **Gyri on the Medial Surface**

1- Cingulate gyrus: between the callosal and cingulate sulci.

- The lower part of the posterior end curves downward behind the splenium of corpus callosum and forms a narrow area (**isthmus**) that connects it with the para-hippocampal gyrus.

2- Medial frontal gyrus: between the superomedial border and cingulate sulcus.

3- Paracentral lobule: surrounds the central sulcus between the two rami of the cingulate sulcus.

4- Precuneus; Infront parieto-occipital sulcus.

5- Cuneus: the triangular gyrus between the parieto-occipital and postcalcarine sulci (between the two branches of the **Y**).

6- Lingual gyrus: the elongated, tongue-like gyrus extending below the postcalcarine sulcus to the occipital pole.

Functional areas of the Superolateral surface

Motor area 4

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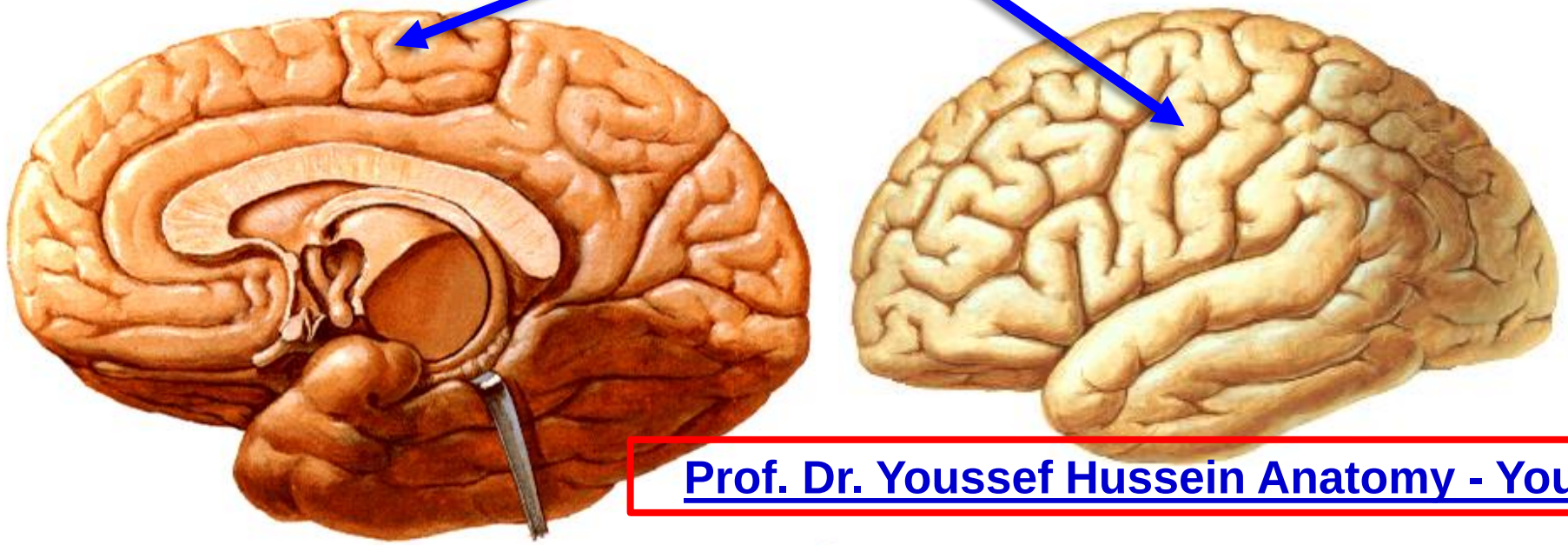
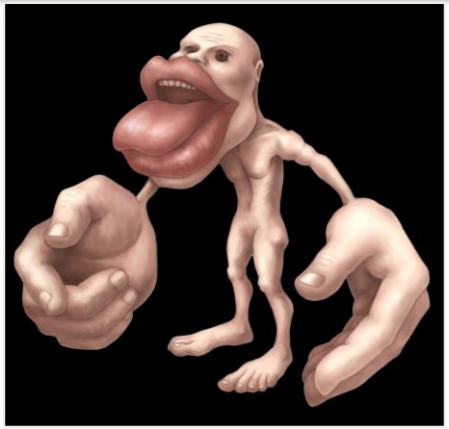
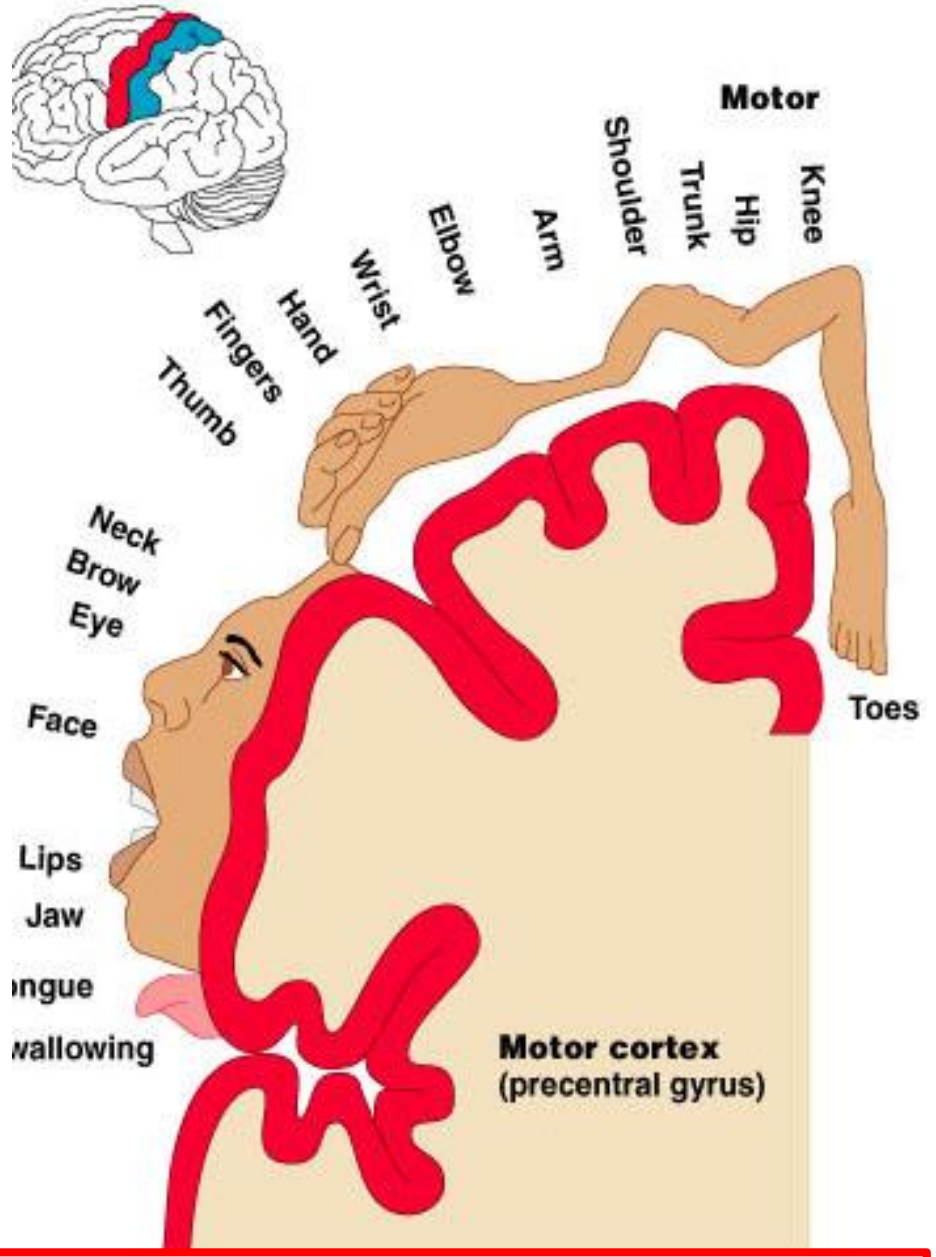


- **Primary motor area** corresponds to the precentral gyrus (**Brodmann area 4**), anterior part of the paracentral lobule Controls motor functions, primarily on the opposite side of the body.

- A body represented in upside down.
- The muscles of the head are represented most ventrally closest to the lateral fissure; then, proceeding dorsally, are the regions for the neck, upper limb, and trunk on the lateral aspect of the hemisphere.
- On the medial aspect of the hemisphere is the motor representation for the pelvis and lower limb.
- size depends on skill, not mass of the muscle
- **Lesion** of the area 4 results in contra-lateral **hemiplegia (UMNL)**.





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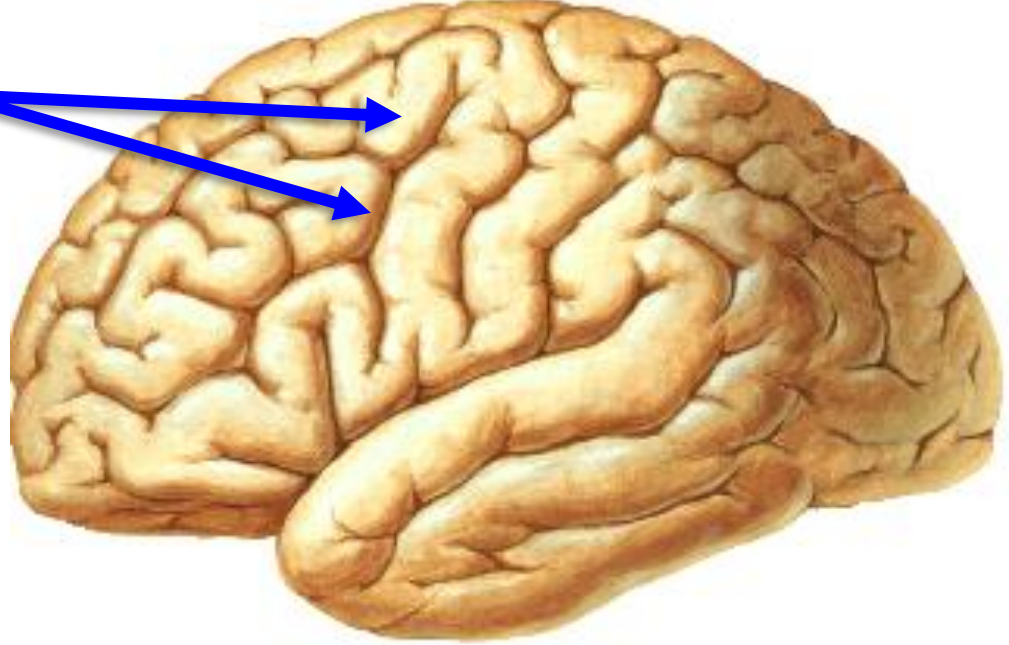
Premotor area 6



- **Located anterior to the precentral gyrus**
- **It is the origin of extrapyramidal fibers**
- **Controls more complex movements**
- **Involved in the *planning* of movements** and storage of the learned movements to bring them later on.

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- Damage here results in an **apraxia,** a disruption of the patterning and execution of learned motor movements.
- Individual movements are intact, and there is no weakness, but the patient is unable to perform movements in the correct sequence.

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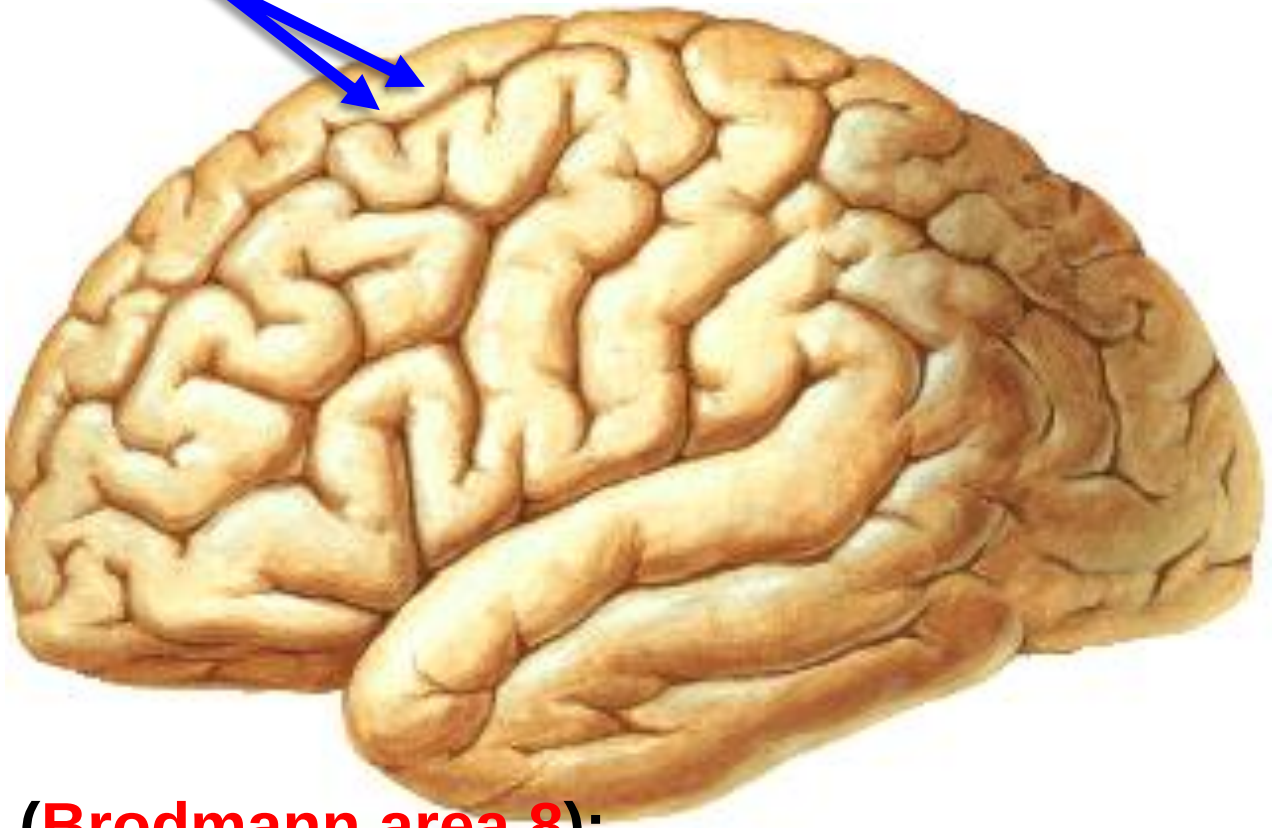
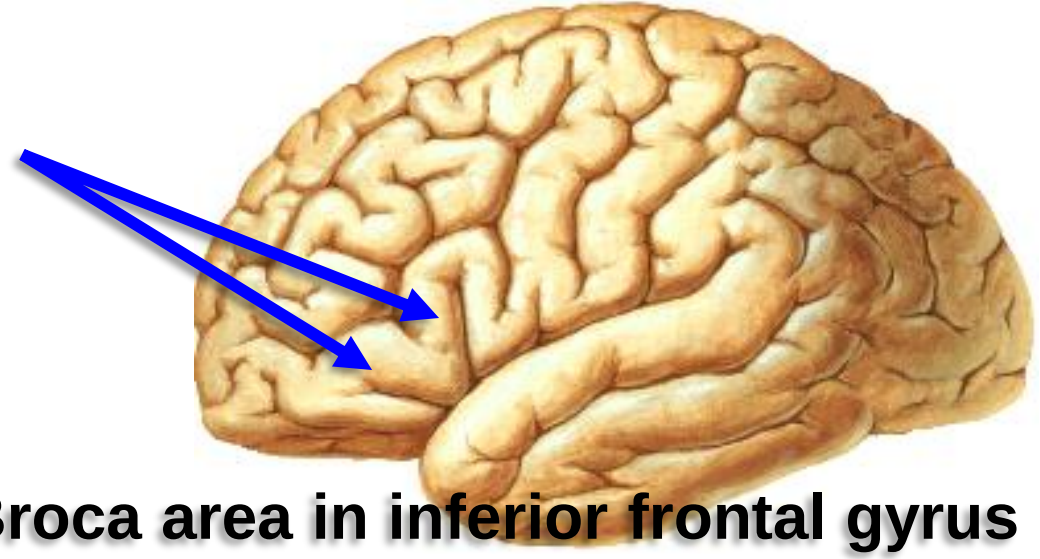
Frontal eye field area 8

