

AN OVERVIEW
OF THE BRAIN

CEPHALONS

ERNESTO SALCEDO, PHD



SHARED FOLDER

- ▶ One Drive Folder
 - ▶ Updated Lectures
 - ▶ Learning Objectives

Shared Folder



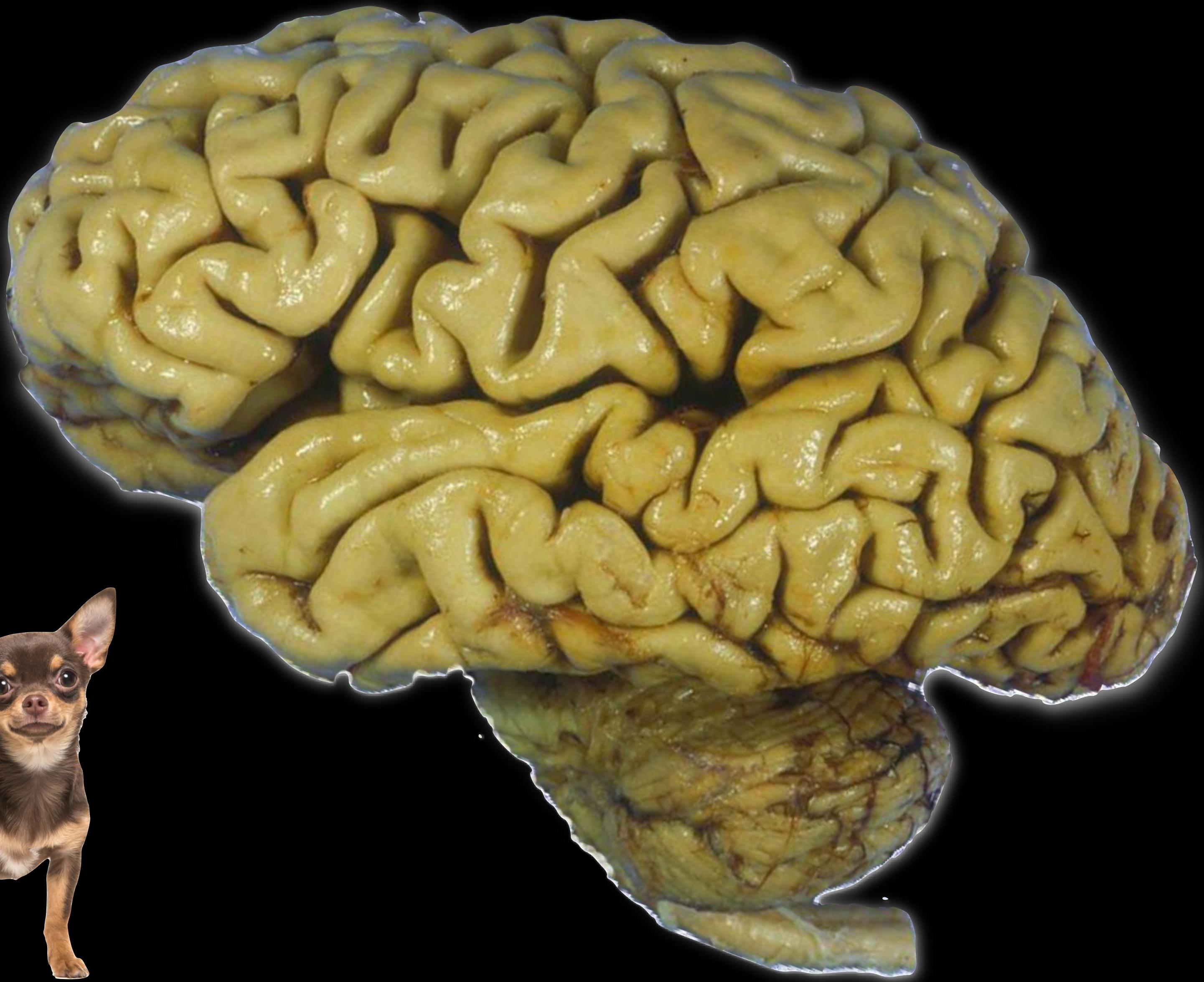
Ernesto Salcedo, PhD

LECTURE OUTLINE

- ▶ Component distribution
- ▶ CNS Subdivisions
- ▶ **Telencephalon**
 - ▶ Hemispheres
 - ▶ Lobes (& bonus lobes)
 - ▶ Primary Cortices
 - ▶ Association Cortex
- ▶ Limbic System
- ▶ **Diencephalon**
 - ▶ all them Thalamii
 - ▶ Pituitary Gland
- ▶ **Brain Stem**
- ▶ Mes-, Met-, and Myelencephalon

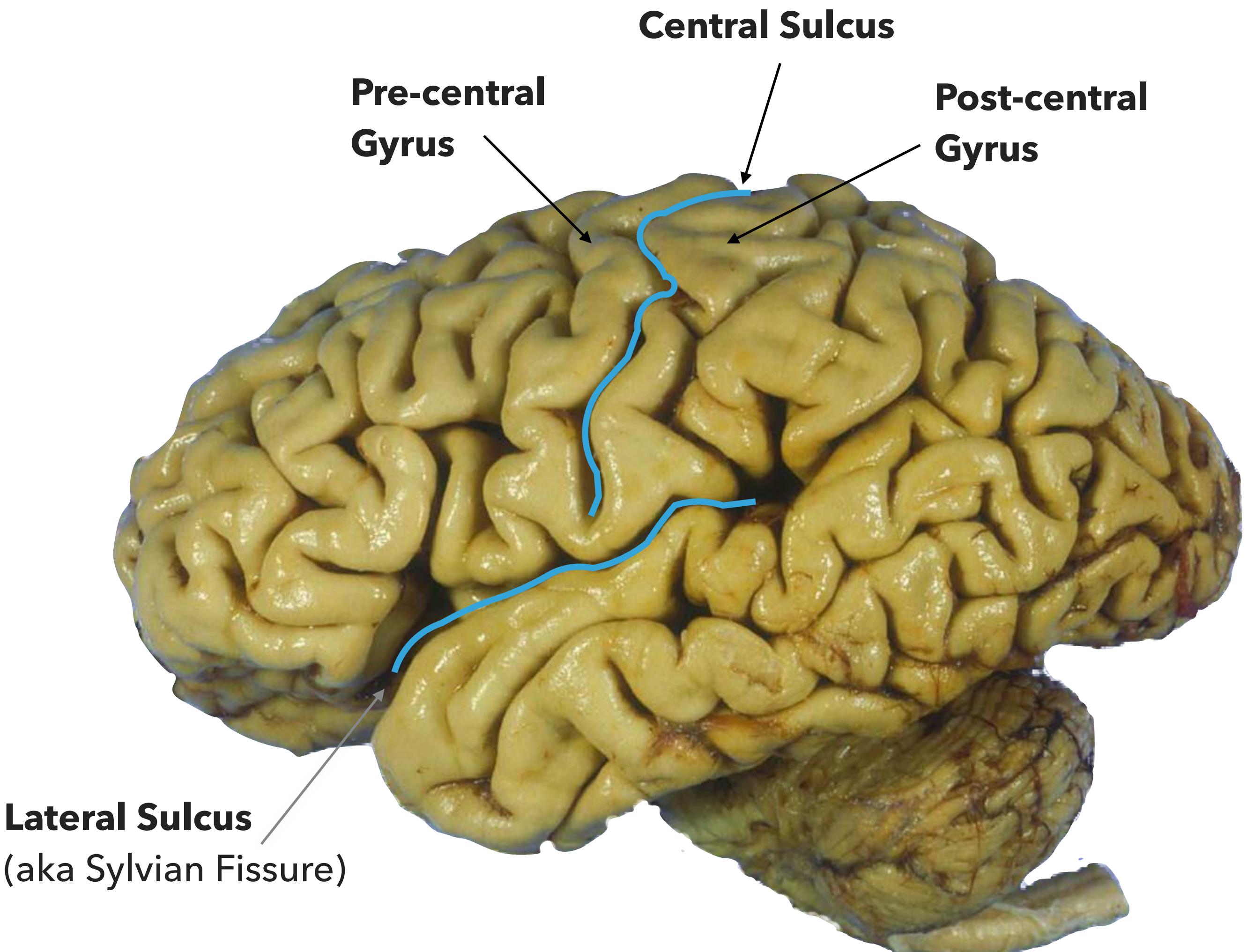
YOUR BRAIN

- ▶ Chihuahua-sized, highly wrinkled organ (~3 lbs)
- ▶ Consistency of Soft Tofu
- ▶ Consumes 20% of your energy
- ▶ Your Control Center
 - ▶ Motor Control and balance
 - ▶ Sensory Systems
 - ▶ Limbic systems
 - ▶ Life support



YOUR BRAIN HAS STRUCTURE

- ▶ Those wrinkles have names
 - ▶ Ridge = Gyrus
 - ▶ Crevice = Sulcus
 - ▶ Gyri and Sulci
- ▶ Appear in roughly the same locations across different peoples' brains
- ▶ Can be used as landmarks

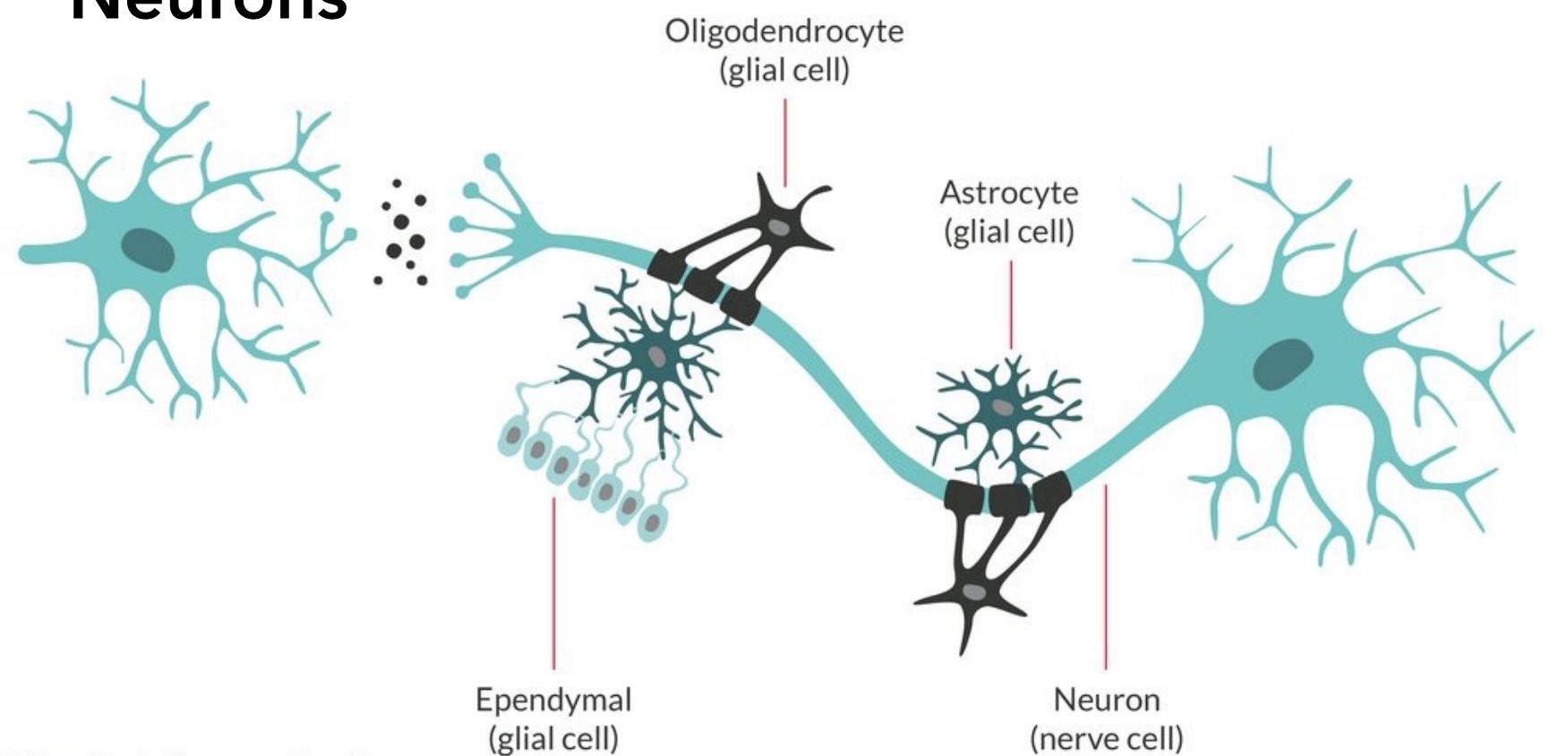


MAJOR BRAIN COMPONENTS

YOUR BRAIN HAS PARTS

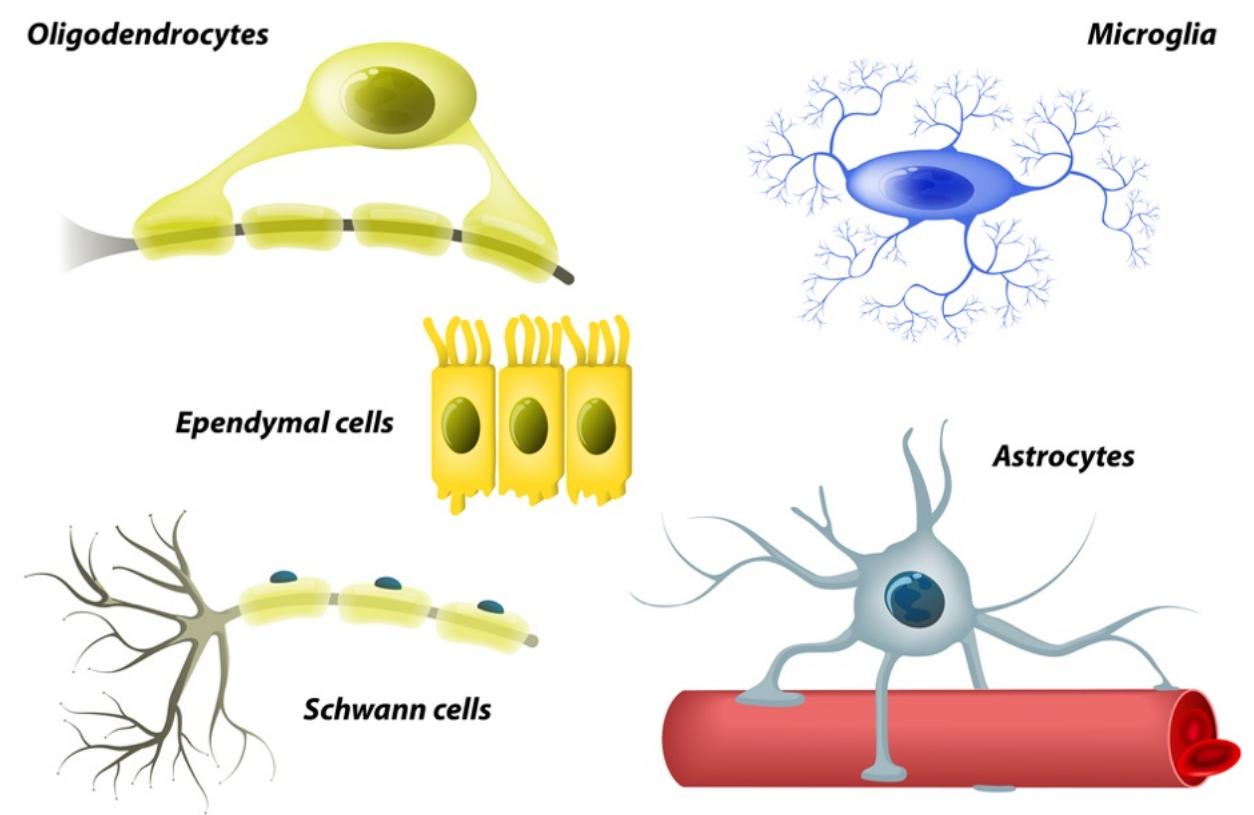
CELLS

Neurons

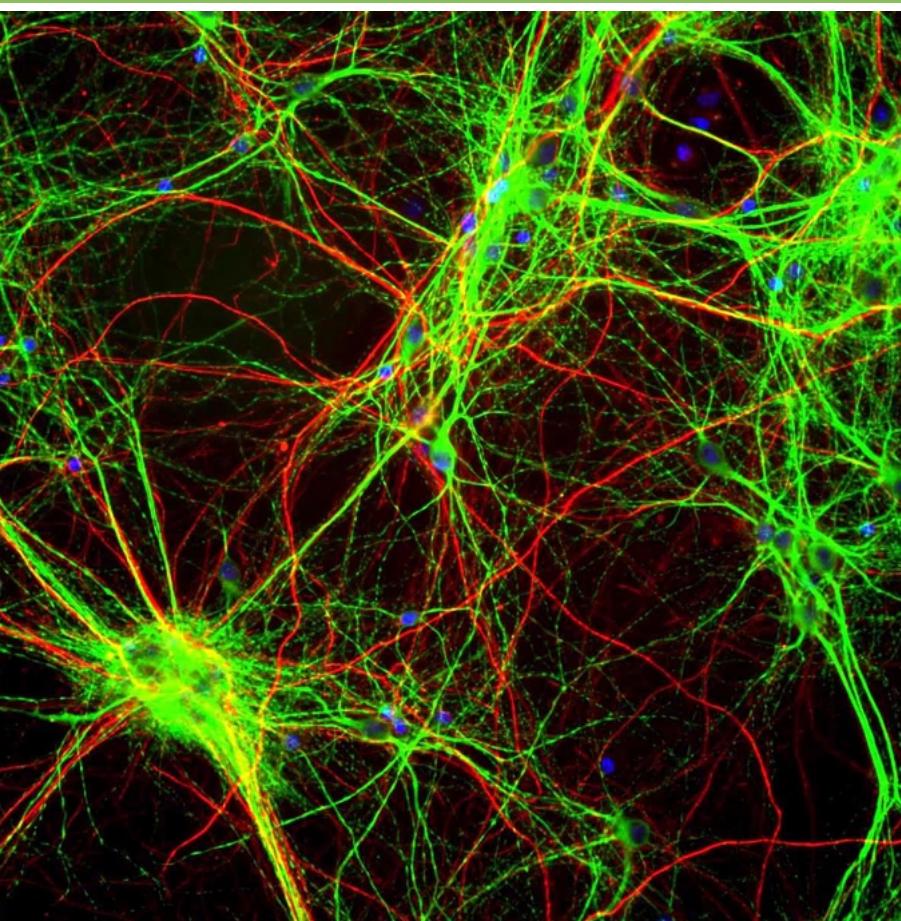


© The Brain Tumour Charity

GLIAL CELLS



WIRES



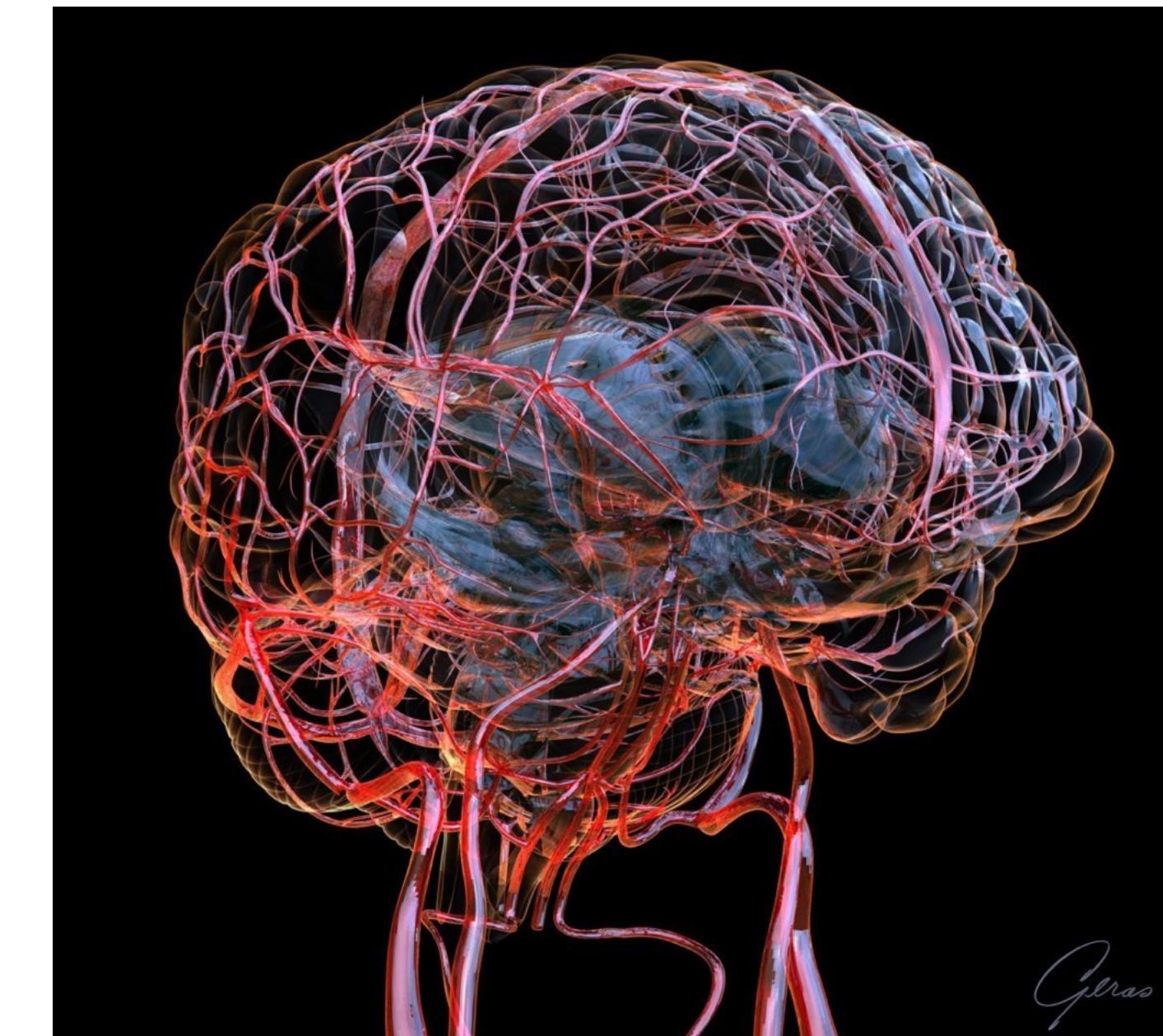
- ▶ The axons of the Neurons

HOLES (OR SPACES)

- ▶ Ventricles filled with CSF

VASCULATURE

- ▶ Brain has no energy storage – needs to be constantly fed blood (like a vampire)
 - ▶ Strokes bad
- ▶ Blood Brain Barrier



STRUCTURAL ORGANIZATION

THE PARTS ARE CLUSTERED

EITHER STRATIFIED ON THE OUTSIDE (OR BURIED DEEP)

Distribution

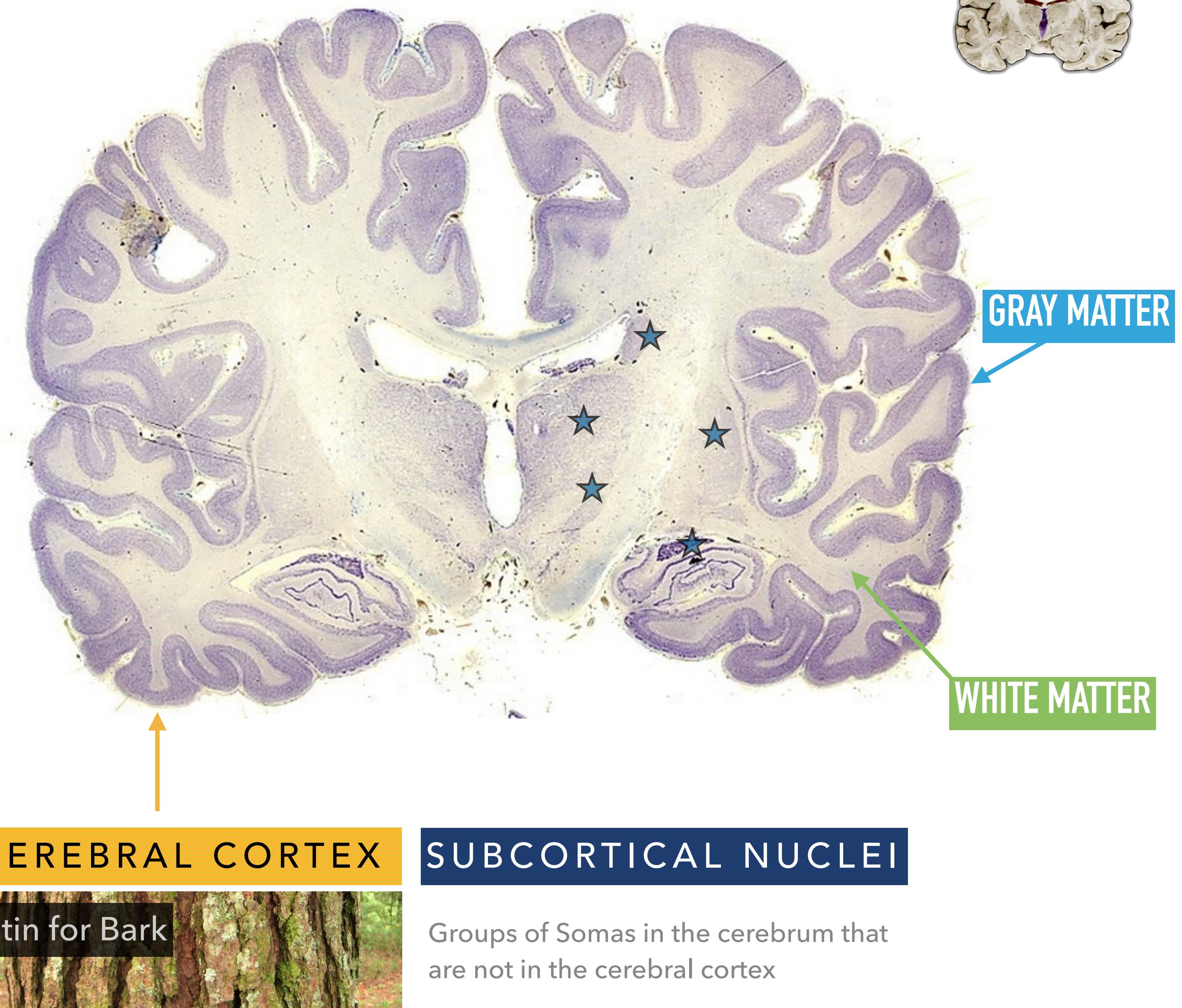
- Gray matter found either
 - on outer edges
 - OR buried deep in the brain
- Axons inside
- Ventricles found inside

