Cerebral Hemispheres & Functional Cortical Areas 1

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Intended Learning Outcomes

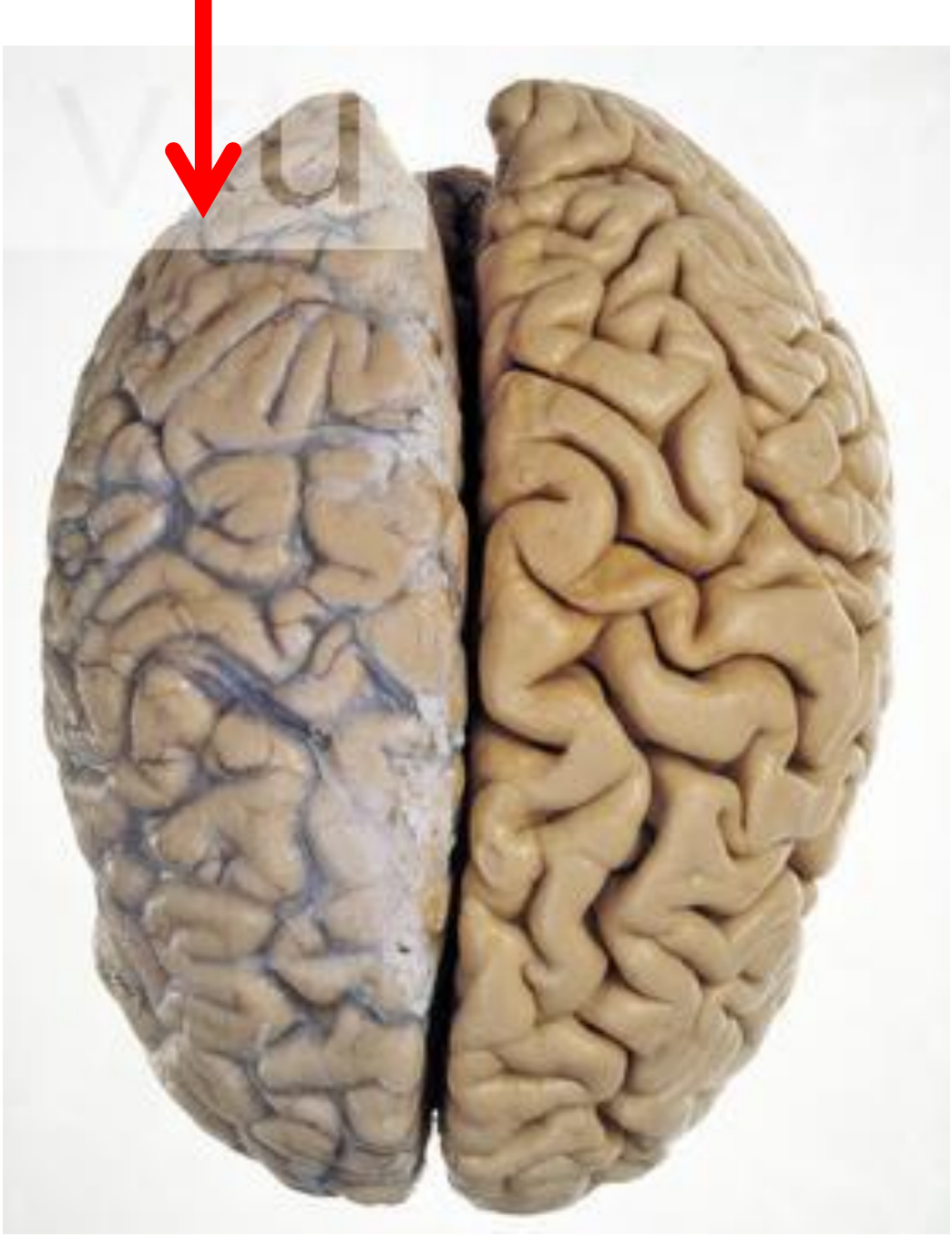
By the end of this lecture , the student will be able to:

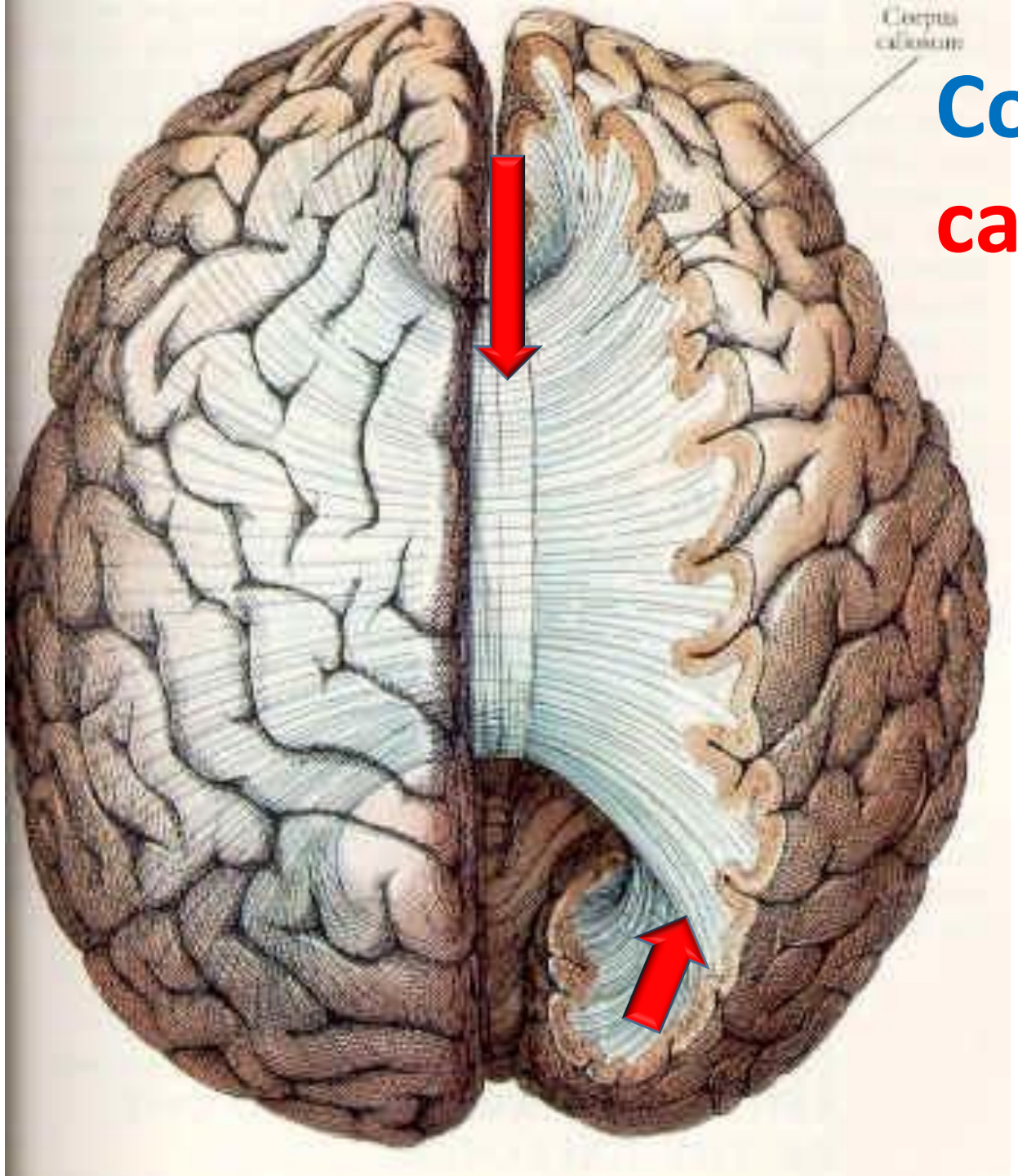
1. **Name major sulci, gyri & lobes of cerebral hemispheres.**
2. **Locate the main cortical functional areas**
3. **Predict effect of lesion in any of these areas**
4. **Define cerebral assymmetry & cerebral dominance.**