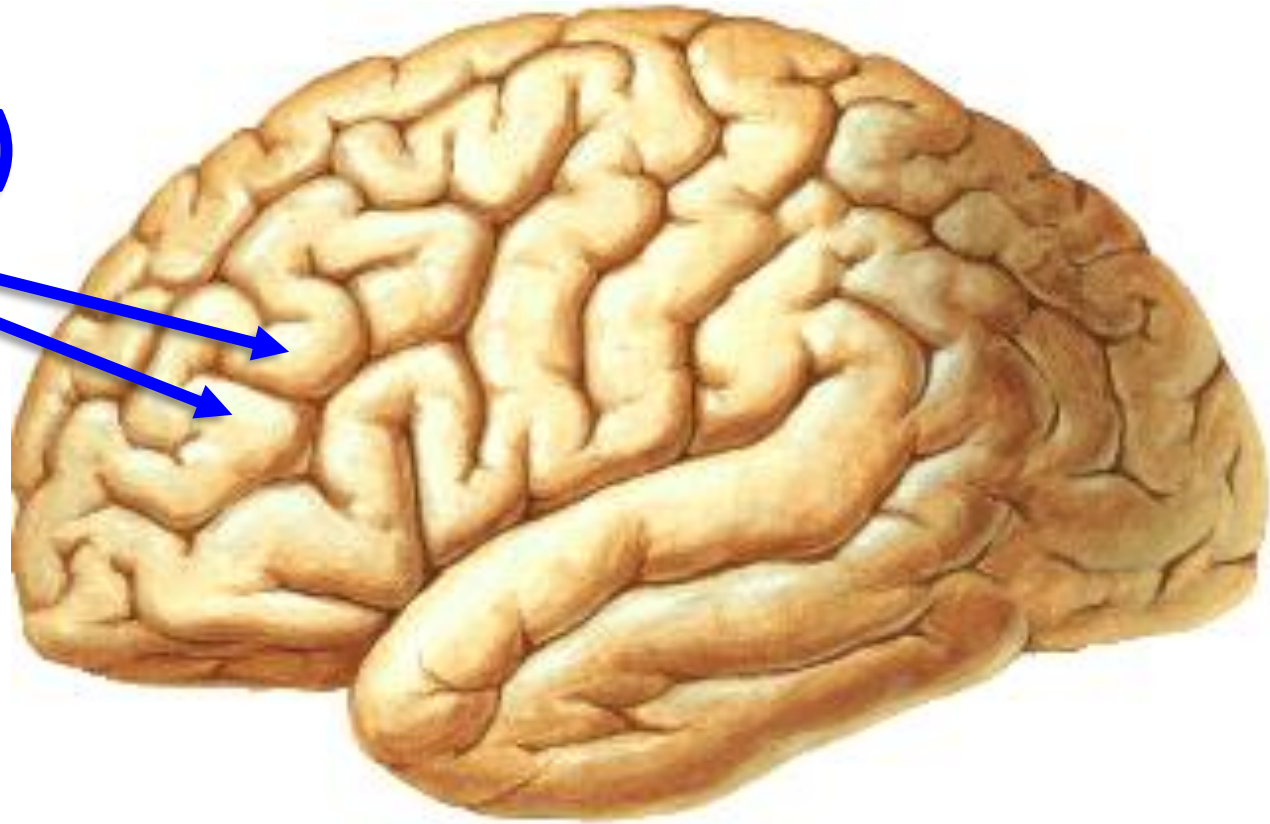


- **Fontal eye field (Brodmann area 8):**
- It lies anterior to the premotor cortex
- **It controls movements of the eyes when eyes follow a moving target.**
- A lesion here results in an inability to make voluntary eye movements toward the contralateral side.

(Broca’s area) 44, 45

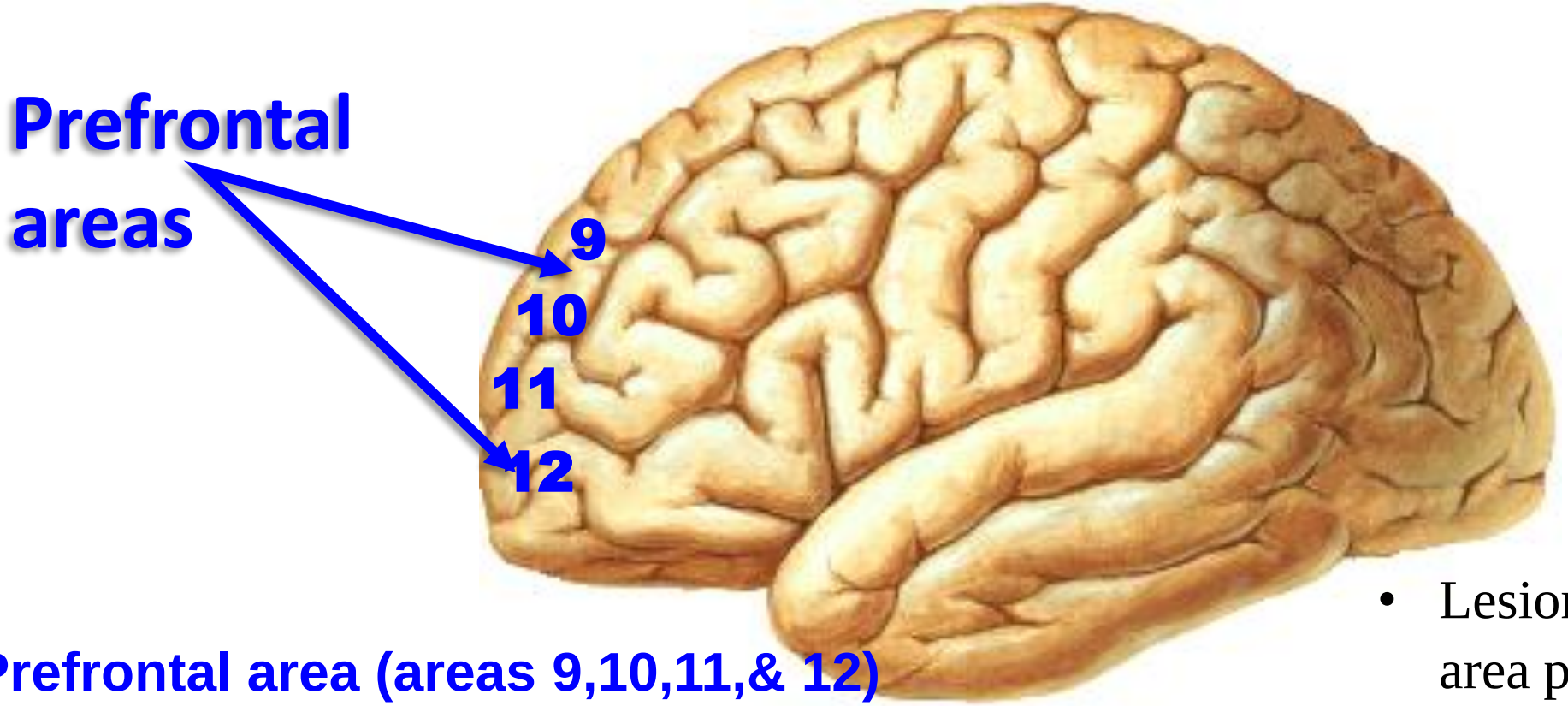


- **Motor speech (Broca's) area (areas 44, 45) Broca area in inferior frontal gyrus of frontal lobe** of the dominant hemisphere (95%)**. Associated with language production.** It brings about the formation of words by its **connections** with the adjacent primary motor areas; the muscles of the speech.
- Lesion in this area produces **Aphasia—higher-order language deficit (inability to understand/produce/use language appropriately); caused by pathology in dominant cerebral hemisphere (usually left in** righthanded people**).**
- Damage of Broca area and primary motor cortex = full loss of language
- **Dysarthria**—partial loss of language (difficulty speaking), damage to the muscles or nerves that control speech.



- **Writing area (**Exner's area**);**

- It lies in the middle frontal gyrus.
- The person able to express himself in written words
- Lesion leading to Agraphia (loss of ability to write)



- Lesions in the prefrontal area produce what is called the **frontal lobe syndrome**.

Prefrontal area (areas 9,10,11,& 12)

- It lies in the most anterior part of the frontal lobe الناصية

- **It is responsible for:**

A- Planning التخطيط , thinking التفكير , remember التذكر and problem solving حل المشكلات

B- Motivating التحفيز , emotions الأنفعالات , good & sinful behavior السلوك الحسن و الخاطئ , mood المزاج , psychological activities الأنشطة النفسية .

C- Telling of lie and truth قول الكذب و الحقيقة

Somatosensory area 1,2,3

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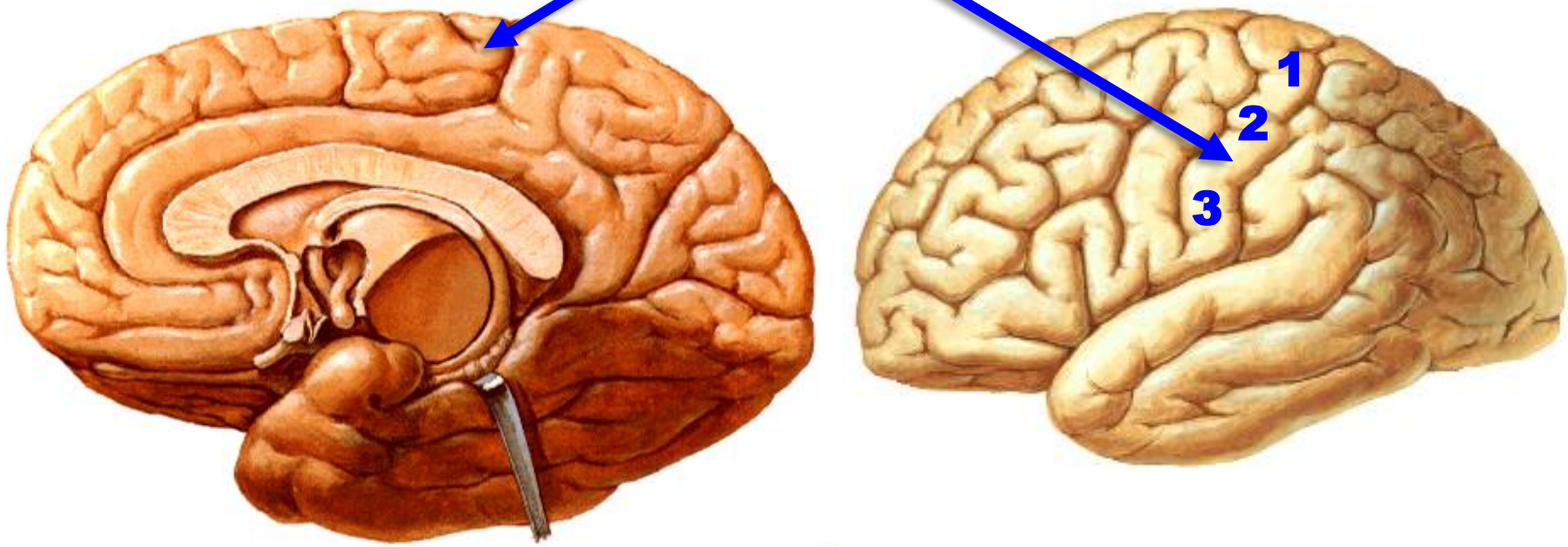

- Somatosensory (**Primary sensory**) cortex corresponds to postcentral gyrus **(areas 1,2,3),** posterior part of paracentral lobule
- It receives sensations from opposite side of body.
- The body represented upside down
- Lesion in this area leads to **loss of sensation** in opposite side of the body.

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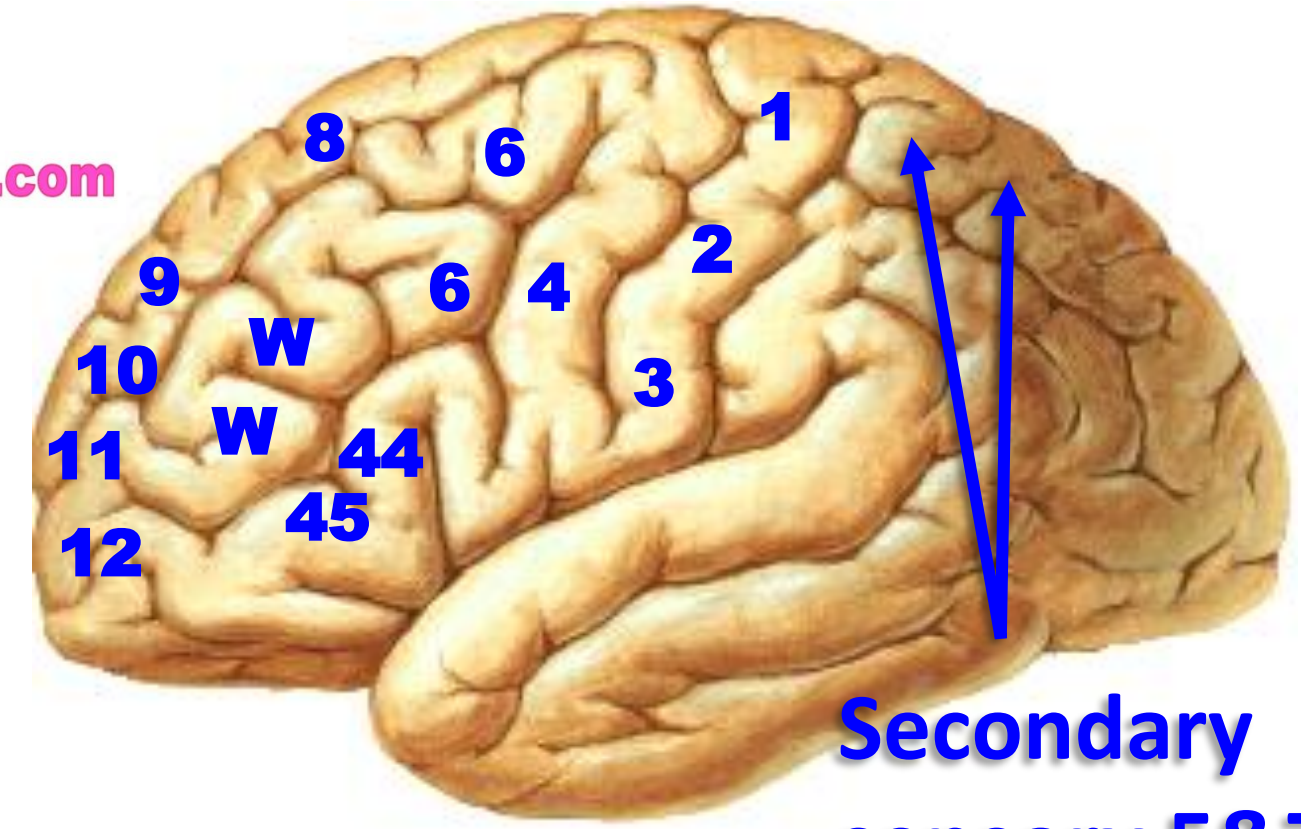
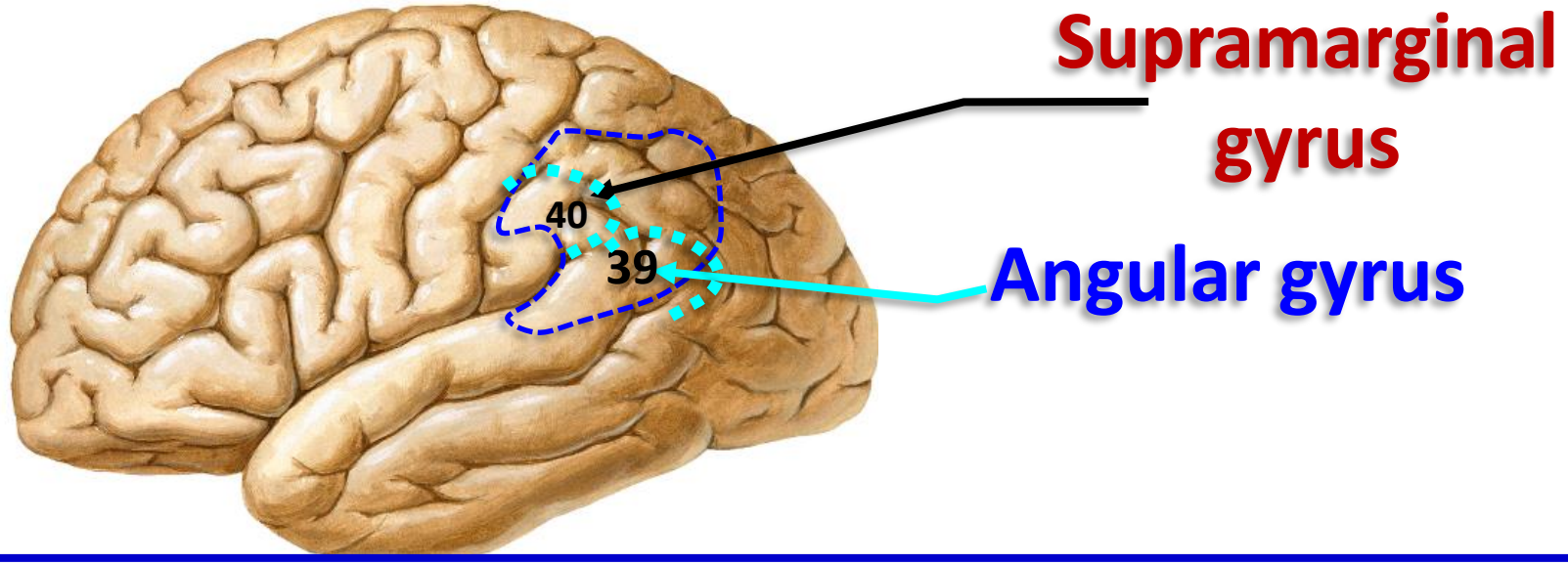