General trend

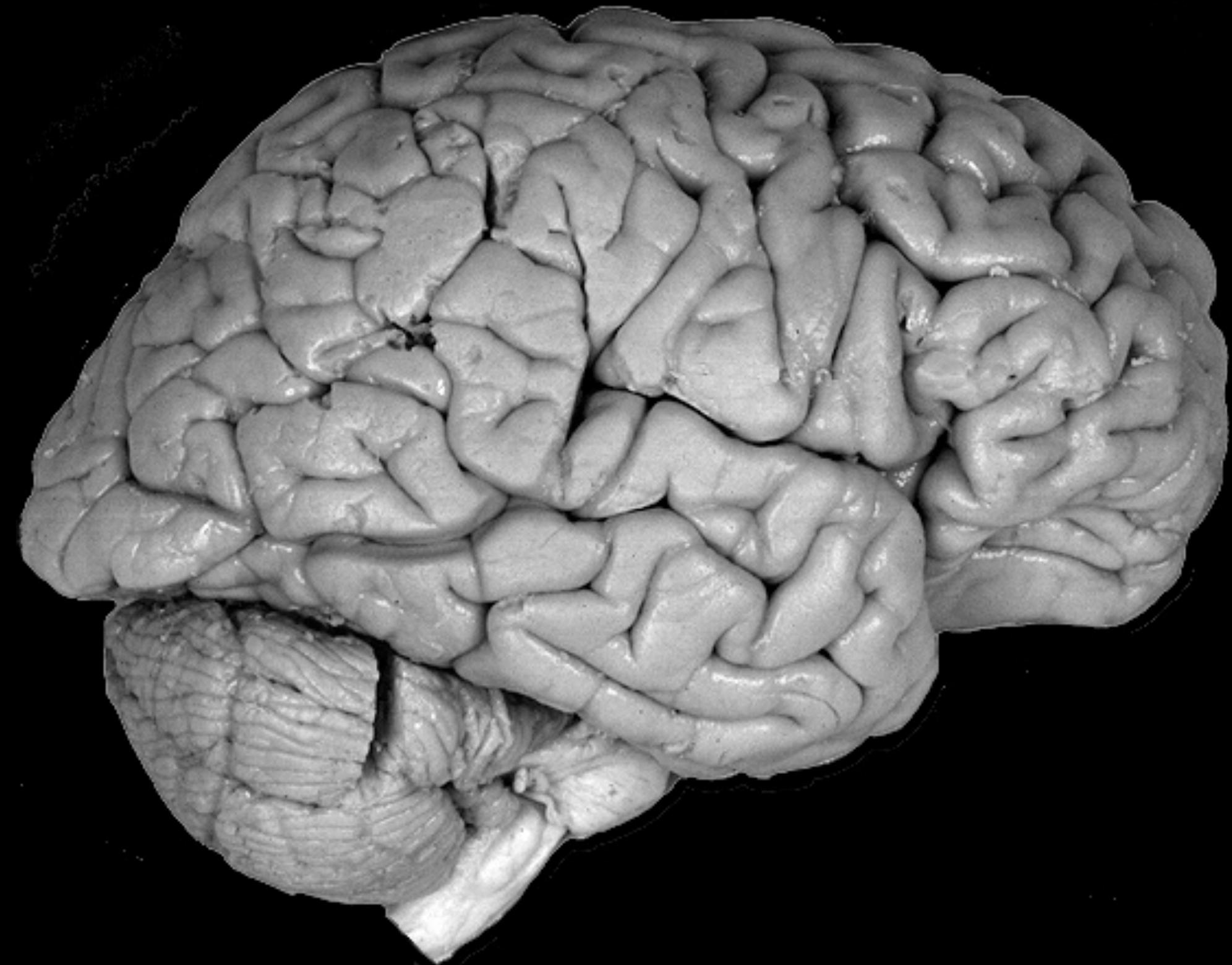
- Processing centers (the somas) are located on the edges
- Communication lines (the axons) are contained within and connect different processing centers

Important Terminology

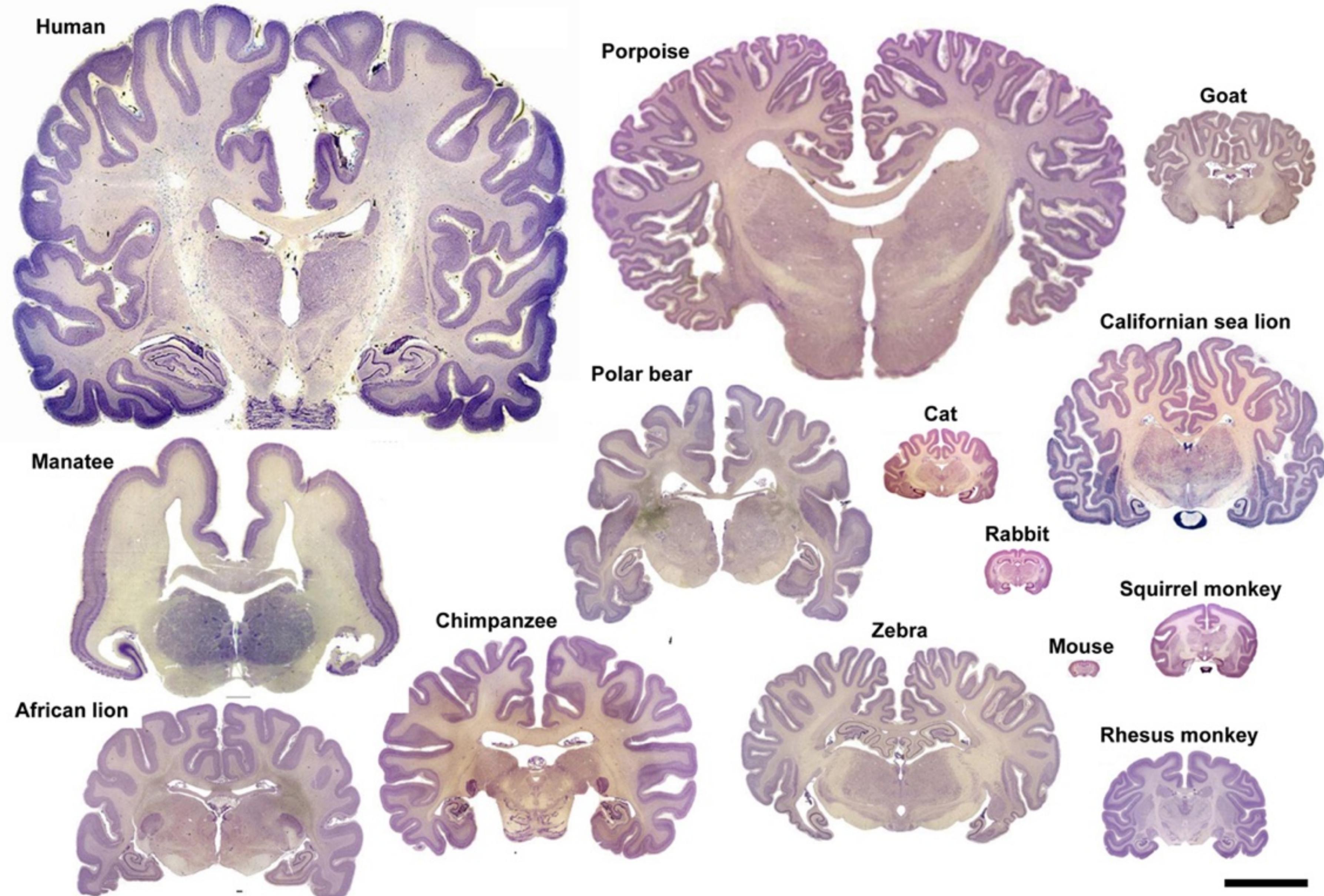
- Gray matter = cell bodies (somas)
- White Matter = myelinated axons



SIDE BAR: WHY IS THE BRAIN SO WRINKLED?

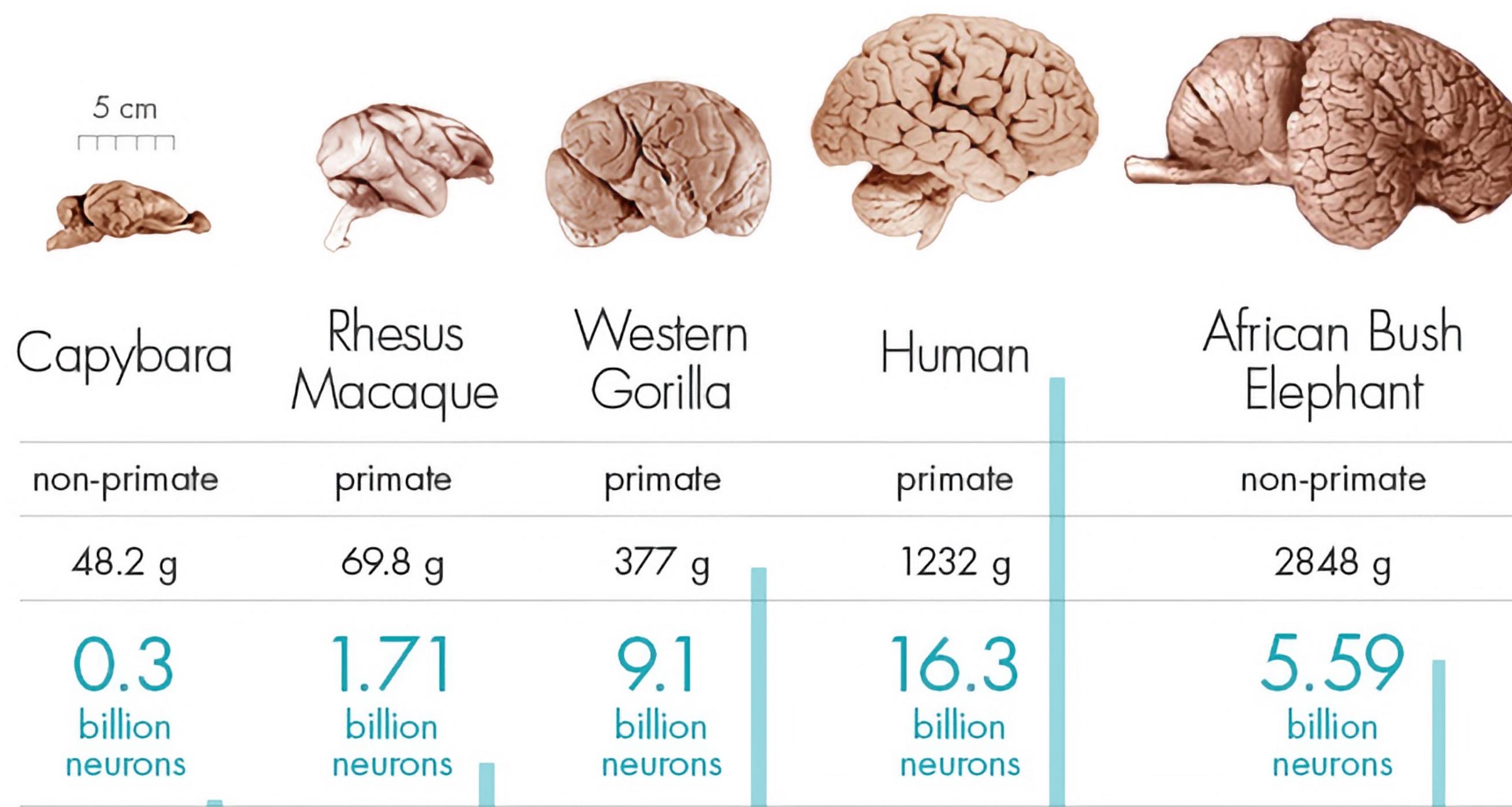


86 BILLION NERVE CELLS.
10 TRILLION SYNAPSES.

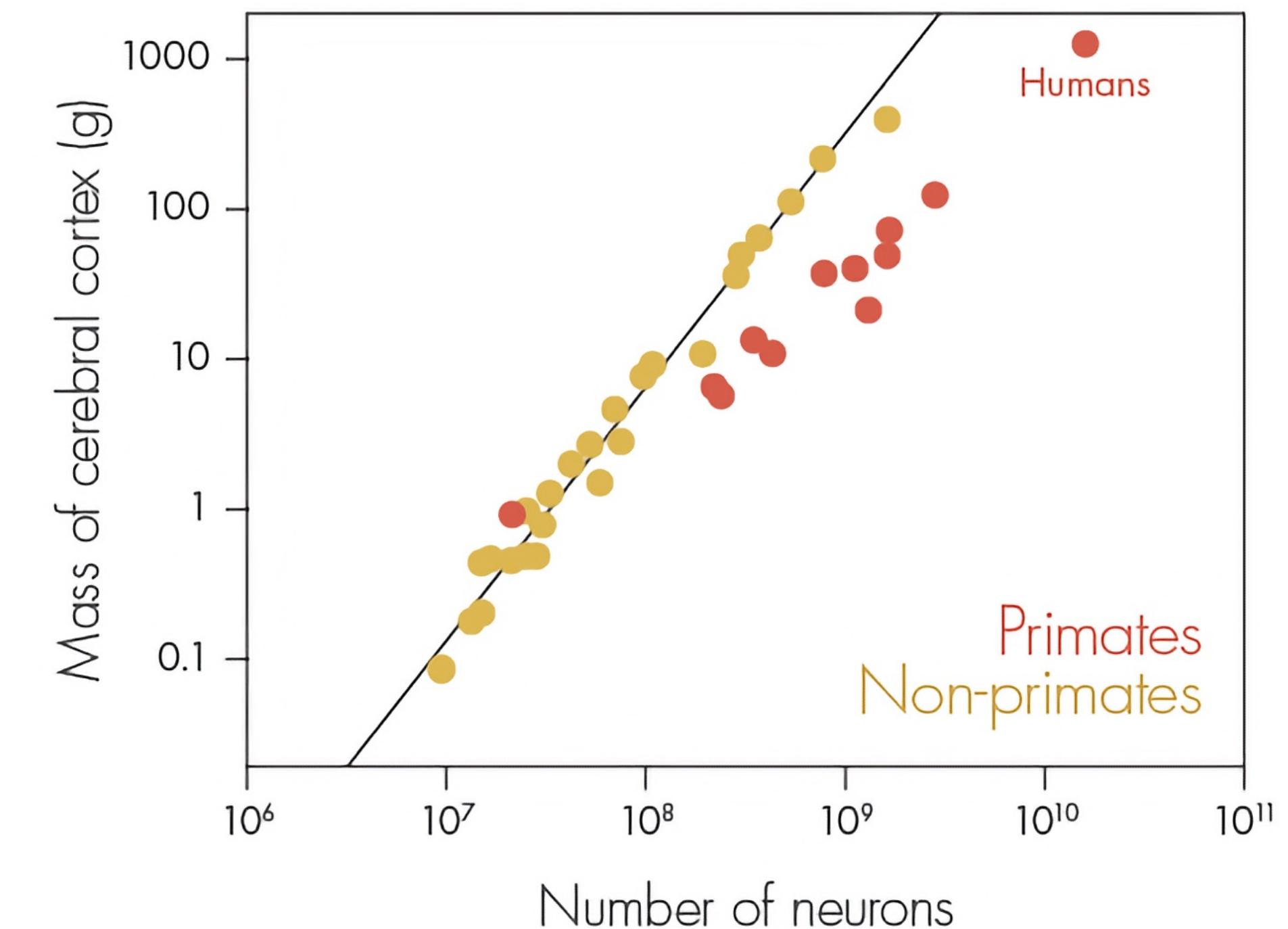


BRAIN SIZE AND NEURON COUNT

Cerebral cortex mass and neuron count for various mammals.



BRAIN DENSITY



- Humans don't have the largest brains, by weight
- But, they do have the densest Cerebral Cortex
 - Teeming with Neurons
- The number of Neurons does not scale linearly with the weight of the cerebral cortex

STRUCTURAL ORGANIZATION

WHITE MATTER IS ORGANIZED INTO TRACTS

▶ Commissural Fibers

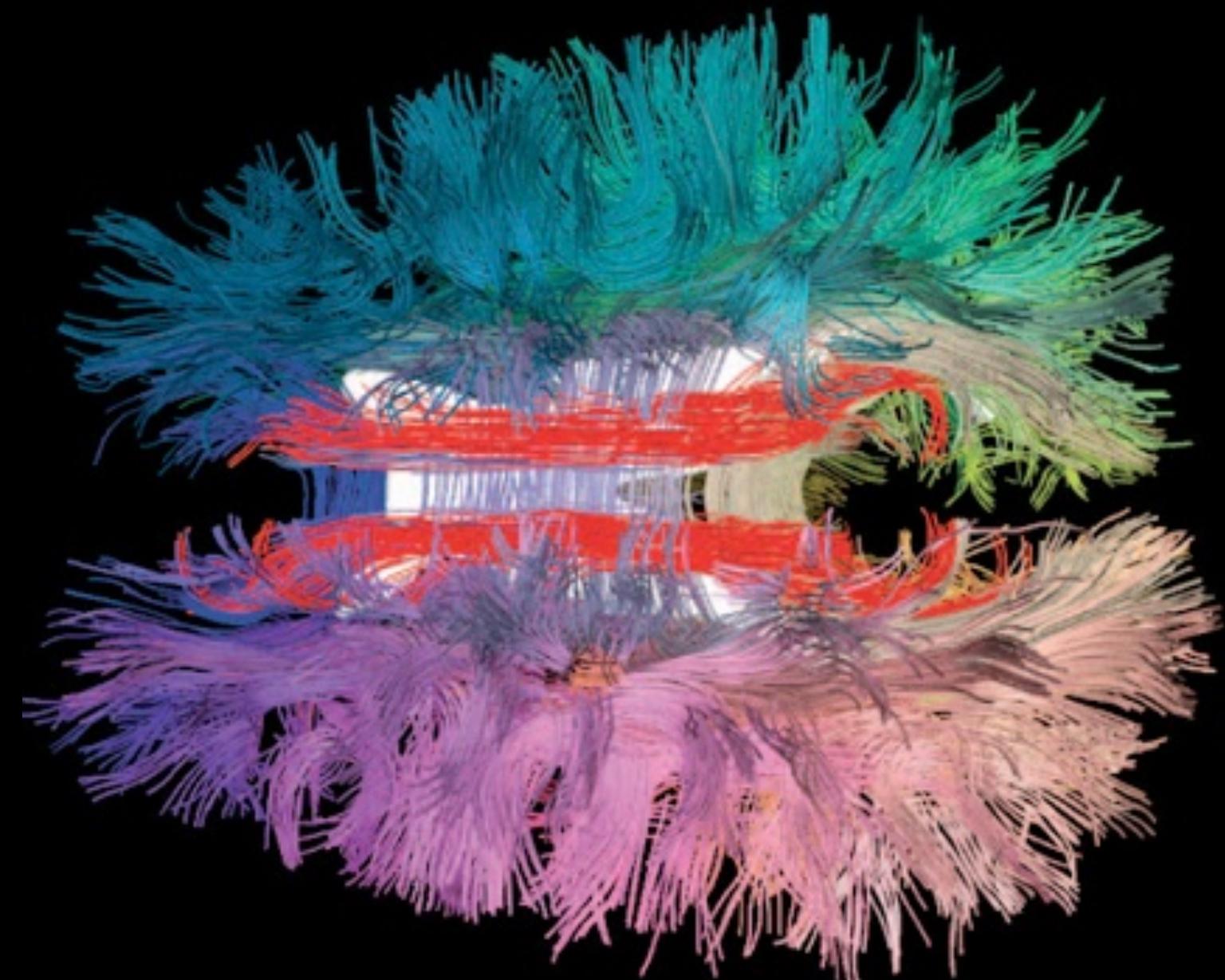
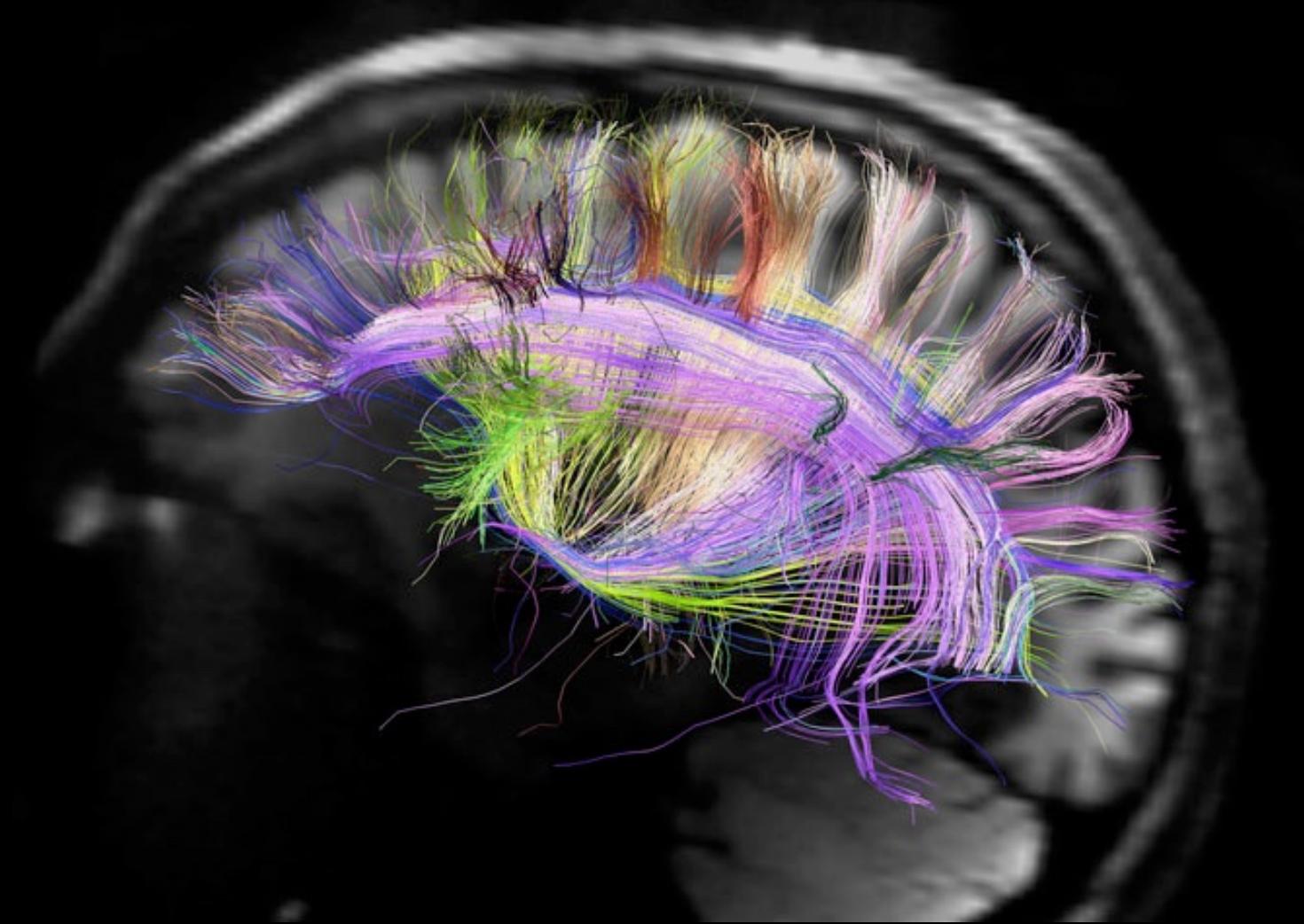
- ▶ Connect opposite hemispheres
- ▶ Corpus Callosum, Anterior, Posterior Commissures