The cerebral hemispheres

Longitudinal fissure

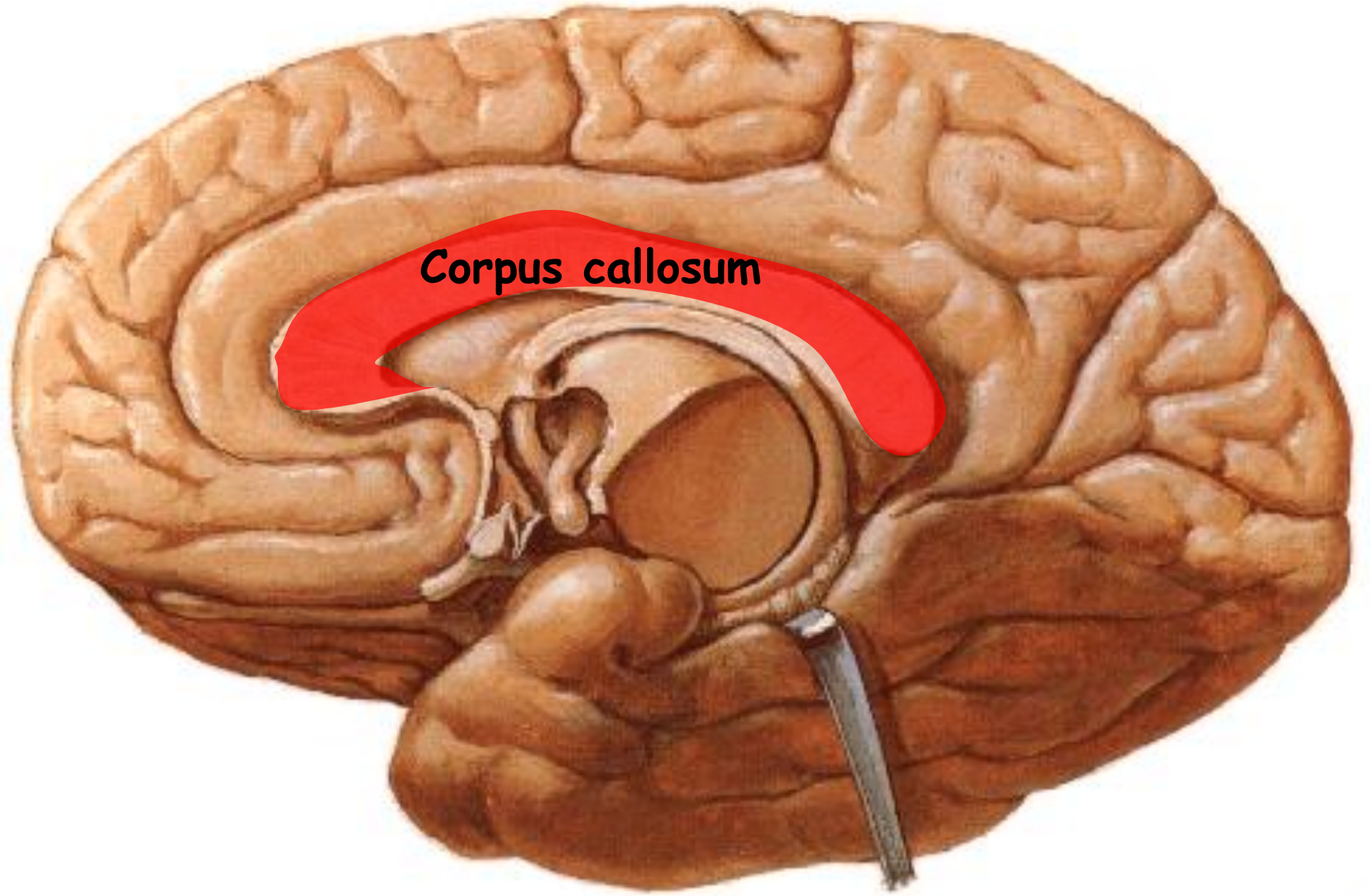
Right & left cerebral hemispheres

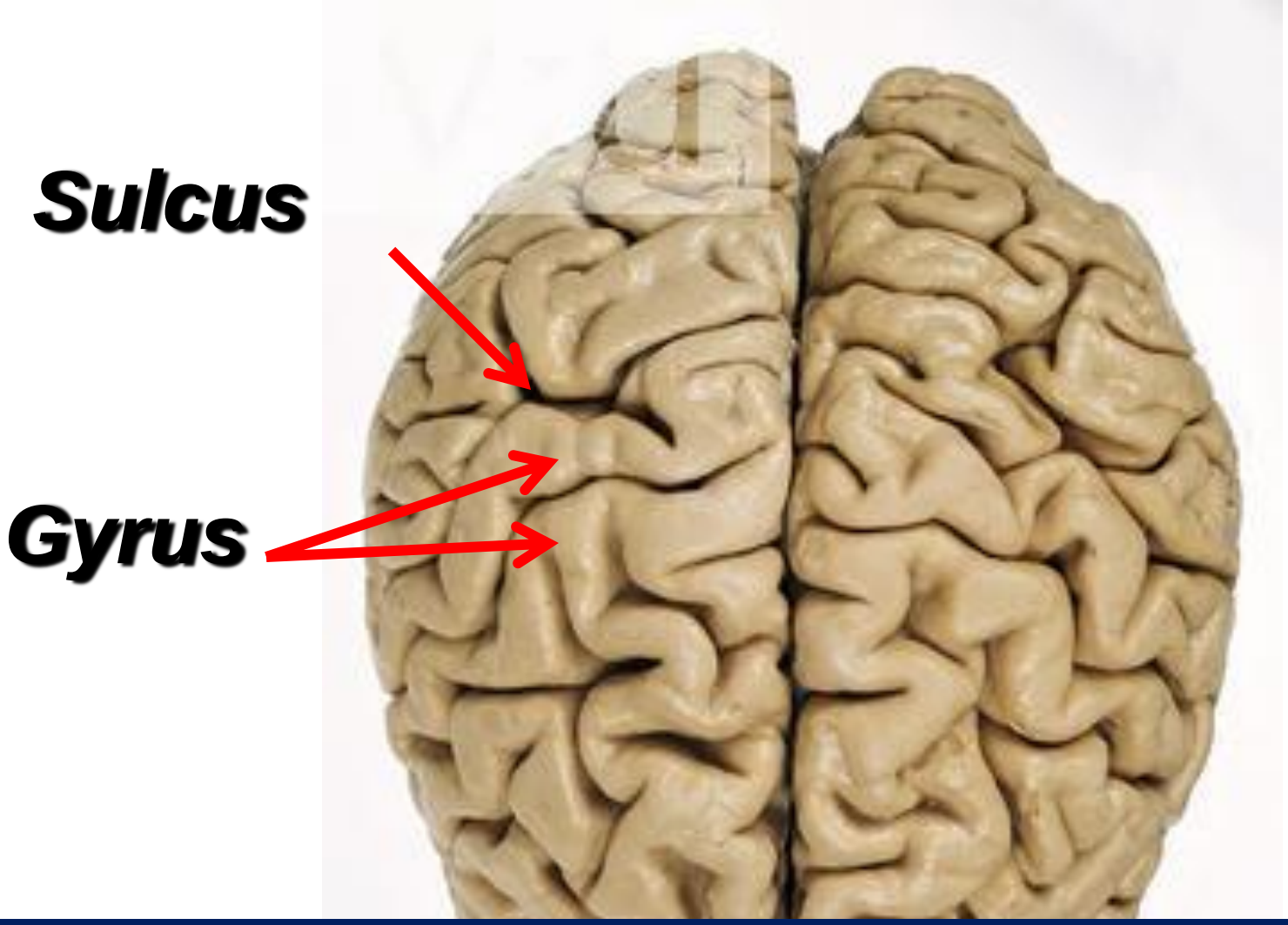




Corpus callosum

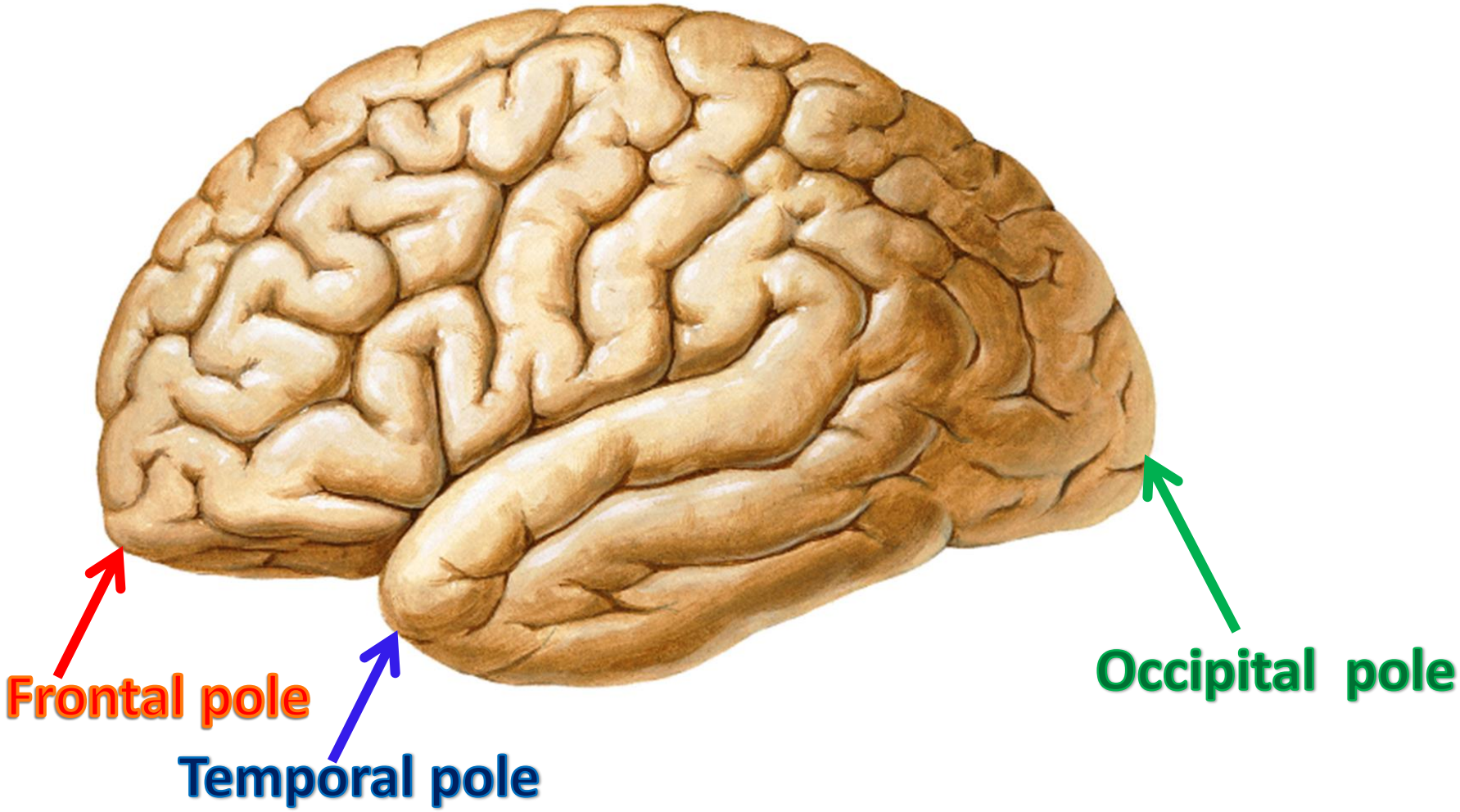
Commissural fibers which connect the right & left hemispheres


Corpus callosum



Surface of cerebral hemisphere is composed of grey matter (cerebral cortex) that is thrown into grooves “Sulci” separated by folds “Gyri” to increase the surface area of the brain.

Each cerebral hemisphere has 3 poles



Each cerebral hemisphere has 3 surfaces

Lateral surface

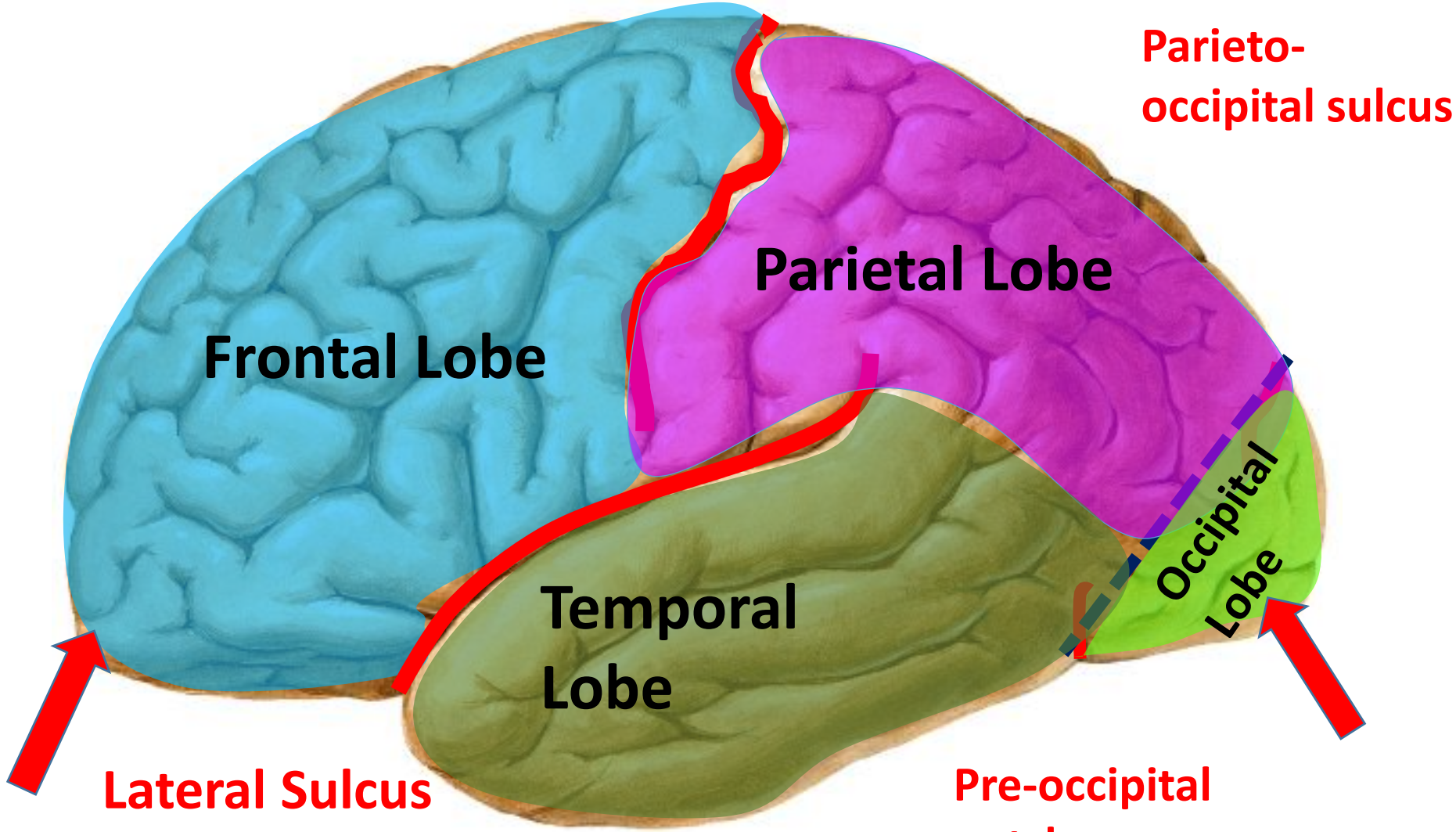
Inferior surface

Medial surface

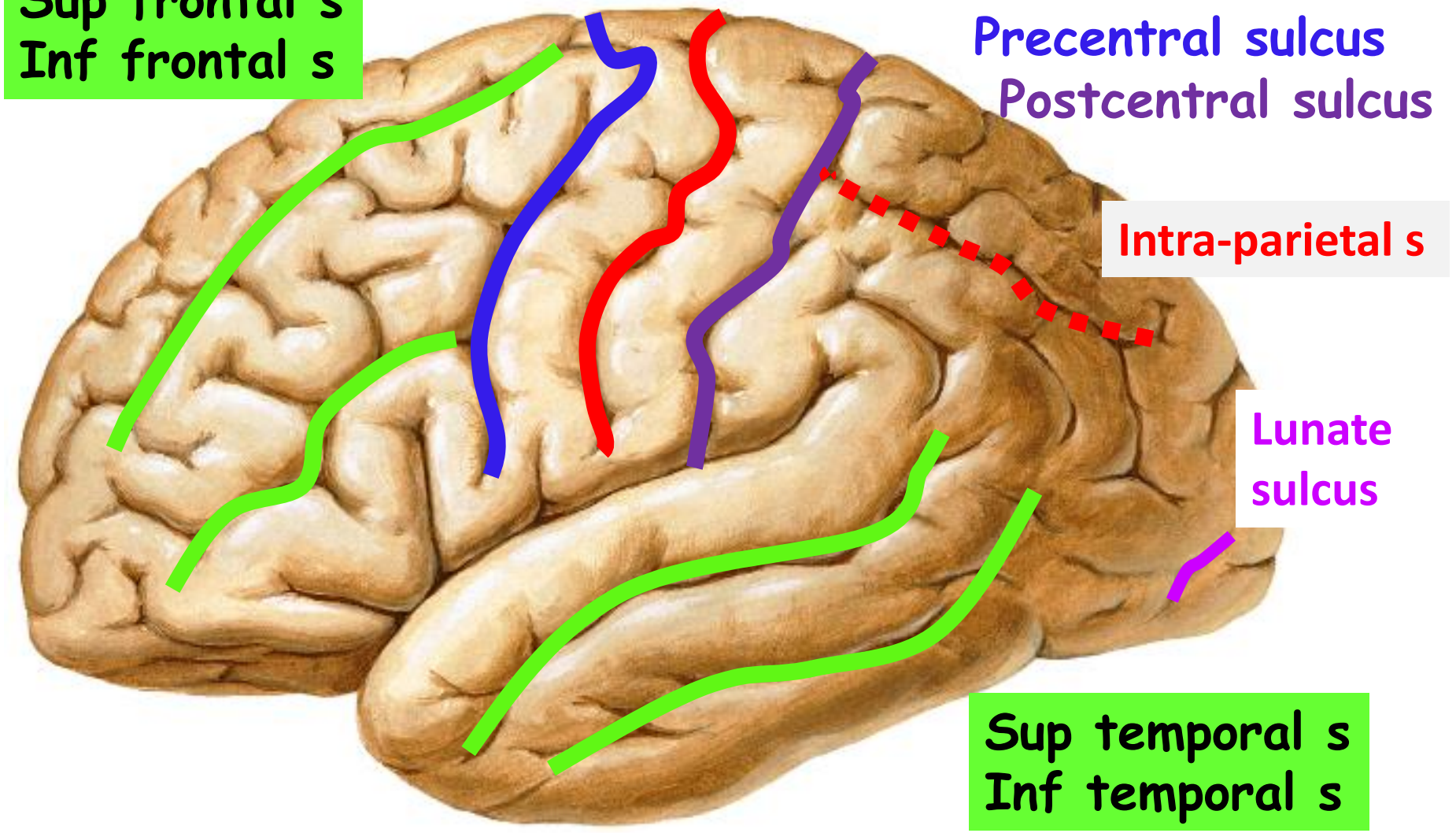
Main sulci that help divide the hemisphere into lobes

Central sulcus

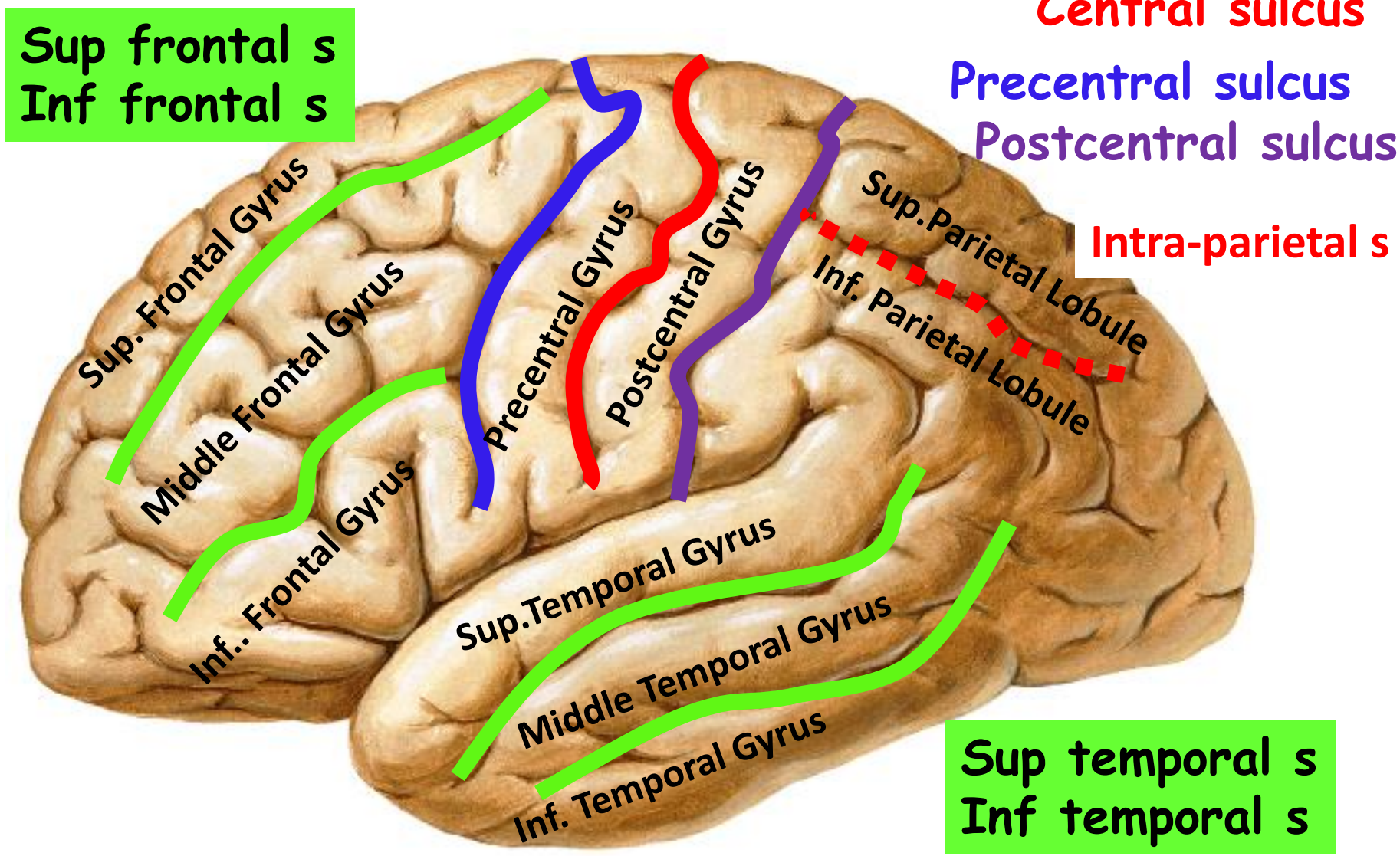
One cm. behind midpoint between frontal & occipital poles