Secondary (Association) sensory area (area 5, 7);

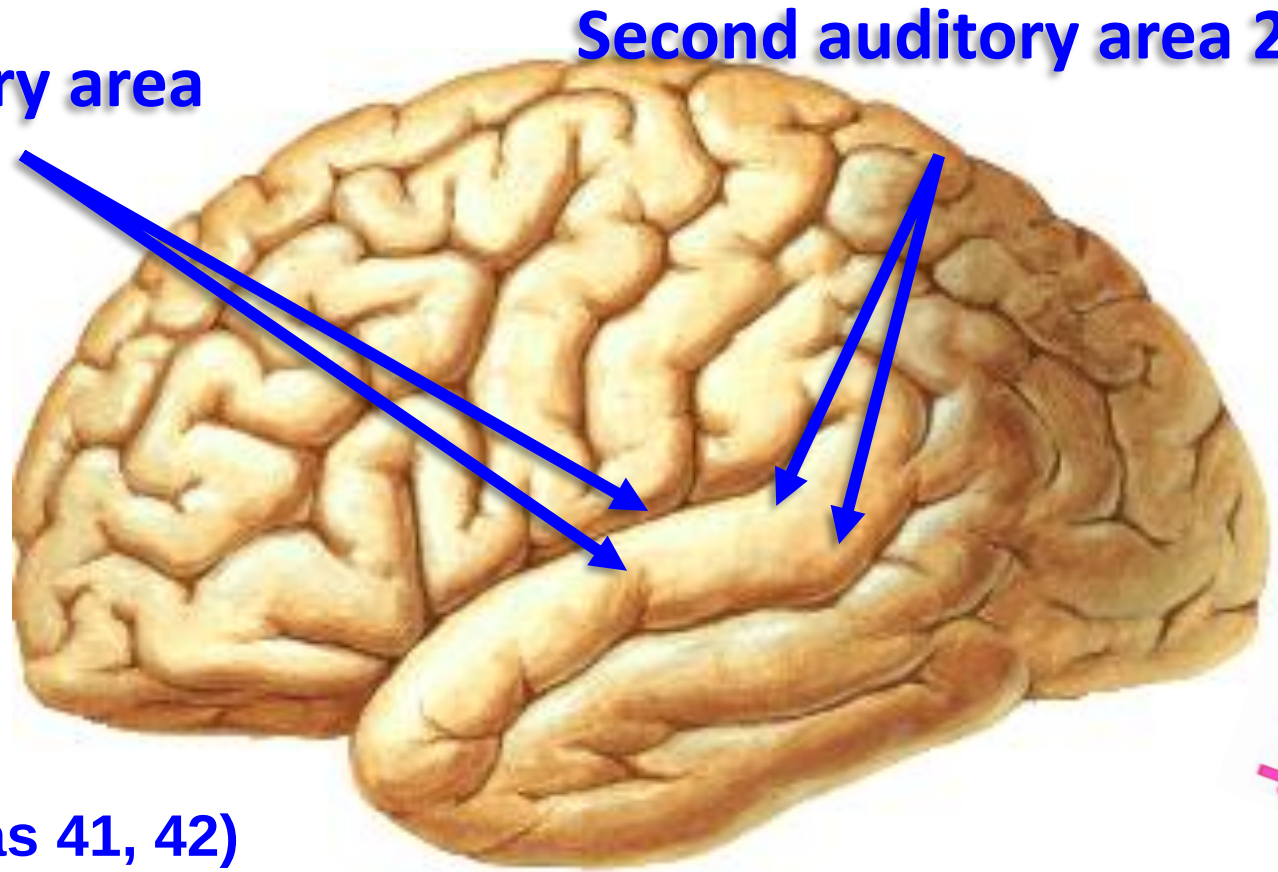
- It occupies the superior parietal gyrus.
- Function, **stereognosis (**ability to identify the familiar objective manually**)** **shape, roughness, size of objects**
- Lesion results in **asteriognosis**



- **Sensory speech area (Wernicke's- area 39, 40). language comprehension**
- **Wernicke area (receptive) in superior temporal gyrus of temporal lobe** extending to inferior parietal gyrus, angular and marginal gyri **.**
- It is connected to motor speech area, auditory area and visual area.
- **Lesion Associated with impaired language comprehension.**
- **Patients do not have insight. Wernicke is a word salad and makes no sense.**

- Lesion in this area produces **sensory aphasia** (can not understanding spoken and written words.). The deficit is characterized by fluent verbalization and lacks meaning.

- **Global aphasia is caused by lesion both Broca and Wernicke areas.**

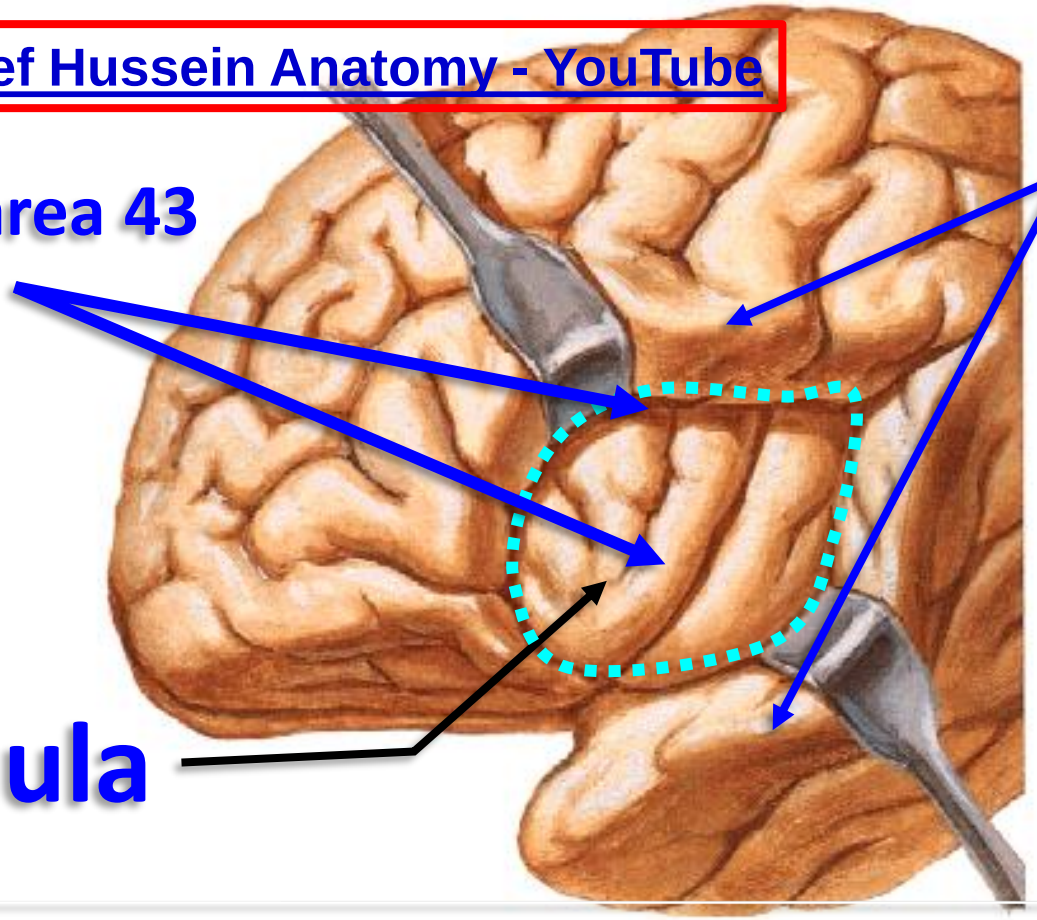


- **Primary auditory area (areas 41, 42)**

- It is present in the floor of the lateral sulcus and the middle part of the superior temporal gyrus **(Heschel's gyrus).**

- It receives auditory radiation from the medial geniculate body (MGB).
- Lesion of this area leads to **diminished hearing**.
- **Auditory association area (Secondary) (area 22):** **behind** the primary auditory area.

- It is responsible for recognition and interpretation of the sounds.



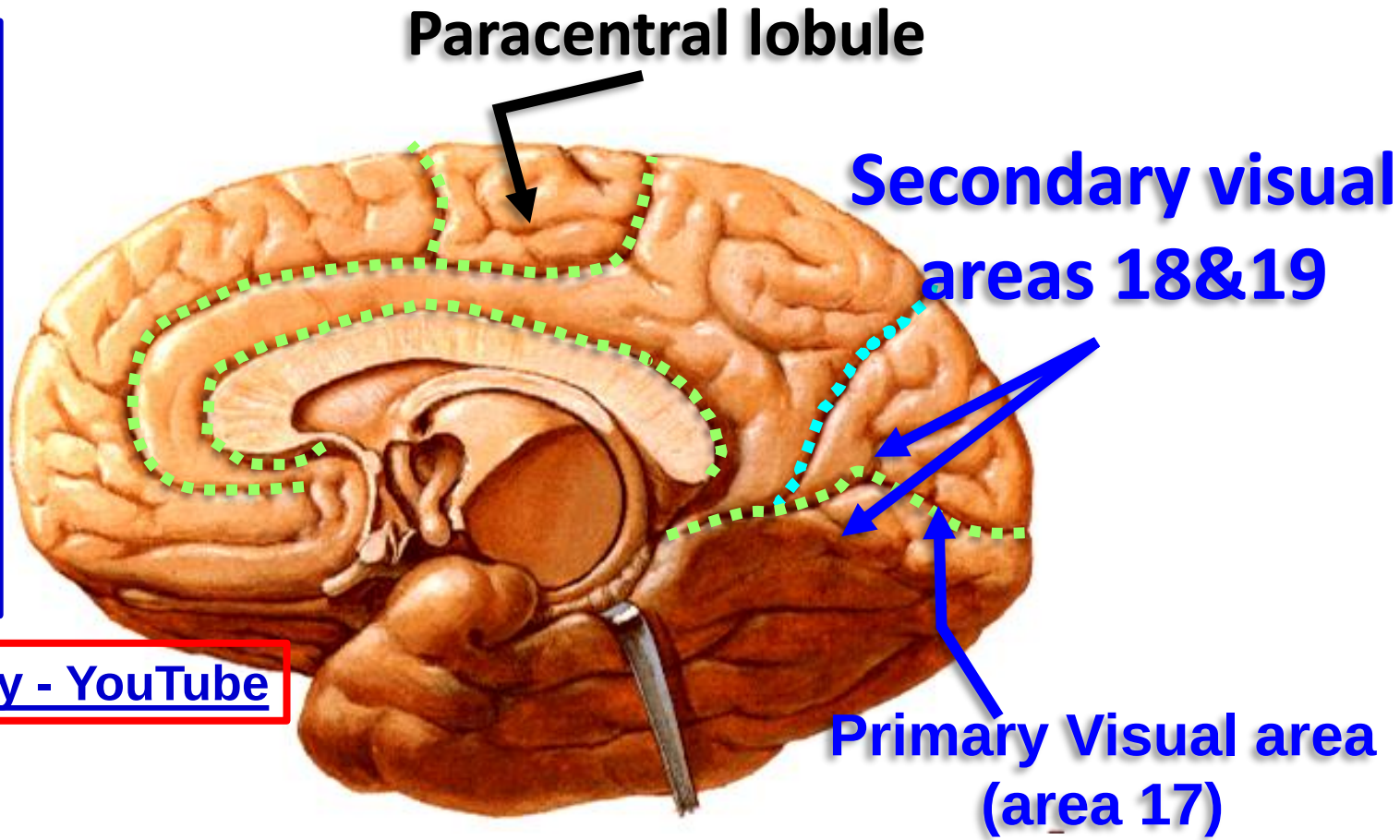
- **Insula** lies at the bottom of the deep lateral sulcus and cannot be seen from the surface unless the lips of the sulcus are separated.
- **Gustatory area** (area 43): lies in the insula .

- It is concerned with the recognition of the taste sensation.

Functional areas of the medial surface

1- Paracentral lobule;

- It is continues with the motor and sensory areas in the lateral surface.
- It gives motor fibres and receives sensation from the pelvis and lower limb of the opposite side.
- It controls the micturition and defecation.



2- Primary Visual area (area 17);

- It lies on the depth of calcarine sulcus
- It receives visual sensation from the lateral geniculate body (**LGB**) via the optic radiation..
- Damage of the primary visual area causes **blindness**.

3- Secondary Visual (association) area (area 18, 19):

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- It lies in the occipital lobe surrounding the primary visual area.
- Damage of this area causes **visual agnosia** (people can not identify the objects).