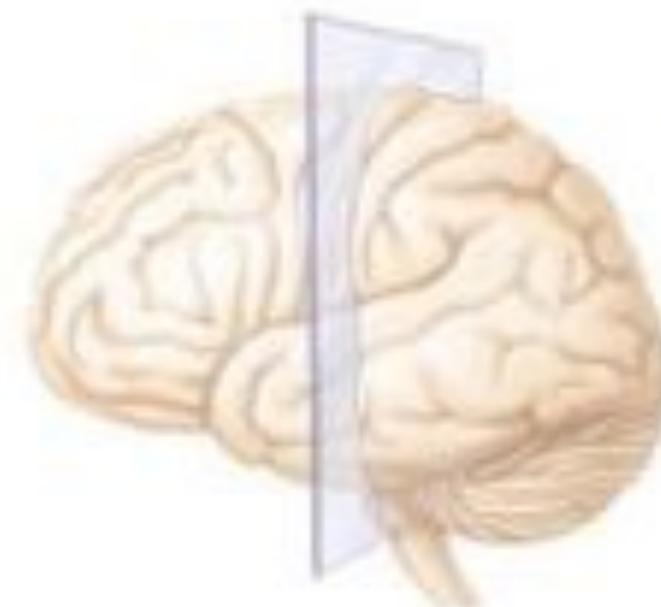
▶ Association Fibers

- ▶ Connect cortical areas on same hemisphere
- ▶ Cingulum, Fasciculi, U-fibers

▶ Projection Fibers

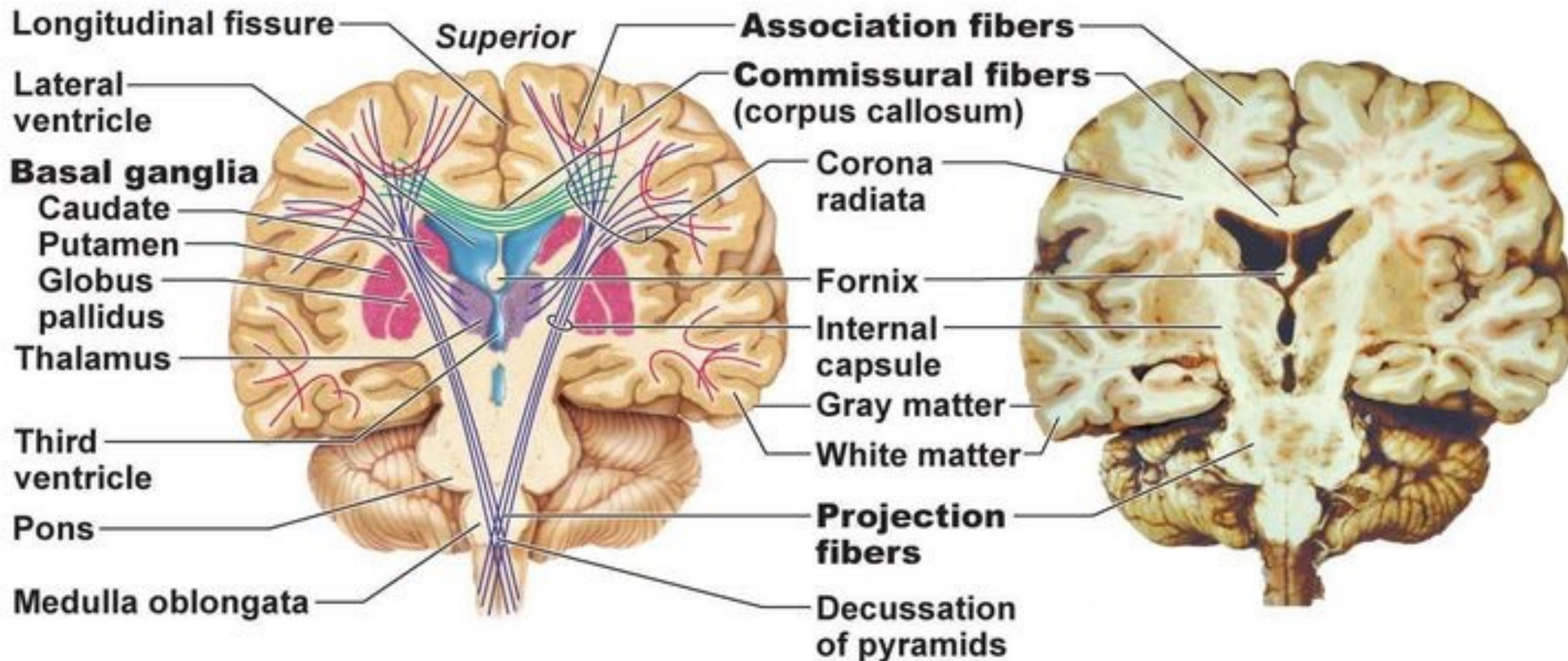
- ▶ Connect cortical areas with deep nuclei, brain stem, cerebellum, spinal cord





WHITE MATTER TRACTS

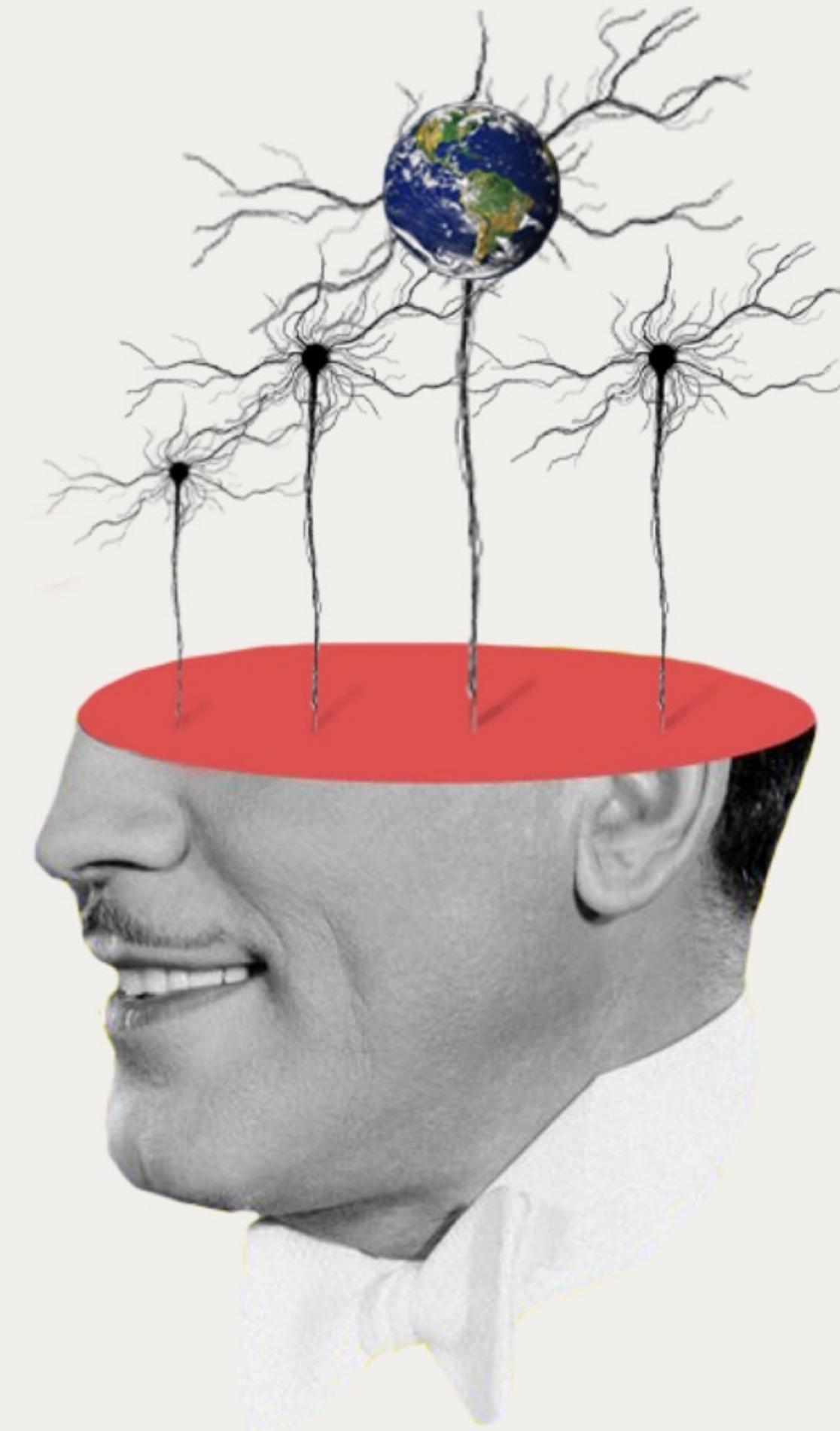
Commissural, Association, Projection



(a) Frontal section

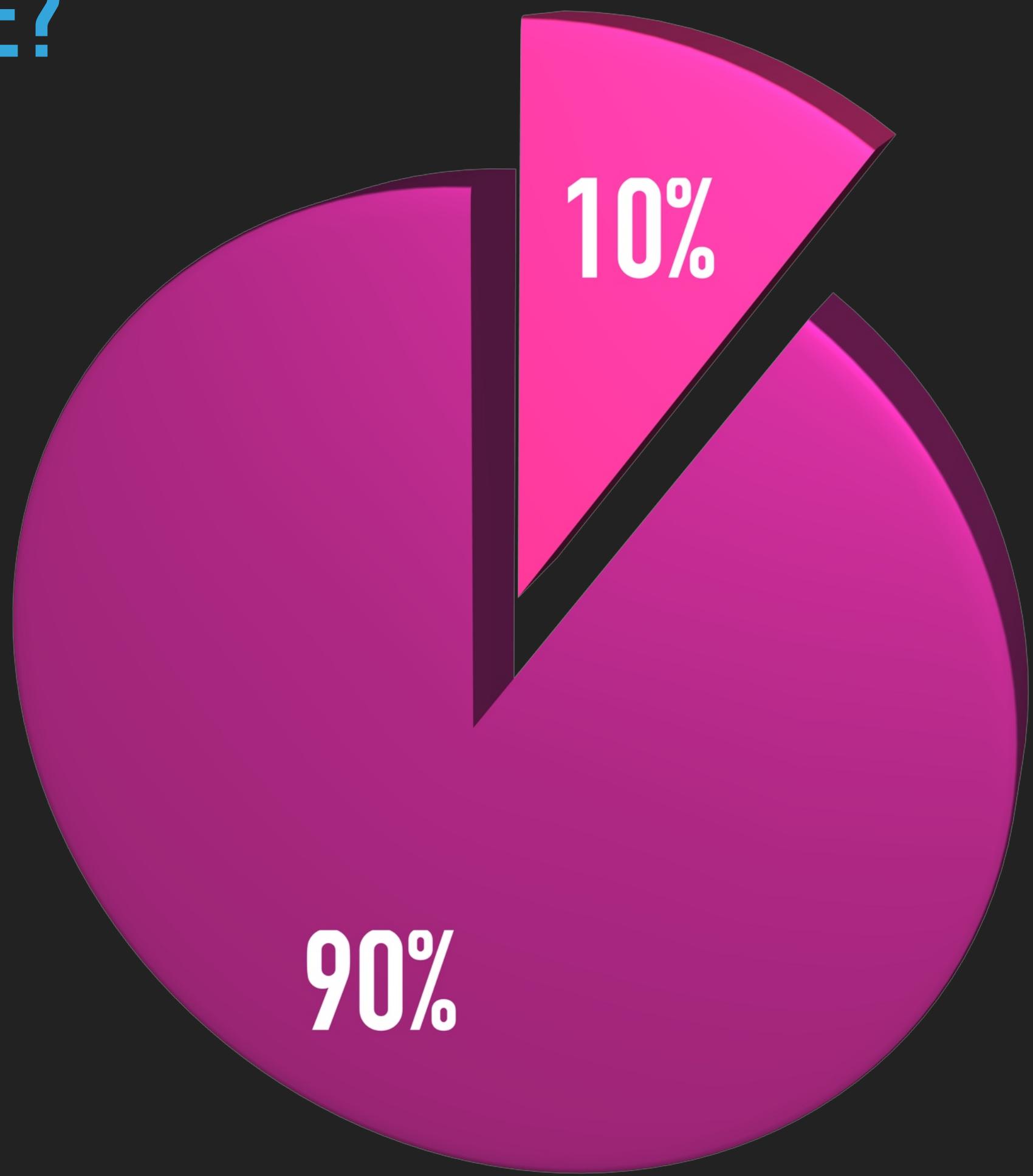
#TodayWeLearned

The Neurons are connected



**The axons in your brain could span a distance of 100,000 miles,
which is four times around the Earth.**

WHAT PERCENT OF OUR BRAIN POWER DO WE USE?



● used

● unused

WE USE ALL OF OUR BRAIN MOST OF THE TIME

- ▶ Small Injuries can be devastating
 - ▶ Gun Shots
 - ▶ Strokes
- ▶ Simple tasks
 - ▶ Driving a car vs texting



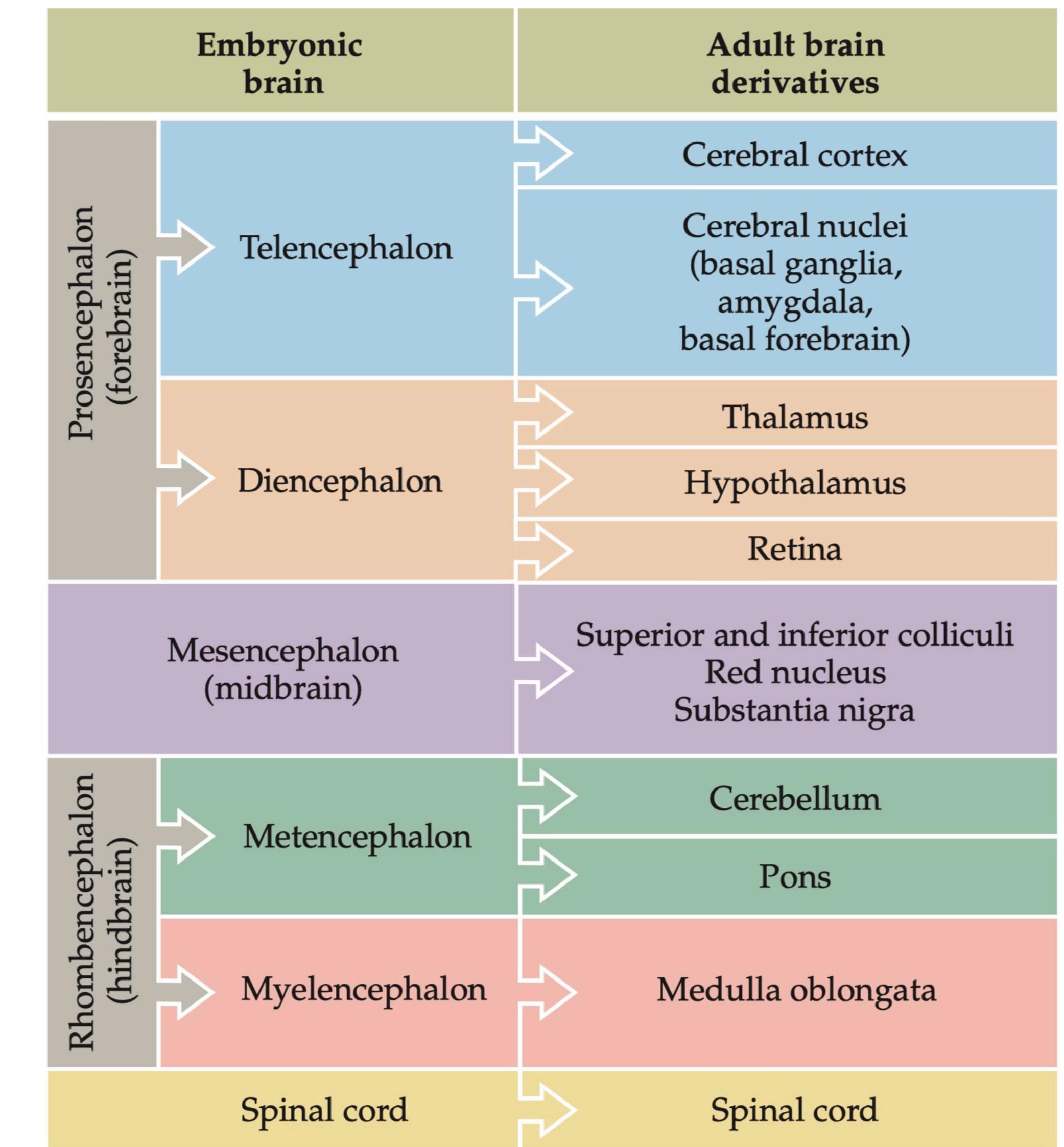
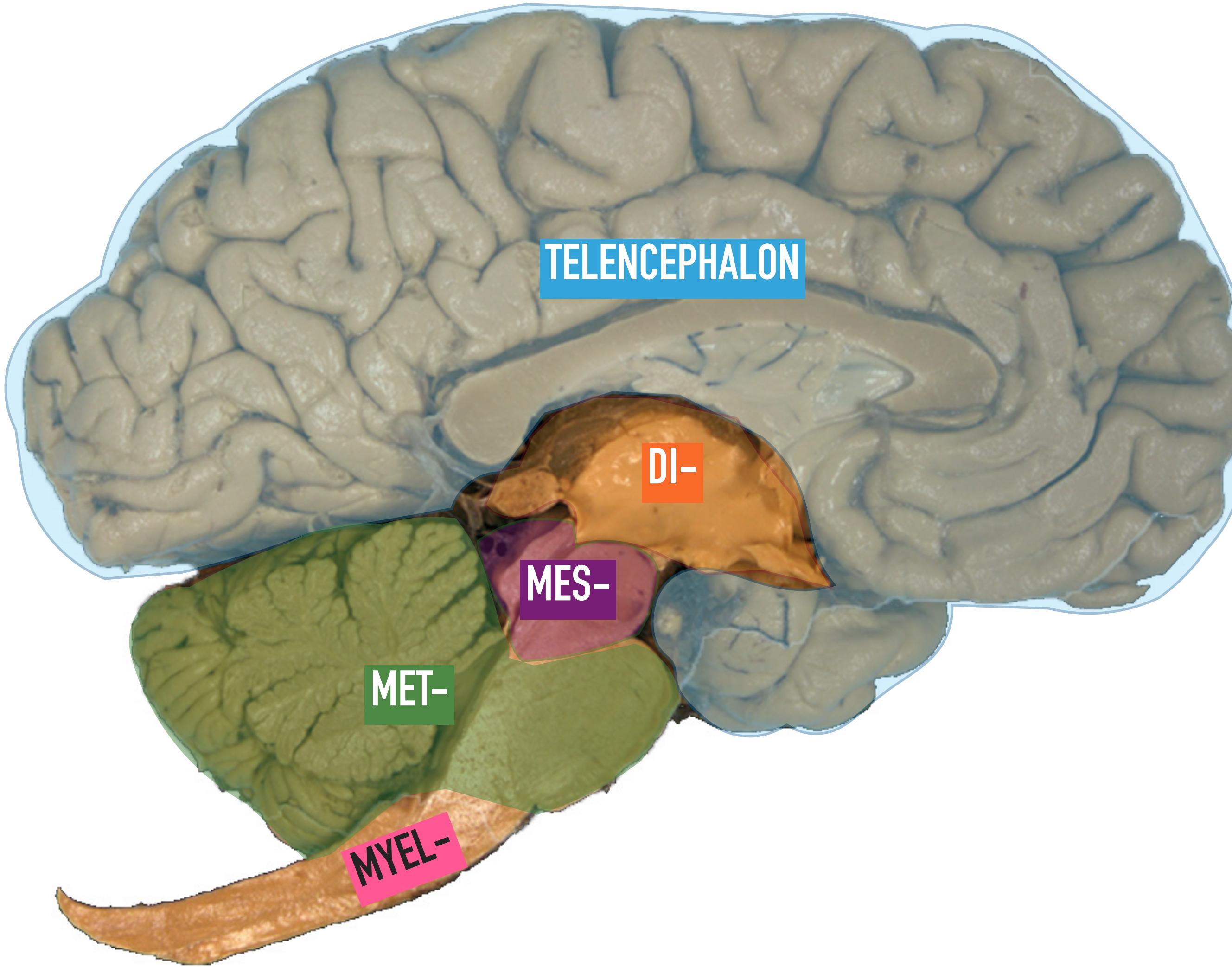


STRUCTURE AND FUNCTION

SUBDIVISIONS OF THE
CNS

Greek: *kephalé* = head

SUBDIVISIONS OF THE CNS



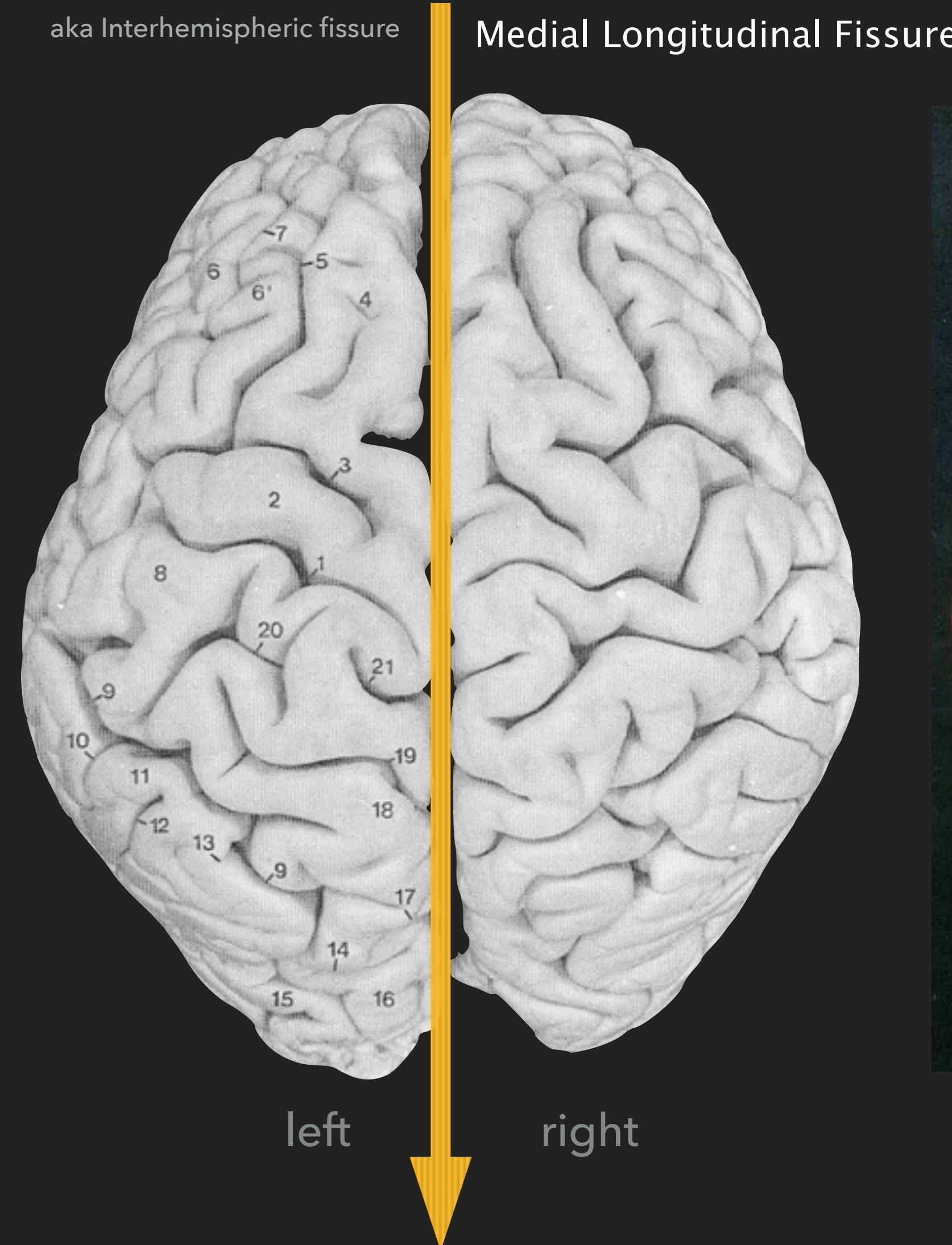
TELENCEPHALON

"Tells the other parts of the brain what to"

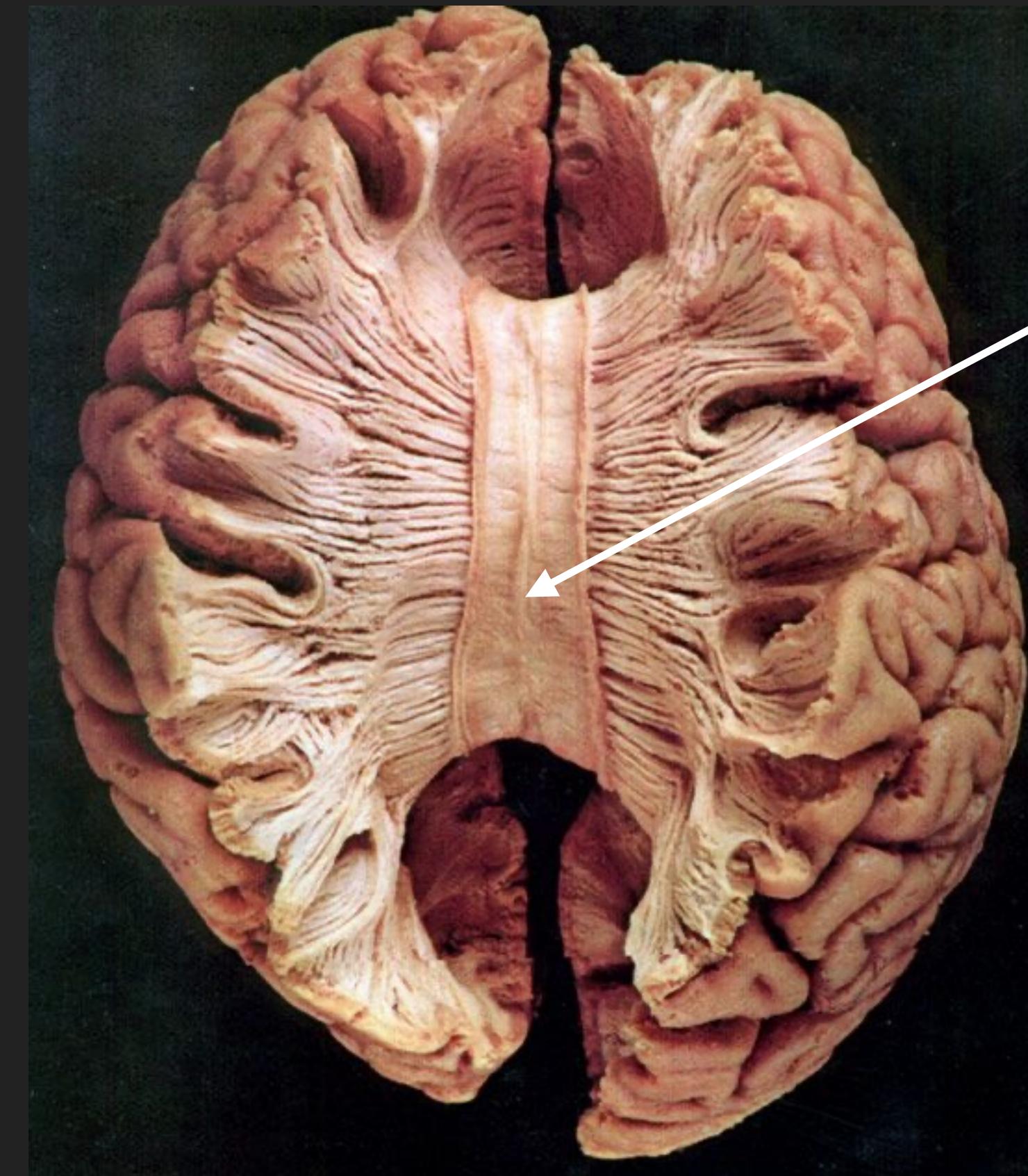
TELENCEPHALON

THE TWO HEMISPHERES OF THE TELENCEPHALON

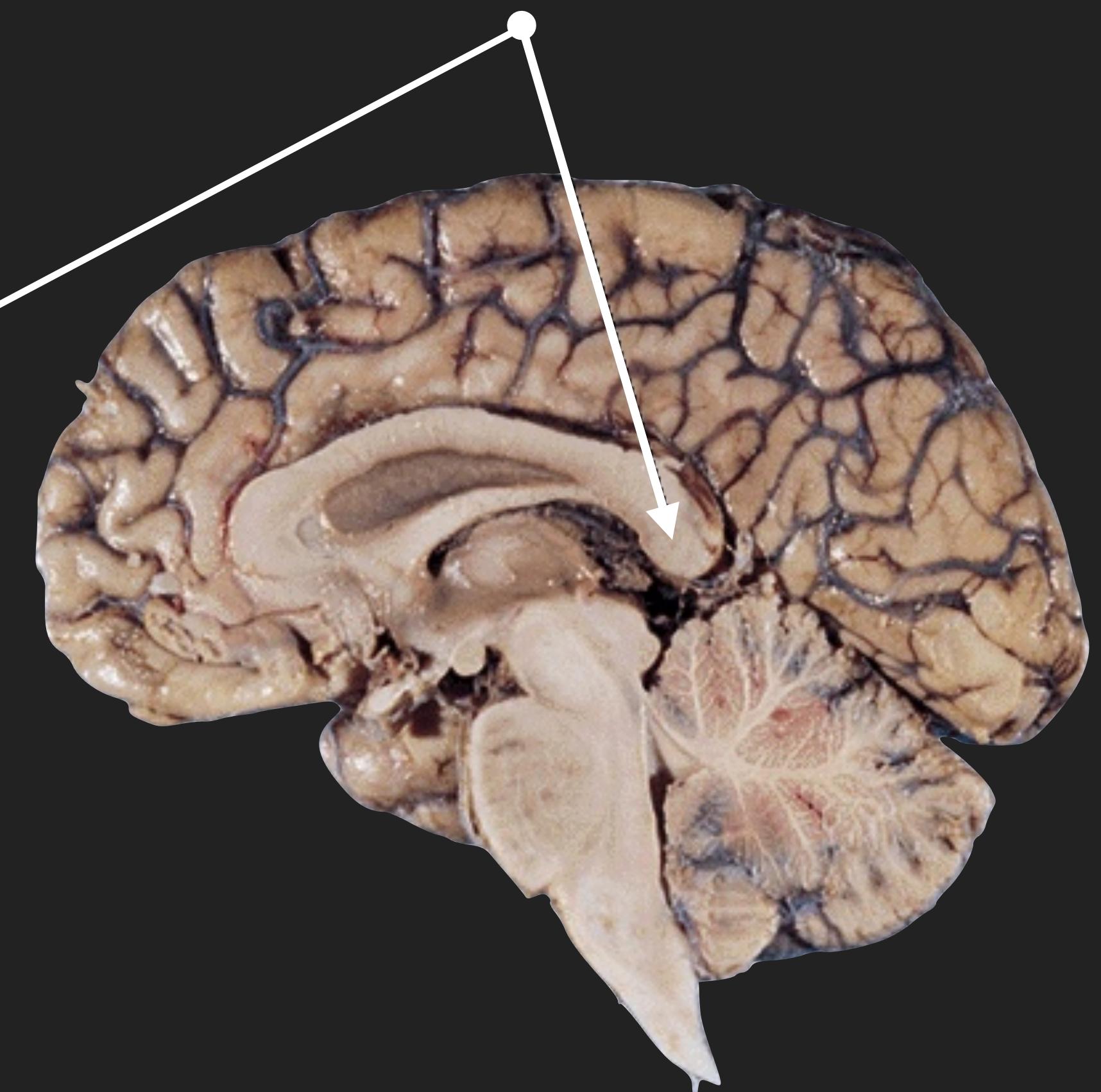
aka Interhemispheric fissure



Medial Longitudinal Fissure



Corpus Callosum



White matter tract connecting hemispheres
(commissural)