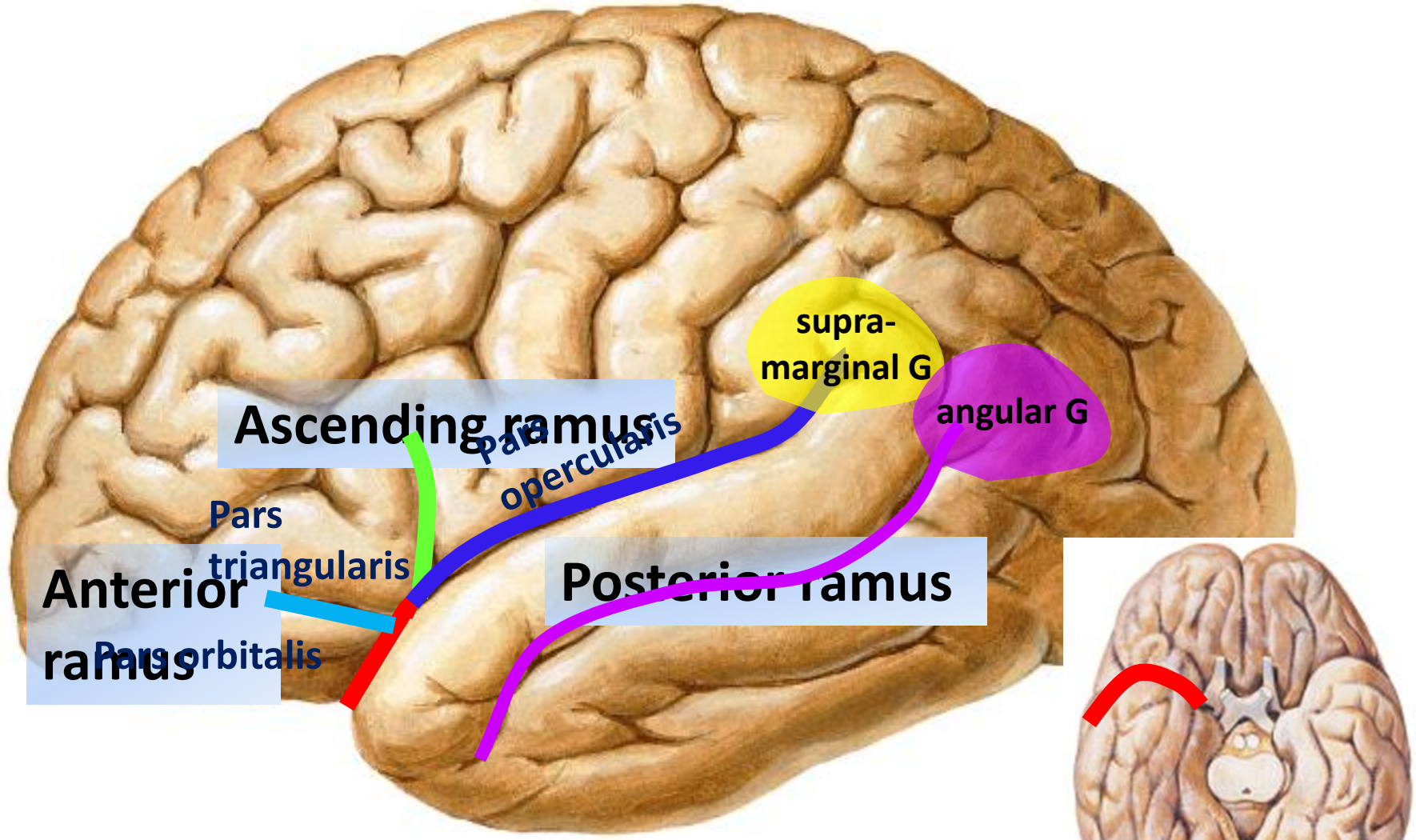
Other sulci on lateral surface of cerebral hemisphere



Gyri on lateral surface of cerebral hemisphere



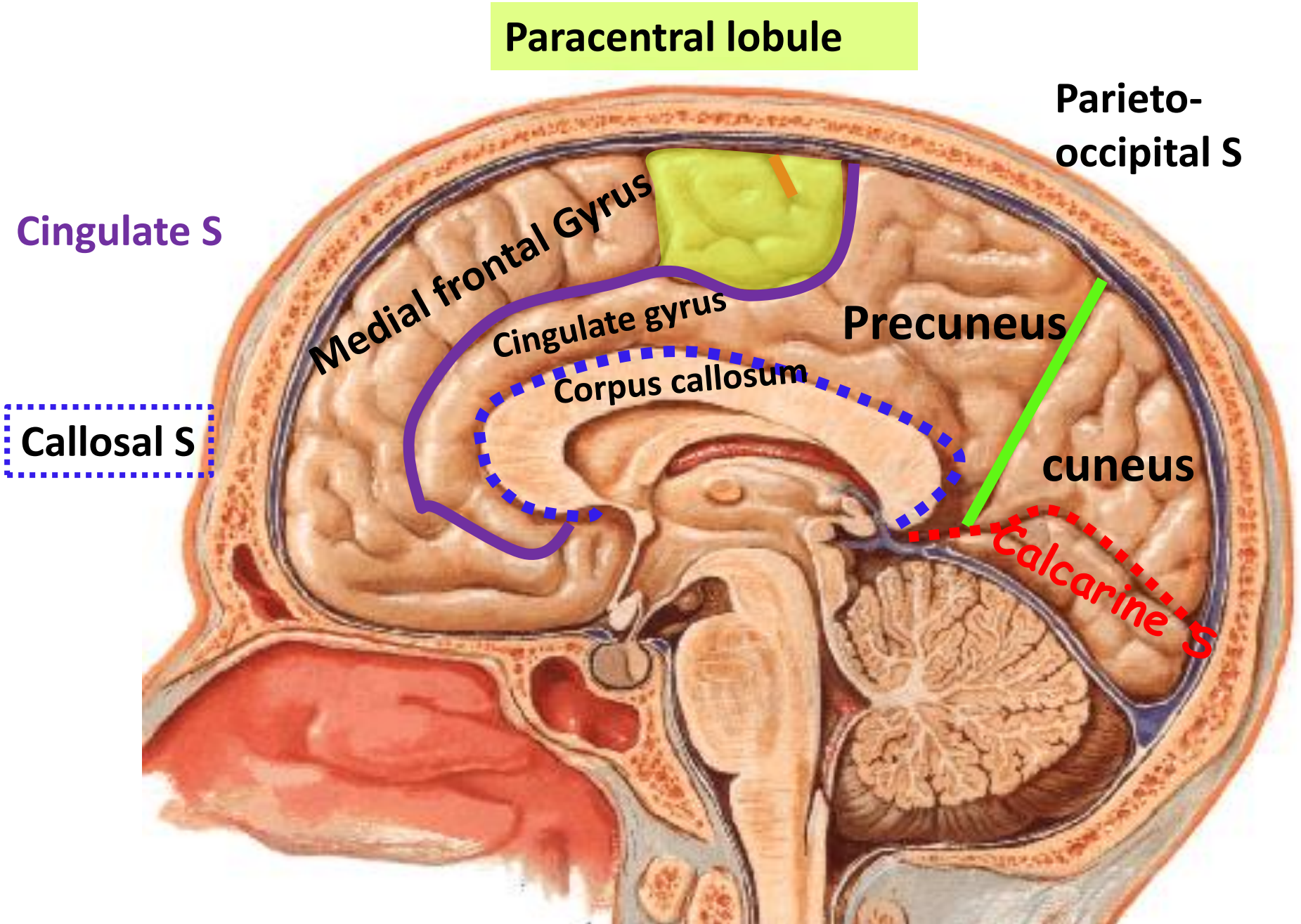
Lateral sulcus

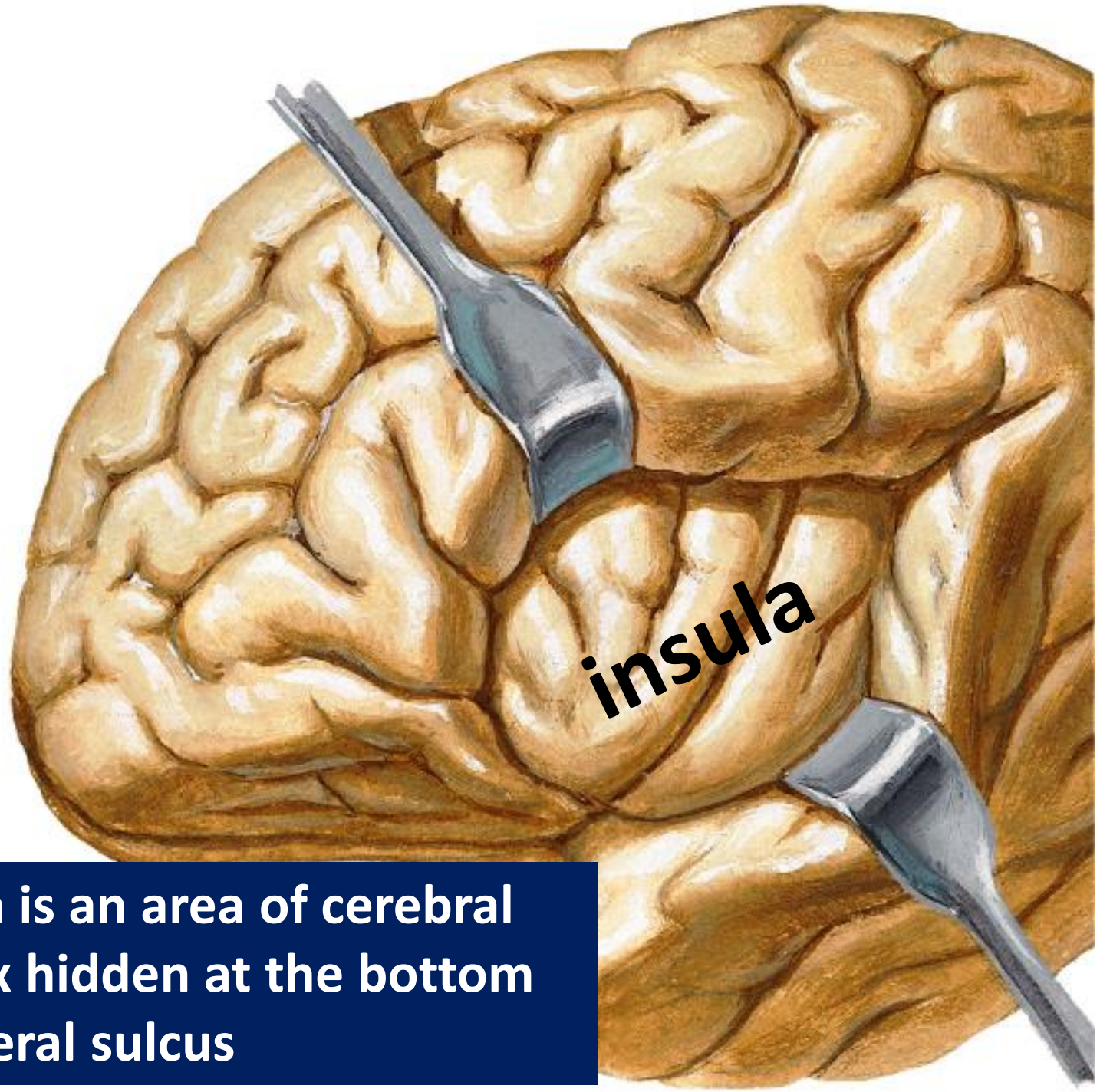


Stem + 3 rami

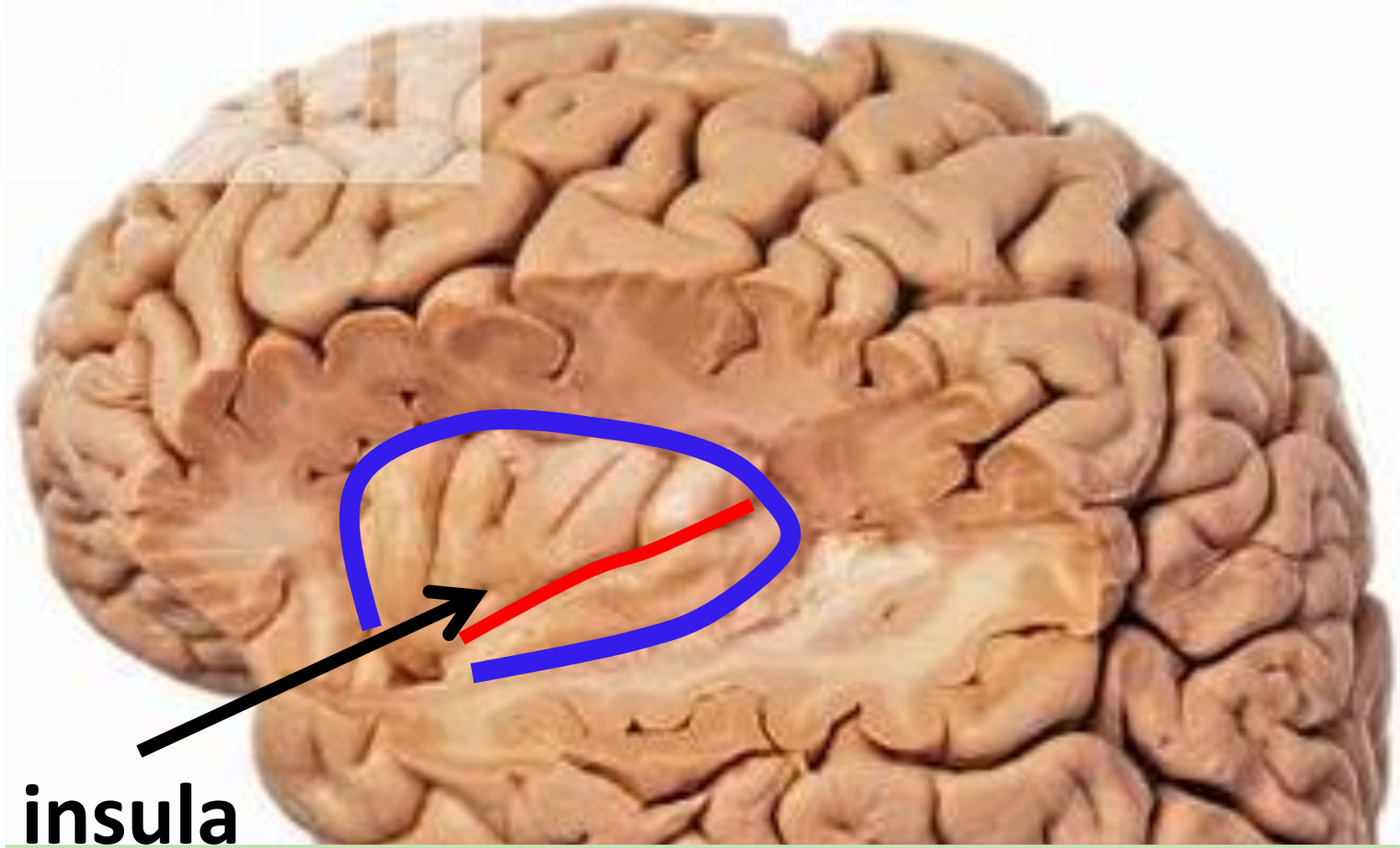
Stem

Sulci & gyri on medial surface of cerebral hemisphere





Insula is an area of cerebral cortex hidden at the bottom of lateral sulcus



Function of insula:

1) Ant. Part ➔Smell, taste & visceral sensation (autonomic)

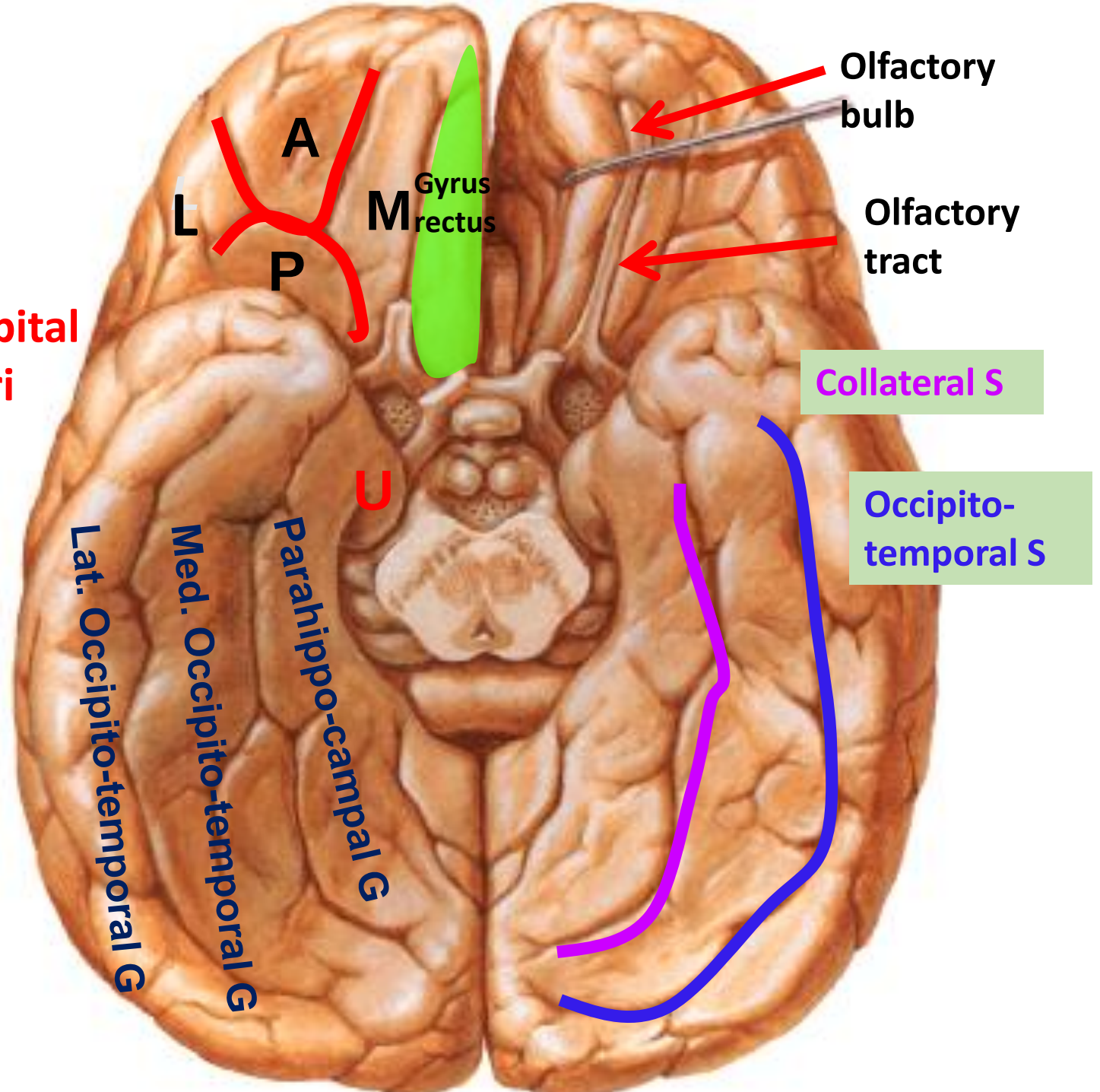
2) Post. Part ➔ 2nd somatosensory area

H- shaped orbital sulci

A → anterior
P → posterior
M → medial
L → lateral

Orbital gyri

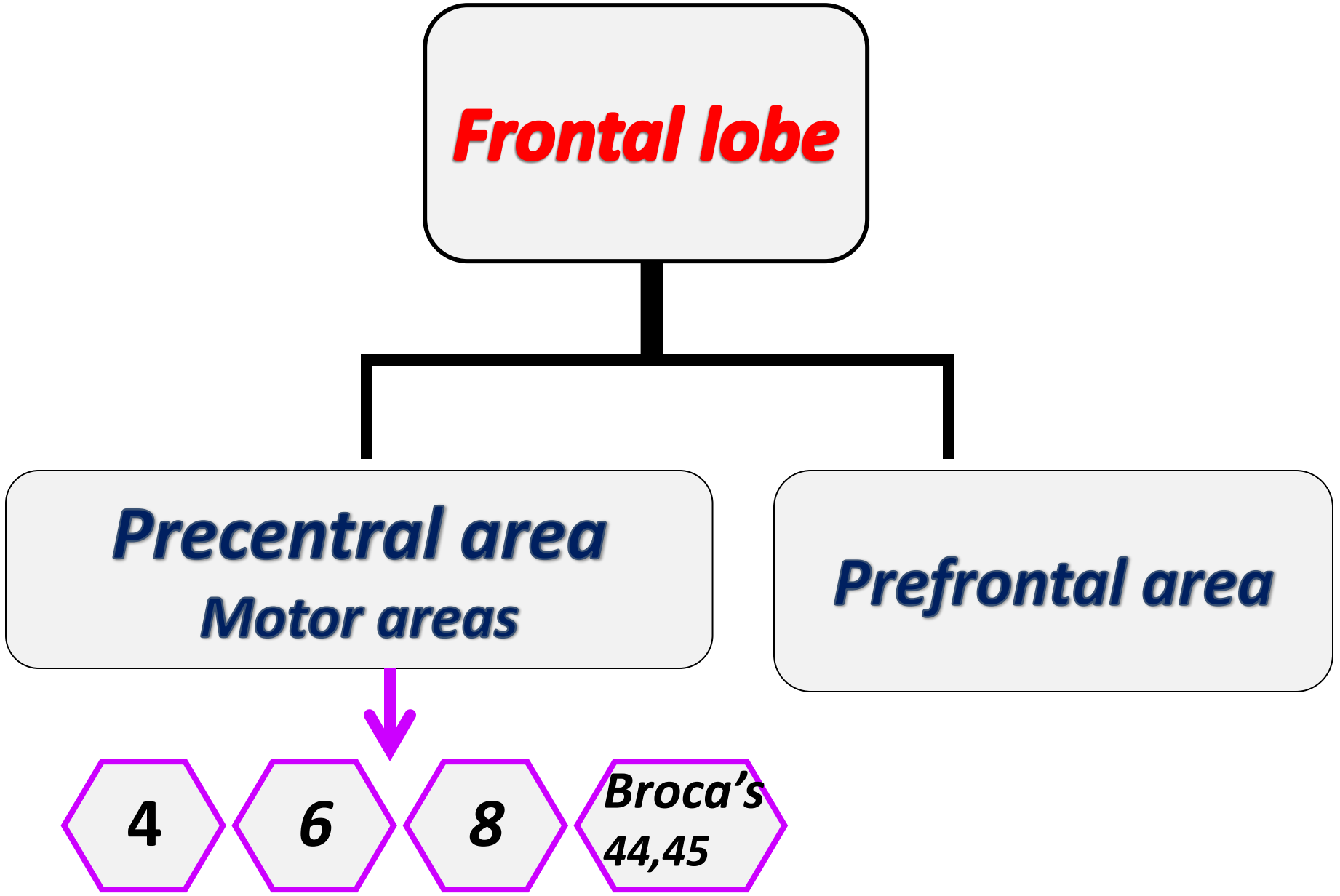
U → uncus



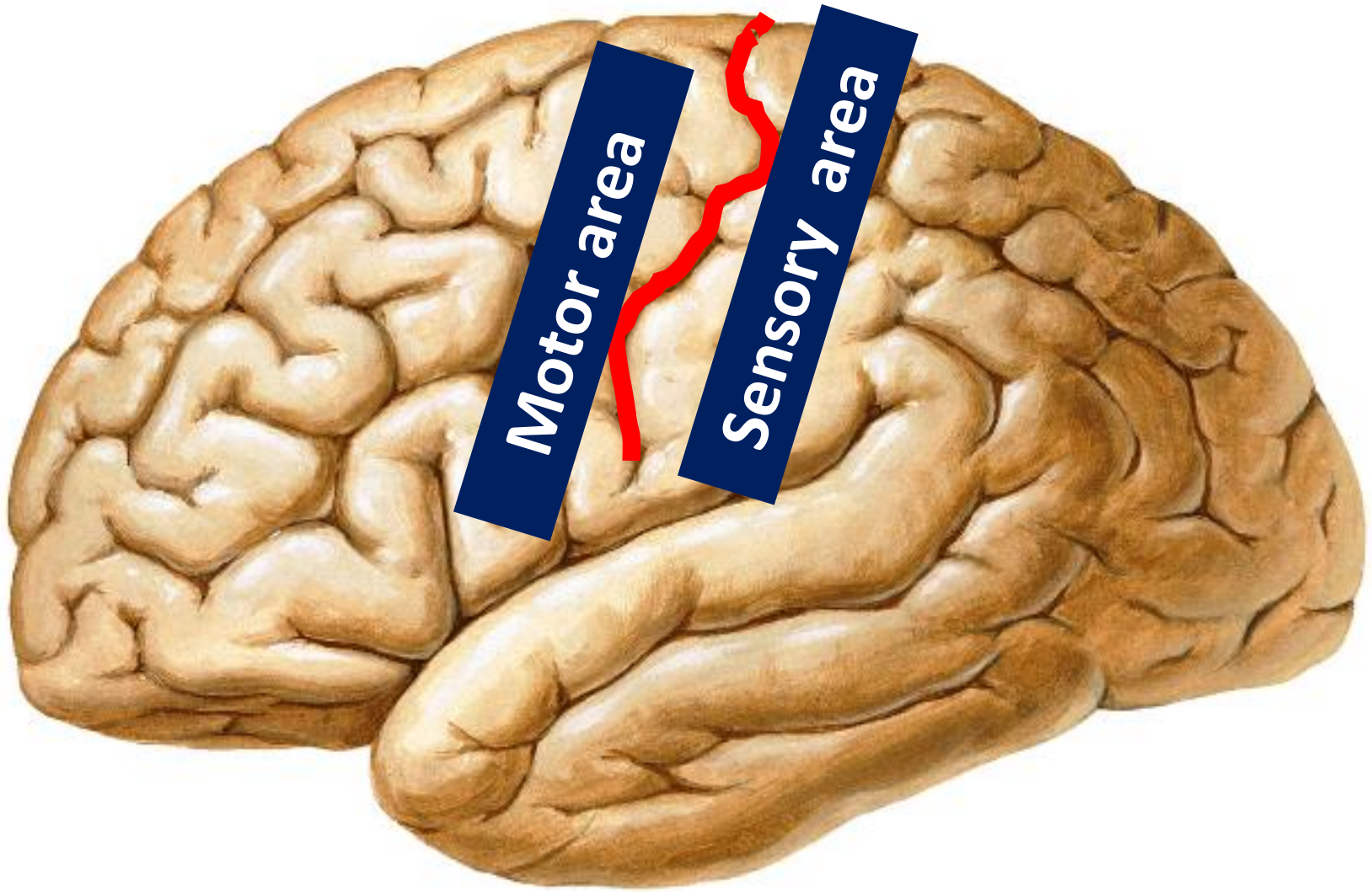
Sulci & Gyri on inferior surface

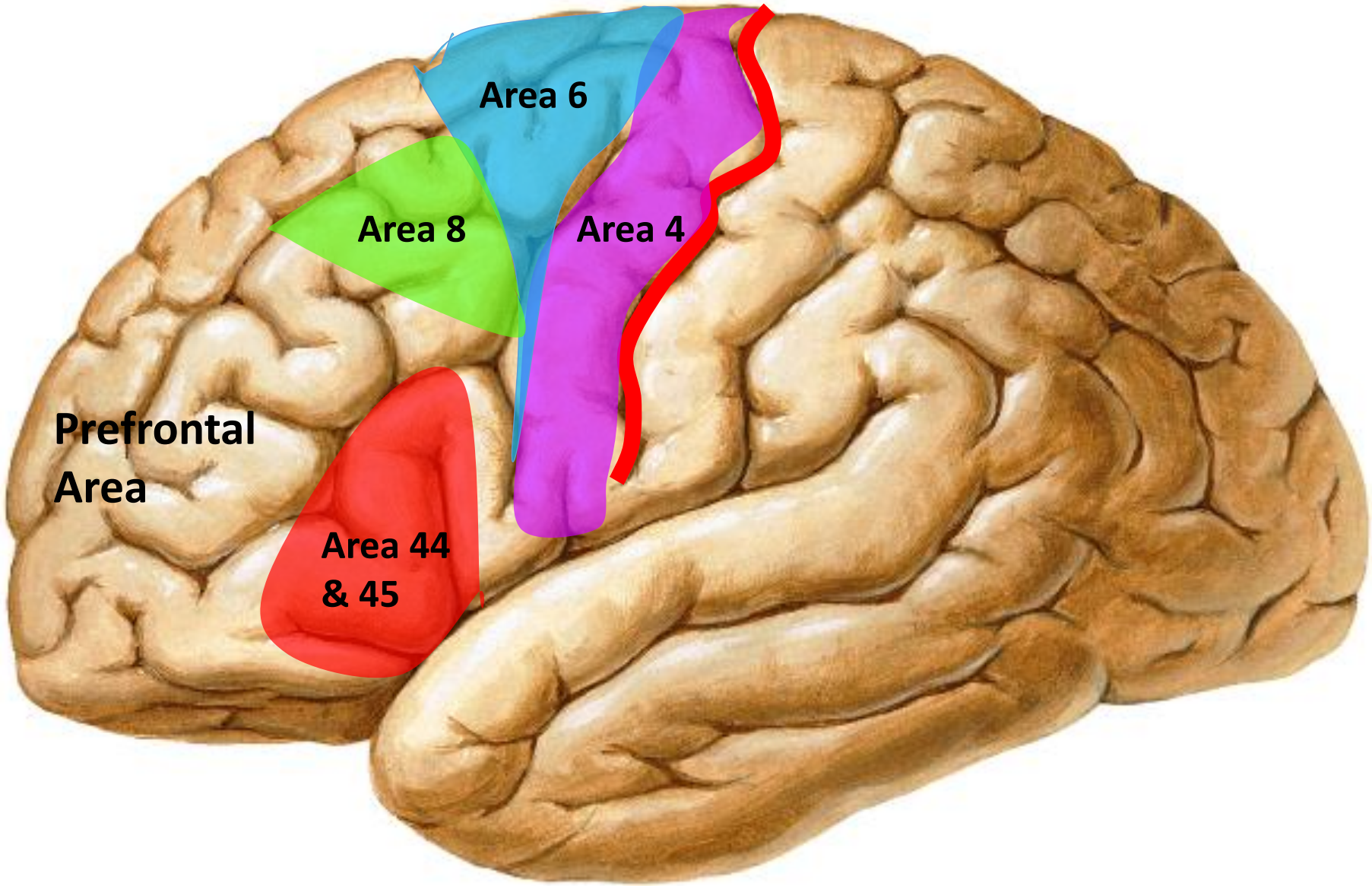
Functional Cortical Areas

The frontal lobe


Frontal lobe
Precentral area
Motor areas
Prefrontal area
4
6
8
Broca's
44,45

Central sulcus




Area 6
Area 8
Area 4
Prefrontal
Area
Area 44
& 45

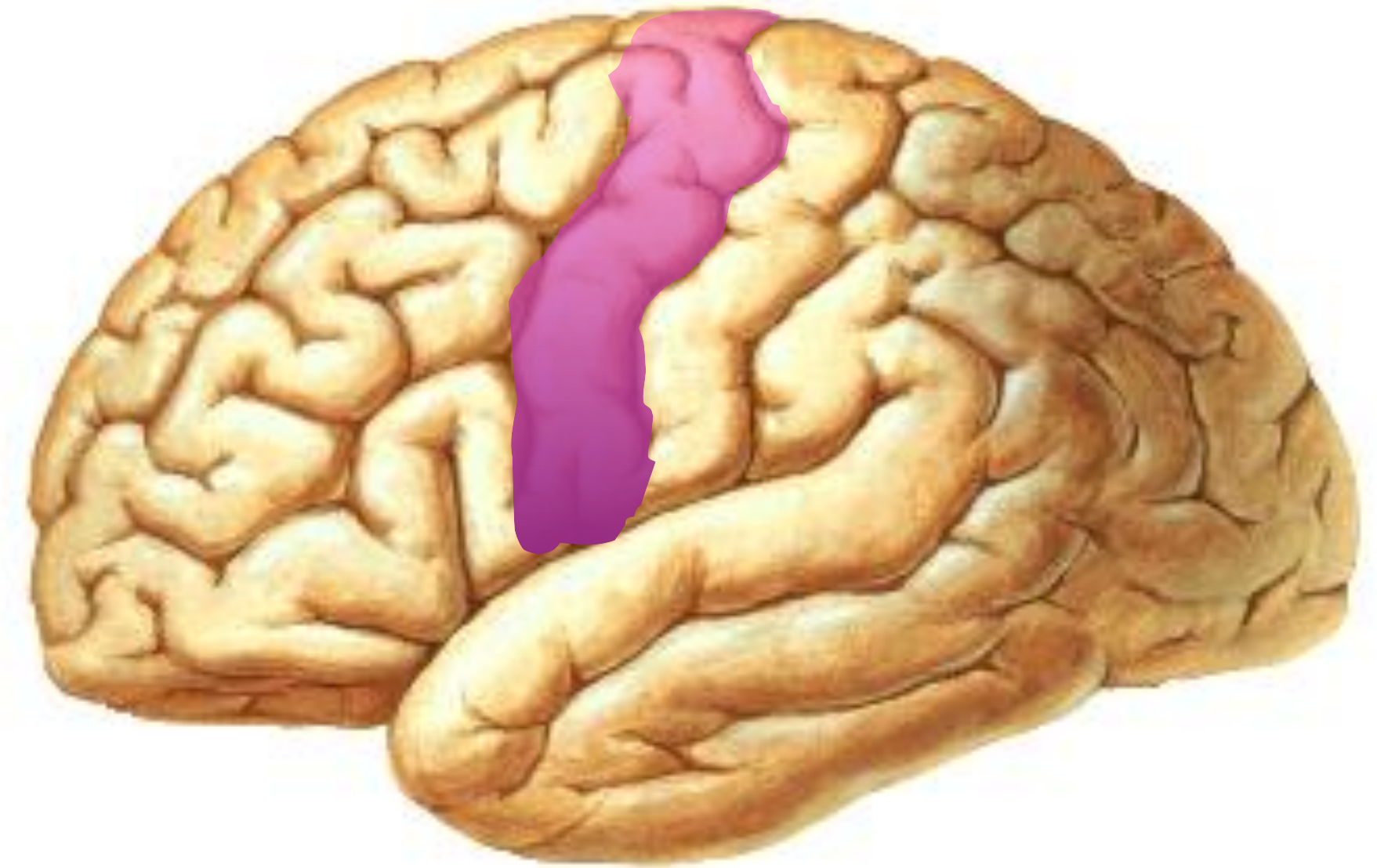
Area 4
Primary motor area

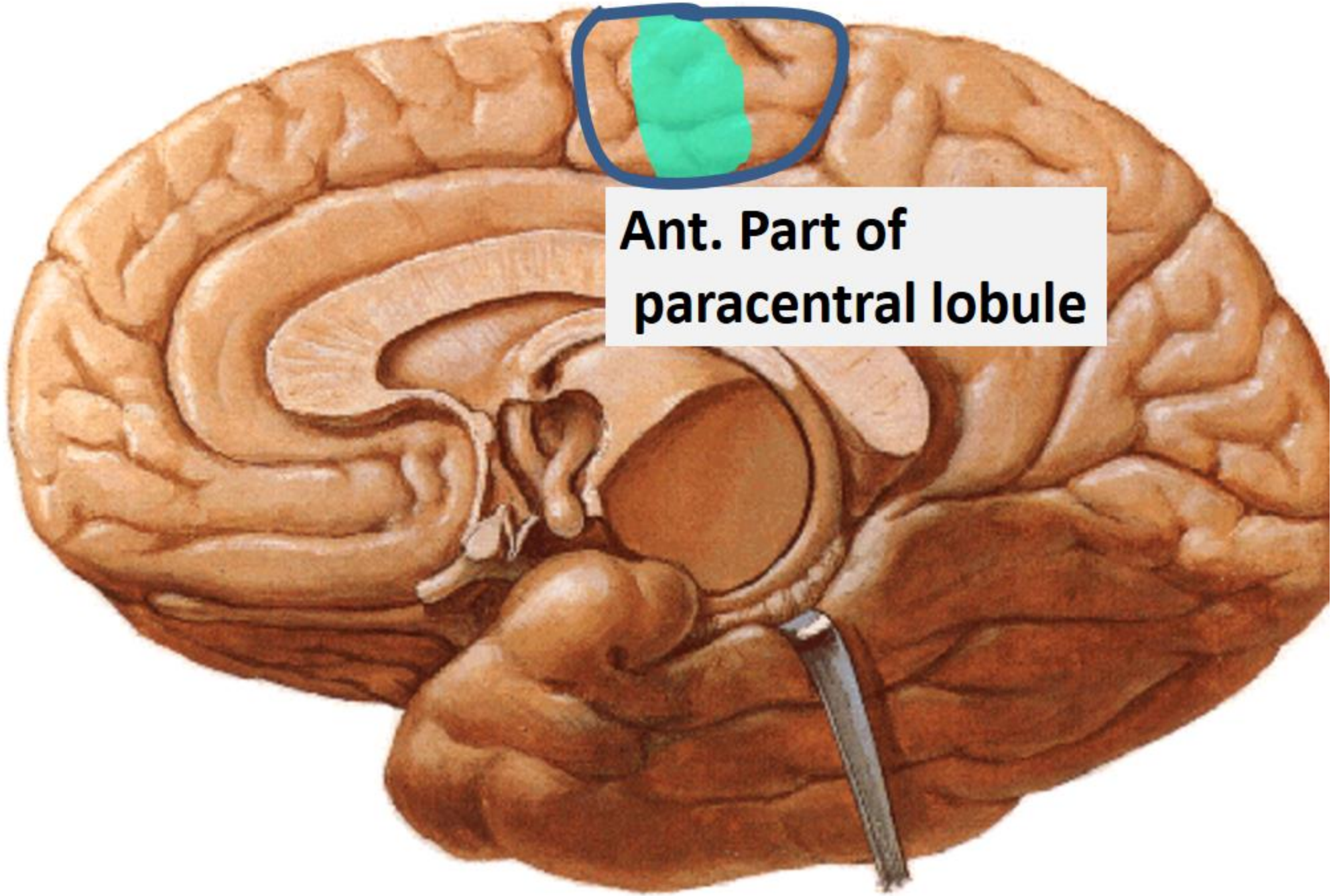
site ***representation*** ***function*** ***lesion***

Area 4 (Primary motor area) :

- **Site:** Precentral gyrus & ant. part of paracentral lobule.
- **Body representation:** it contains a map of contralateral ½ of body represented upside down (motor homunculus) so face is lower down & leg and foot in paracentral lobule.
- **Representation is proportionate to skill;** so parts with fine skilled movements e.g. hands occupy larger areas.
- **Function:** initiates discrete voluntary movements which were planned in area 6.
- **Lesion:** Contralateral hemiplegia.

Precentral gyrus




Ant. Part of
paracentral lobule

Representation

Contralateral half of body

Up side down

(face lower down

while leg & foot are

in paracentral lobule)