Sulci & Gyri of the inferior surface

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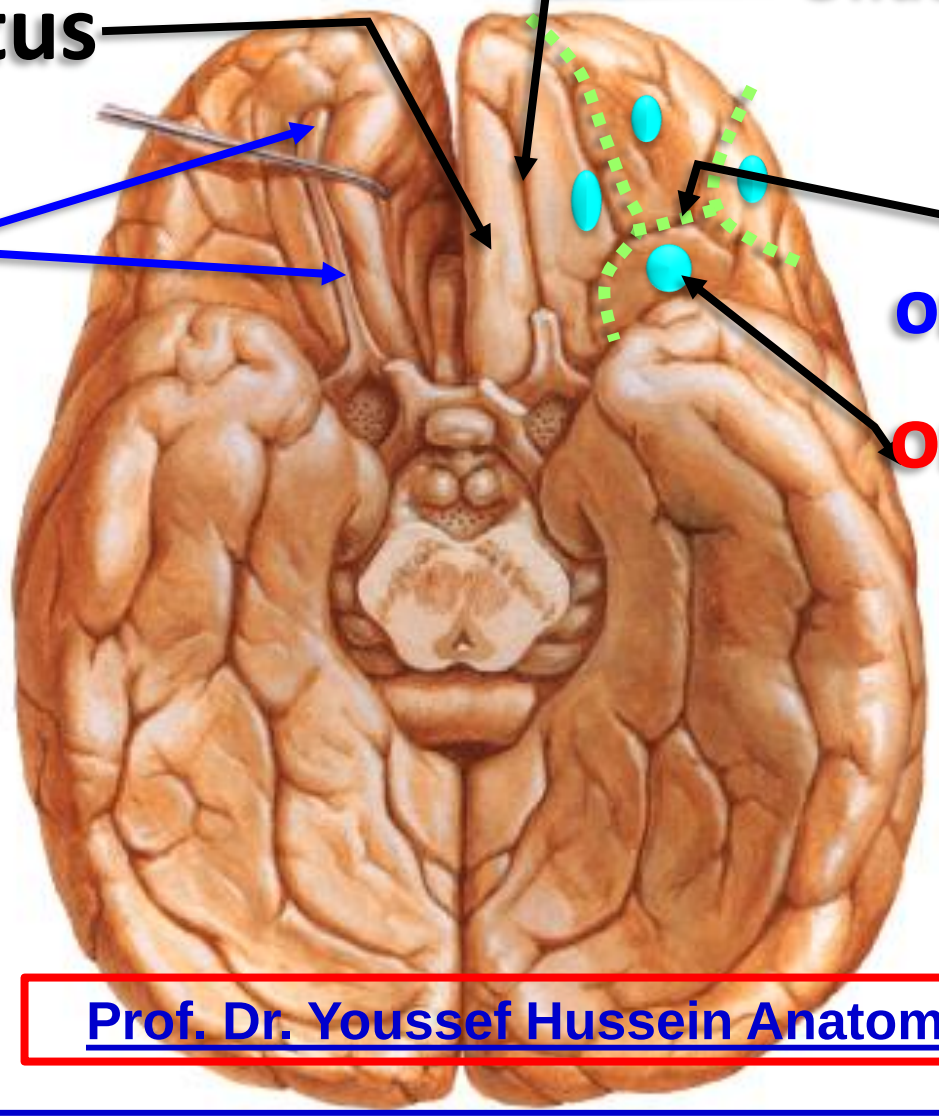

- **On the orbital surface:**

- Olfactory sulcus; on orbital surface close and parallel to medial orbital border, contains olfactory bulb and tract.

Gyrus rectus: between medial orbital border and olfactory sulcus. Its Functions (unclear) is related to Intellectual and emotional expression, It may be involved in higher cognitive function as personality

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- Orbital sulcus: is H shaped sulcus lateral to the olfactory sulcus.

- Anterior, posterior, lateral and medial orbital gyri: on the orbital surface.

- On the tentorial surface:

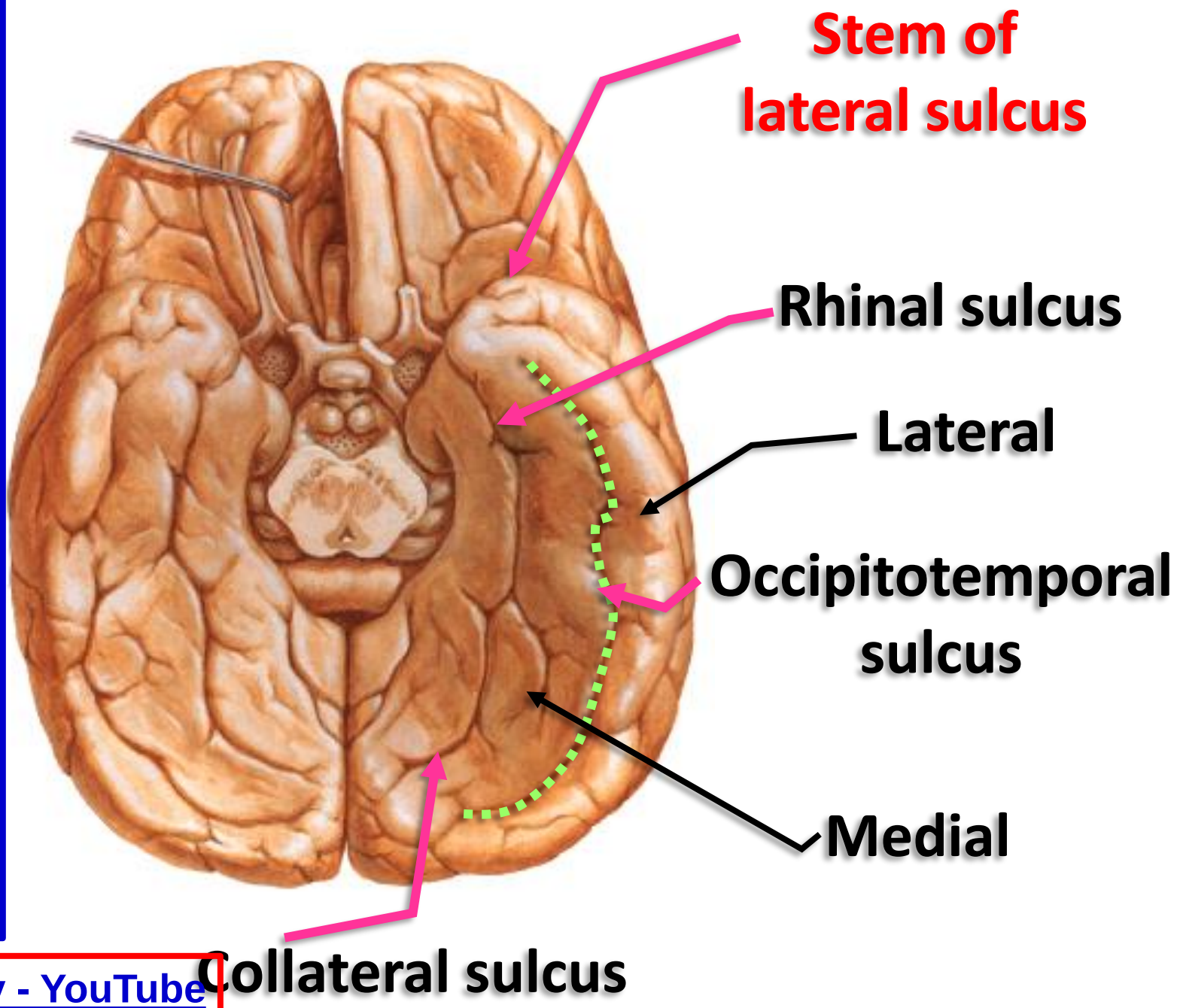
1- Stem of lateral sulcus between the frontal and temporal lobes.

2- Occipito-temporal sulcus: from occipital pole to temporal pole.

3- Medial and Lateral occipitotemporal gyrus: medial and lateral to occipitotemporal sulcus.

4- Collateral sulcus: It runs anteriorly below the calcarine sulcus.

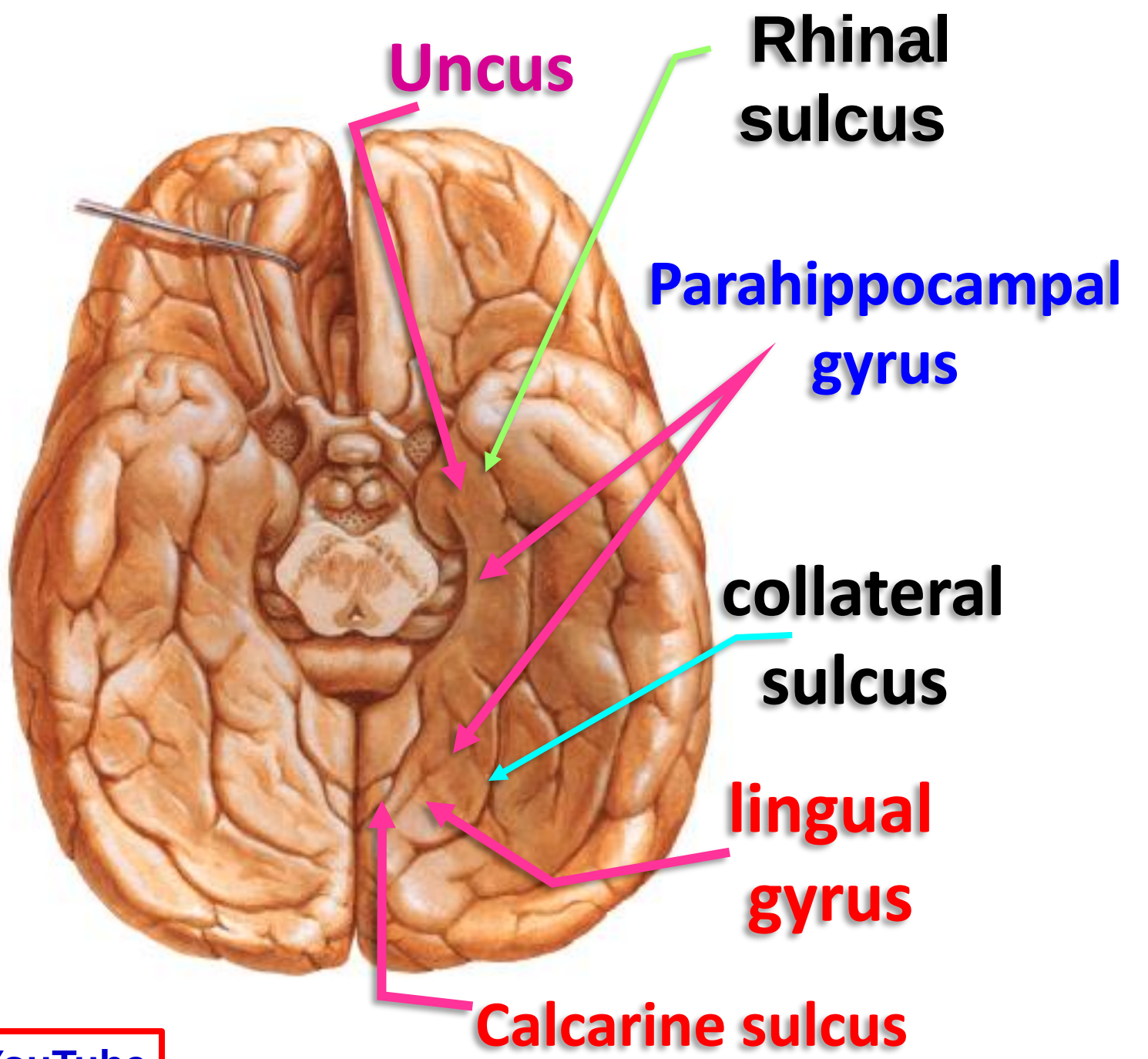
5- Rhinal sulcus: extends anteriorly from collateral sulcus.



On the tentorial surface:

- **Lingual gyrus** between collateral sulcus and calcarine sulcus
- **Para hippocampal gyrus** anterior to the lingual gyrus (**Limbic system**)

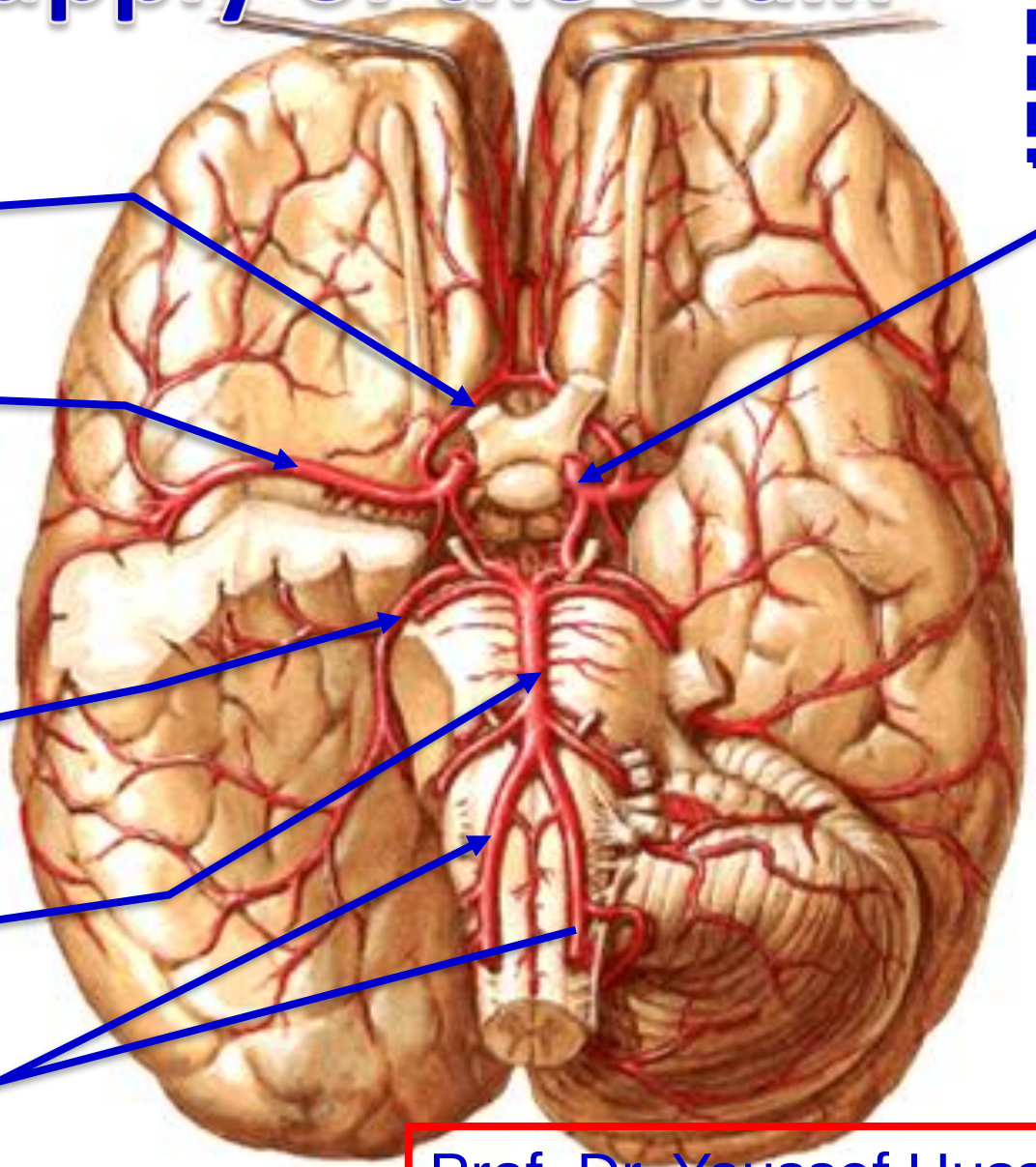
- **Uncus** anterior to Para hippocampal gyrus, a hook-shaped convolution close to the temporal pole medial to the rhinal sulcus. **Center of the olfactory**



Blood supply of the brain

Blood Supply of the Brain

Vertebral system
Carotid system



Anterior cerebral Artery

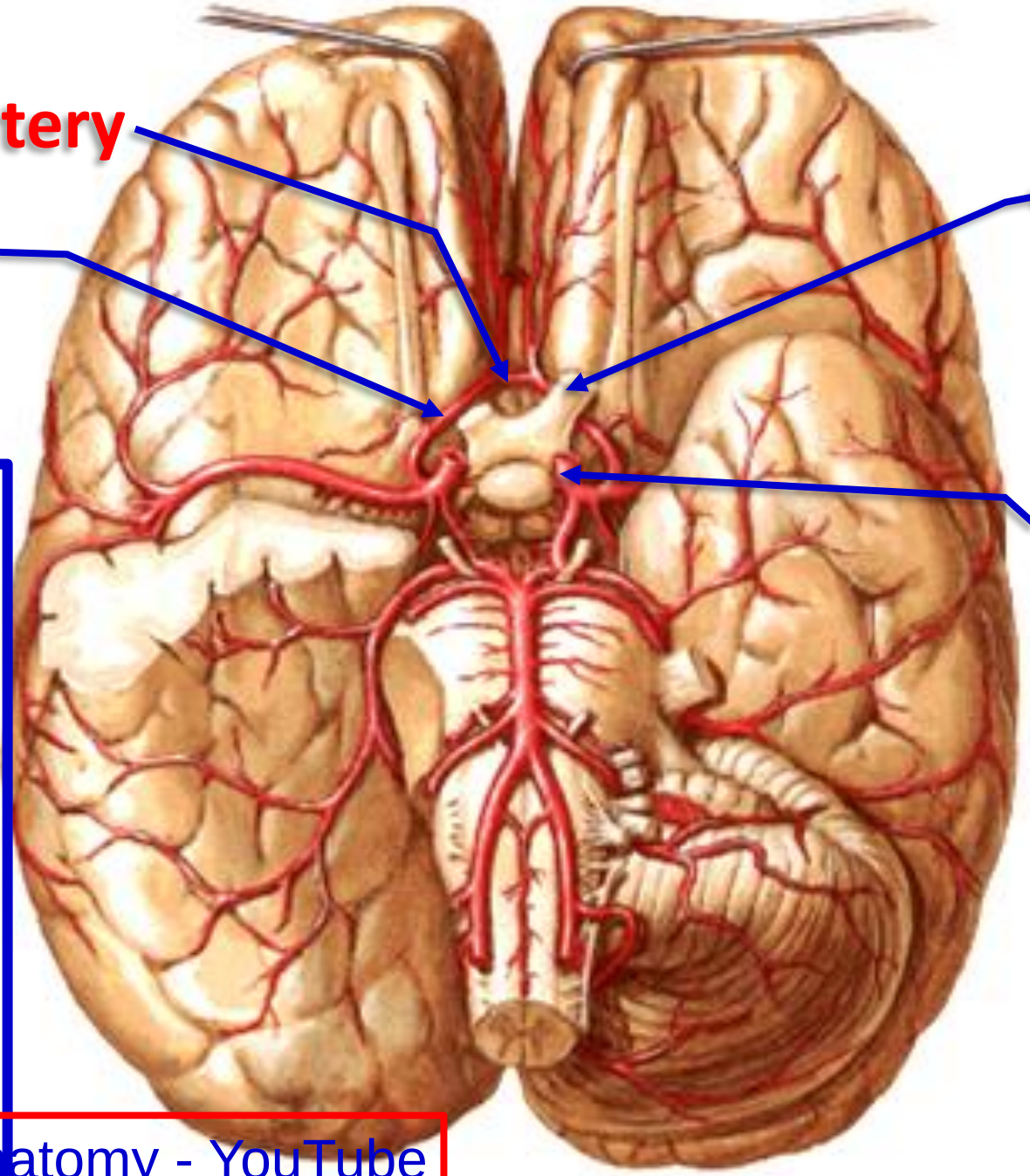
Middle cerebral Artery

Posterior cerebral Artery

Basilar Artery

4th part of Vertebral Artery

Int carotid Artery



- **Anterior Cerebral Artery**

** **Origin:** one of 2 terminal branches of internal carotid artery.

** **Course**:

- It passes medially above optic nerve to median longitudinal fissure.