FUNCTIONAL DOMAINS

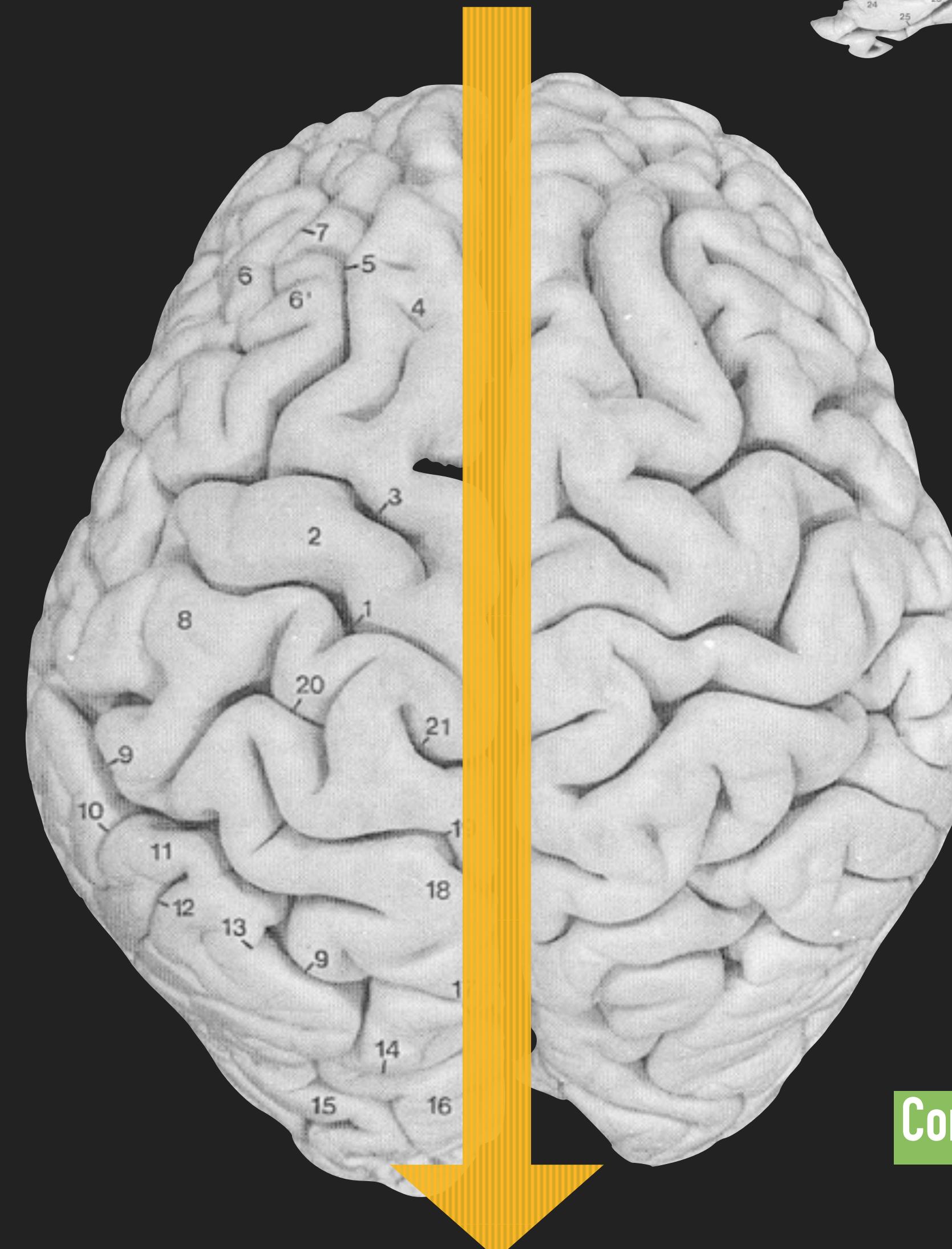
CEREBRAL HEMISPHERES

LEFT SIDE

- Talking
- Writing
- Arithmetic
- Scientific skills
- Reasoning

Controls RIGHT side

Medial
Longitudinal
Fissure



RIGHT SIDE

- Music awareness
- 3D perception
- Art awareness
- Imagination
- Ideas

Controls LEFT side

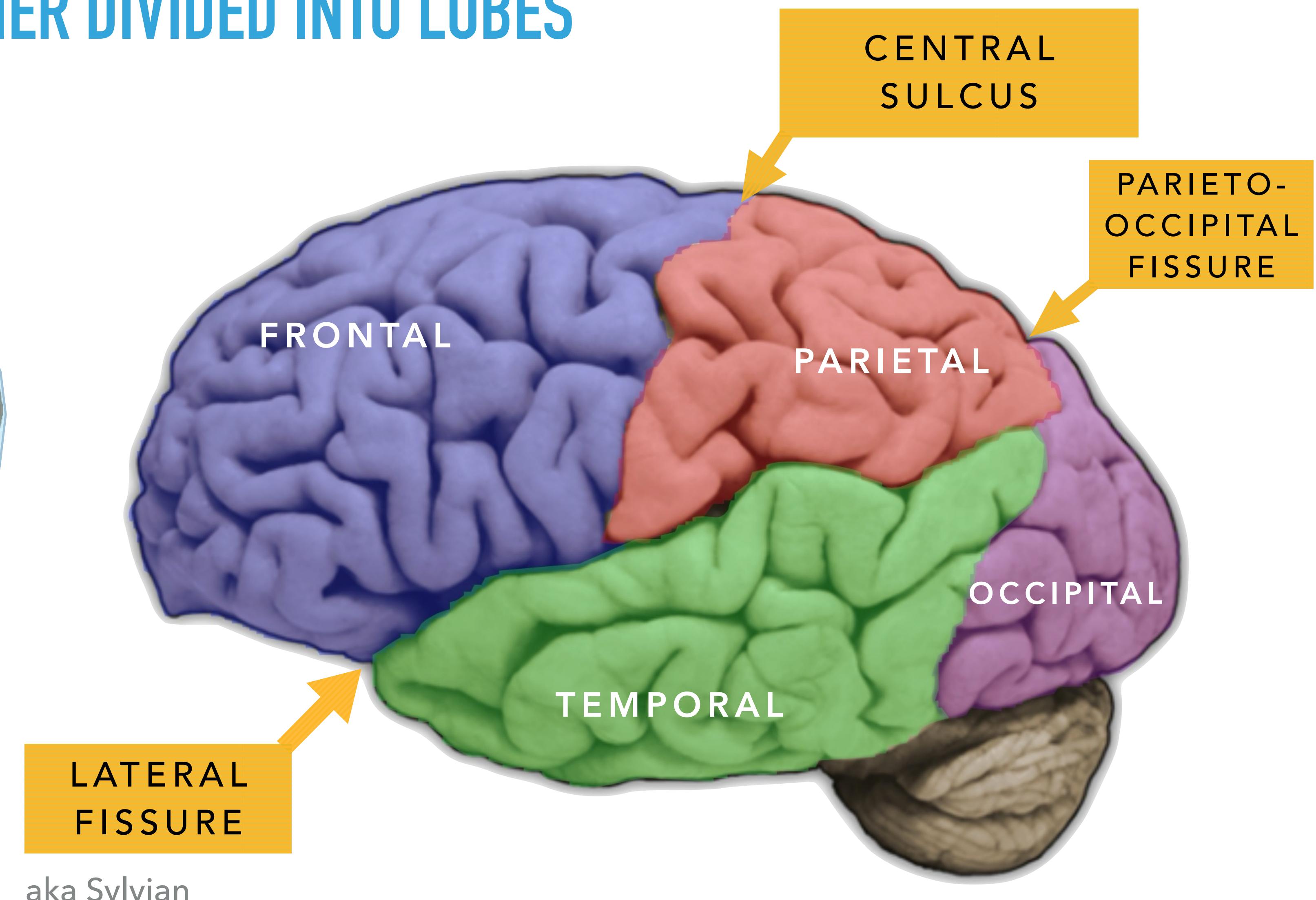
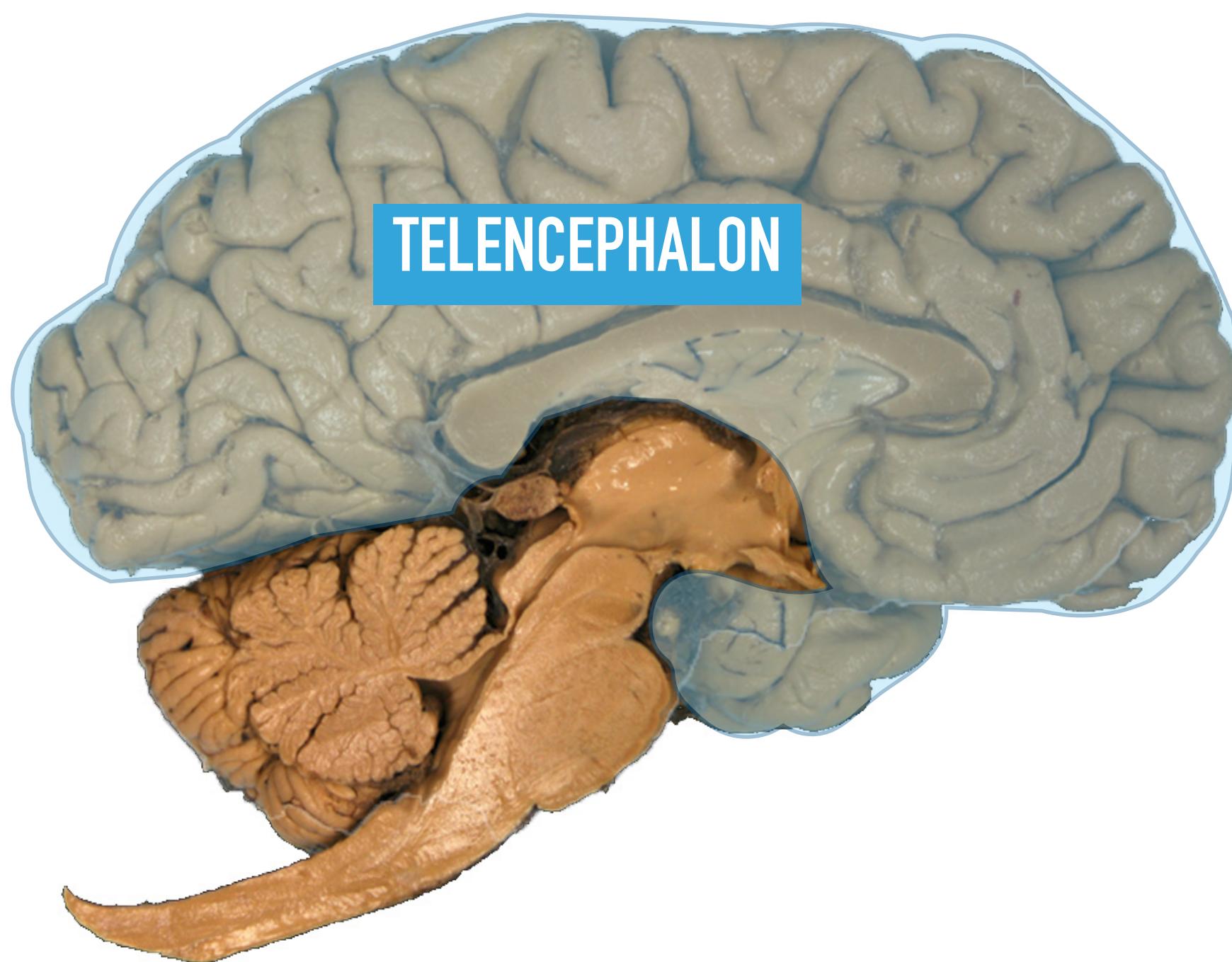


SIDEDNESS DEMONSTRATION

- ▶ Rotate dominant hand and opposite foot in opposite directions
- ▶ Rotate dominant hand & same foot in opposite directions

SUBDIVISIONS

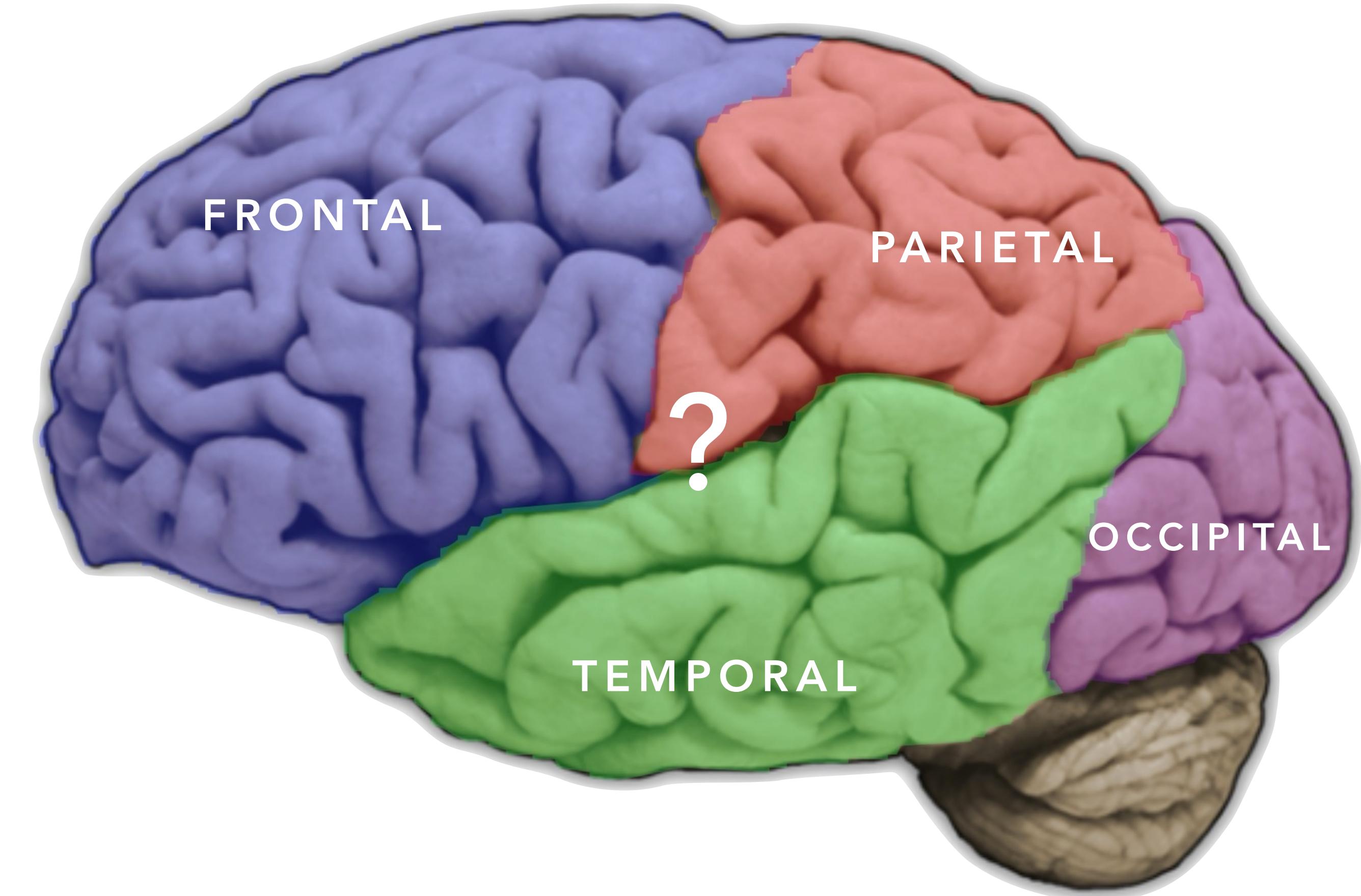
EACH HEMISPHERE IS FURTHER DIVIDED INTO LOBES



aka the Cerebrum

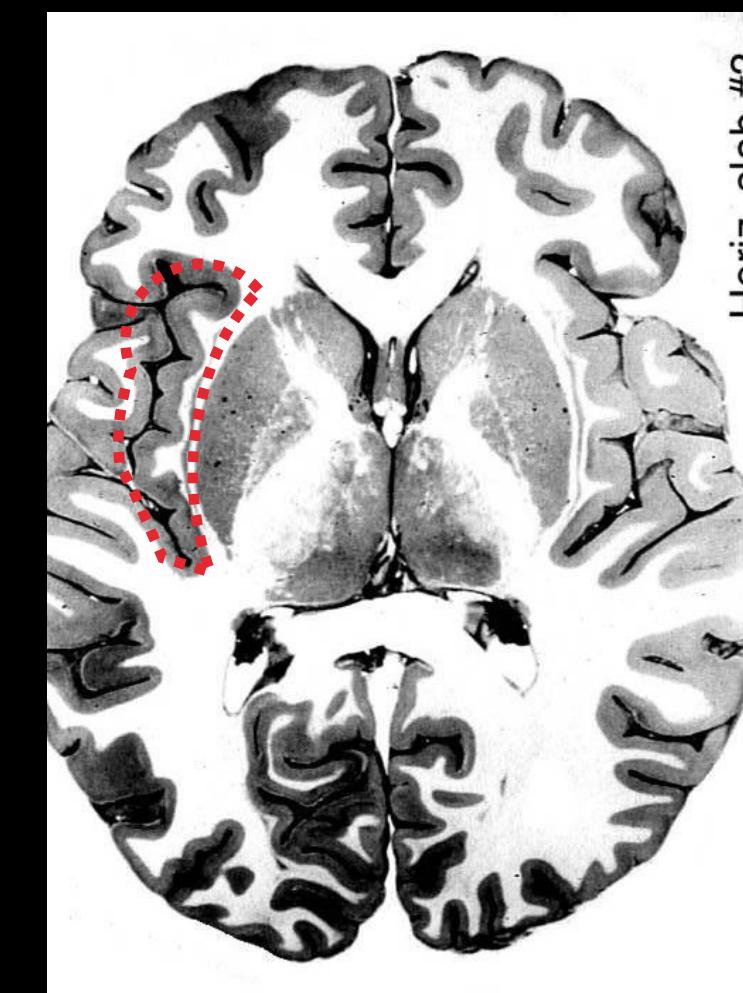
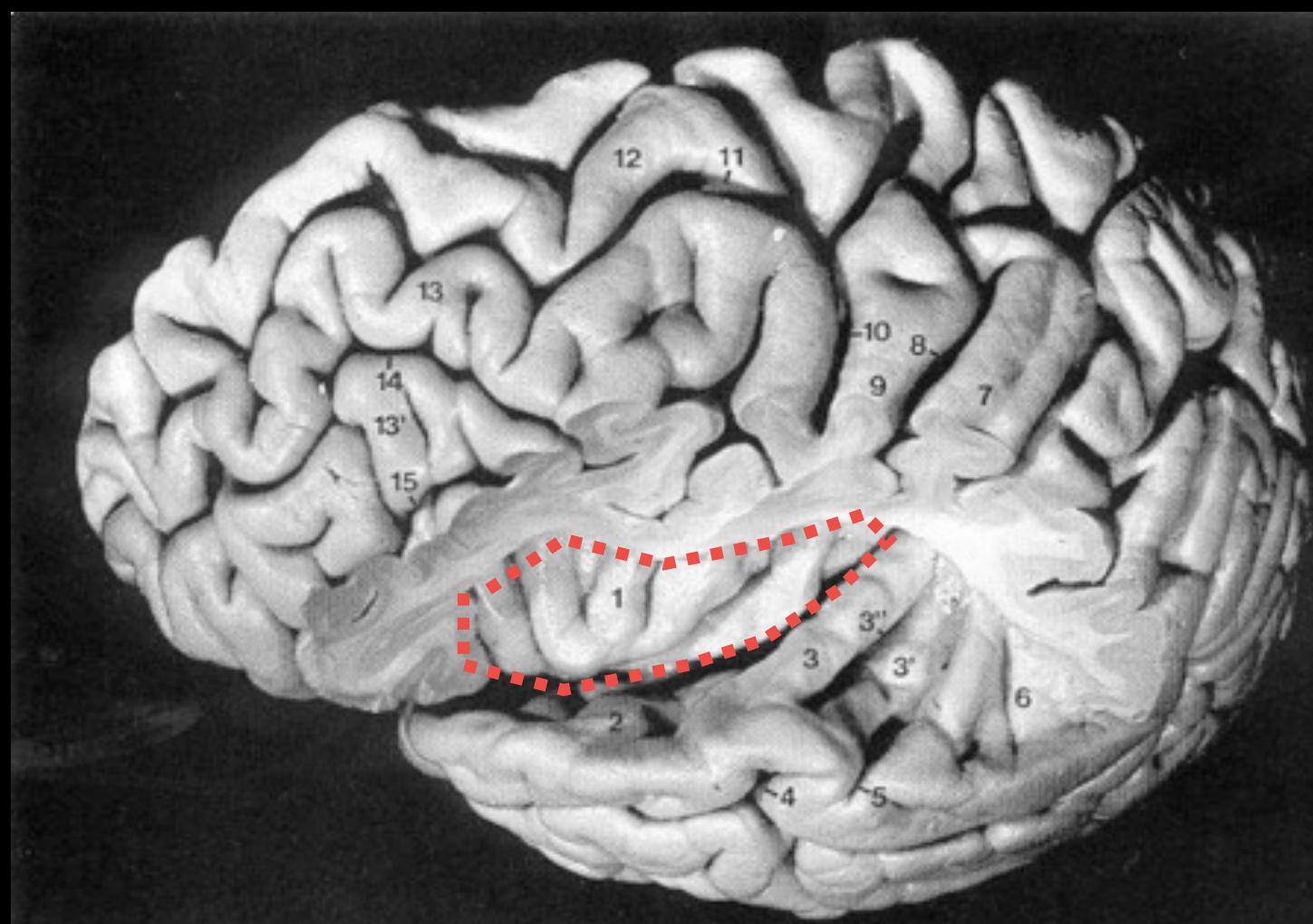
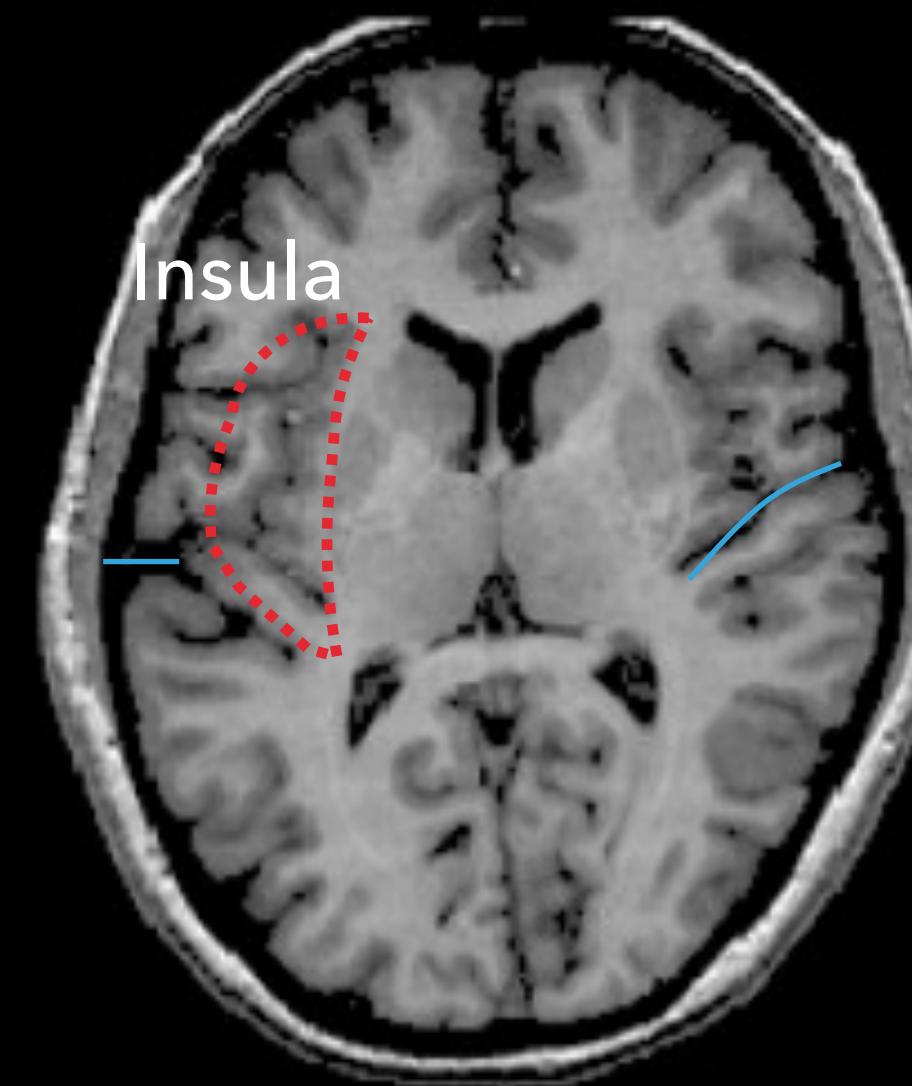
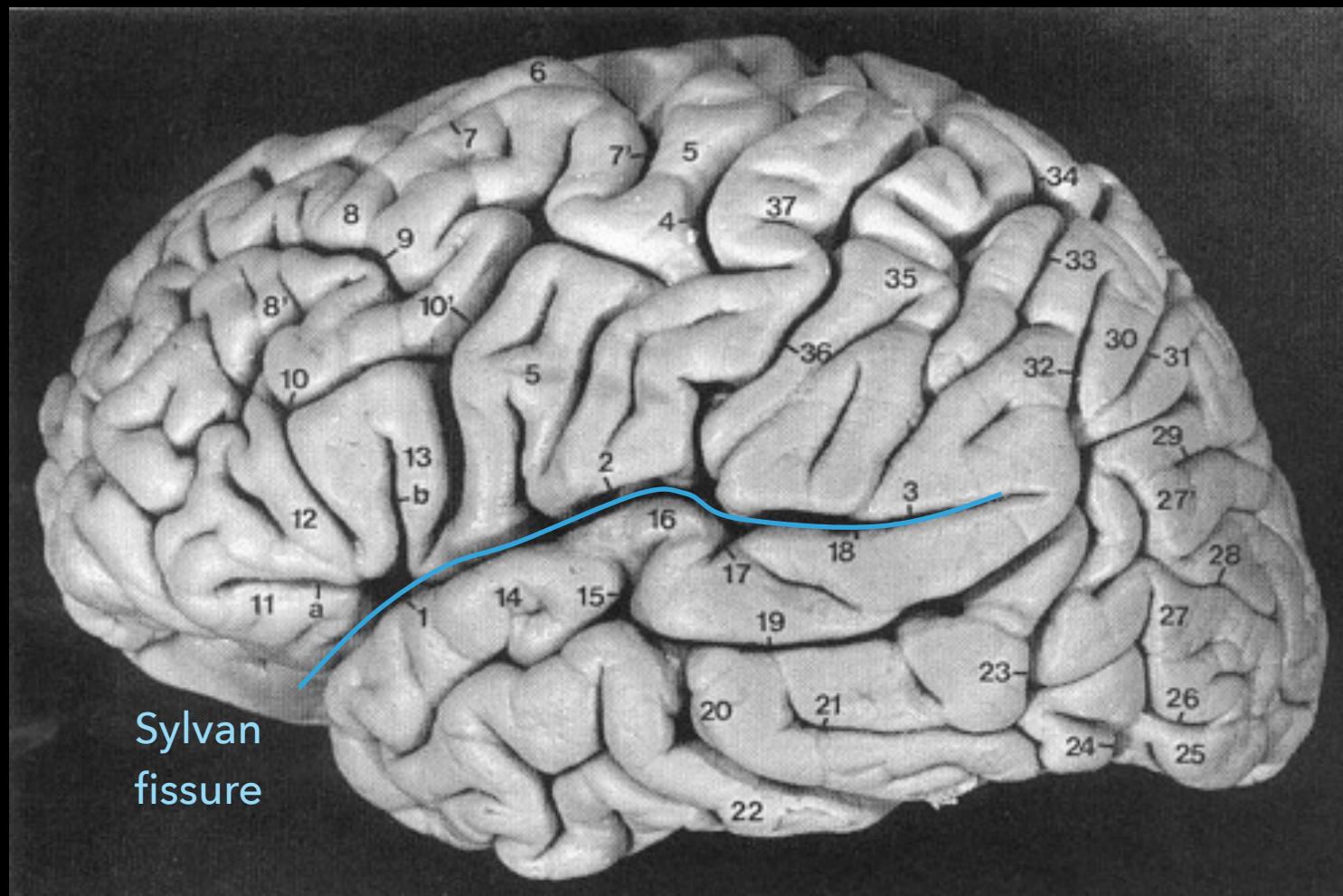
BONUS LOBES