Area of represntation

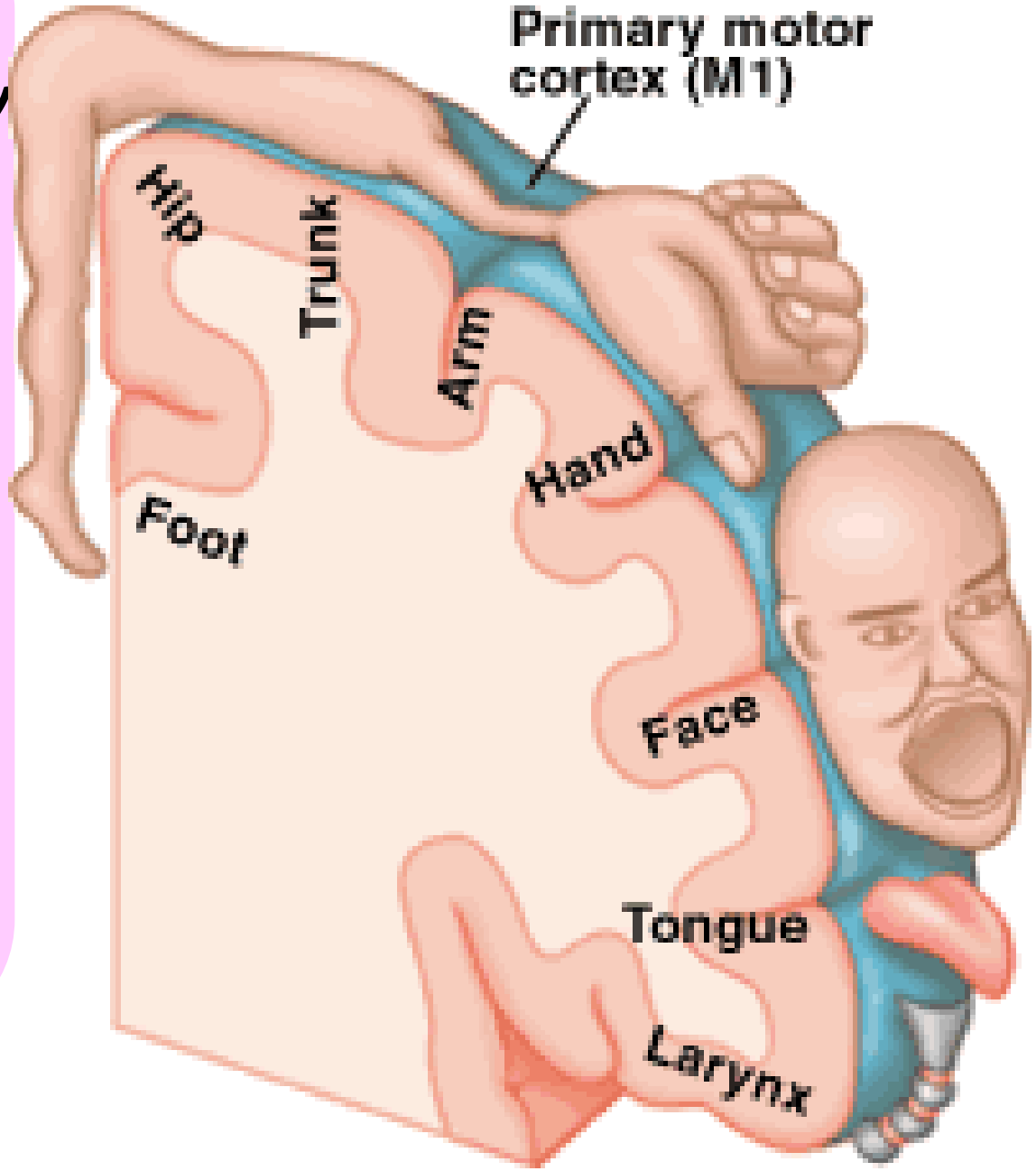
is according to skill

of movements

not according to

size of

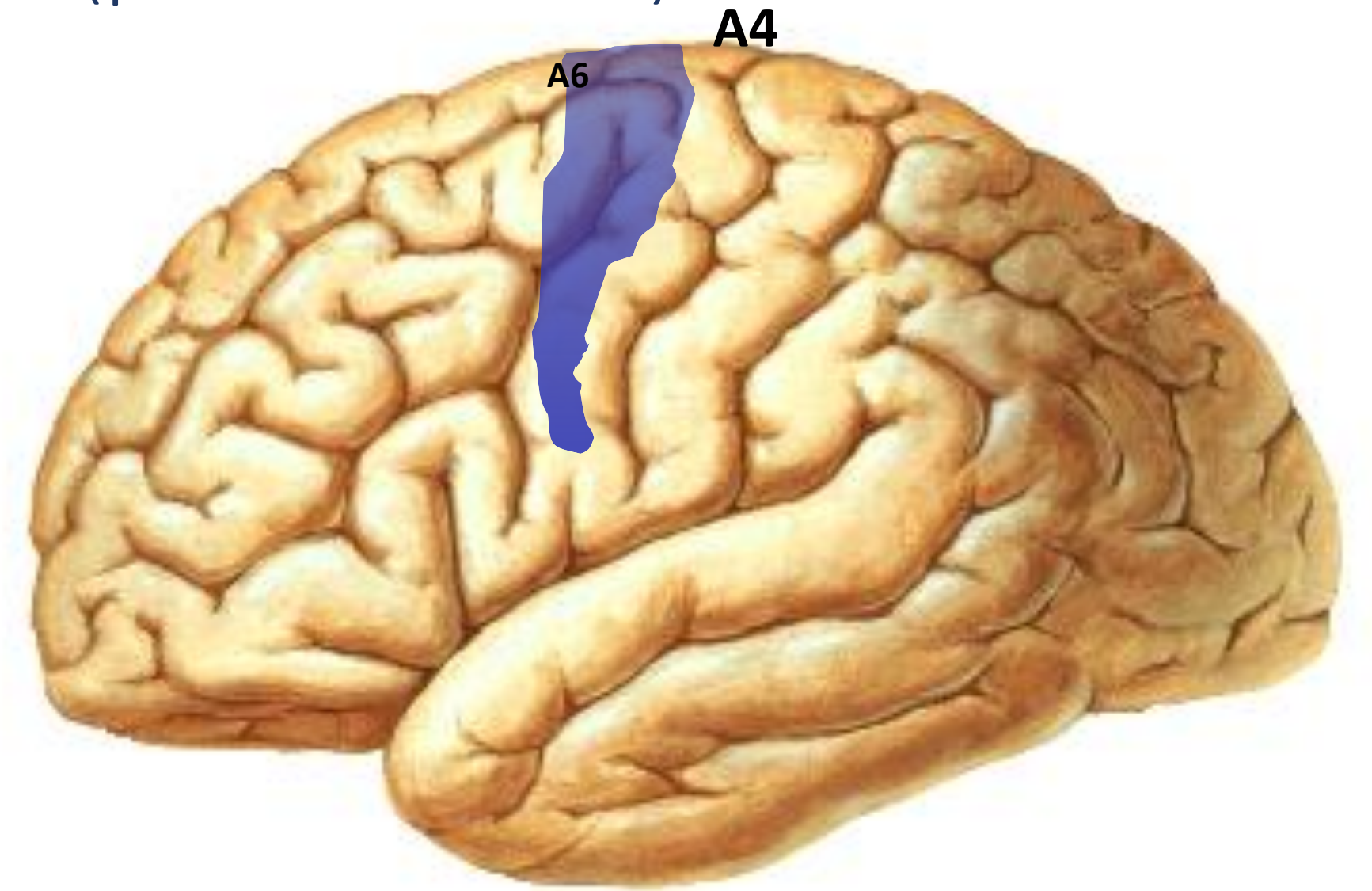
body part

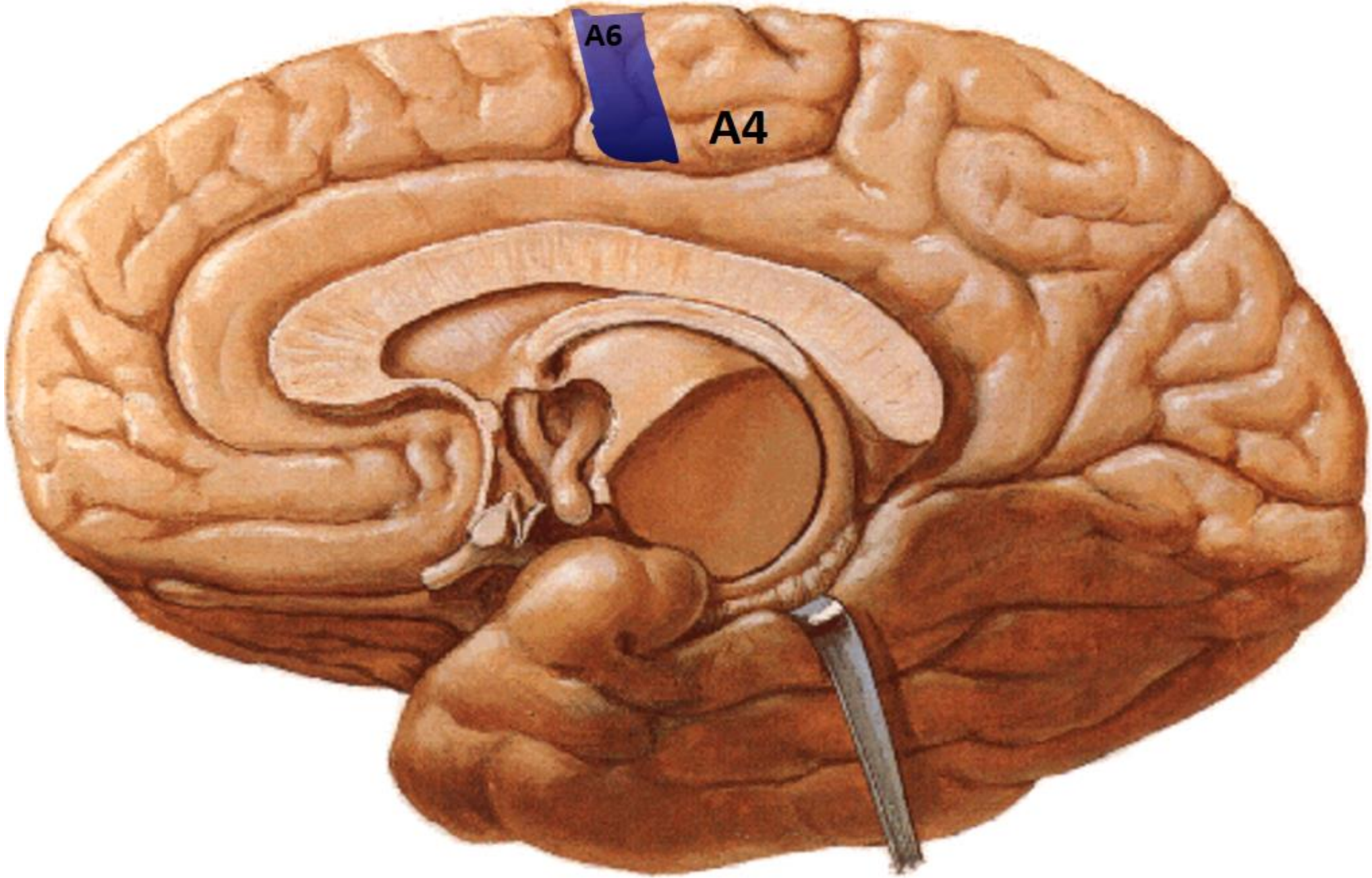


Premotor Area 6

- **Site** → infront of area 4 in sup., middle & inf. frontal gyri + extends on med. surface
- **Functions** → plans the movement & stores the plan. It adjusts the posture to start the movement. It inhibits muscle tone & grasp reflex.
- **Lesion** → awkwardness of movements "apraxia" , spasticity of muscles & reapearance of grasp reflex.

Area 6 (premotor area)



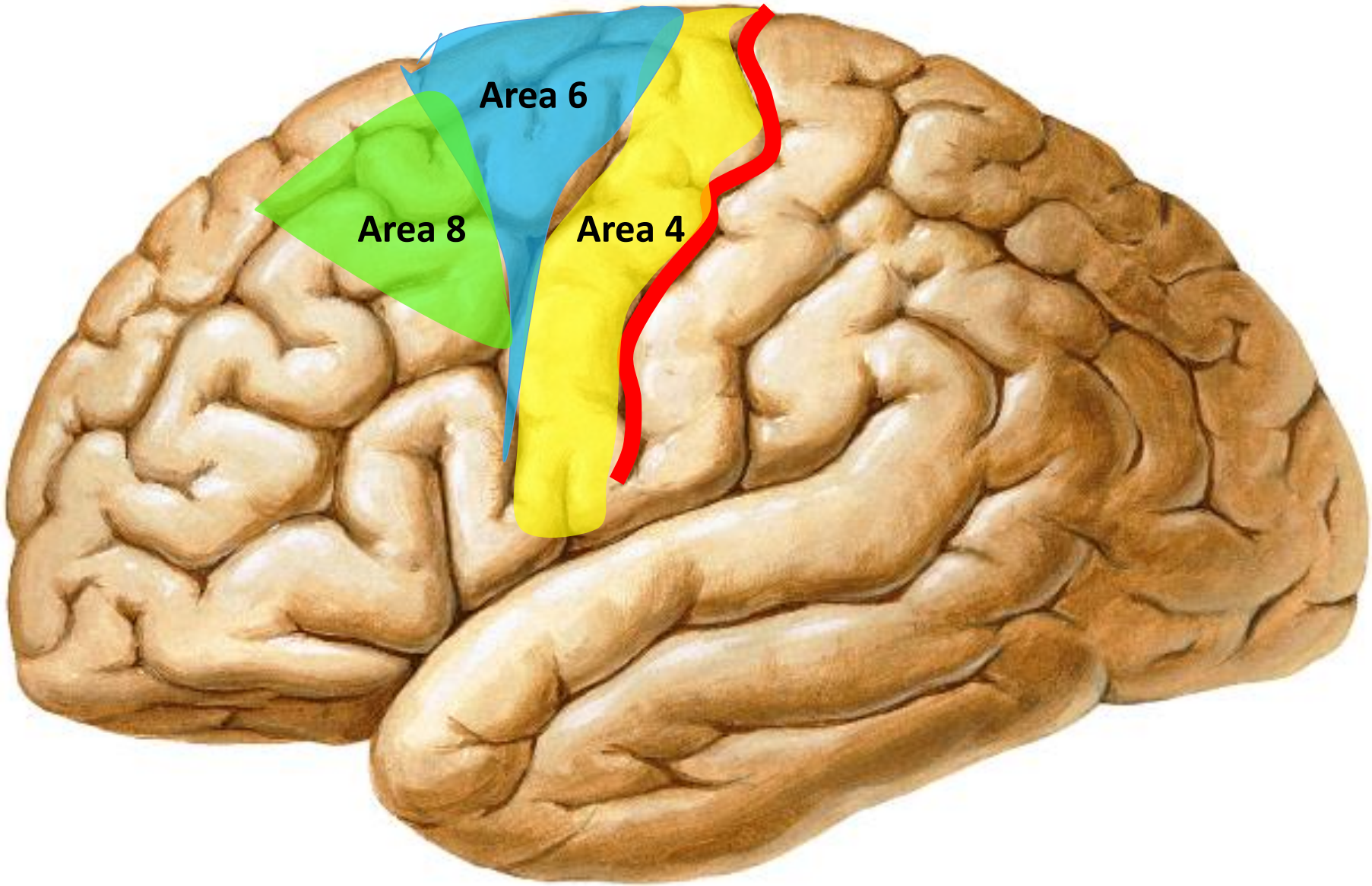

A6
A4

Area 8 (frontal eye field)

- **Site → infront of area 6 in sup. & middle frontal gyri**
- **Function → voluntary conjugate eye movements. Its stimulation leads to contralateral deviation of both eyes.**
- **Lesion → 1) ipsilateral deviation of both eyes towards side of the lesion**

  2) inability to turn eyes to opposite side

Reflex conjugate eye movement is not affected since it is controlled by occipital eye field.


Area 6
Area 8
Area 4

Function

Frontal eye field A8

Responsible for voluntary conjugate Eye movement

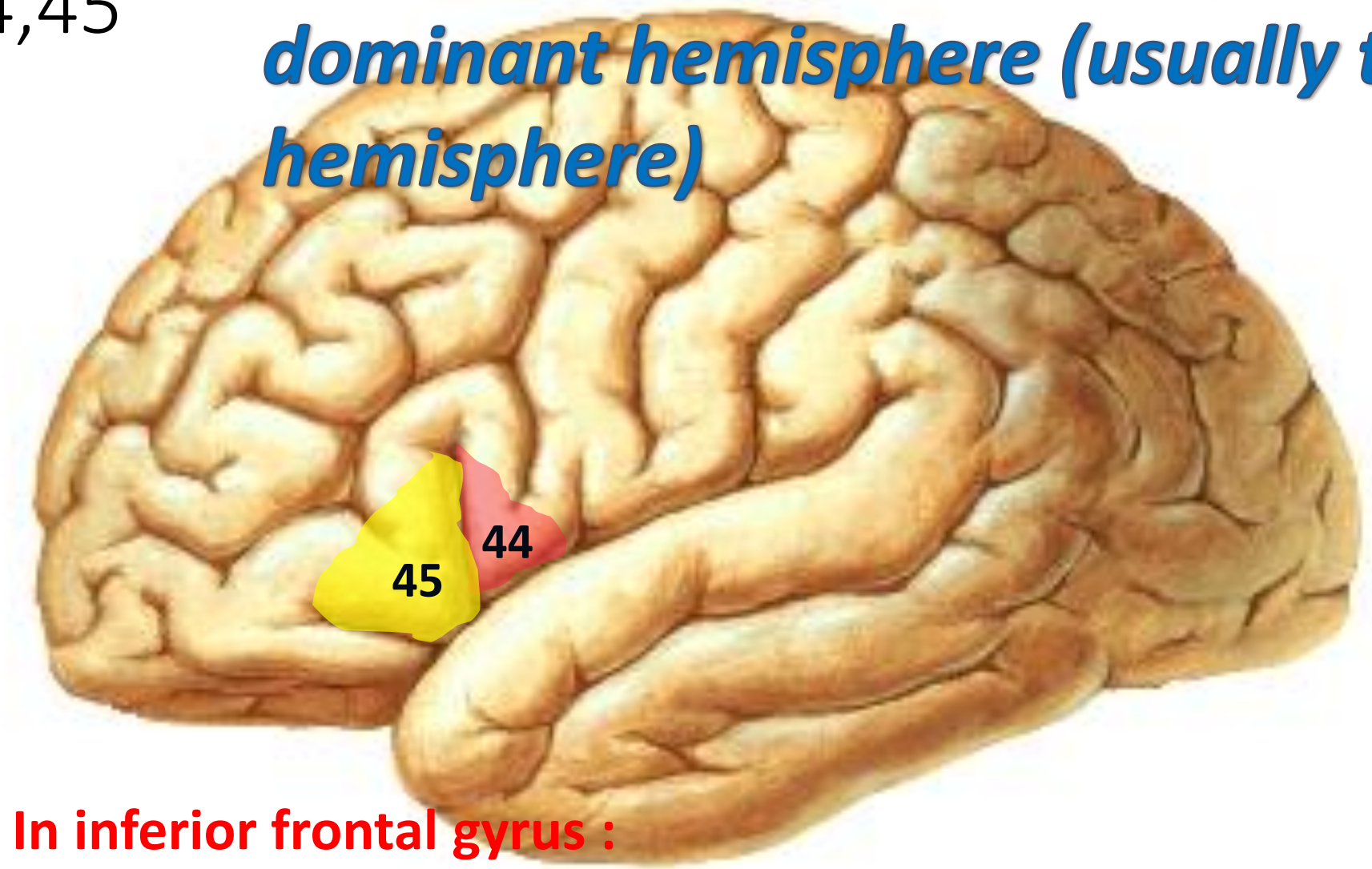
➔ Contralateral deviation of both eyes

Eyes deviate to the right

Stimulation of left frontal eye field A8

Broca’s area
areas 44,45

Broca’s area is present only in the dominant hemisphere (usually the left hemisphere)



In inferior frontal gyrus :

pars triangularis (A 45) & pars opercularis (A 44)

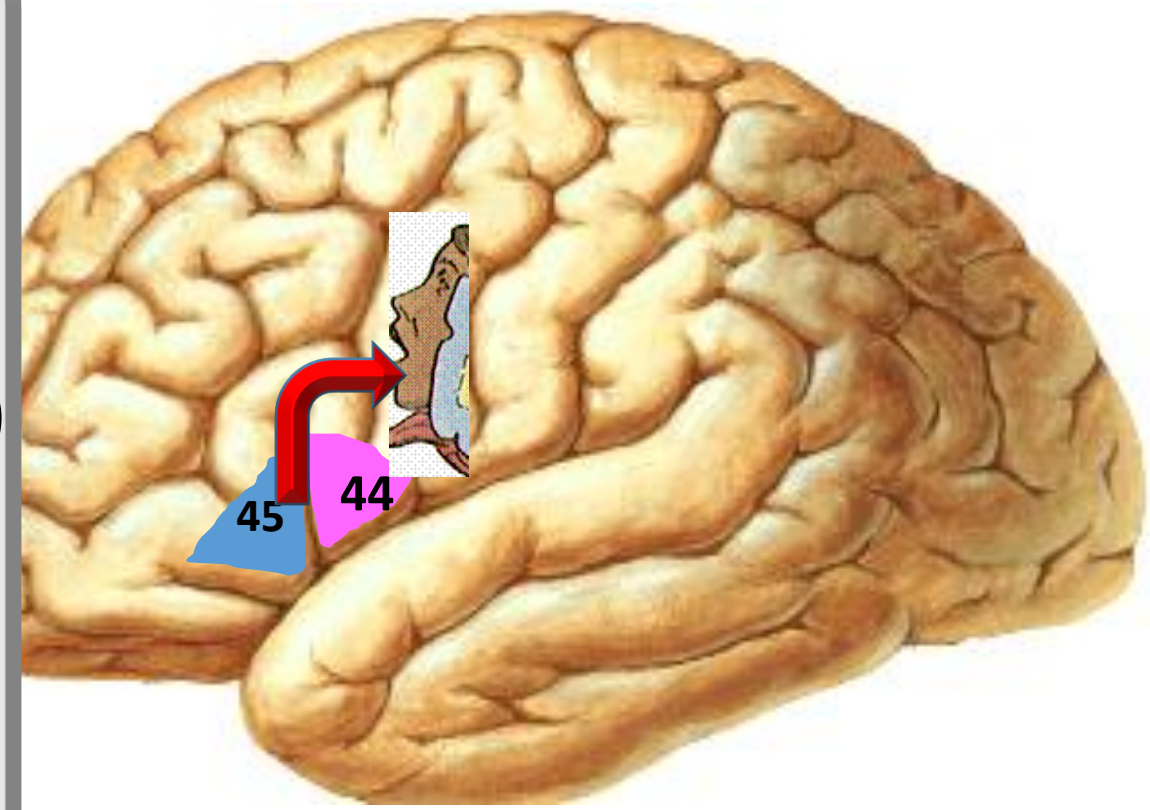
Function

Broca's area

(motor speech area)