- It communicates with the opposite side by anterior communicating artery.

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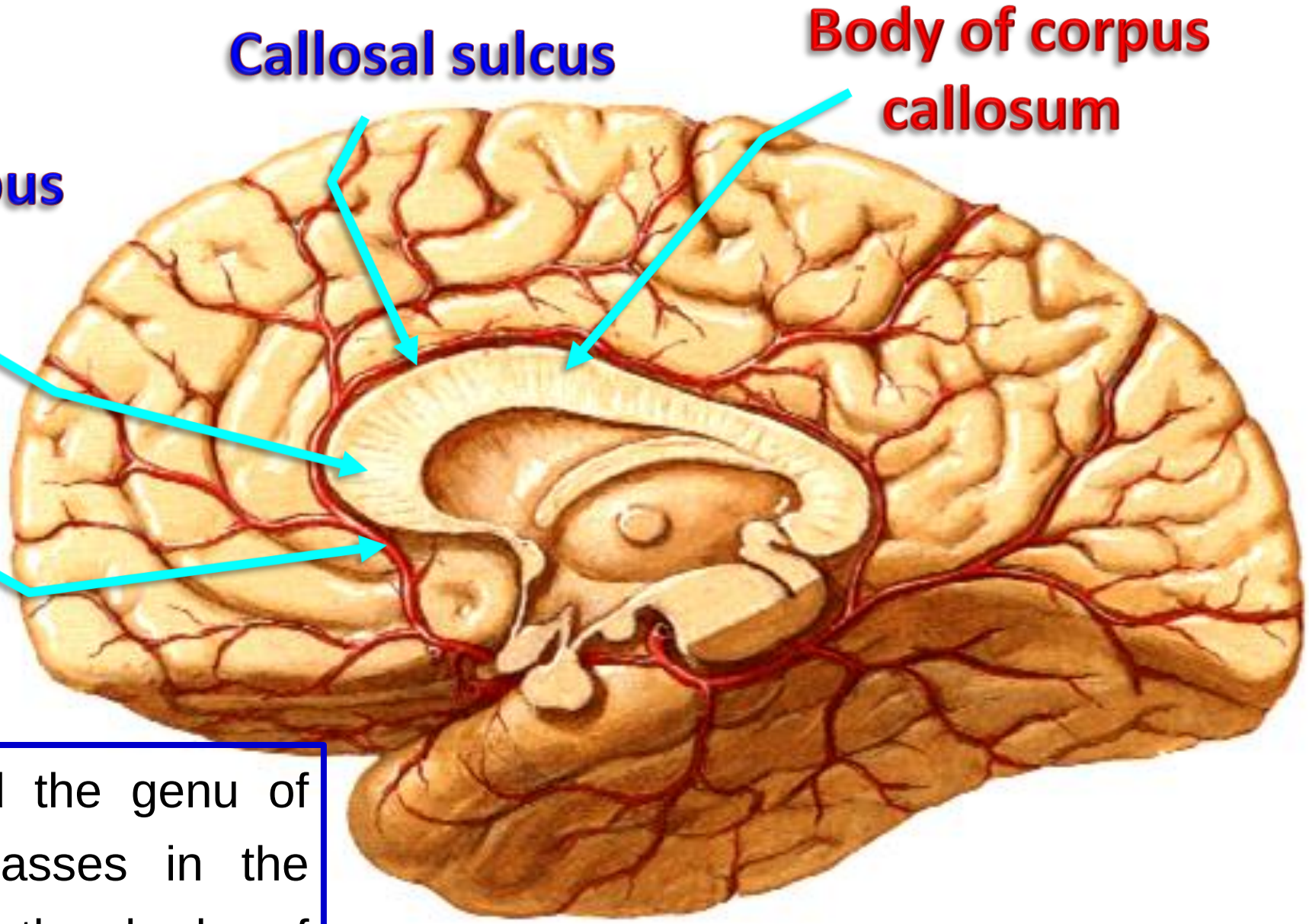
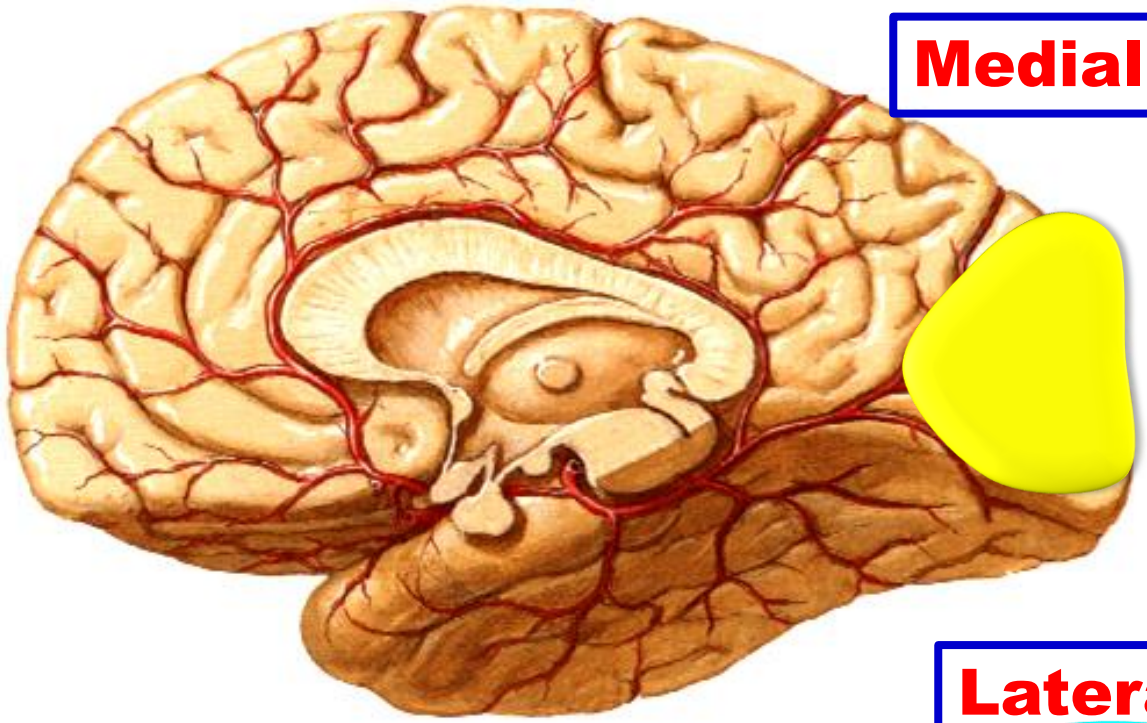


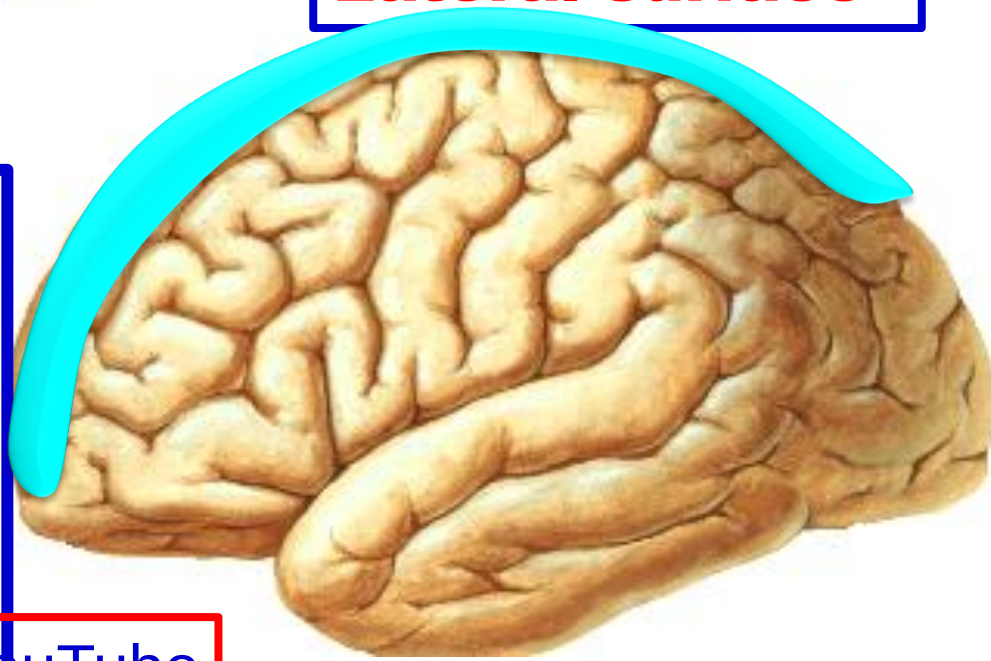
- Then, it curves around the genu of corpus callosum and passes in the **callosal sulcus** above the body of corpus callosum in the medial surface.

Inferior surface



Medial surface

Lateral surface

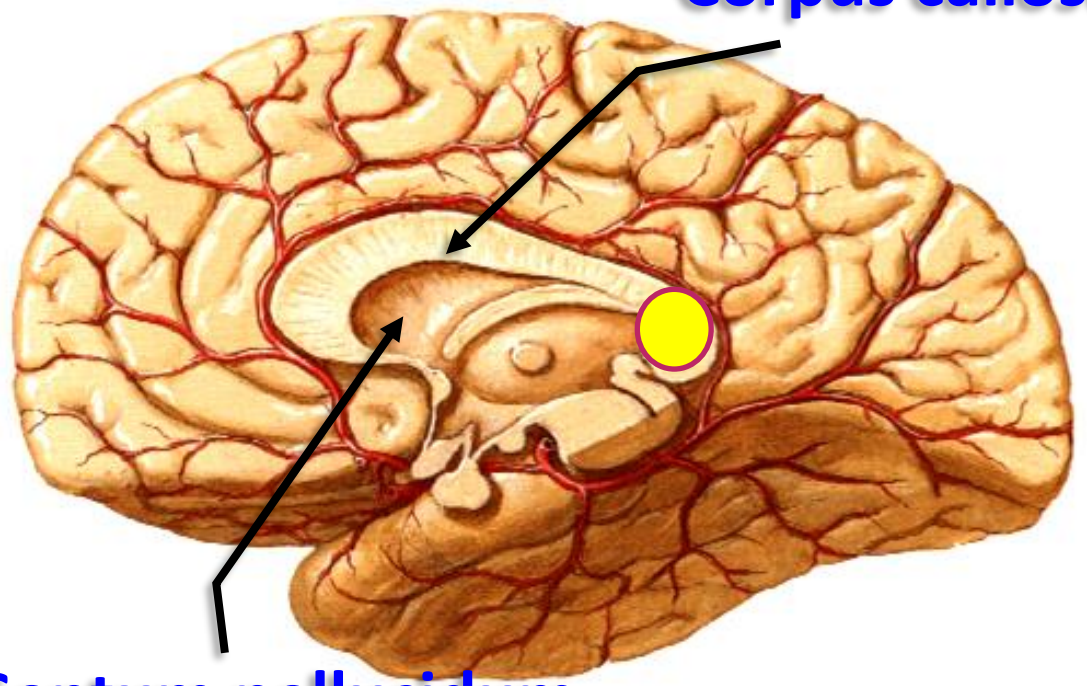


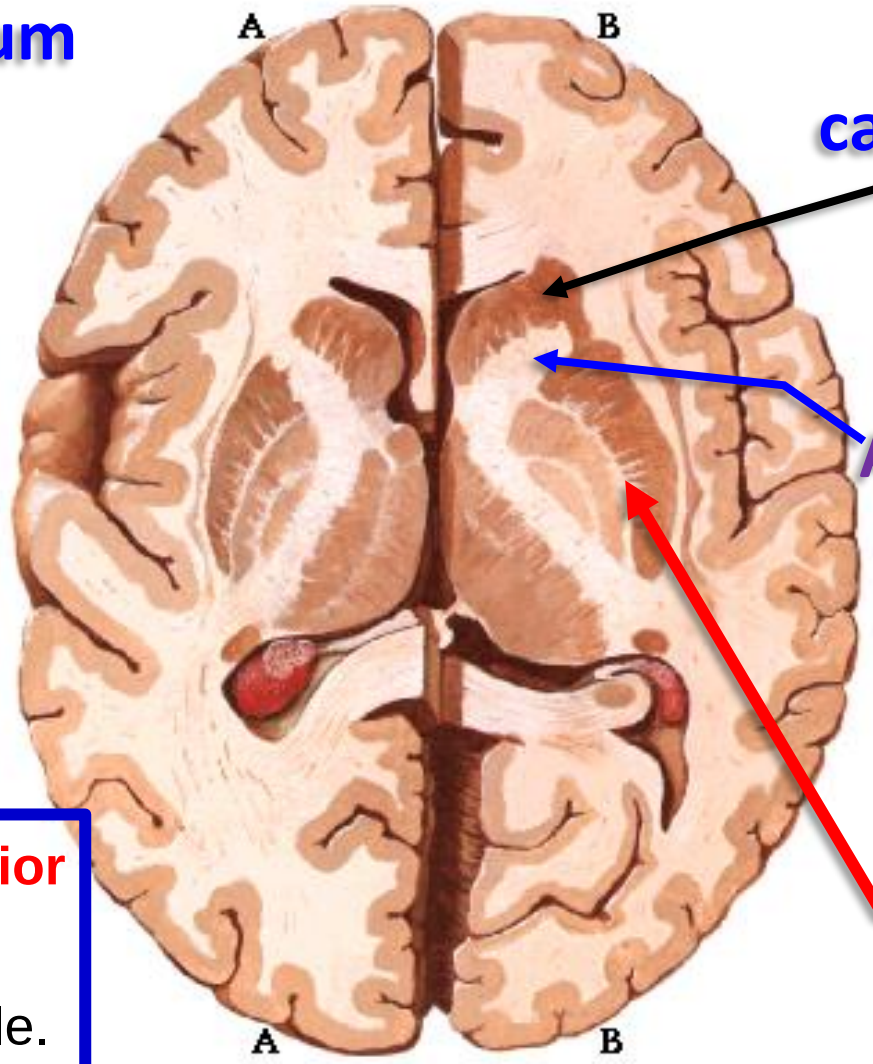
- **Cortical branches of anterior cerebral artery,**

a- Medial surface except the occipital lobe.

b- Upper one finger breadth of superolateral surface except the occipital lobe.

c- Medial part (1/3) of the orbital surface on the inferior surface.