- ▶ In addition to the four main lobes are two bonus lobes
 - ▶ Not visible from surface
 - ▶ Often overlooked



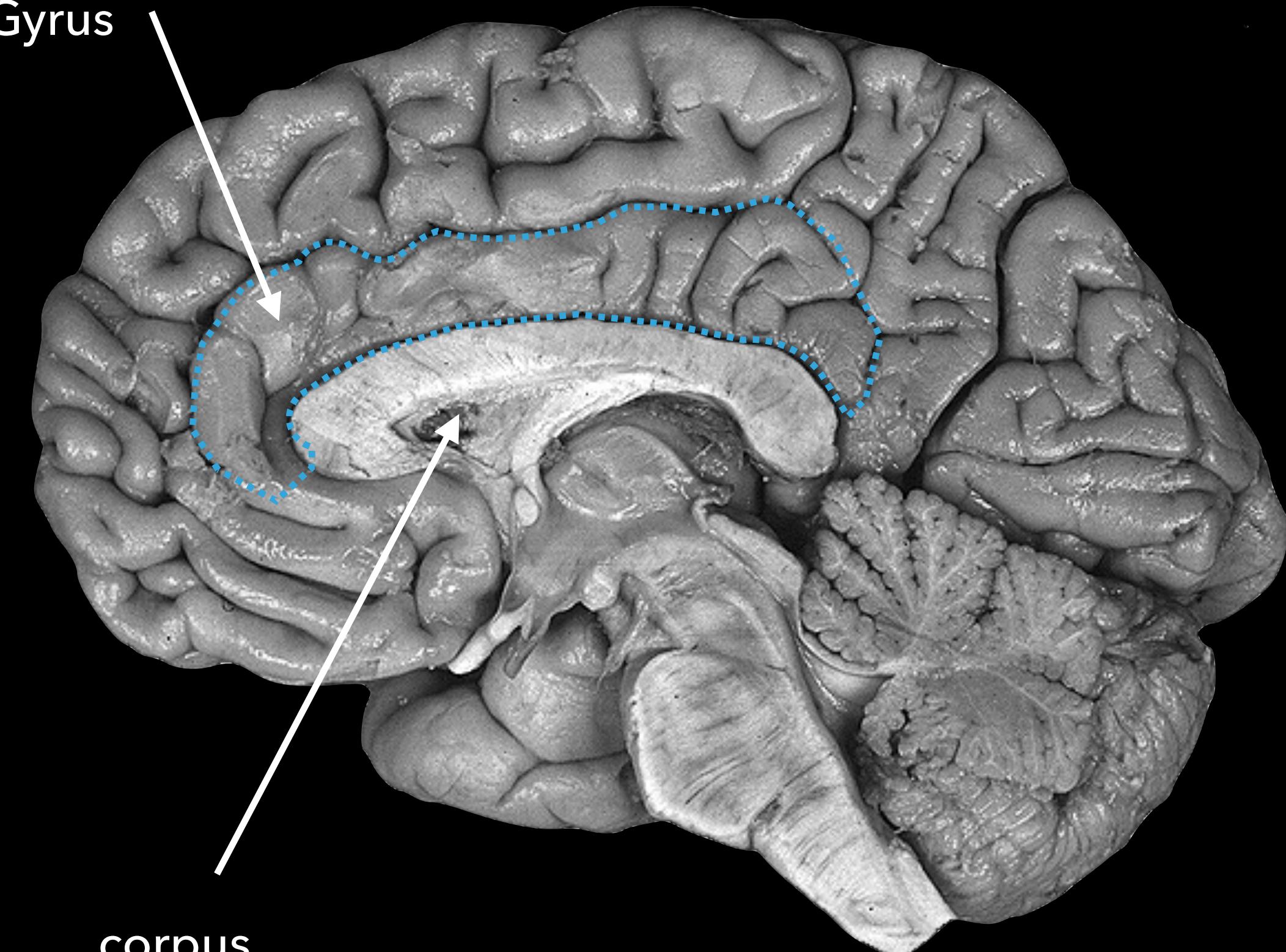
FIND THEM LOBES

BONUS LOBES: INSULA



CINGULATE GYRUS

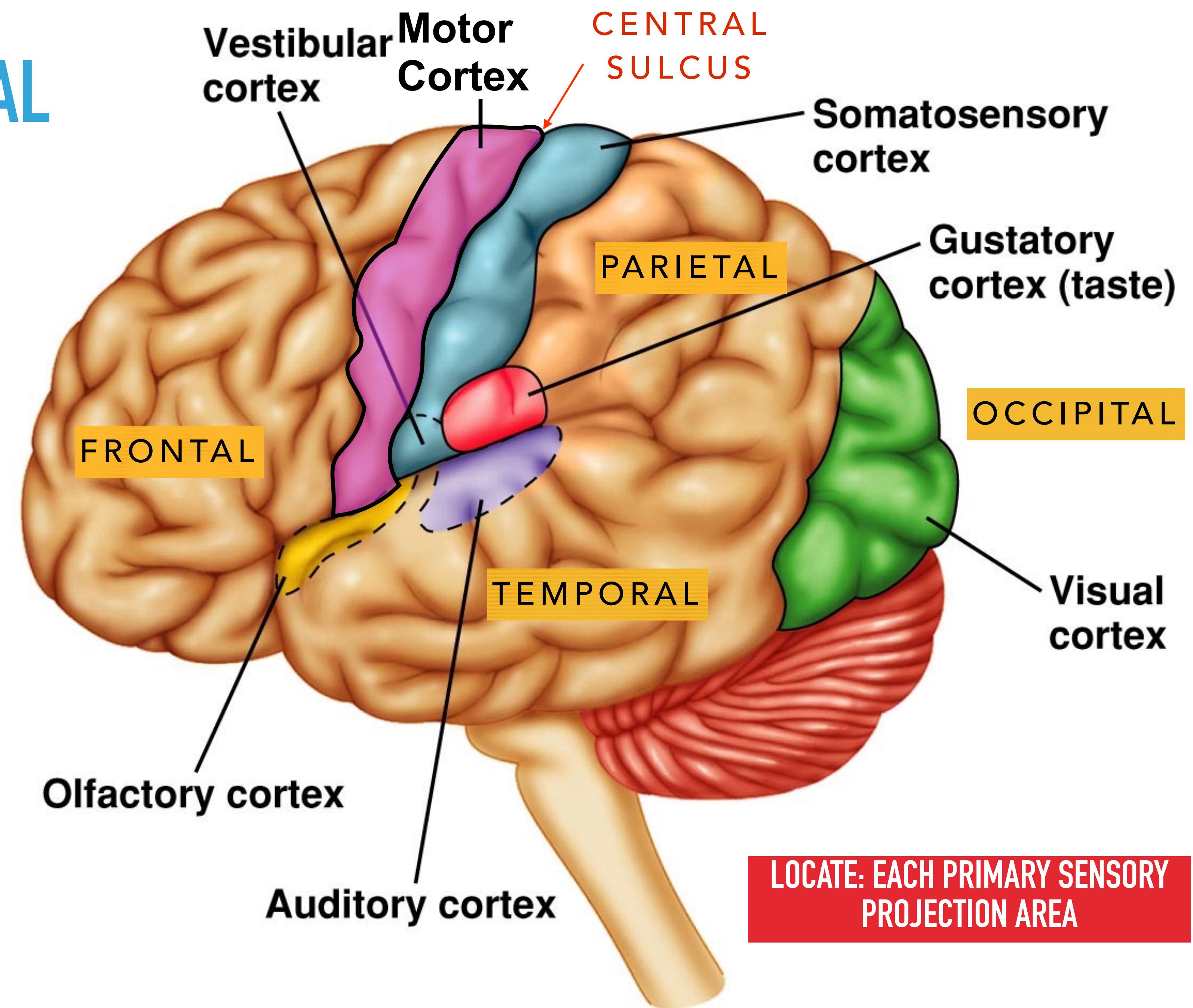
Cingulate
Gyrus



corpus
callosum

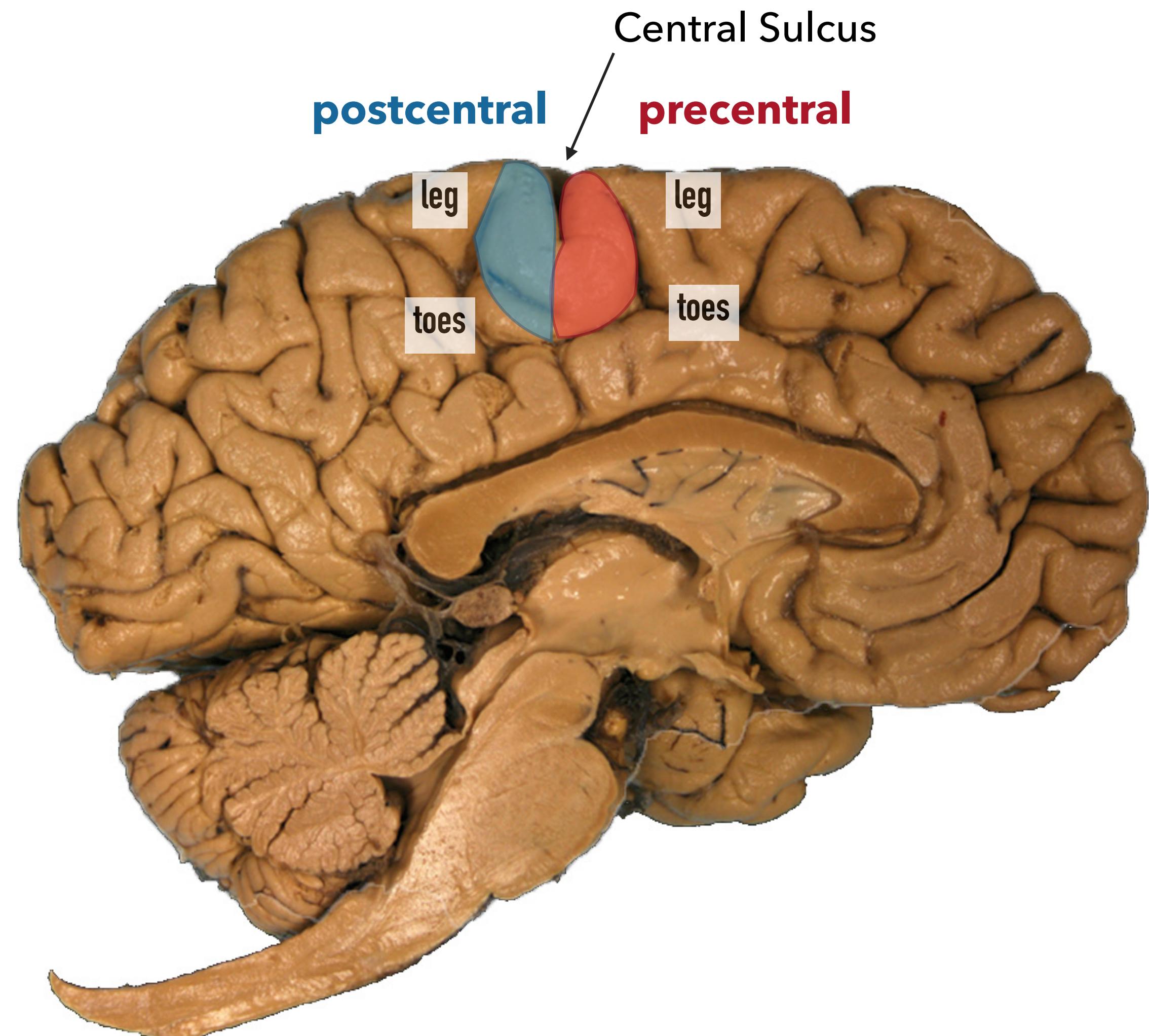
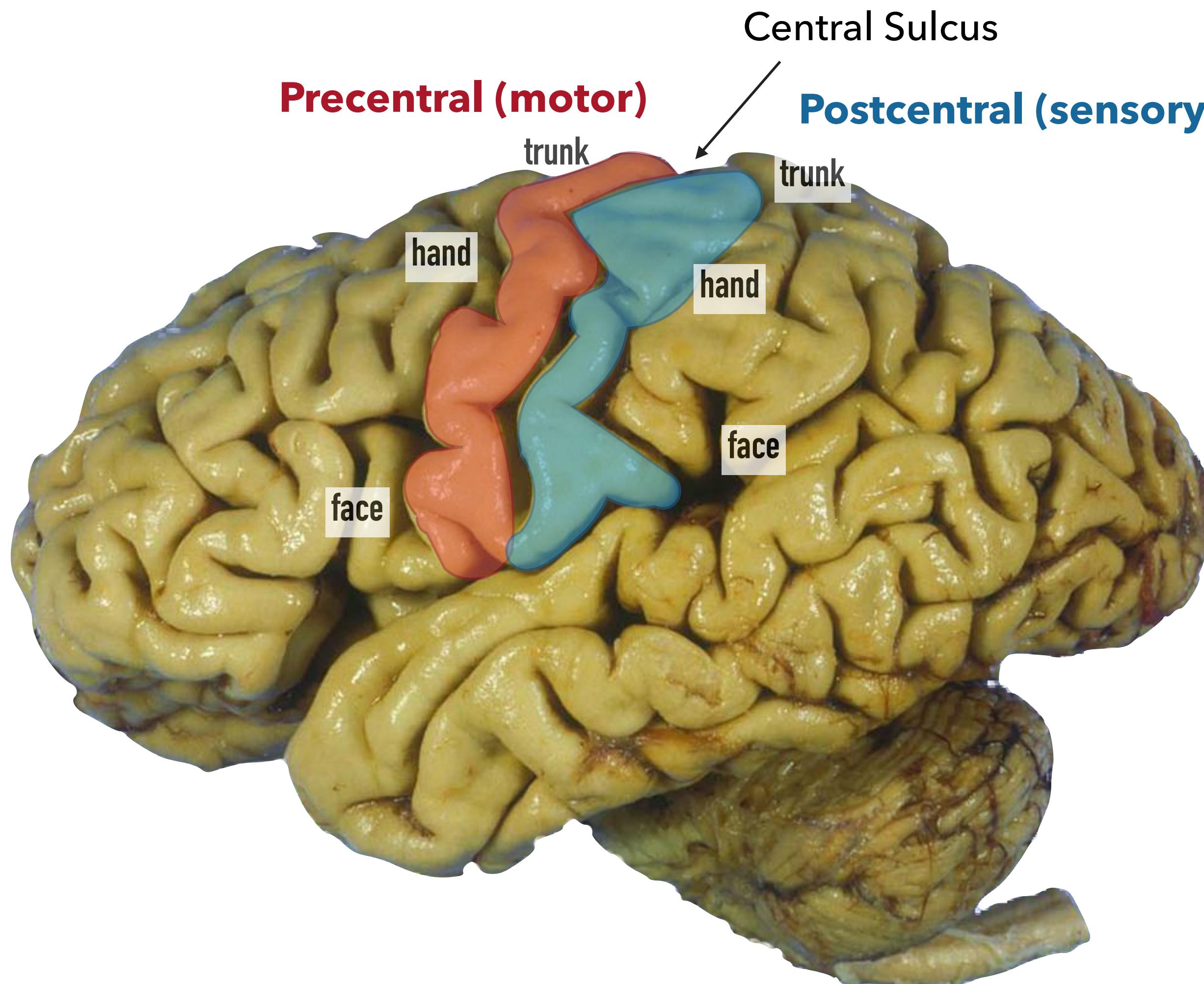
EACH LOBE HAS REGIONAL SPECIALIZATIONS

- ▶ Primary cortices
 - ▶ Regions in the cortex that receive unprocessed sensory information or execute voluntary movement
- ▶ Three main Divisions
 - ▶ Sensory
 - ▶ Motor
 - ▶ Association (not colored here)



PRIMARY CORTICES

MOTOR AND SOMATOSENSORY CORTEX

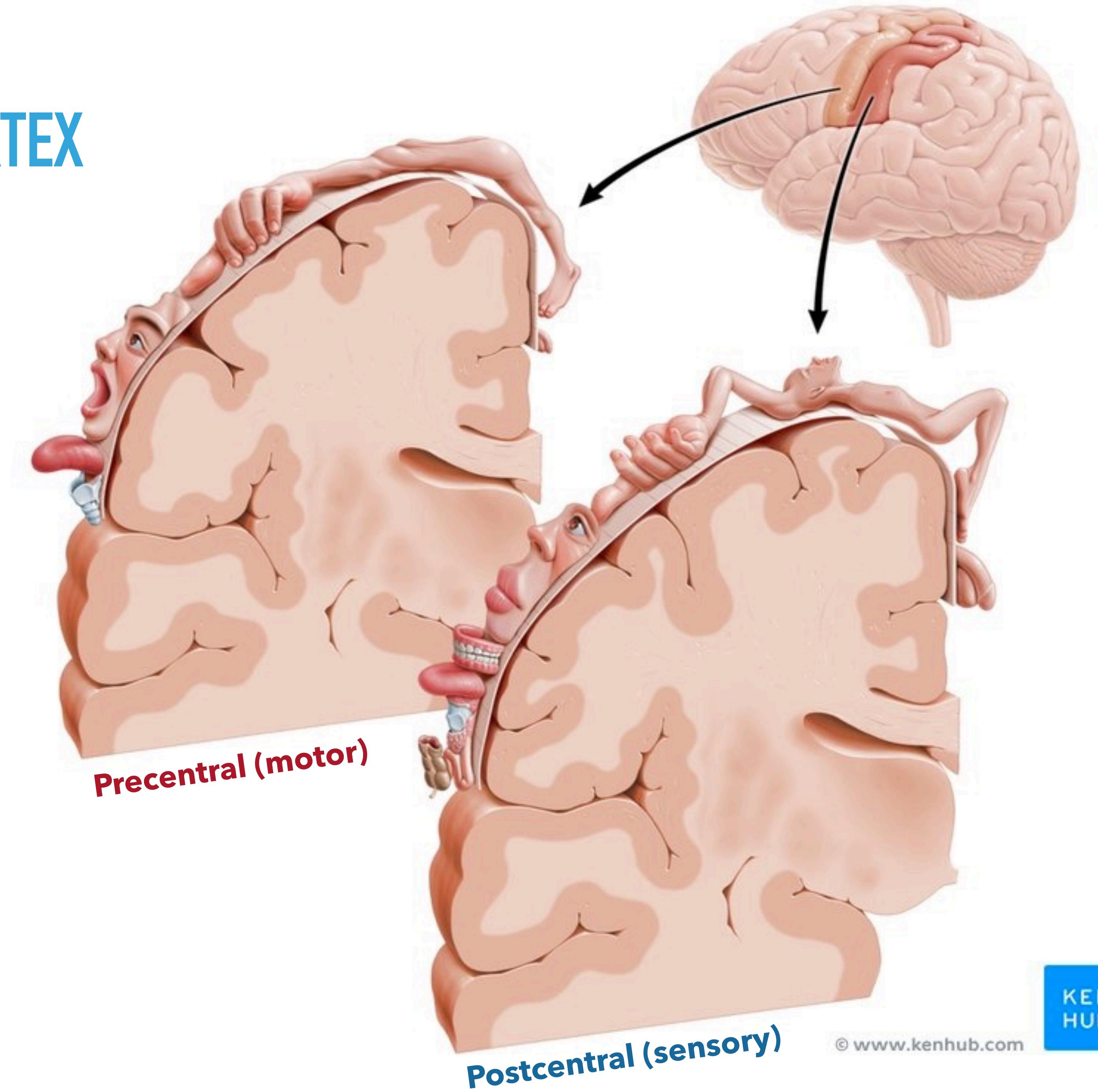


The two gyri running parallel to the central sulcus

PRIMARY CORTICES

MOTOR AND SOMATOSENSORY CORTEX

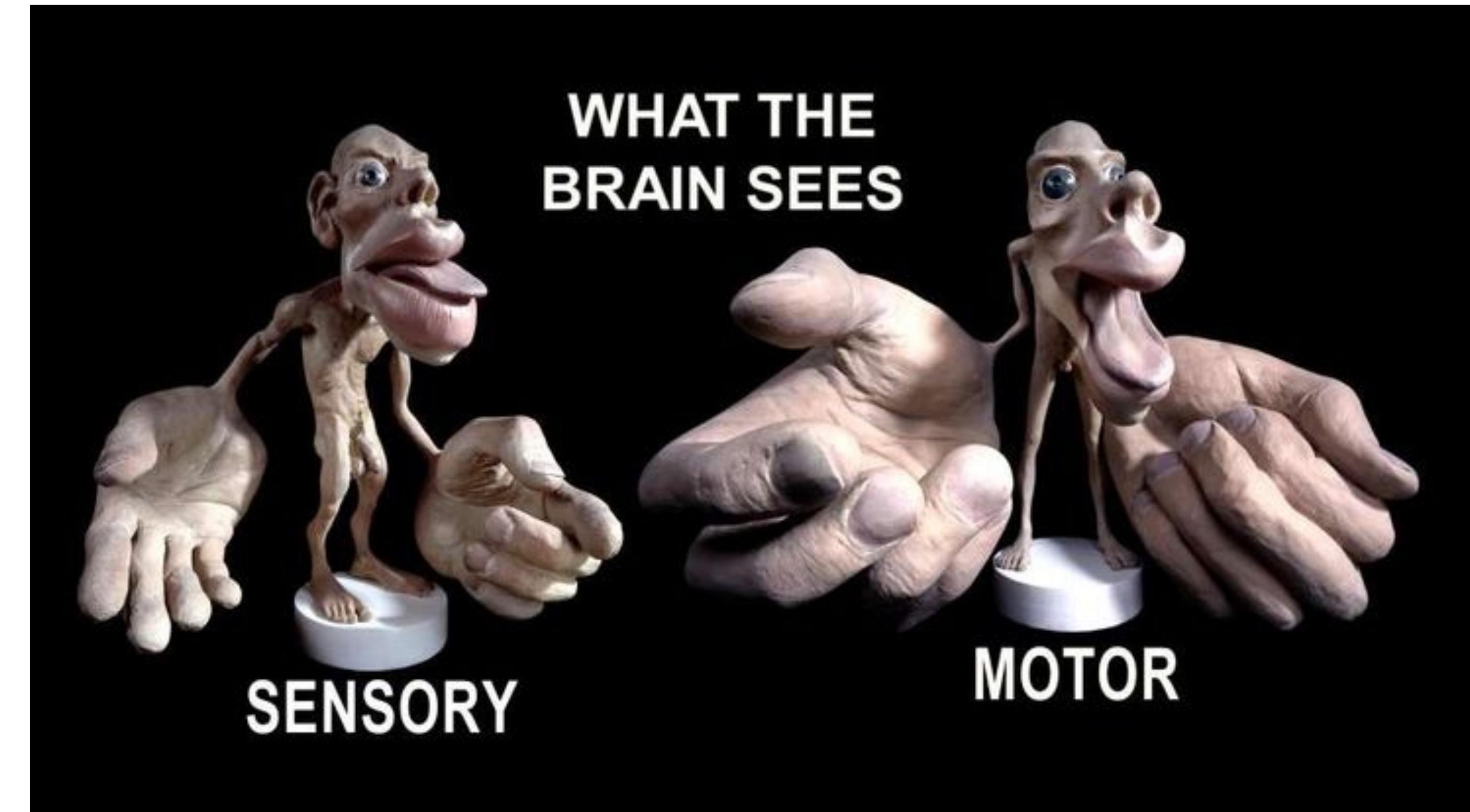
- ▶ Each Gyrus contains a representation of your body
 - ▶ **Homunculus** - little man
- ▶ Primary Motor Cortex (precentral)
 - ▶ executes voluntary movement
- ▶ Primary Somatosensory Cortex (postcentral)
 - ▶ Receives somatosensory from you body
 - ▶ The **face area** in the homunculus is in lower part of the post-central gyrus (know this)
- ▶ Not a 1:1 mapping ratio