Responsible for production of Intelligible words

(لغة مفهومه)

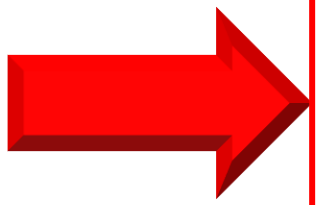


Programs sequence of muscle contractions to produce intelligible sounds (words)

then send these orders to the nearby motor area 4

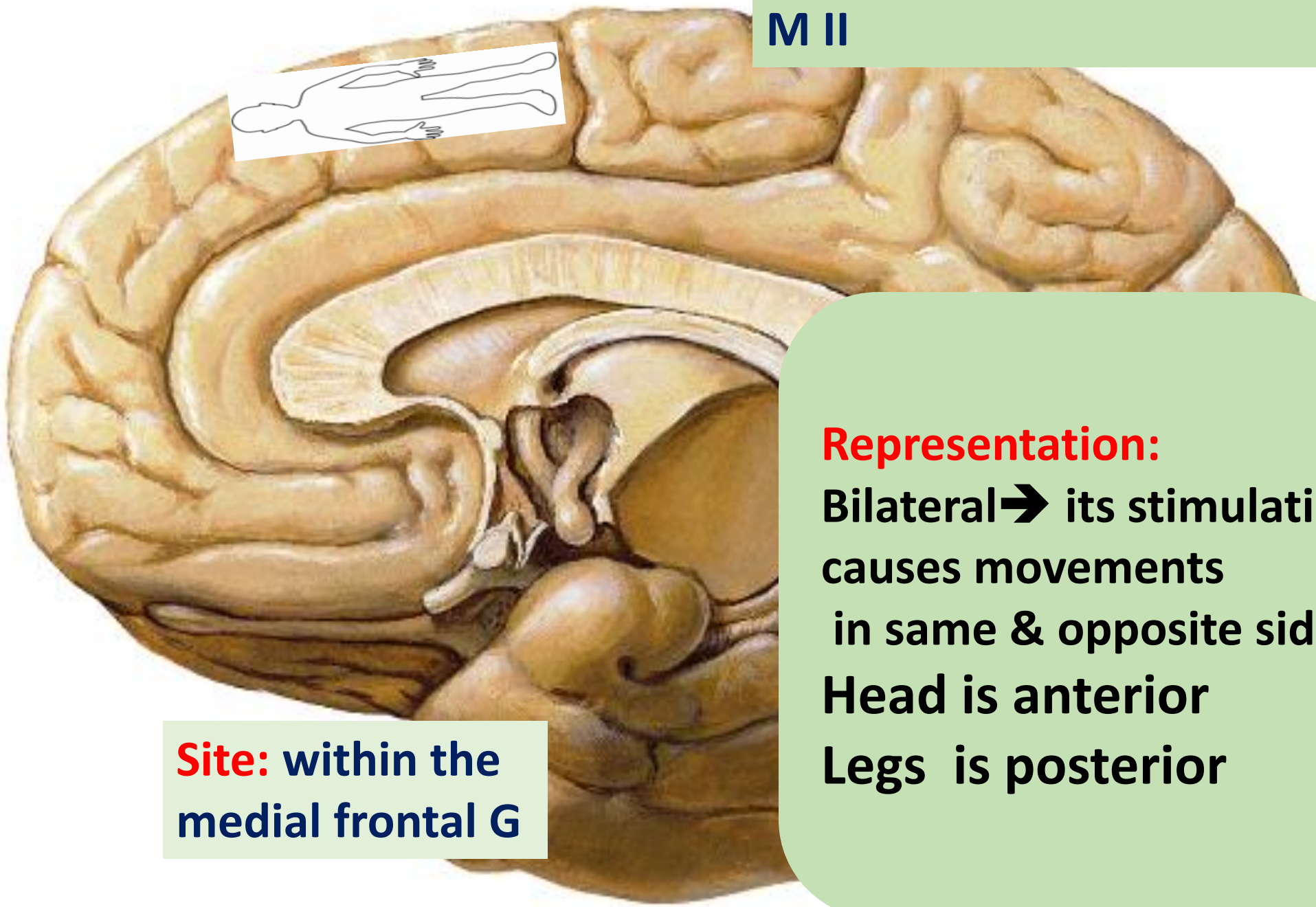
Lesion:

motor (expressive) aphasia



The patient cannot pronounce the words easily, but selects the proper words.

Supplementary motor area
M II



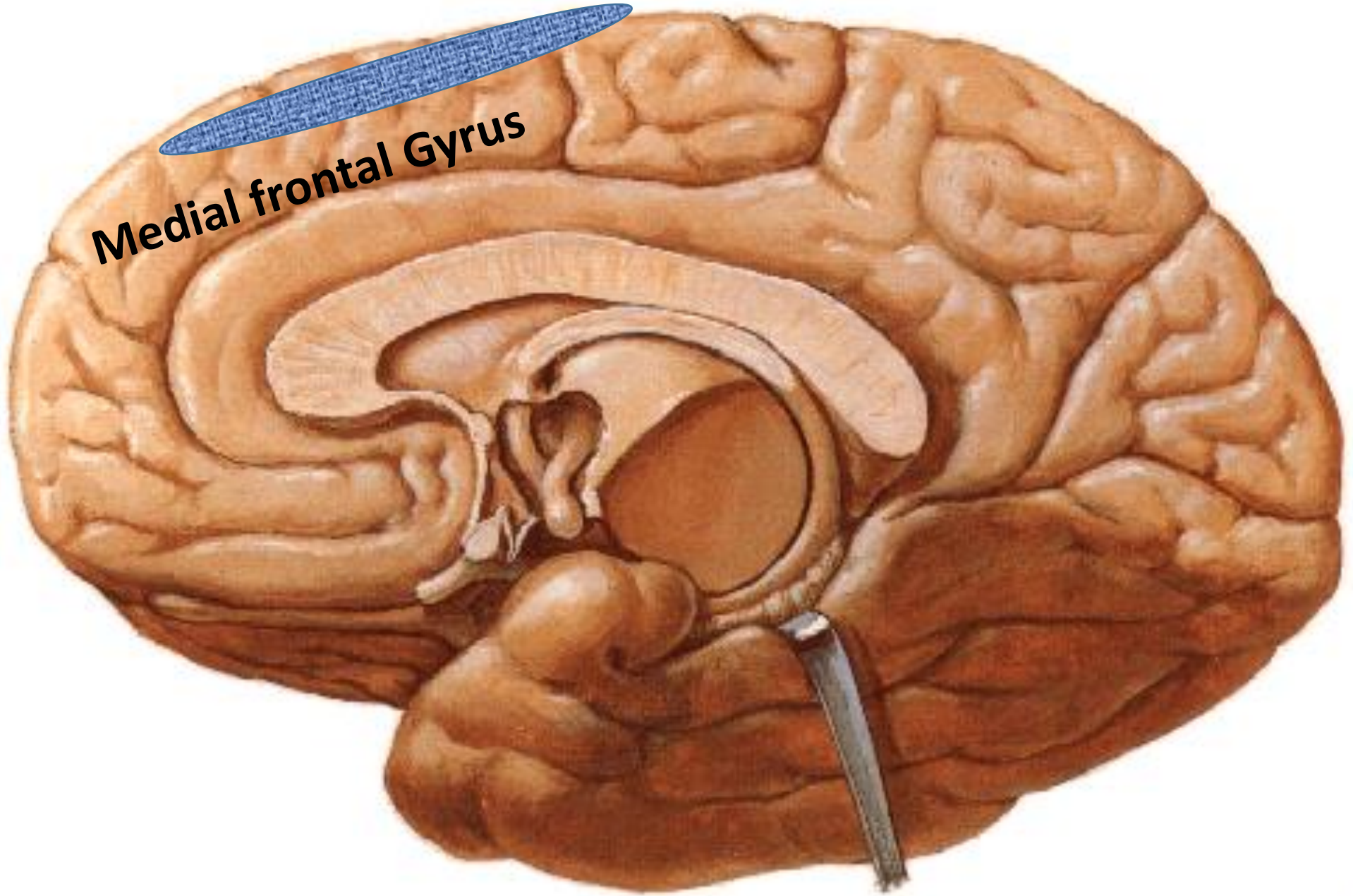
Site: within the medial frontal G

Representation:

Bilateral➔ its stimulation causes movements in same & opposite sides

Head is anterior

Legs is posterior


Medial frontal Gyrus

MII Function

- It plans & stores programmes for difficult or **complex movements** for example movements involving both hands

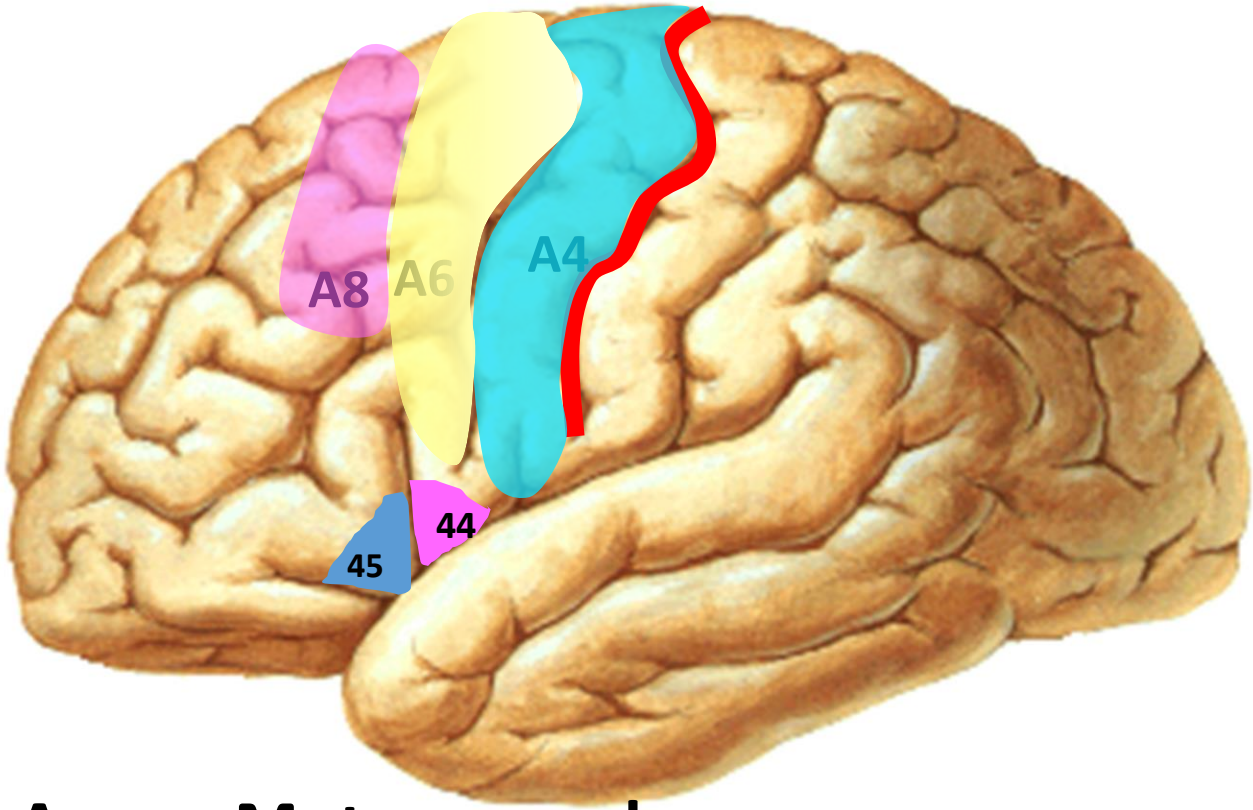
Bimanual movement

- **Contains a superior speech center**

- **Lesion** → temporary : aphasia & inability to move (Akinetic mutism)

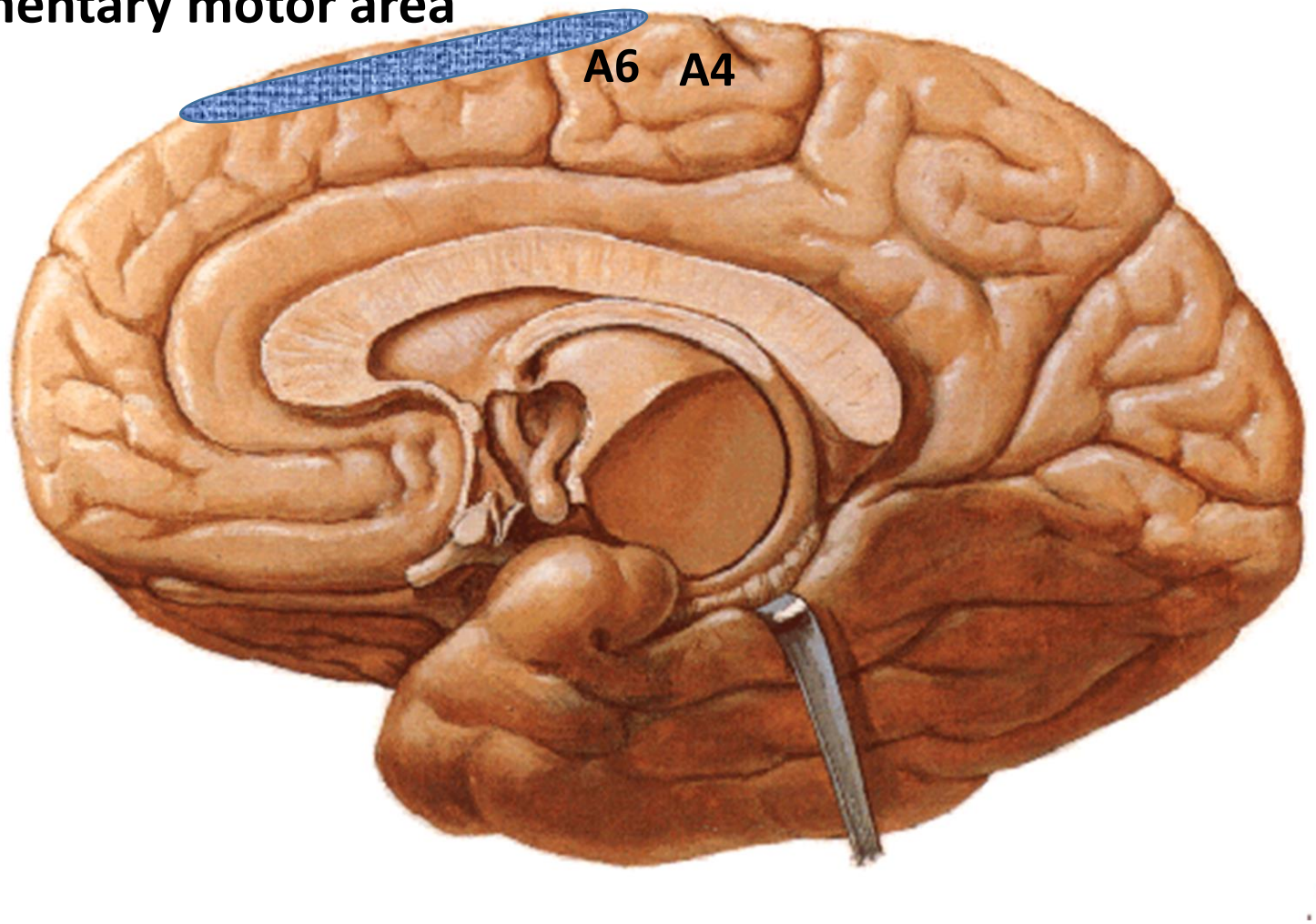
difficulty in performing complex movements