Head of the caudate nucleus

Anterior limb of internal capsule

lentiform nucleus

- **Central branches; pass through the anterior perforated substance to supply**

1- Anterior part of anterior limb of internal capsule.

2- Head of caudate nucleus.

3- Lentiforrn nucleus.

4- Corpus callosum except splenium.

5- Septum pellucidum.

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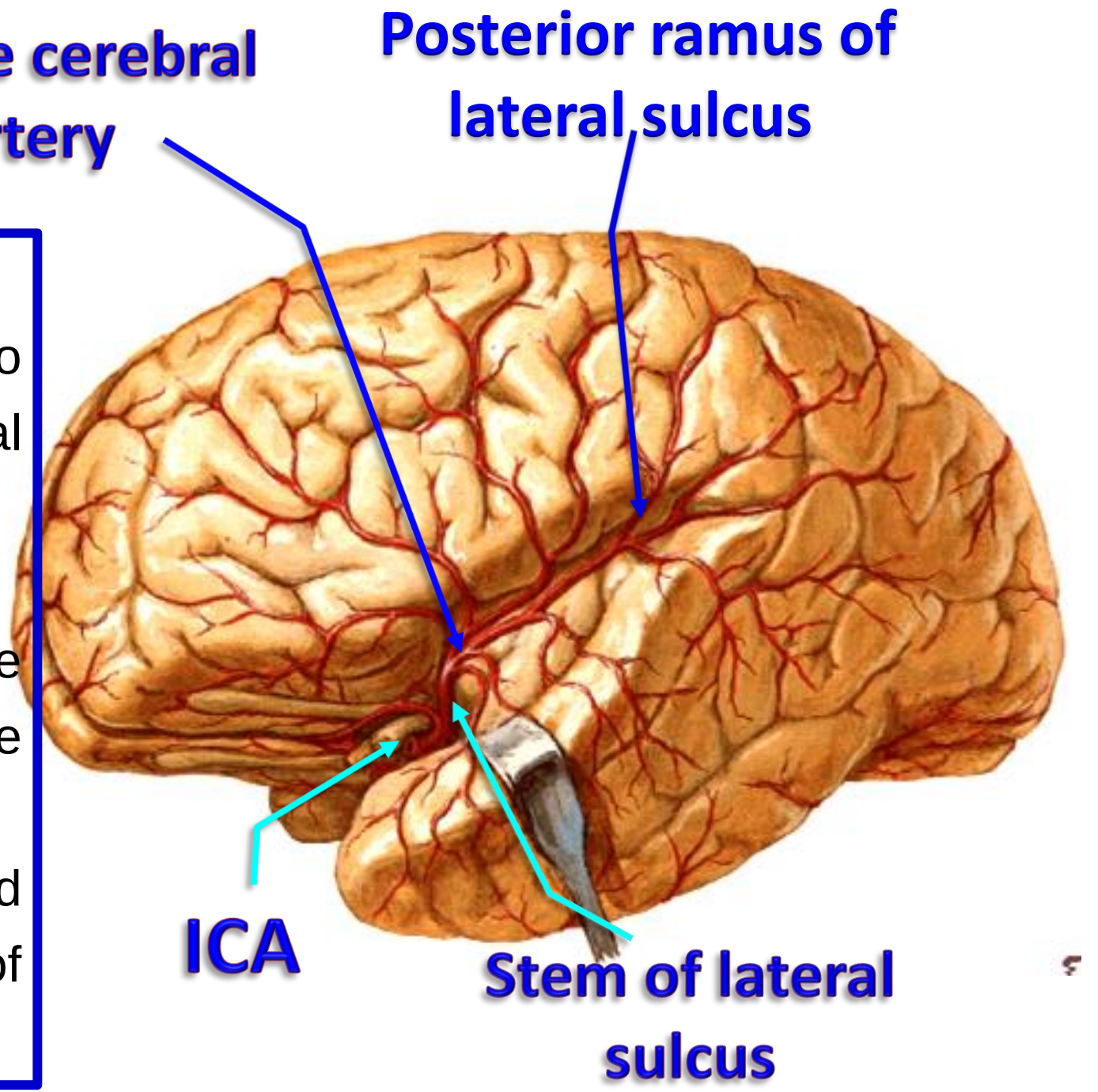
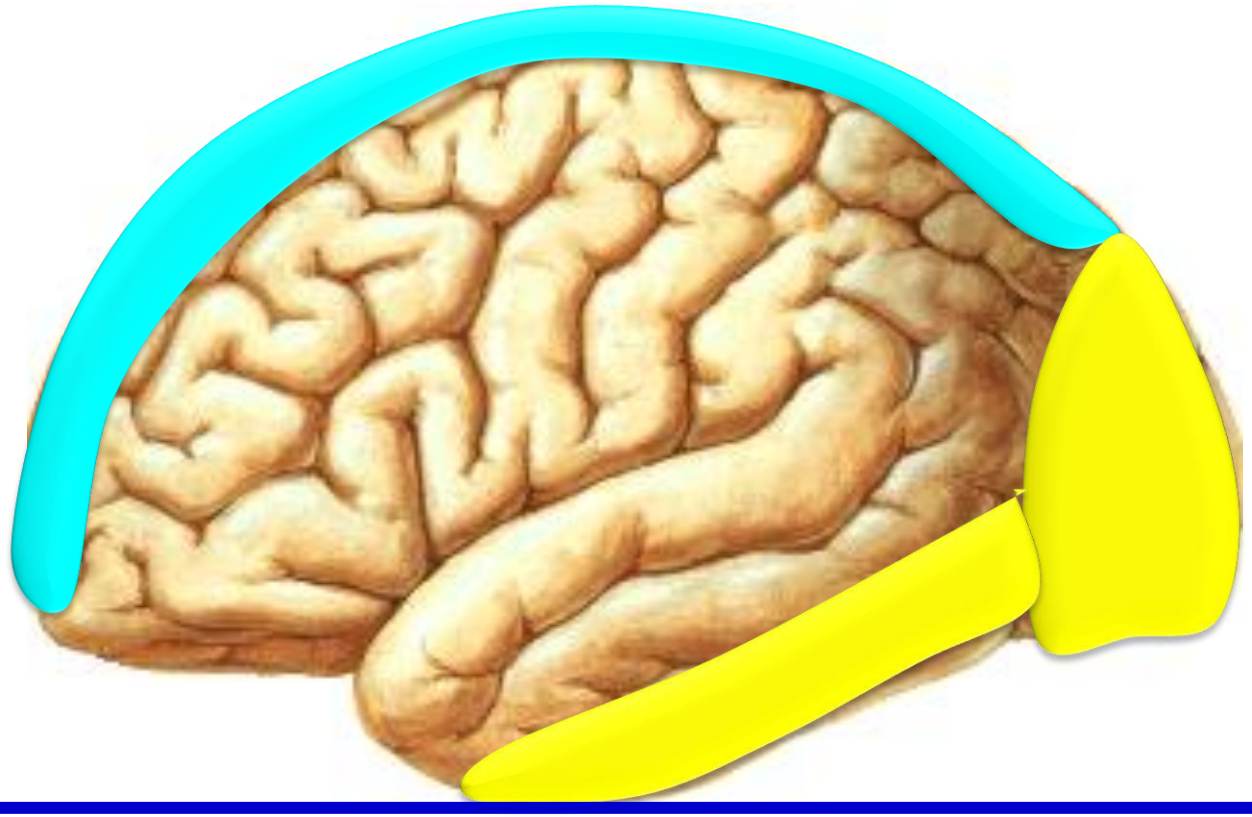
- **Middle Cerebral Artery**

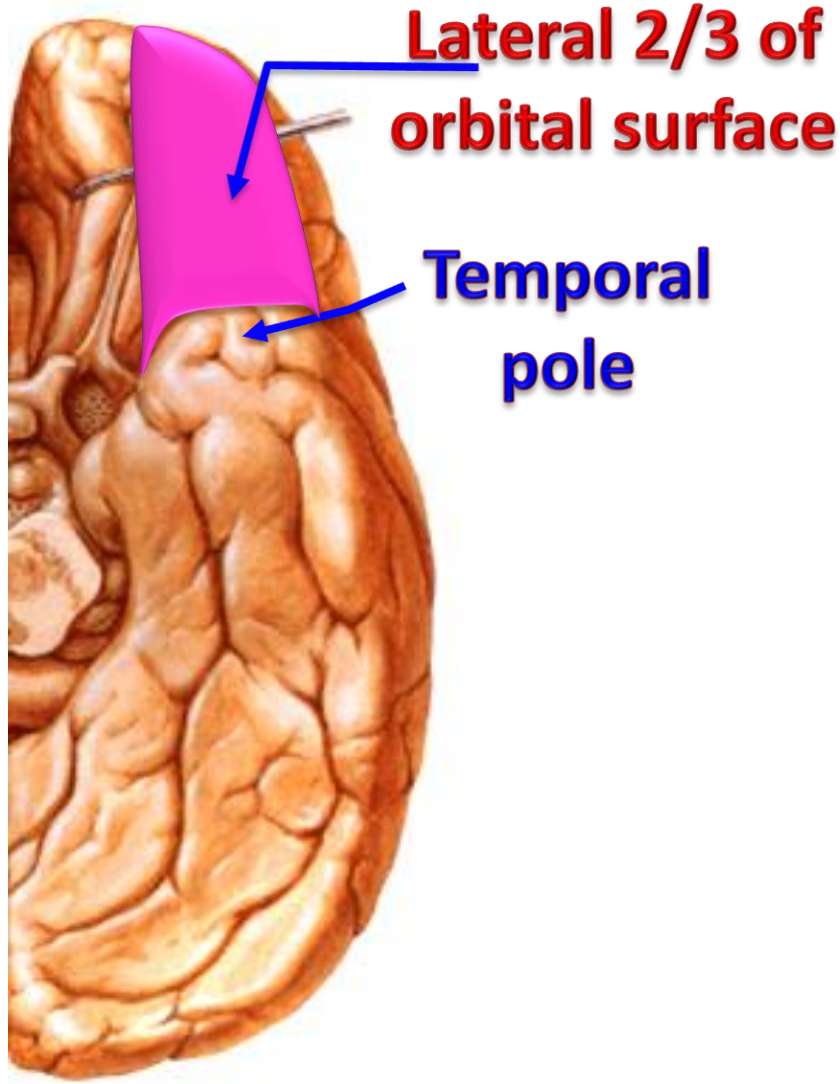
** **Origin**: is the larger of the two terminal branches of the internal carotid artery.

** **Course:**

- It passes laterally in steam of the **lateral sulcus** (opposite to the pterion).
- Then it turns upward and backward in the posterior ramus of the lateral sulcus.







- **Cortical branches of middle cerebral artery**

1- Superolateral surface including the insula **except**;

a- Upper one inch (by anterior cerebral artery).

b- Lower part (by posterior cerebral artery).

c- Occipital lobe {supplied by the posterior cerebral artery).

2- Lateral part (2/3) of the orbital surface of the **inferior surface**.

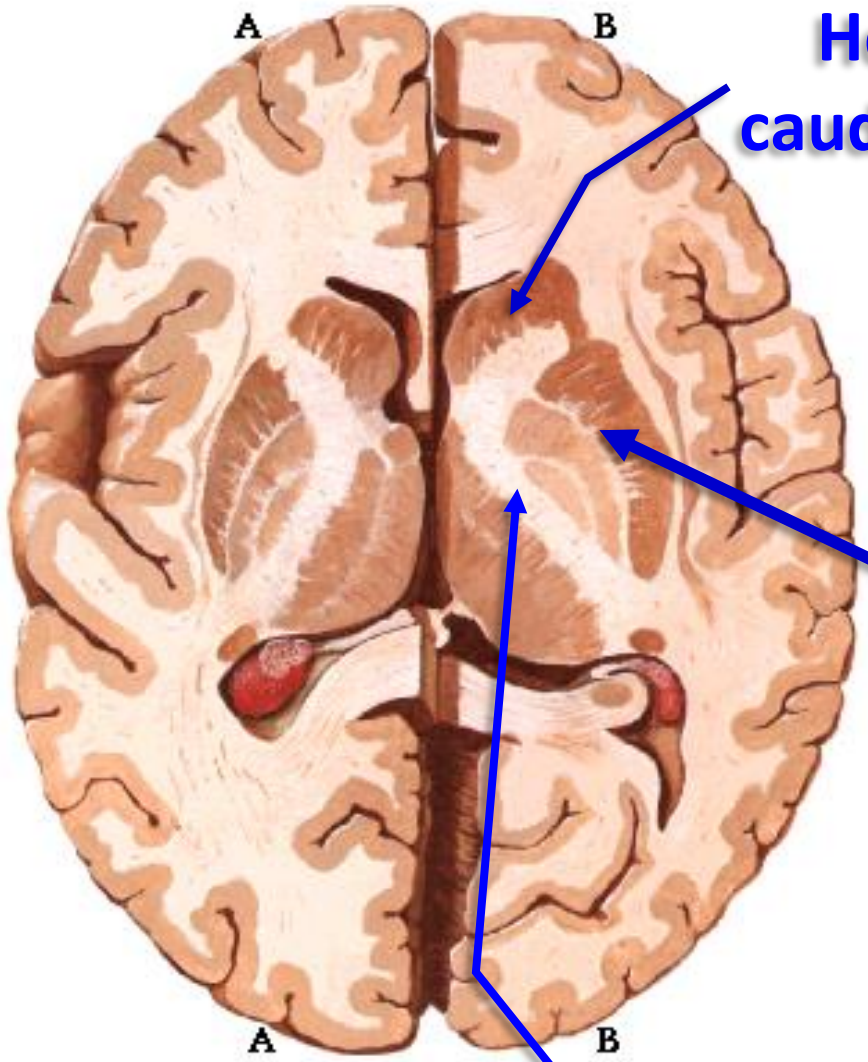
3- Temporal pole.

- **Central branches; pass through the anterior perforated substance**

1- Posterior part of the anterior limb, genu and posterior limb of the internal capsule.
2- Head of caudate nucleus.
3- Lentiform nucleus.

*** Middle cerebral artery supplies:**

1- Motor and sensory areas of opposite side of the body **except** lower limb and perineum by anterior cerebral artery.
2- Writing center in middle frontal gyrus.
3- Motor speech area in inferior frontal gyrus.
4- Auditory area in superior temporal gyrus.
5- Most of the internal capsule.