THE HOMUNCULUS

"little man" - in Latin

- ▶ Sensory and motor maps do not have a 1:1 mapping ratio to cortical surface area.
- ▶ Some regions disproportionately represented



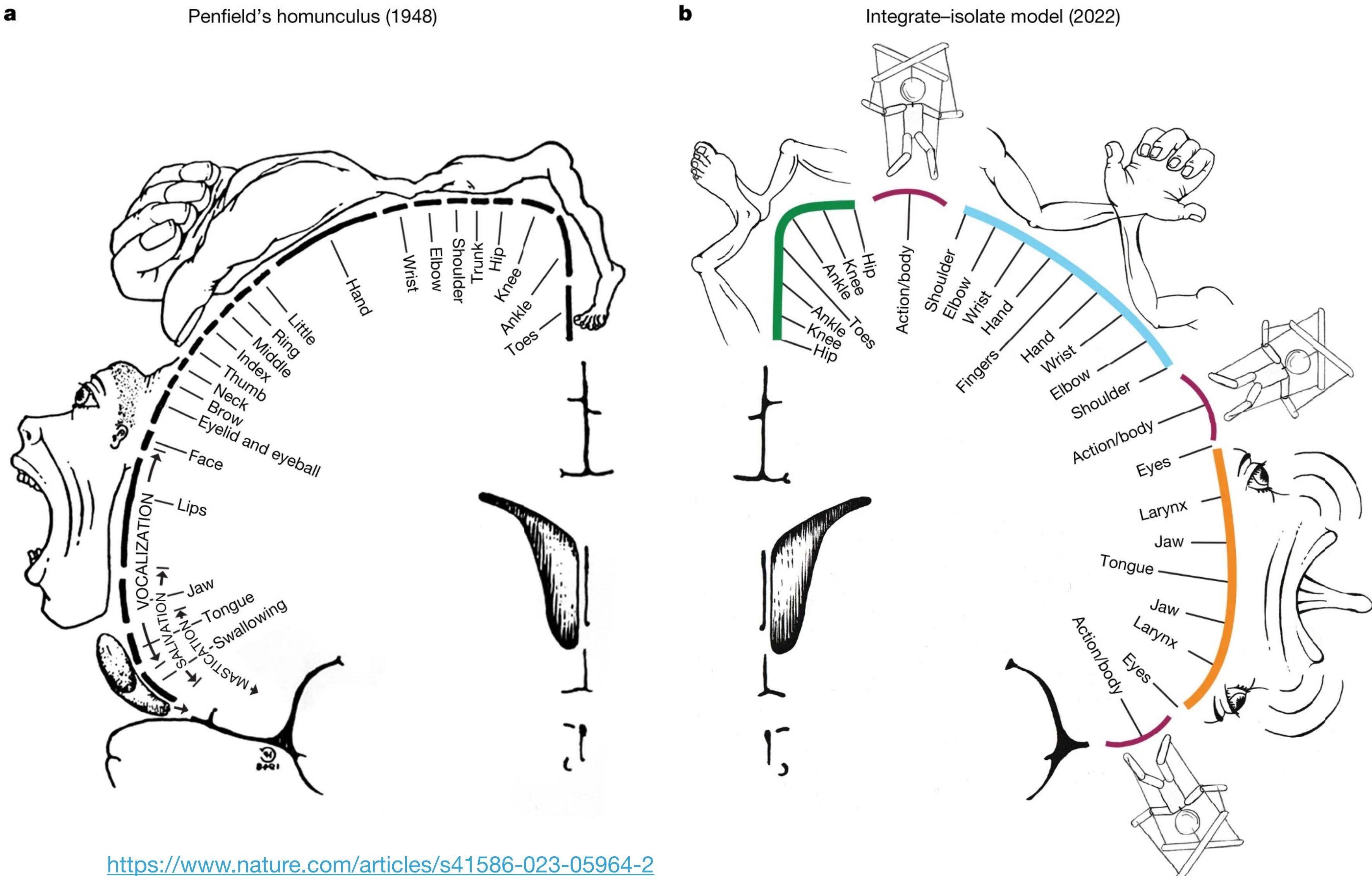
PRIMARY CORTICES

2023: AN UPDATED MOTOR CORTEX

DON'T MEMORIZE

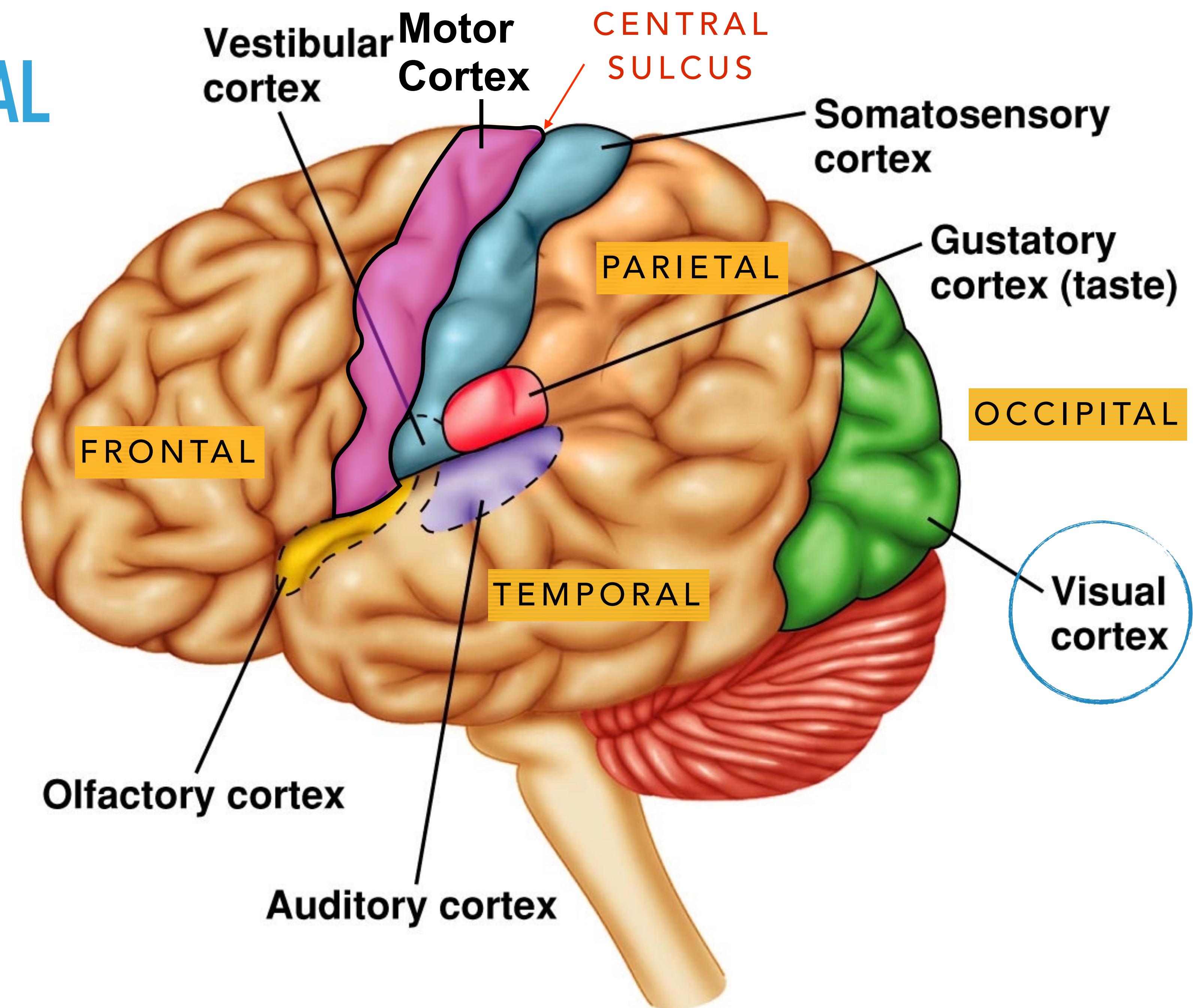
FYI only

- ▶ Original Map in 1930
 - ▶ exposed brain, electrical jolts
- ▶ 2023: fMRI at high resolution.
- ▶ Found similarities and differences
 - ▶ Face, hands and toes still in same location.
 - ▶ distal surround by proximal
- ▶ Three New Areas discovered with Mind-Body connections
 - ▶ connected to parts of the brain involved in thinking, planning, mental arousal, pain, and control
 - ▶ base functions such as blood pressure and heart rate
 - ▶ Meditation, Exercise, and Wellness



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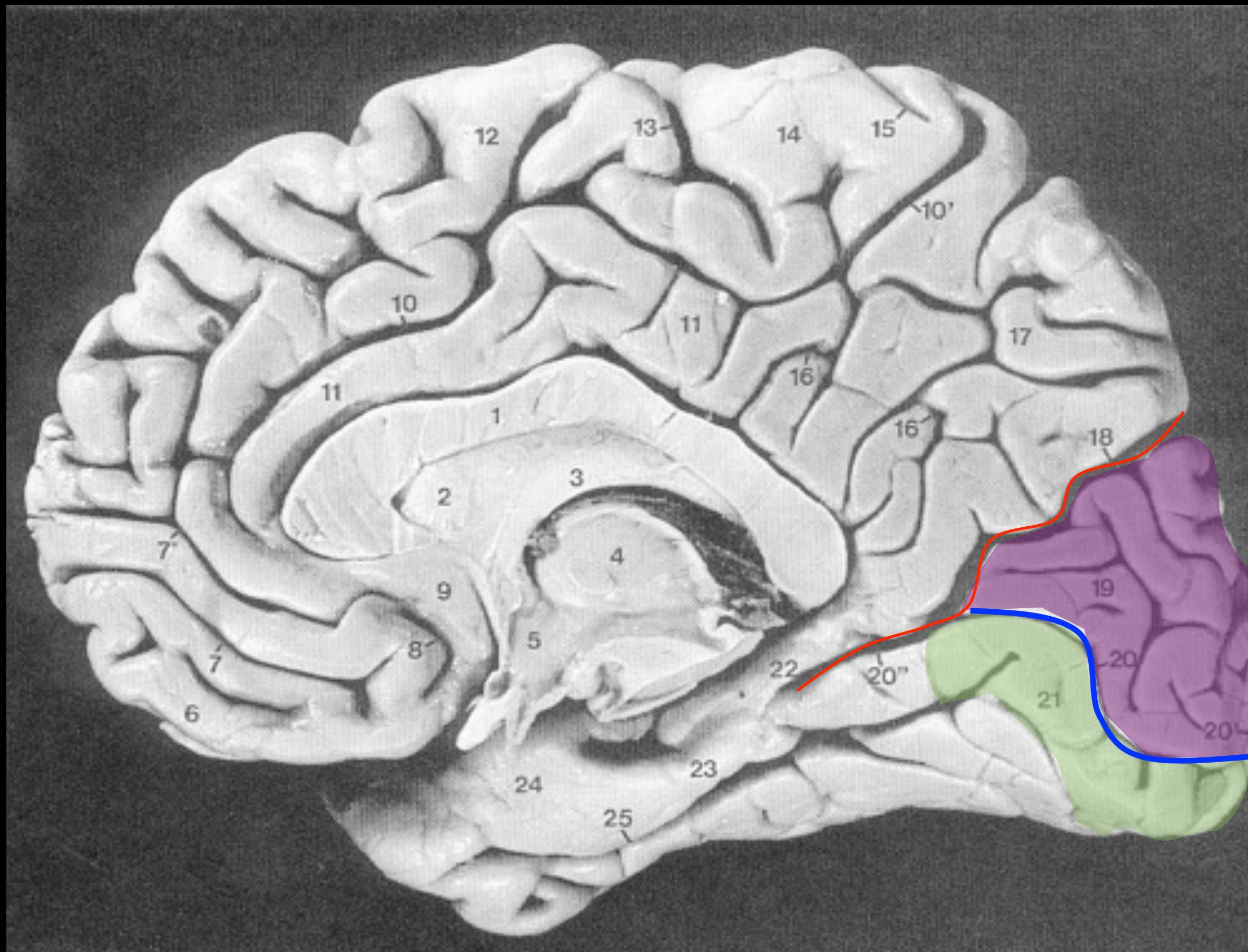
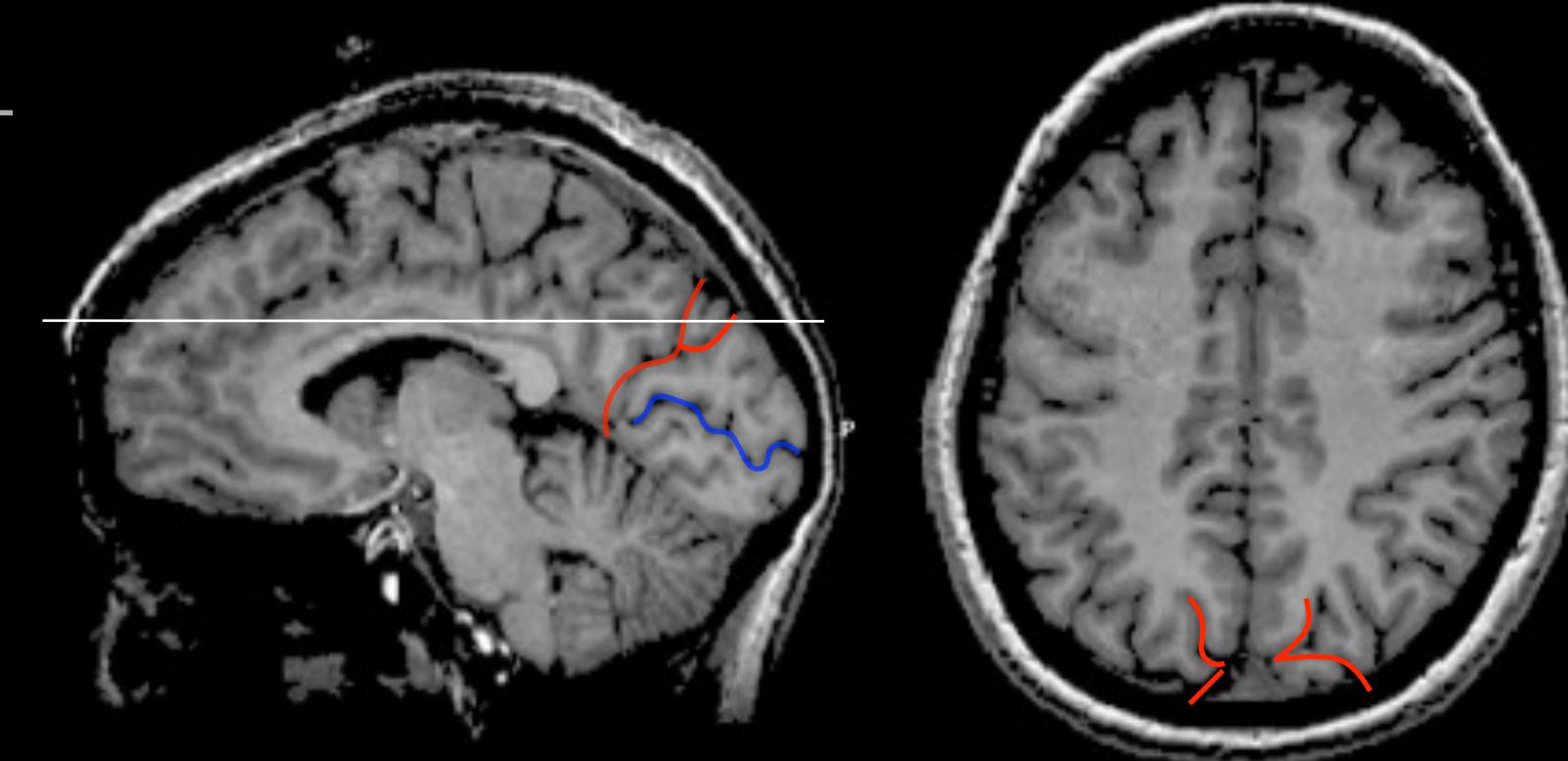


PRIMARY CORTICES

VISUAL CORTEX (VI)

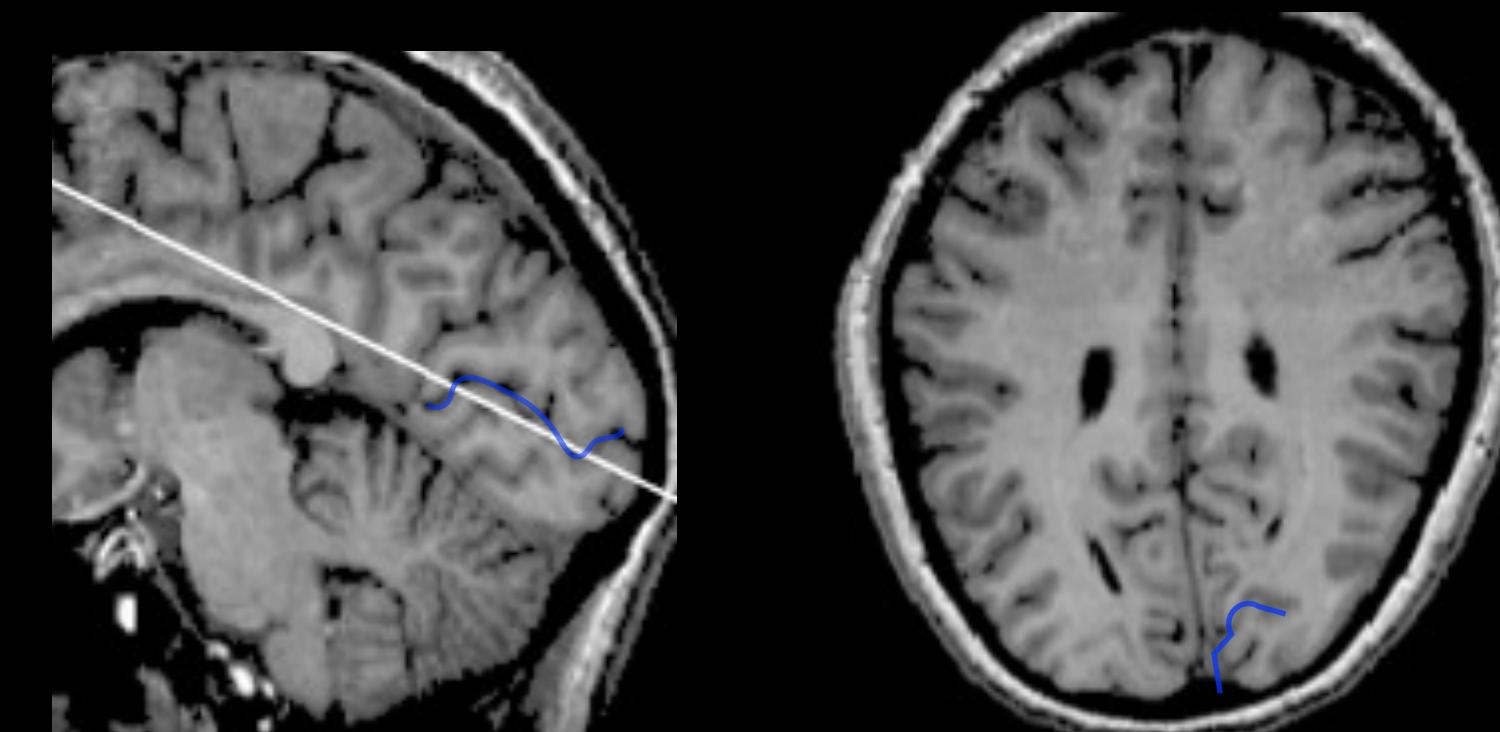
Parieto-occipital fissure (red)

- separates parietal and occipital lobes
- deep, often Y-shaped from sagittal view, X-shaped in horizontal and coronal views



Calcarine sulcus (blue)

- straddles V1



Cuneus (purple)

- visual areas on medial side above calcarine
- lower visual field

Lingual gyrus (green)

- visual areas on medial side below calcarine and above collateral sulcus
- upper visual field

PRIMARY CORTICES

AFFERENTS INTO V1 ARE MASSIVE

- ▶ V1 aka the Striate Cortex
- ▶ Optic Radiation from LGN
- ▶ Striped appearance (white line) due to Massive Fiber input
- ▶ Line of Gennari = Main termination site of fibers from the LGN