Precentral area

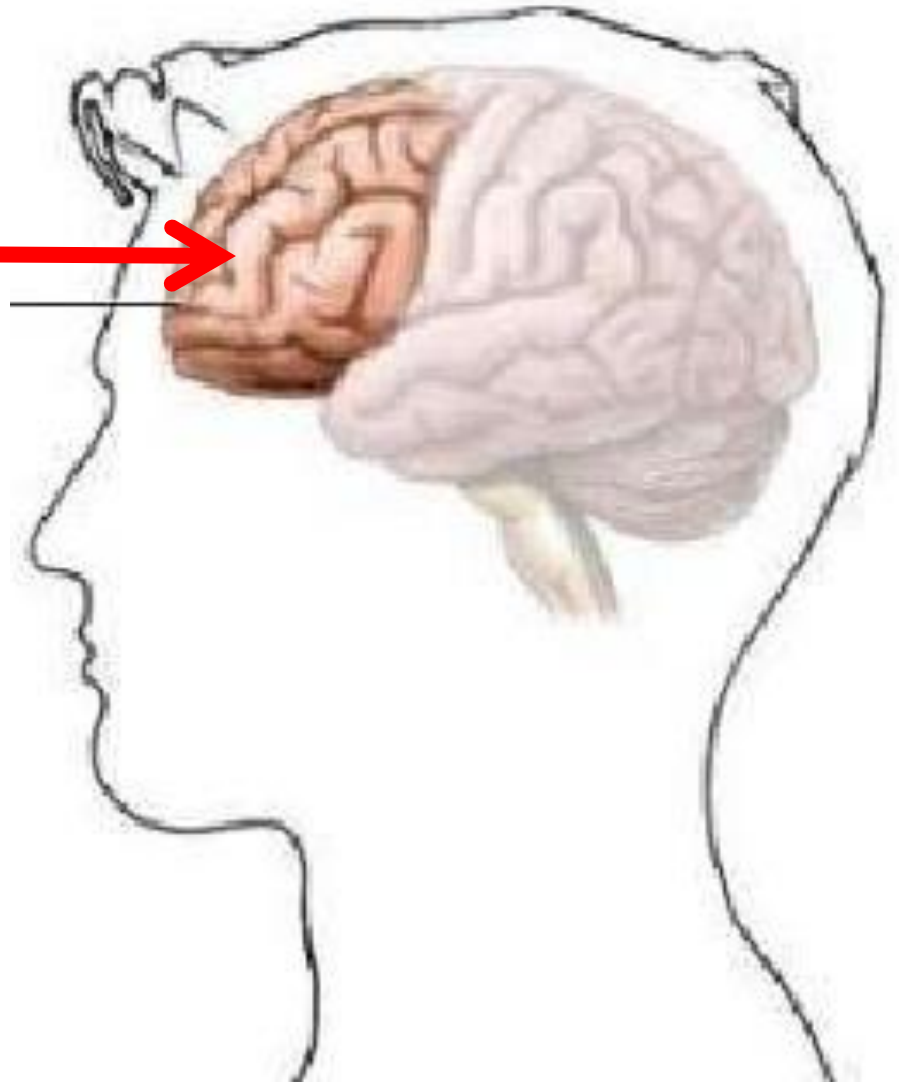


Broca's Area = Motor speech area

Supplementary motor area

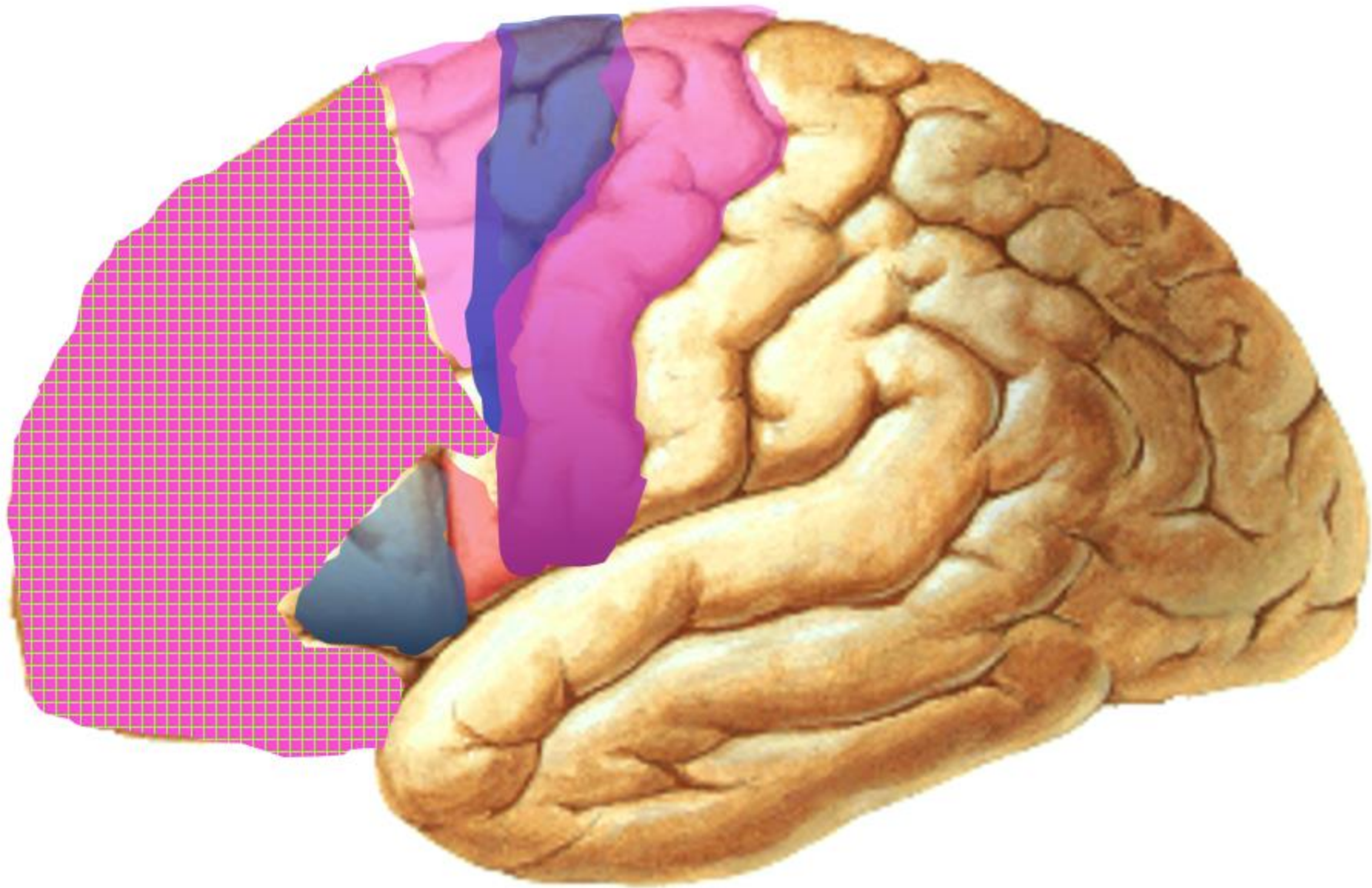


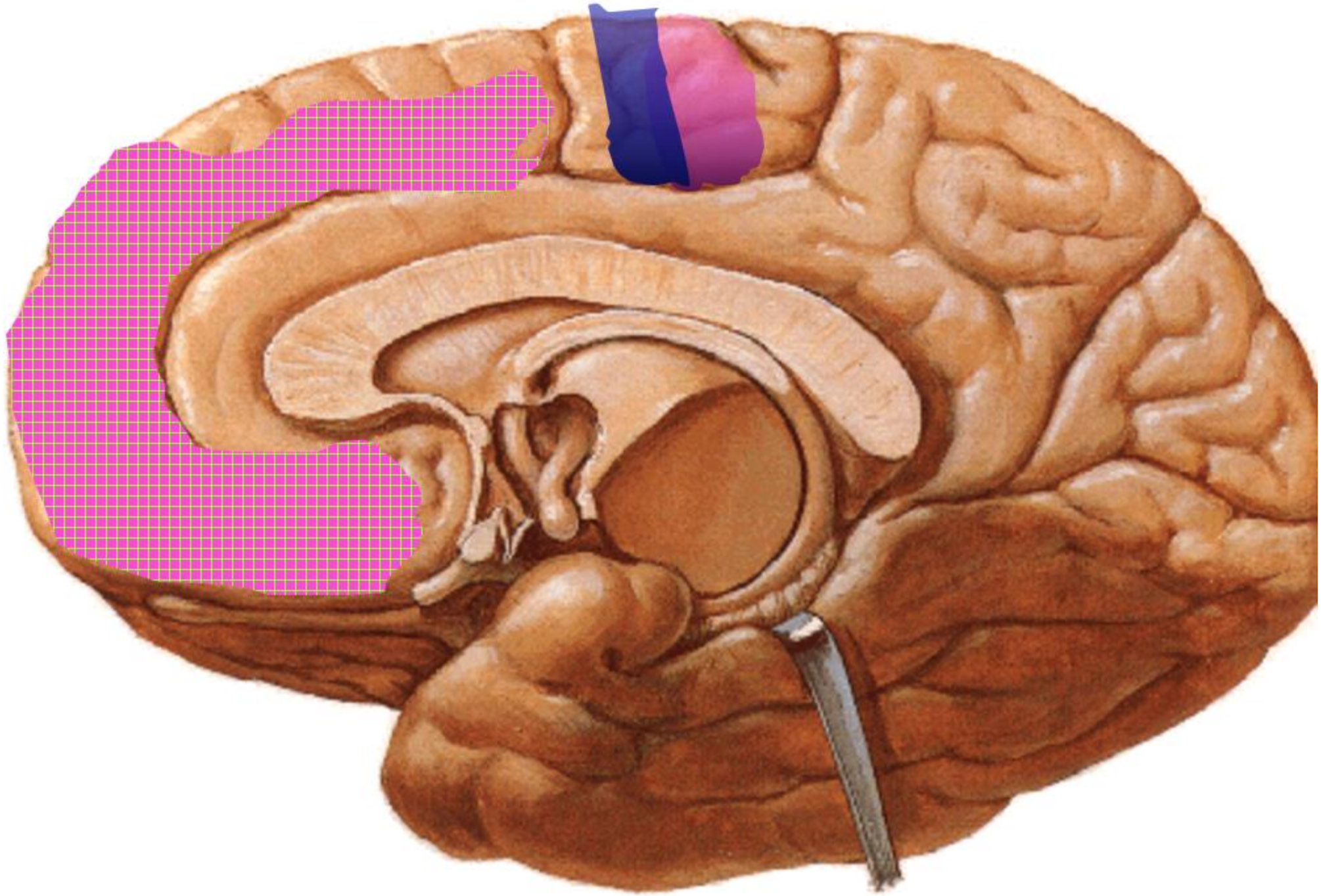
Prefrontal area



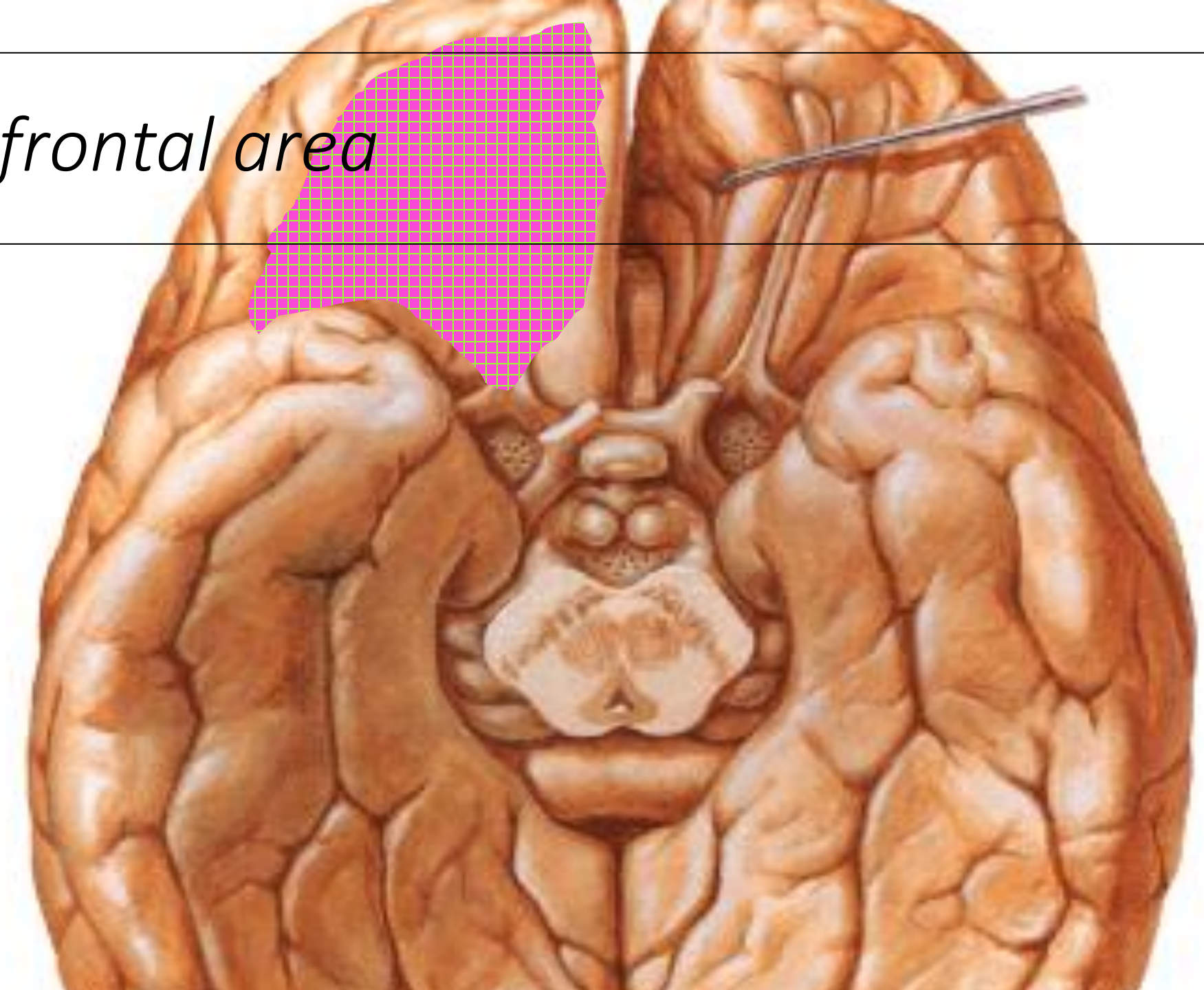
Site :

1) Remainder of sup., middle & inf. frontal gyri
2) Most of medial frontal gyrus
3) Orbital gyri





Prefrontal area



Function

1) Intelligence
2) Expression of emotion
3) Ability to predict consequences of an action
4) Controls behavior ,mood & personality

Lesion ➔

Changes in

Behavior, Mood & Personality

Thank you