Head of the caudate nucleus

lentiform nucleus

Internal capsule

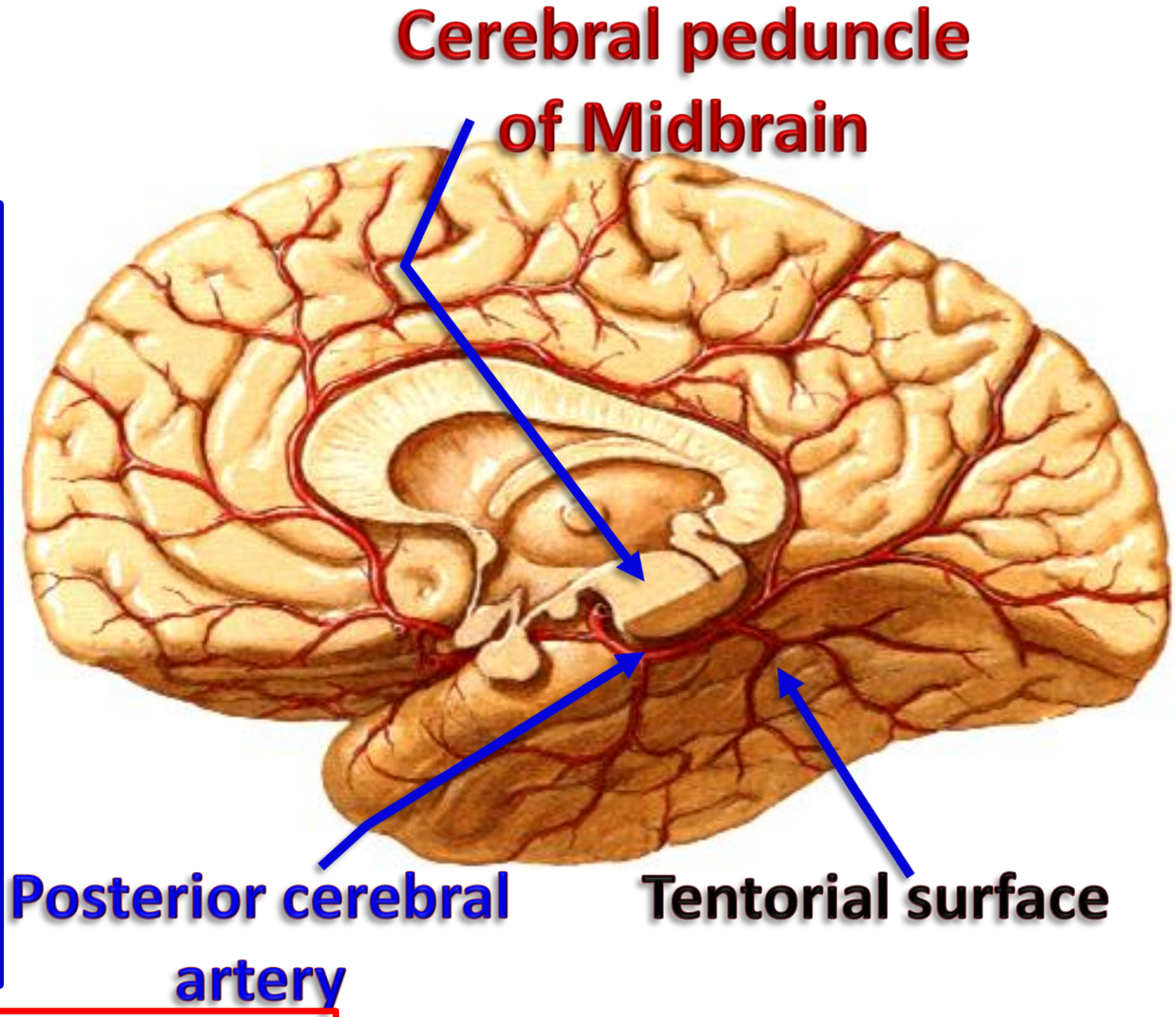
- **Posterior Cerebral Artery**

** **Origin:** one of the two terminal branches of the basilar artery.

** **Course;**

- It winds round the cerebral peduncle to reach the **tentorial surface** of the cerebral hemisphere.

- It runs backward to reach the occipital pole.



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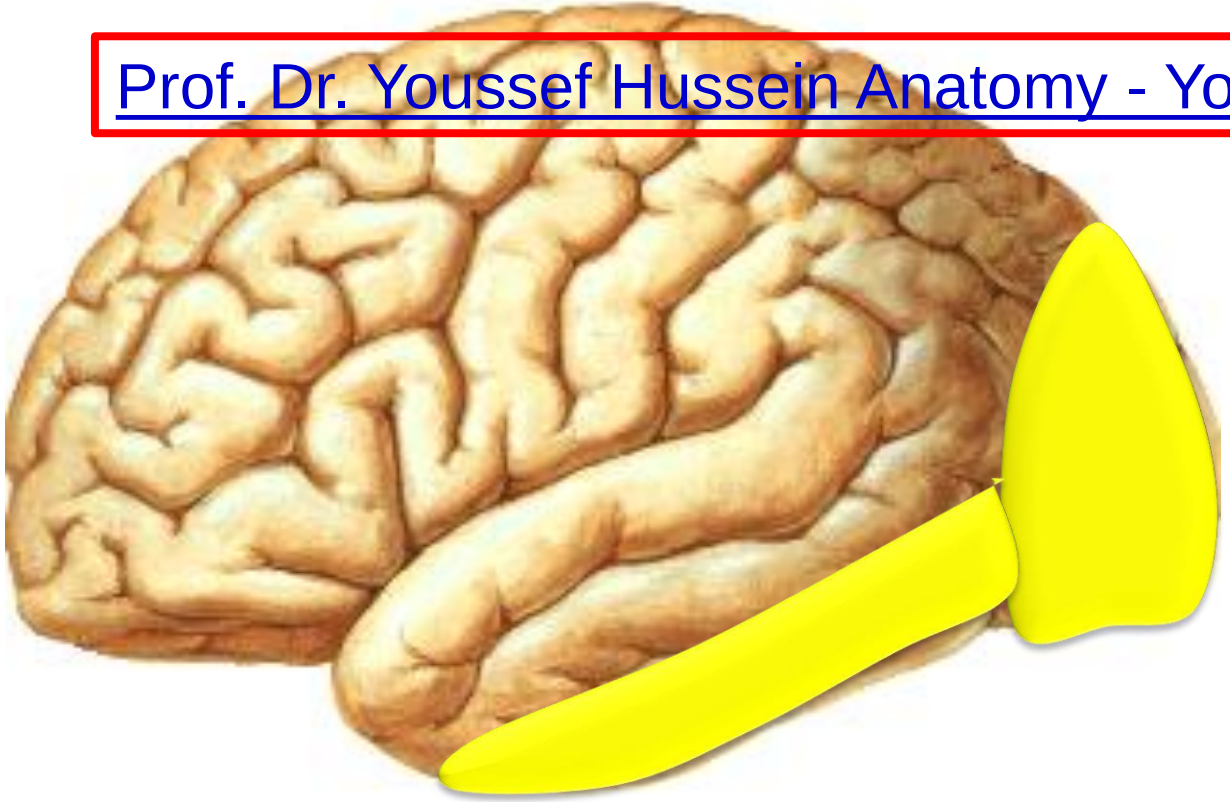
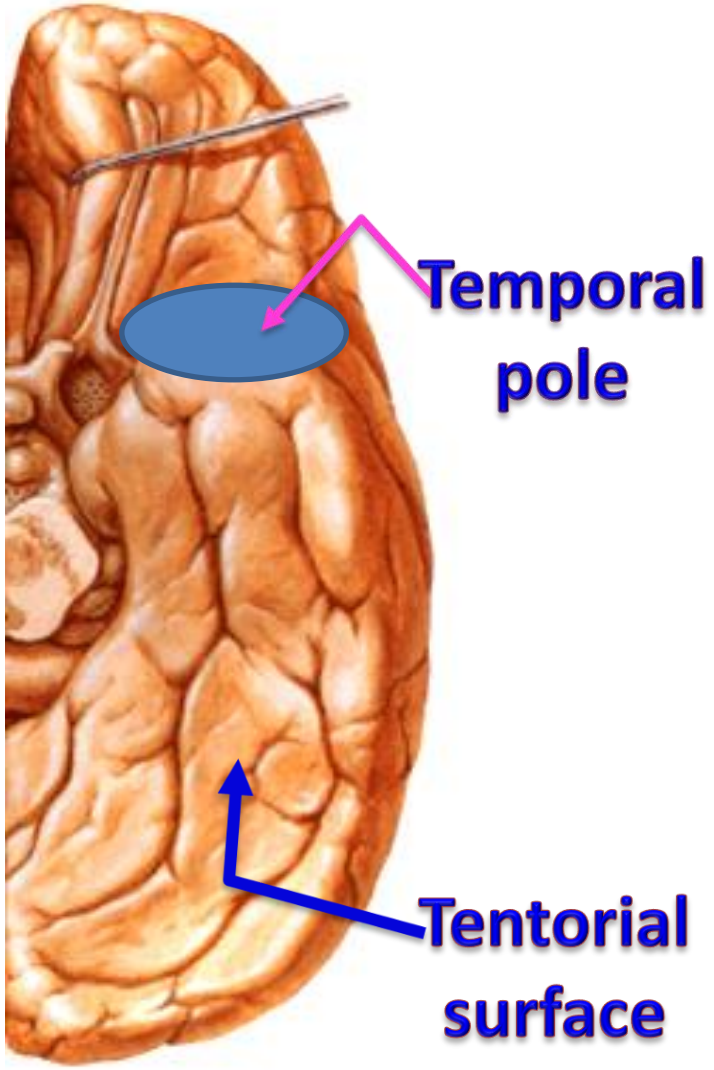




- **Cortical branches of Posterior cerebral artery**

1- All surfaces of the occipital lobe (**visual center**)

2- One finger breadth on the superolateral surface along the inferior border.

3- **Tentorial surface** of the cerebral hemisphere **except** temporal pole.

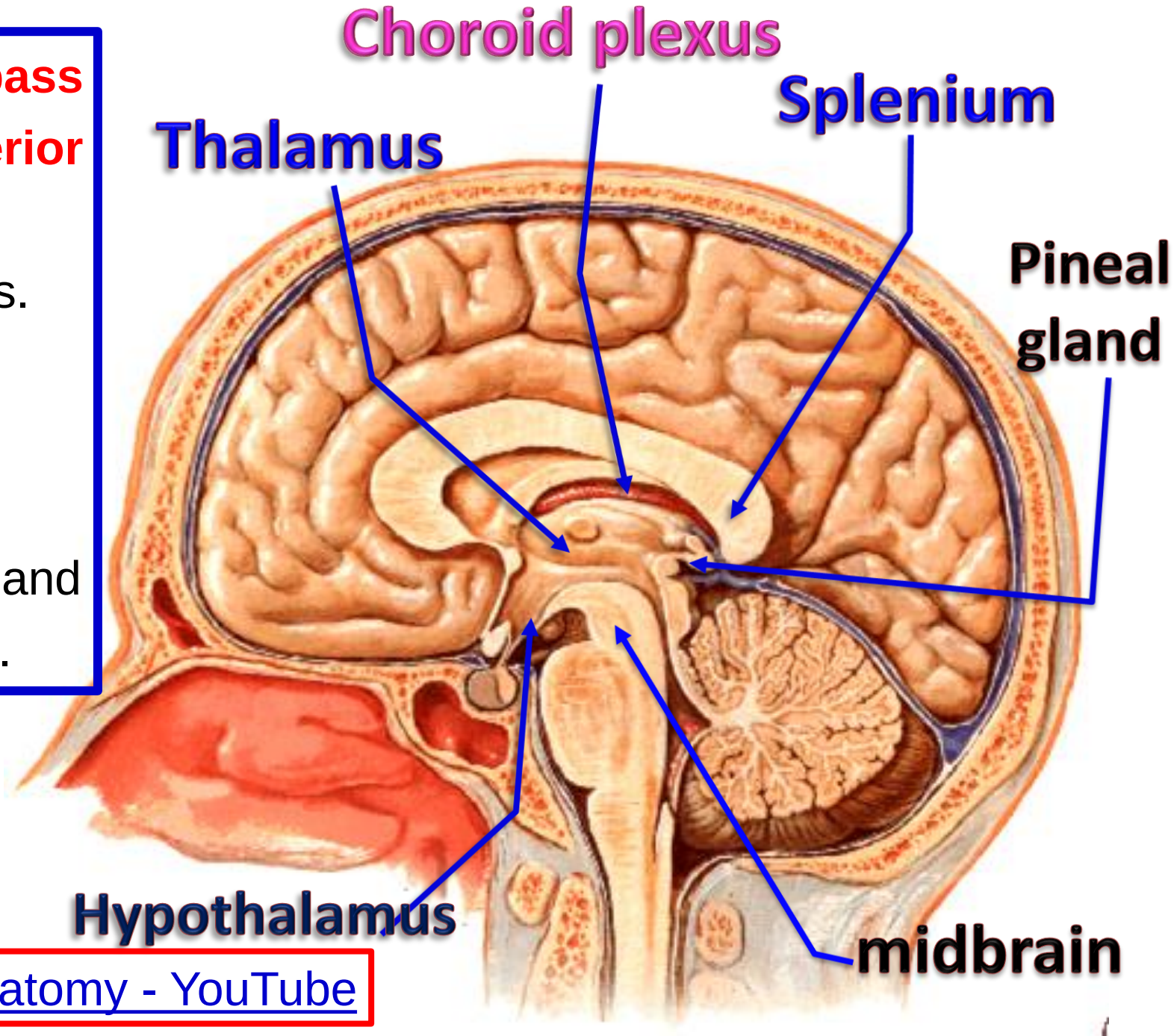
- **Central branches; pass through the posterior perforated substance**

a) Thalamus and hypothalamus.

b) Midbrain and Pineal body.

c) Splenium of the corpus callosium.

d) Choroid plexuses of the 3rd and central part of lateral ventricles.



- **Anterior cerebral artery stroke**

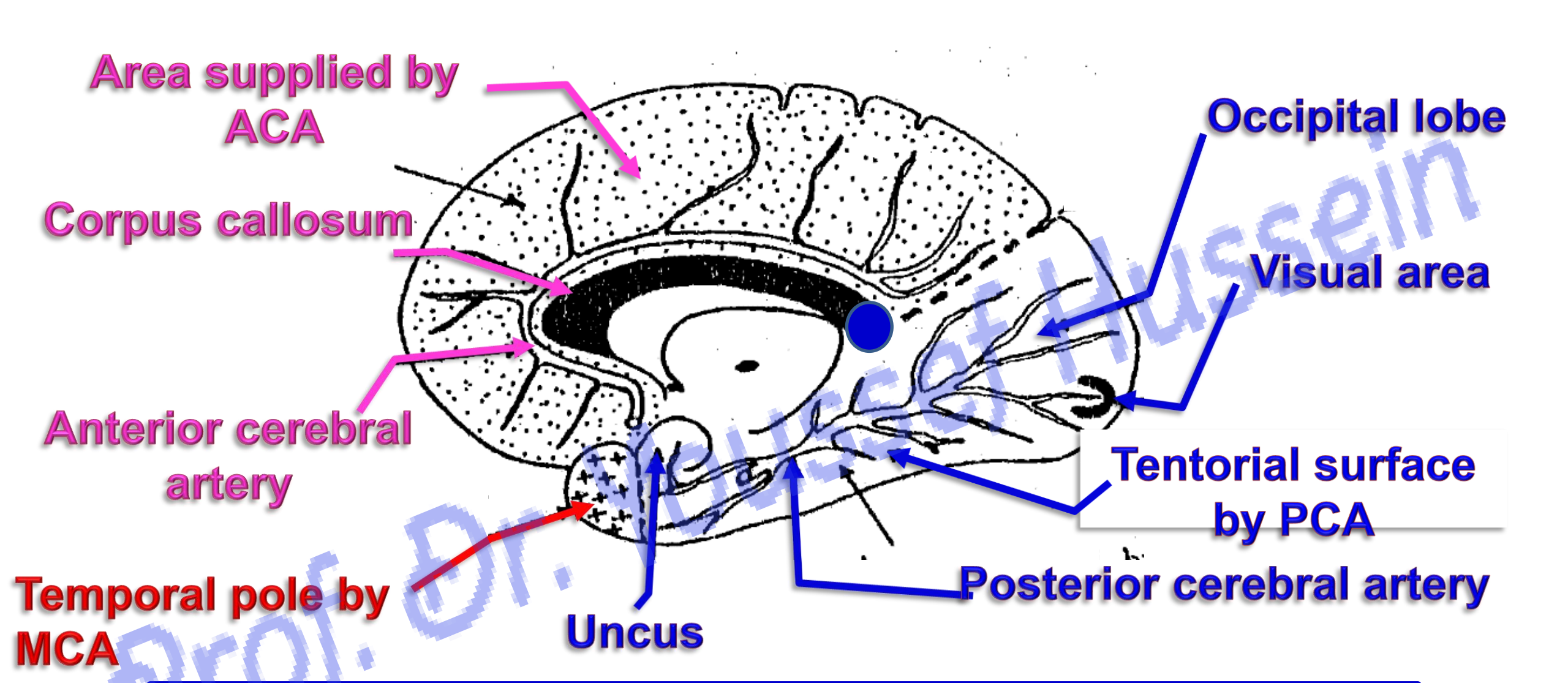
- **Motor and sensory cortices (lower limb) -----Contralateral paralysis and sensory loss of lower limb, urinary incontinence.**