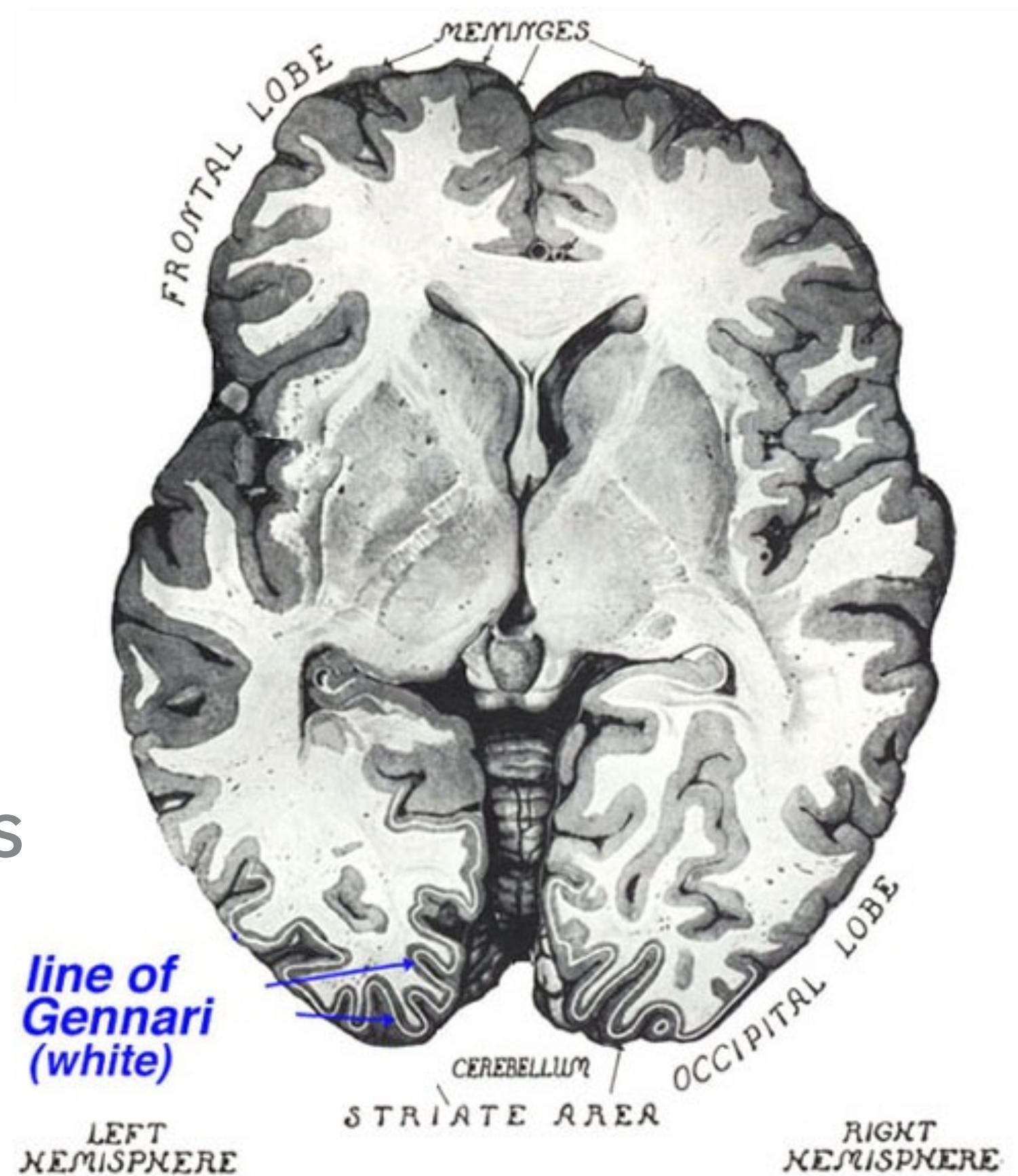
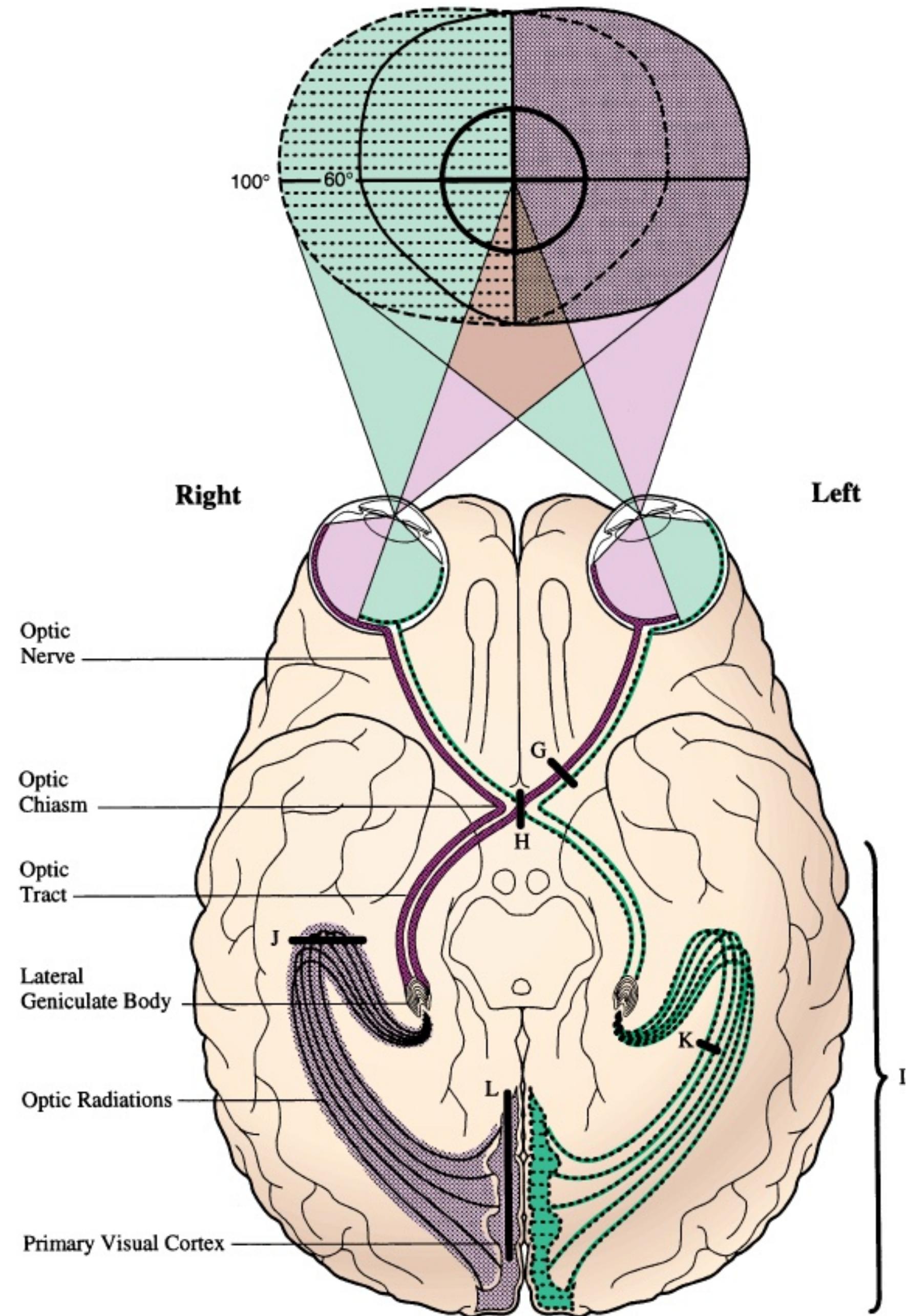


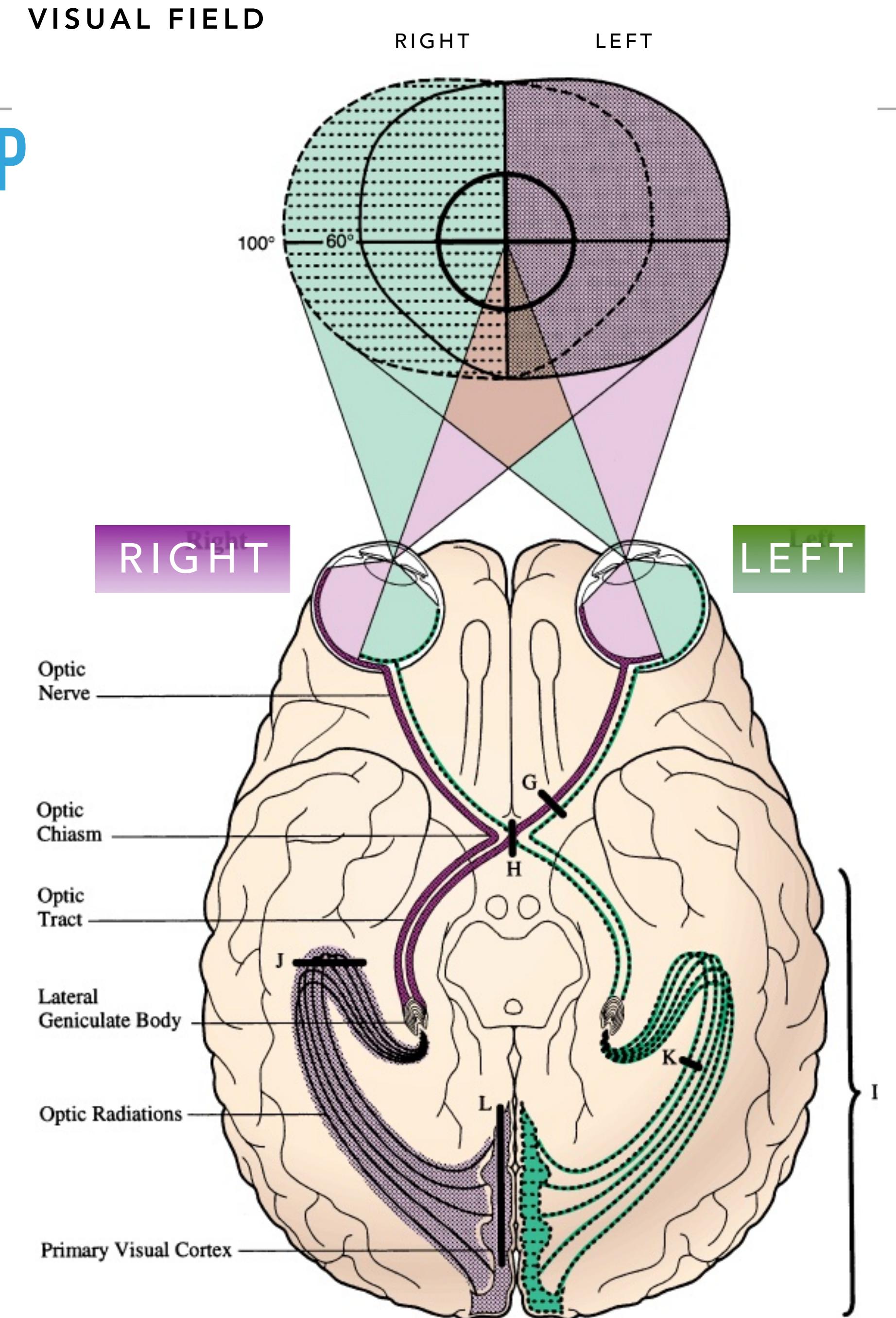
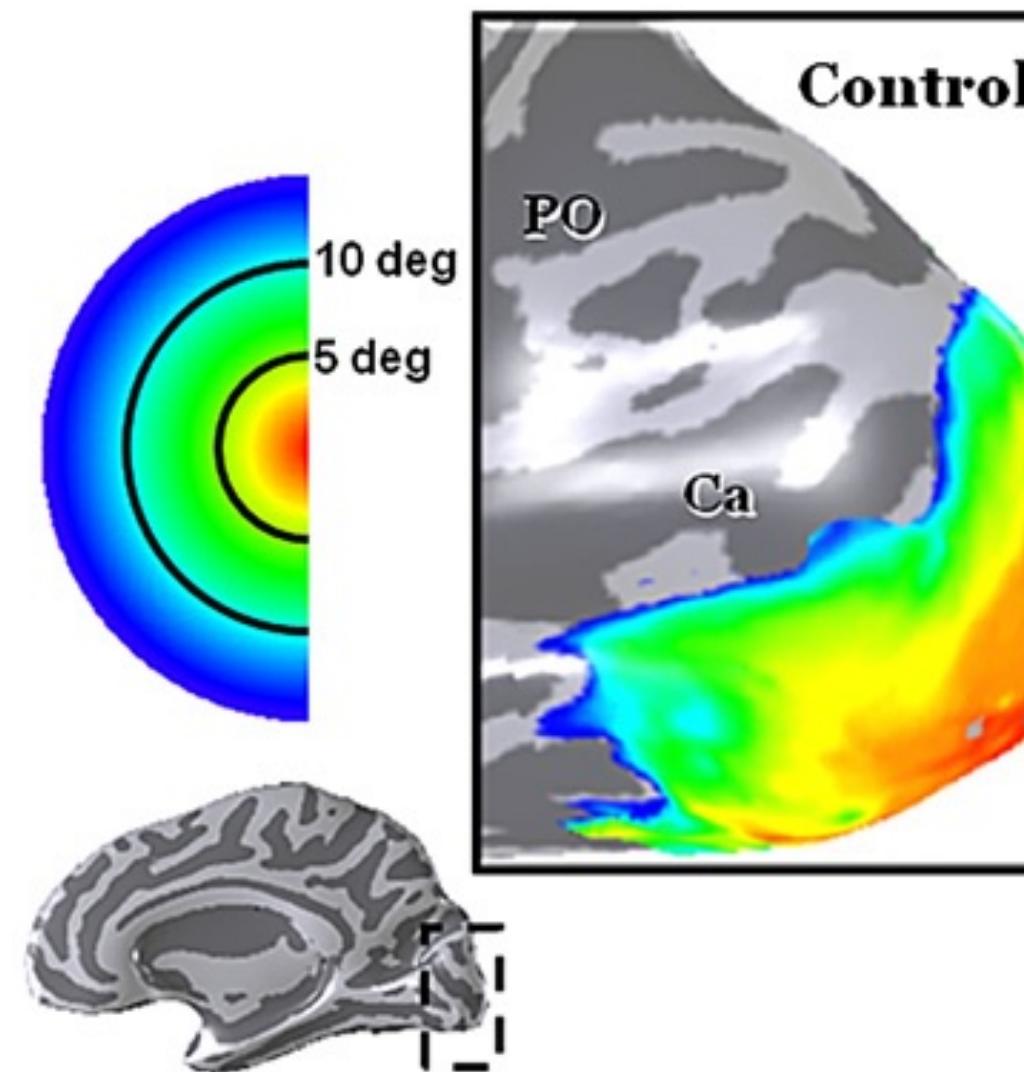
Figure 5. Horizontal section of the brain showing the line of Gennari in the striate cortex. From Polyak (1957).



PRIMARY CORTICES

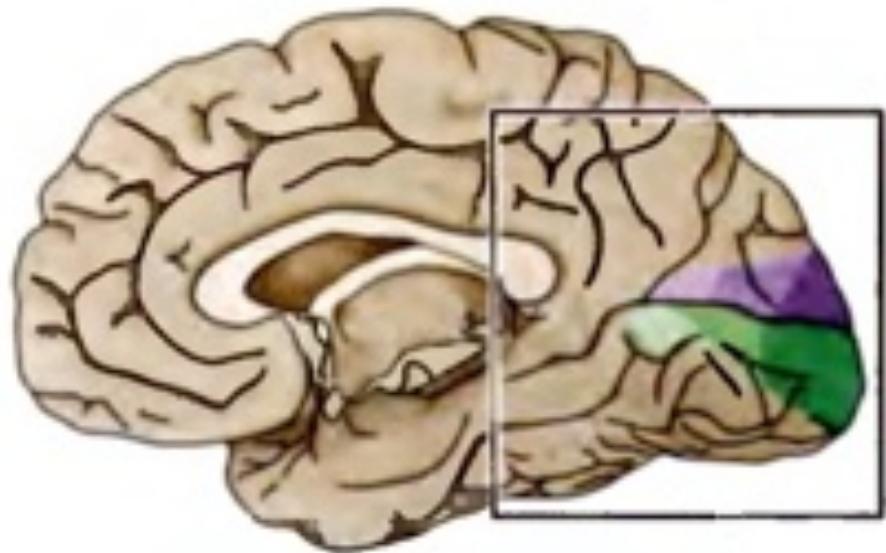
PRIMARY VISUAL CORTEX (V1) HAS RETINOTOPIC MAP

- ▶ Output from retina mapped spatially onto V1
- ▶ But, it's inverted because of Eye Lens
- ▶ Visual Field Inverted on retina
 - ▶ Left visual field imaged onto right retina (both eyes)
 - ▶ Right visual field imaged onto left retina (both eyes)
- ▶ Hemispheric mapping matches retinal mapping
 - ▶ Right retina (Left Visual Field info) goes to Right hemisphere
 - ▶ Left retina (Right Visual Field info) goes to Left hemisphere

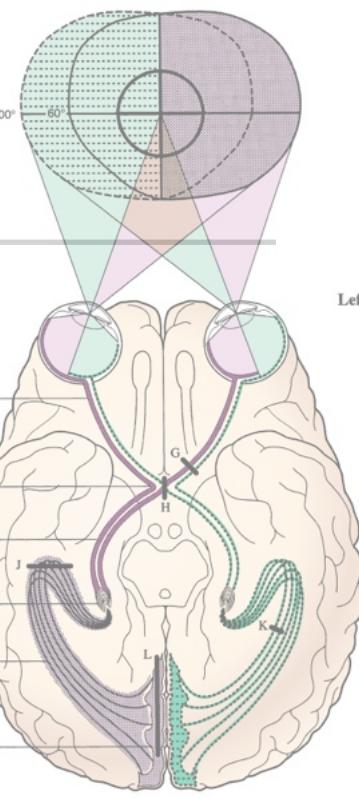
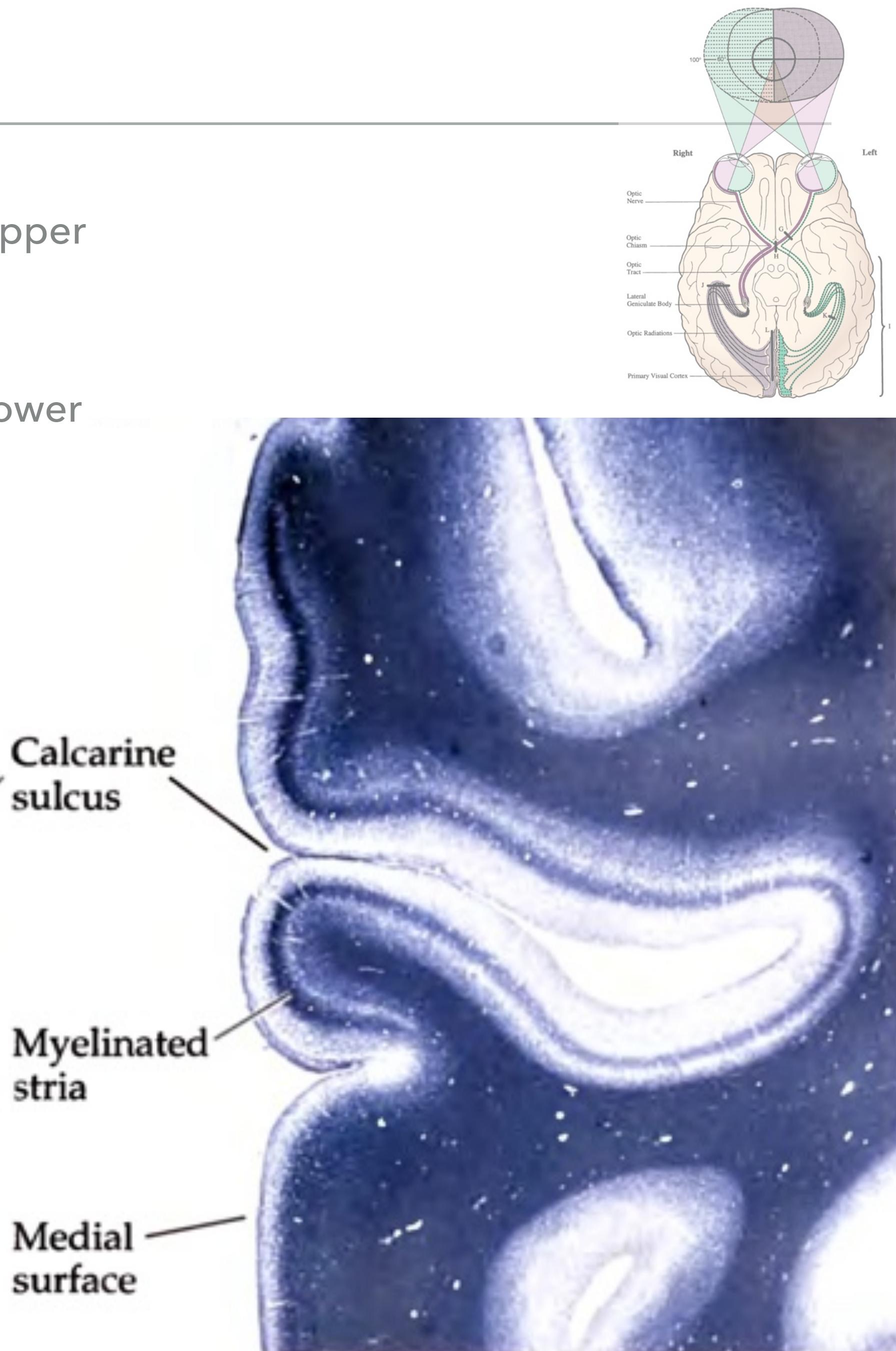
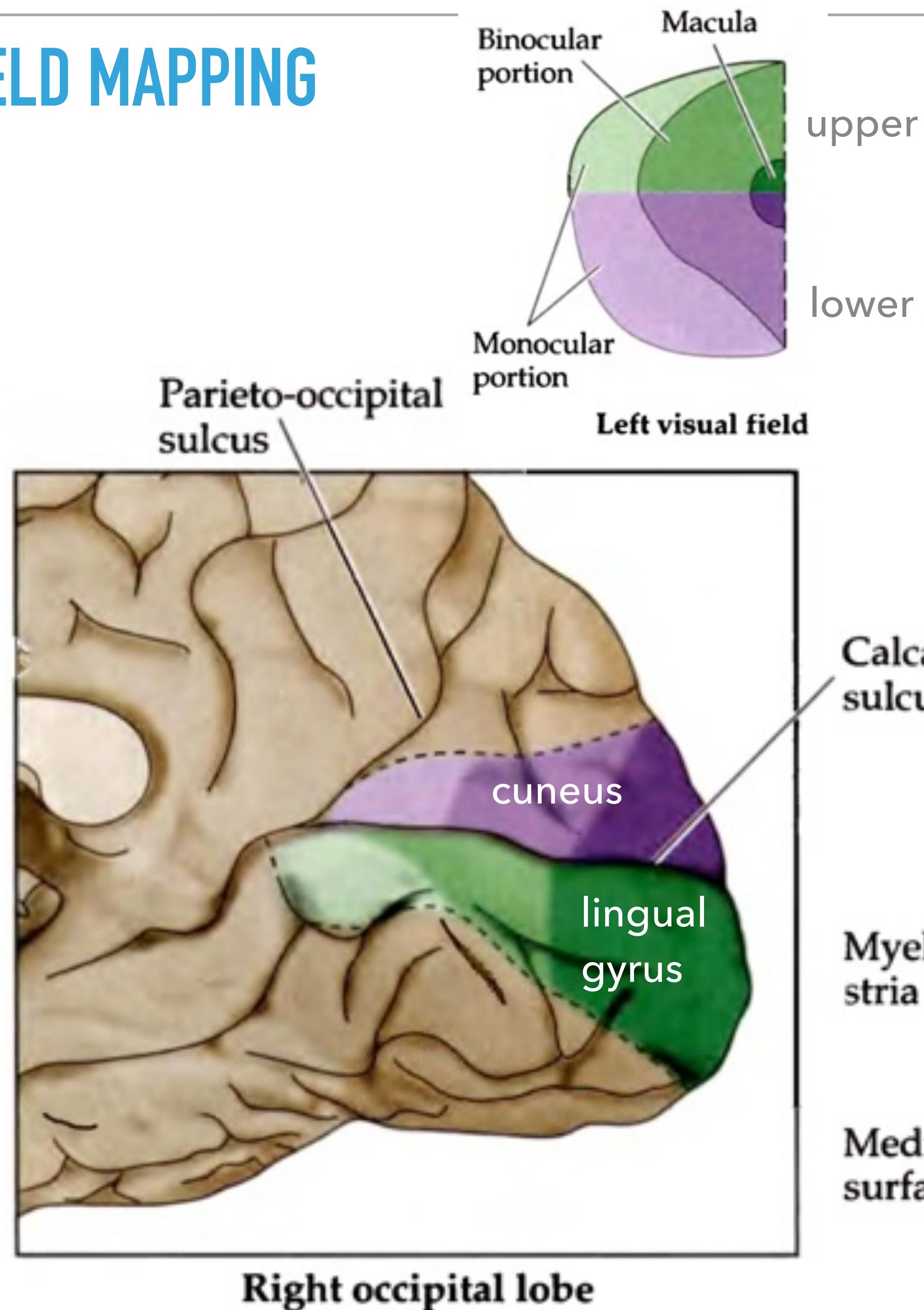


PRIMARY CORTICES

LOWER AND UPPER VISUAL FIELD MAPPING ALSO INVERTED IN V1

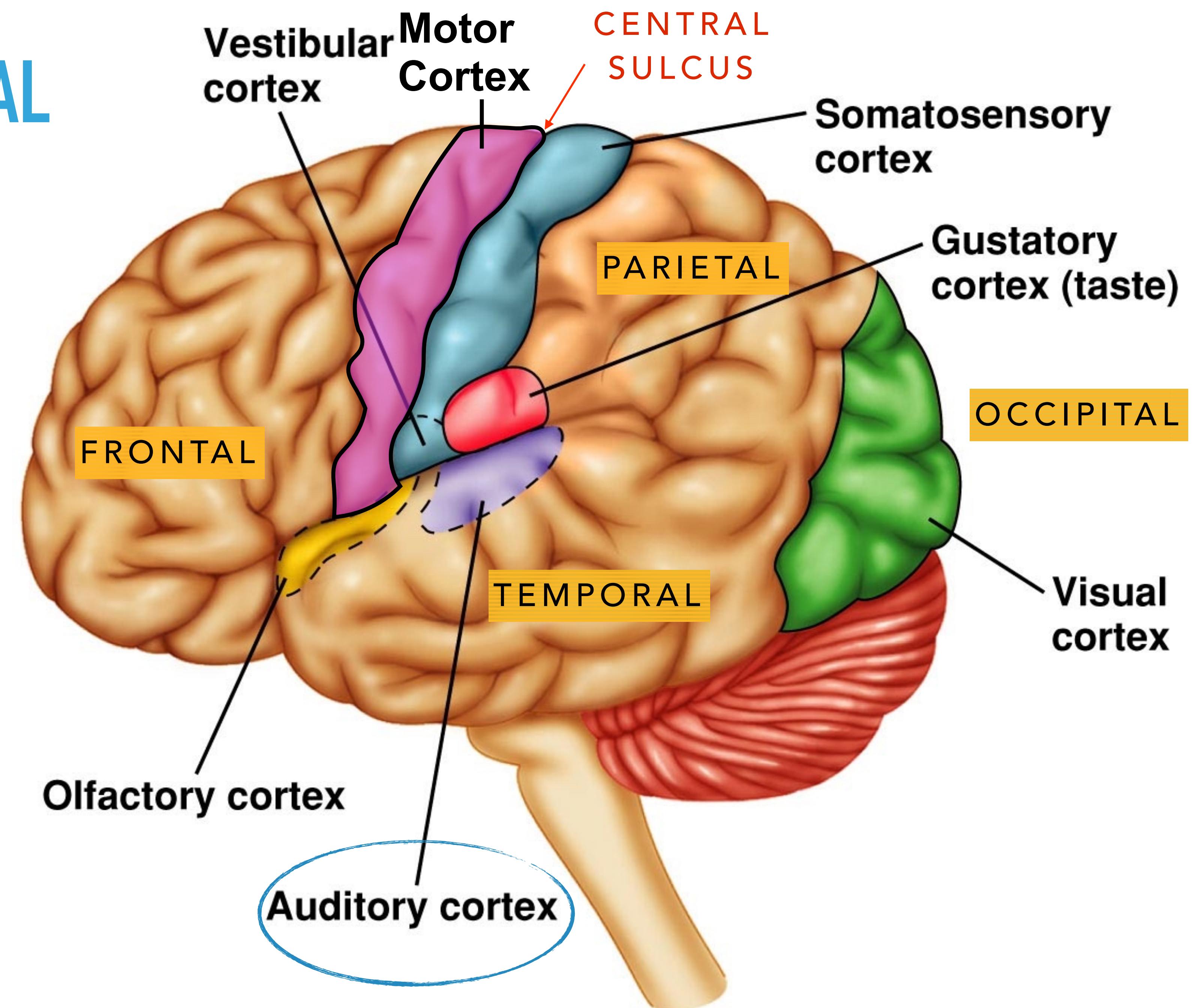


- ▶ V1 straddles the calcarine sulcus in the occipital lobe
- ▶ Two significant gyrii in V1:
 - ▶ cuneus
 - ▶ lingual gyrus
- ▶ Upper and Lower fields
 - ▶ upper visual field - lingual gyrus
 - ▶ lower visual field - cuneus