- **Middle cerebral artery**

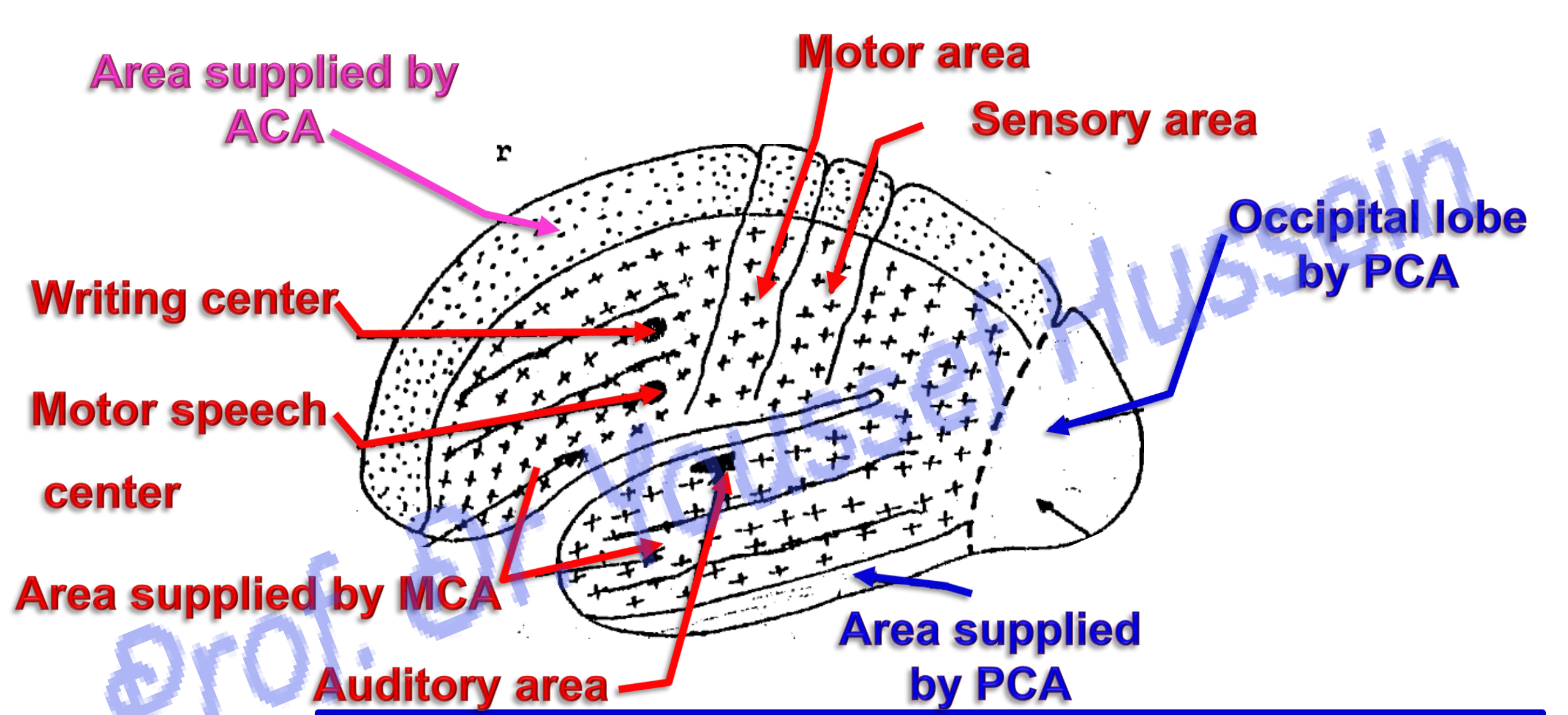
- **Motor and sensory cortices (upper limb and face)----- Contralateral paralysis and sensory loss of lower face and upper limb.,**
- **Temporal lobe (Wernicke area); frontal lobe (Broca area).**
  - **Aphasia if in dominant (usually left) hemisphere.**
  - **Neglect if lesion affects nondominant (usually right) hemisphere.**
- **Wernicke aphasia is associated with contralateral superior quadrant visual field defect (quadrant anopsia) due to temporal lobe involvement. The middle cerebral artery also supplies the proximal parts of the visual radiations as they emerge from the lateral geniculate nucleus. These fibers course into the temporal lobe before looping posteriorly to rejoin the rest of the visual radiation fibers.**

- **Posterior cerebral artery**

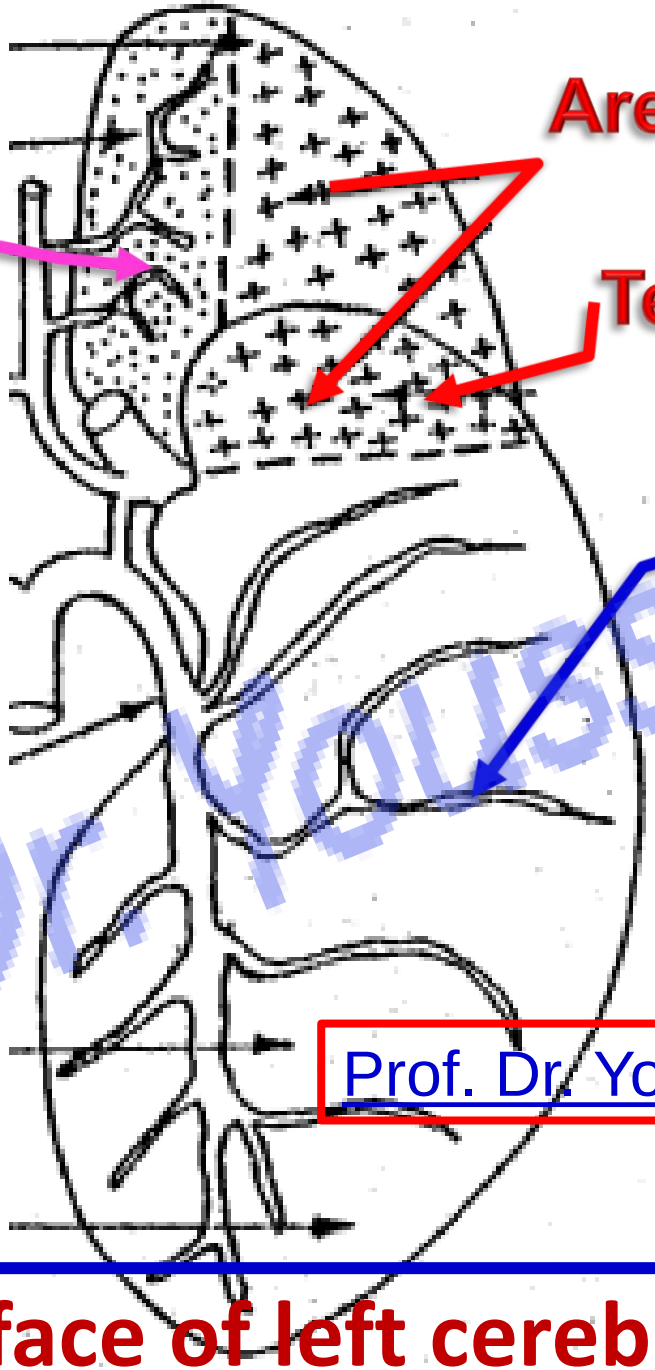
- **Occipital lobe. ----- Contralateral hemianopia with macular sparing;**
- **Alexia without agraphia unable to read at all, However, they are able to write (pure word blindness) (dominant hemisphere, extending to splenium of corpus callosum);**
- **Prosopagnosia (nondominant hemisphere, face blindness unable to recognize faces, despite having healthy vision).**



Medial surface of right cerebral hemisphere



Superolateral surface of left cerebral hemisphere



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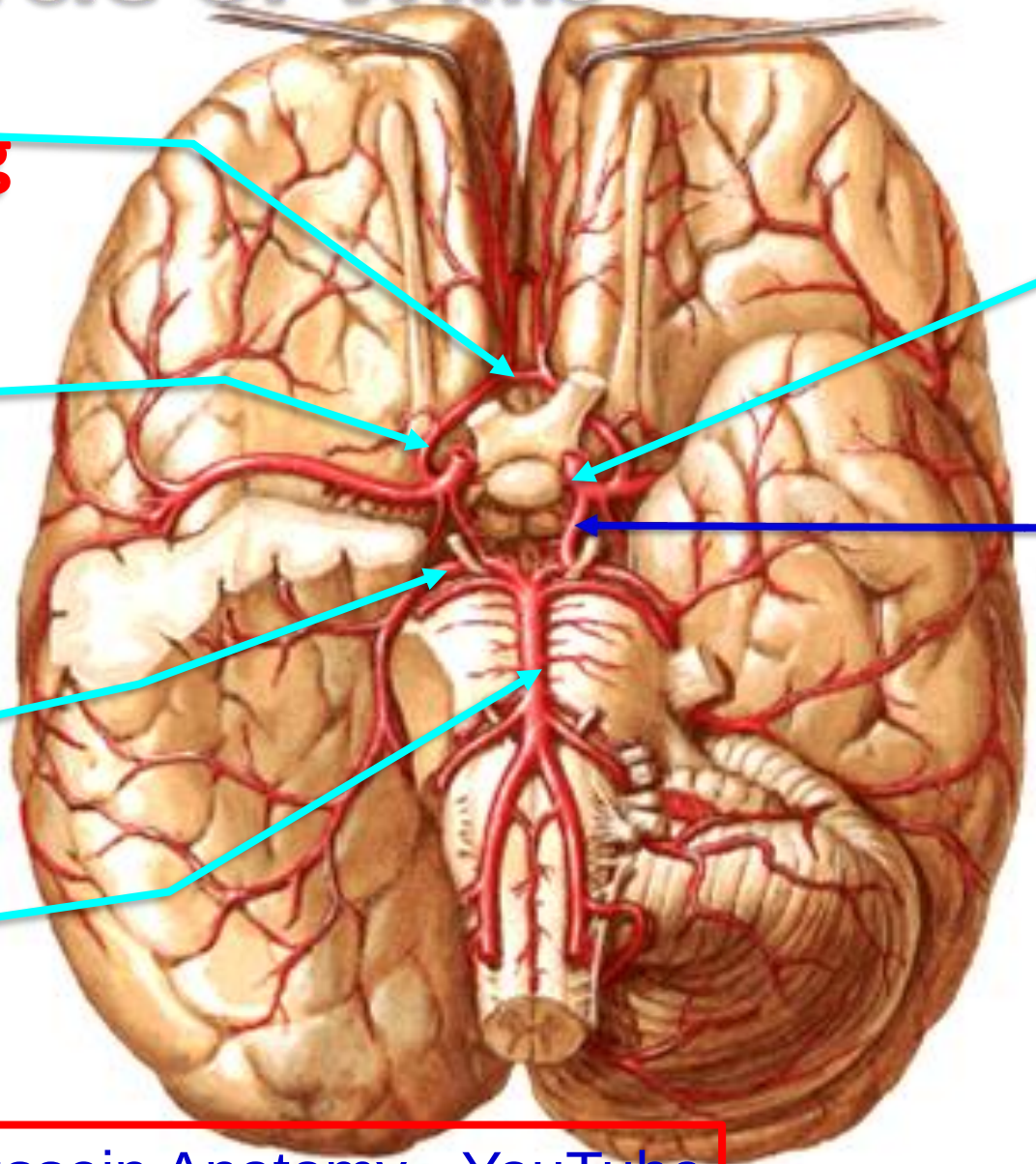
Inferior surface of left cerebral hemisphere

Circle of Willis

Circle of Willis



Ant. communicating Artery

Ant. cerebral Artery

Post. cerebral Artery

Basilar Artery

Int carotid Artery

Post. Communicating artery

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• Circle of Willis

- **Site**; it is situated in interpeduncular fossa at the base of the brain.
- **Formation**; anastomosis between carotid systems and vertebral system.

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- The arteries sharing in the circle are;

1 - Two internal carotid arteries.

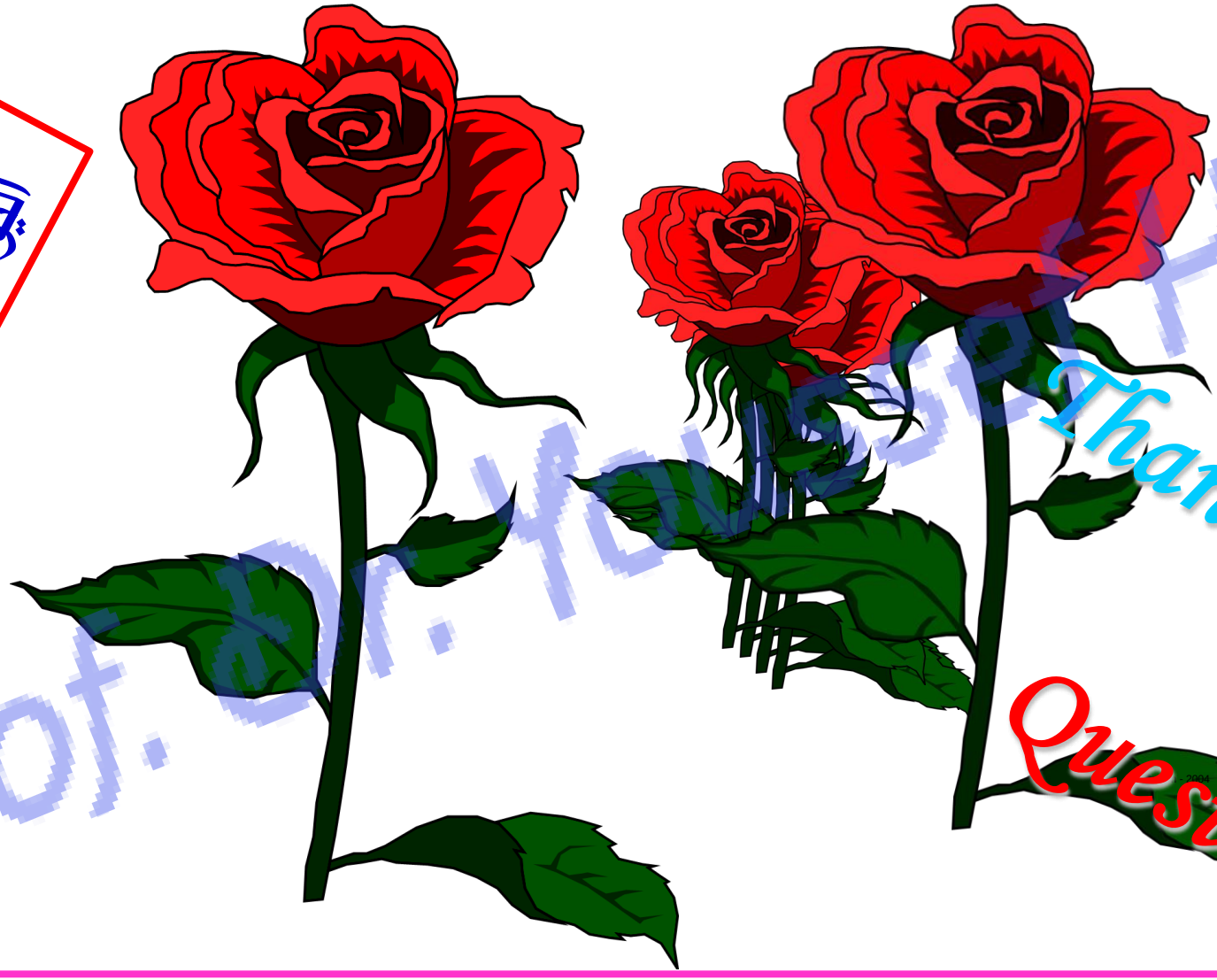
2- Two anterior cerebral arteries from internal carotid artery.

3- One anterior communicating artery; between 2 anterior cerebral arteries.

4- Two posterior cerebral arteries terminal branches of basilar artery.

5- Two Posterior communicating arteries from internal carotid artery to the posterior cerebral artery of the same side.

https://www.youtube.com/channel/UCVSNqbibj9UWYaJdd_cn0PQ



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