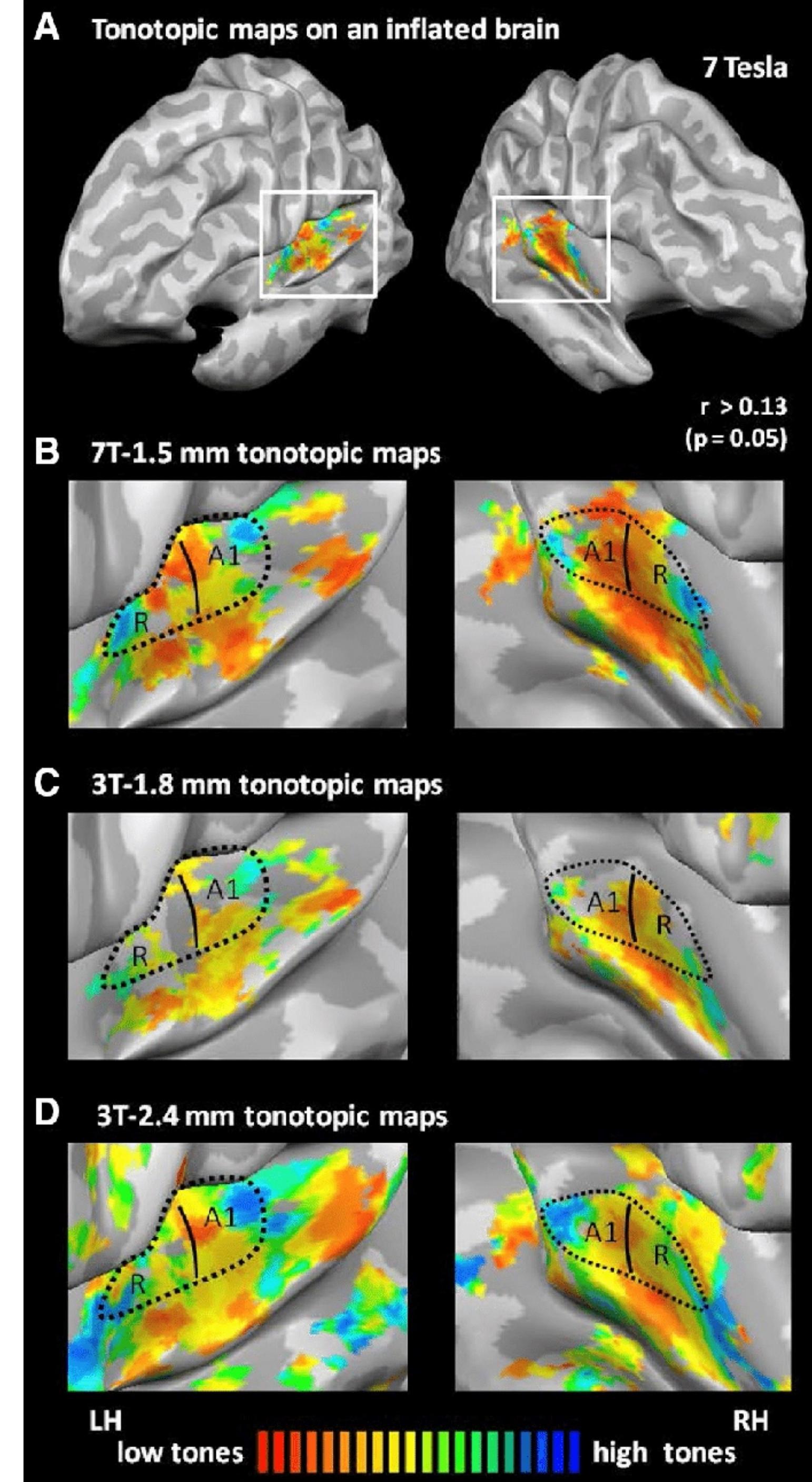
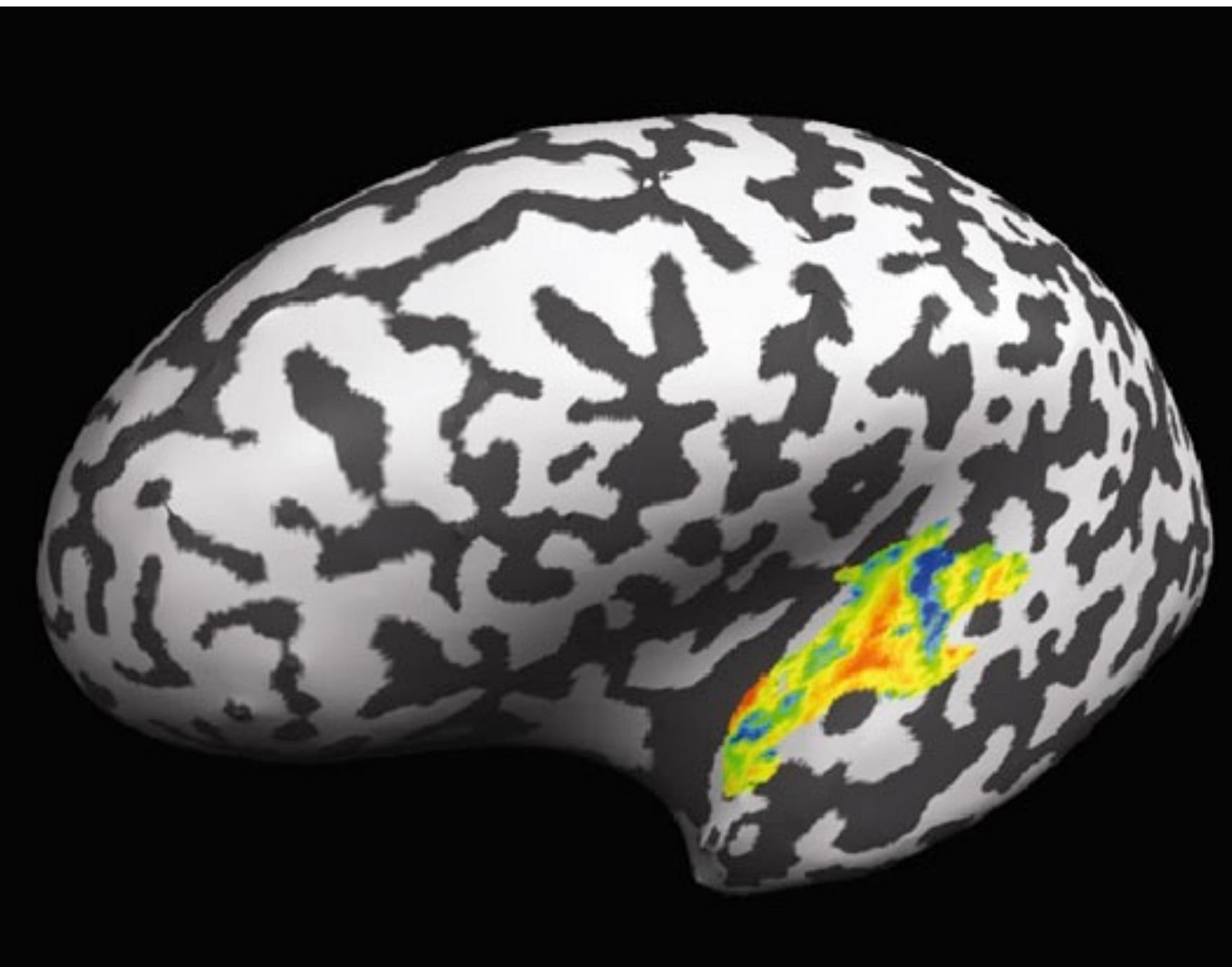
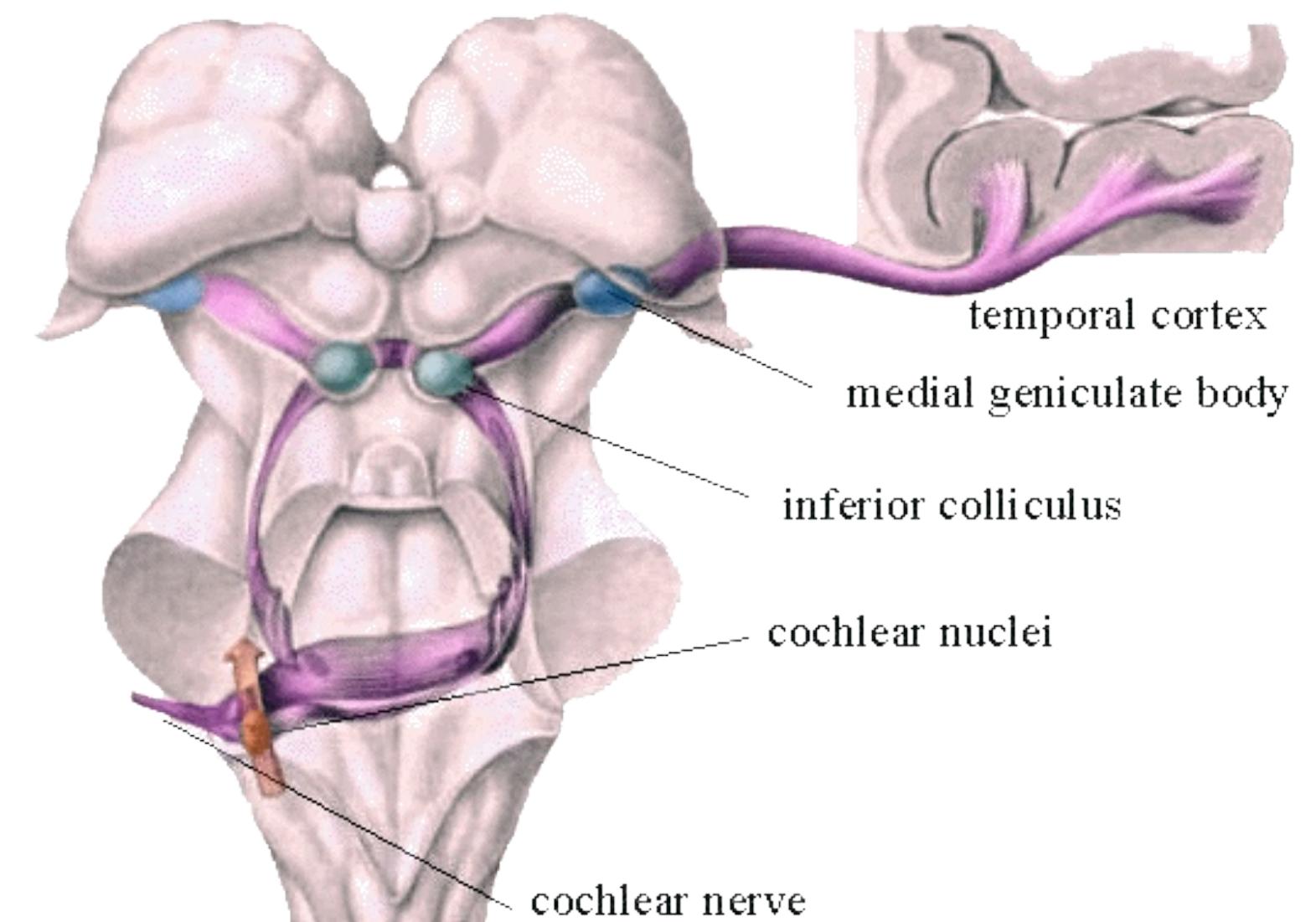
EACH LOBE HAS REGIONAL SPECIALIZATIONS

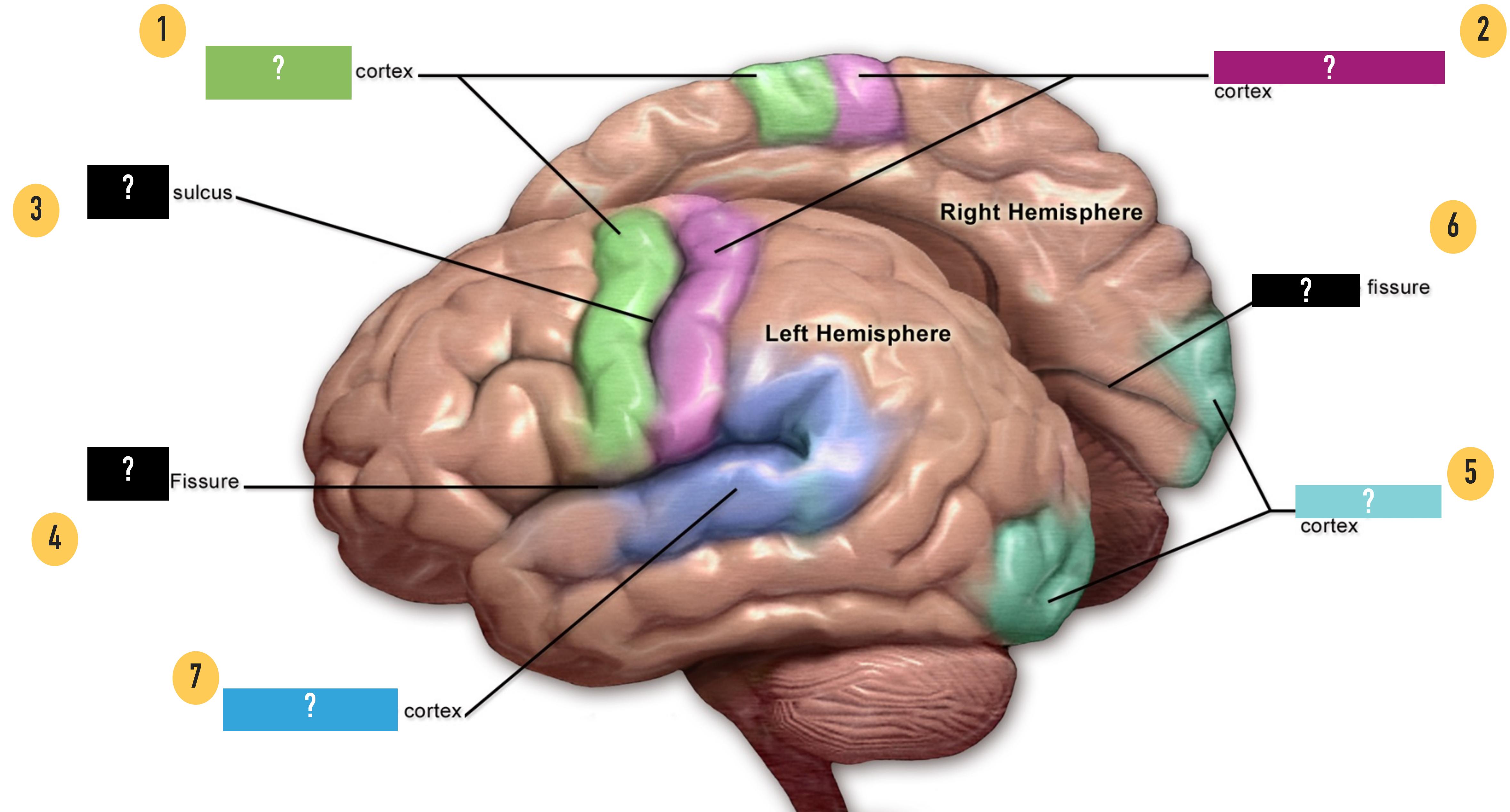
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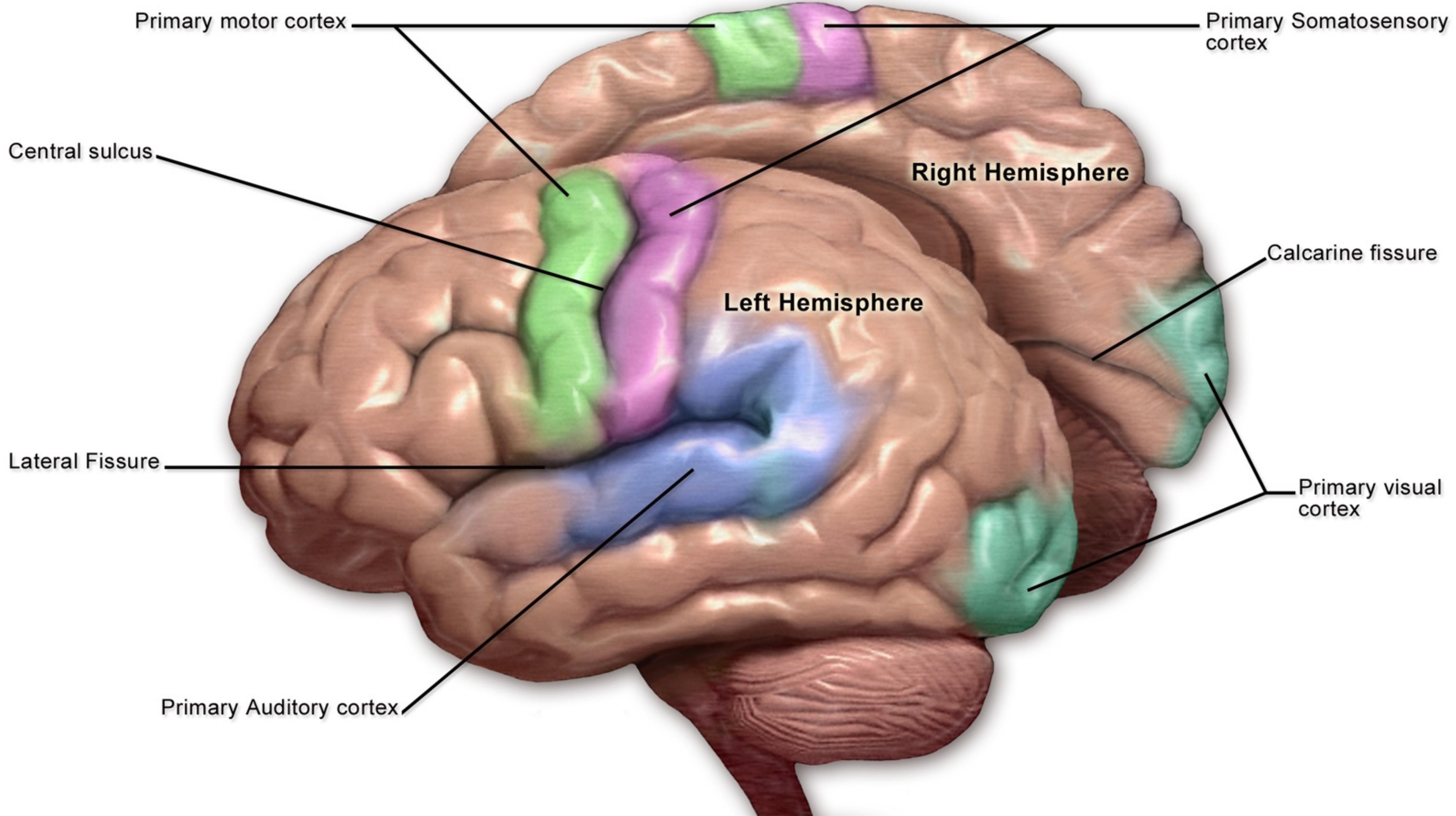


AUDITORY CORTEX RECEIVES AUDITORY AFFERENTS

- ▶ Found in the Temporal Lobe
- ▶ contains a tonotopic map for sound frequencies



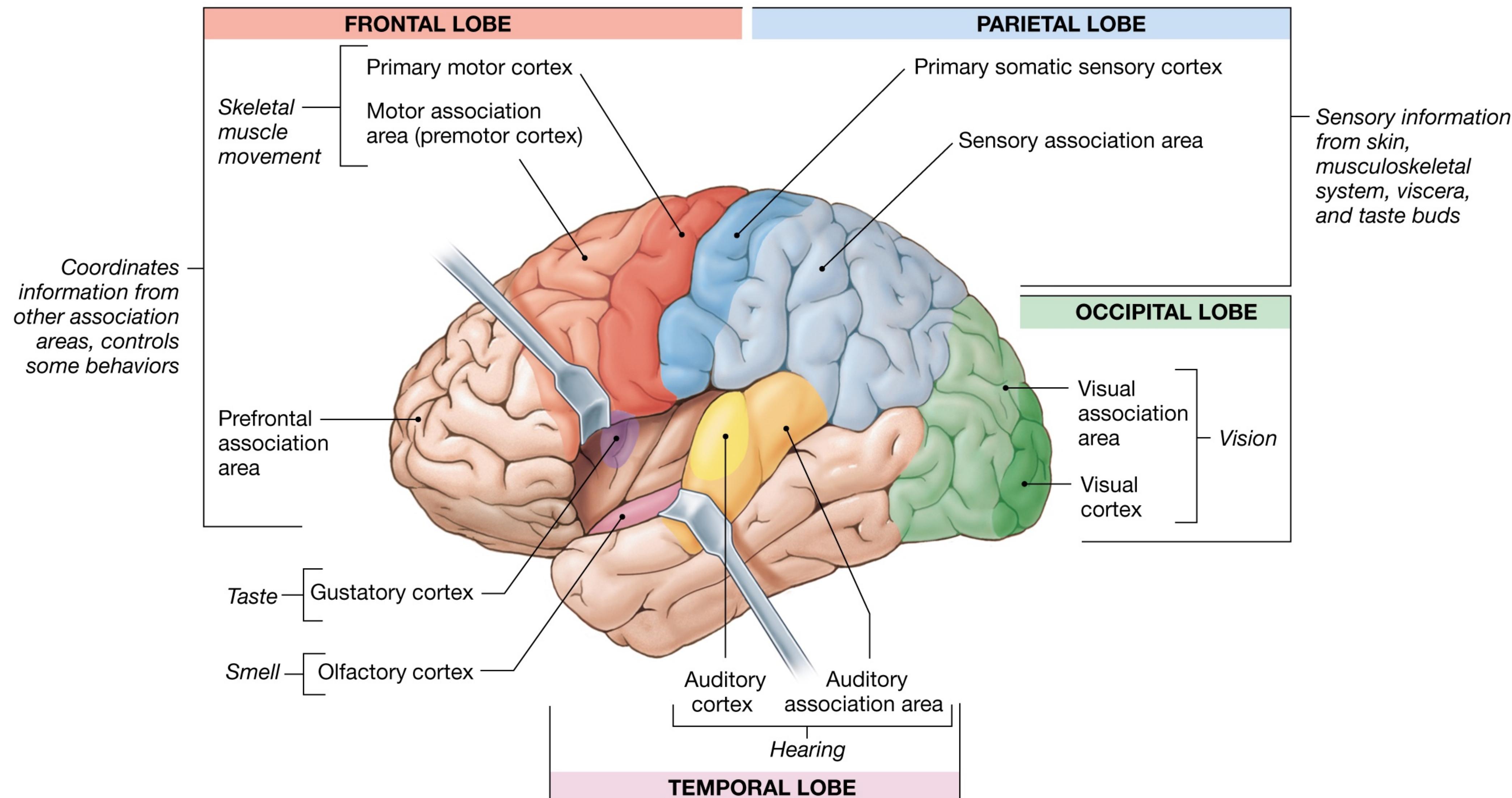




IN SUMMARY

PRIMARY CORTICES

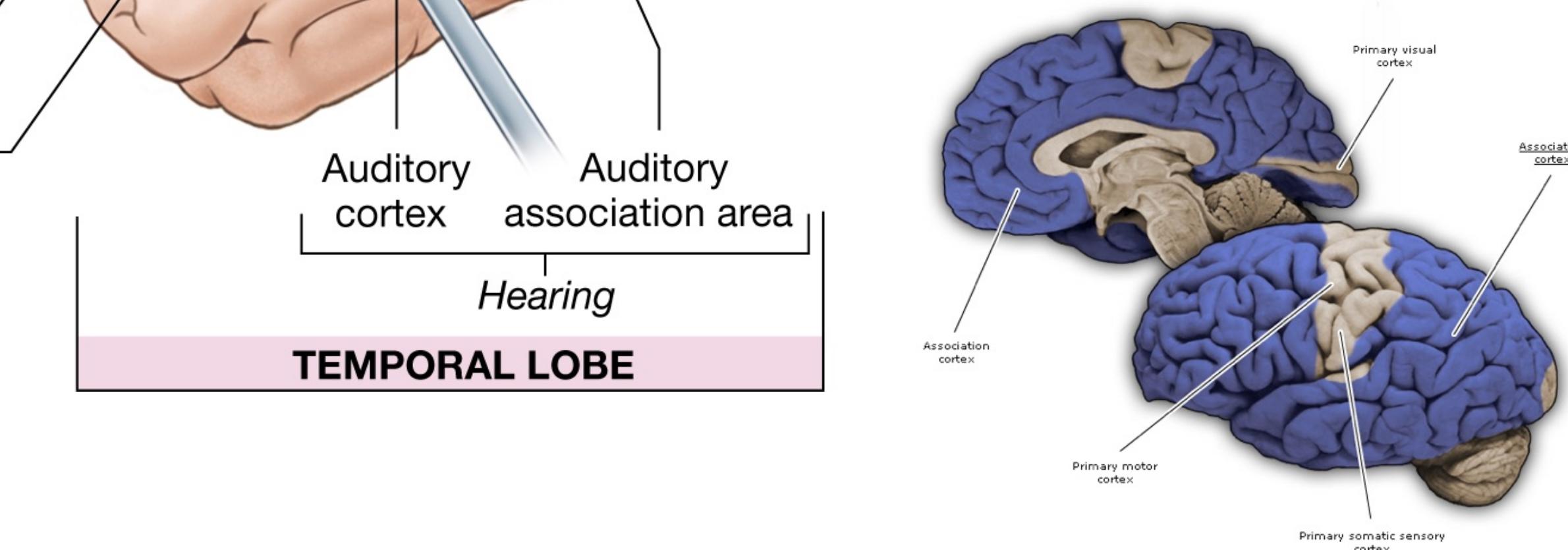
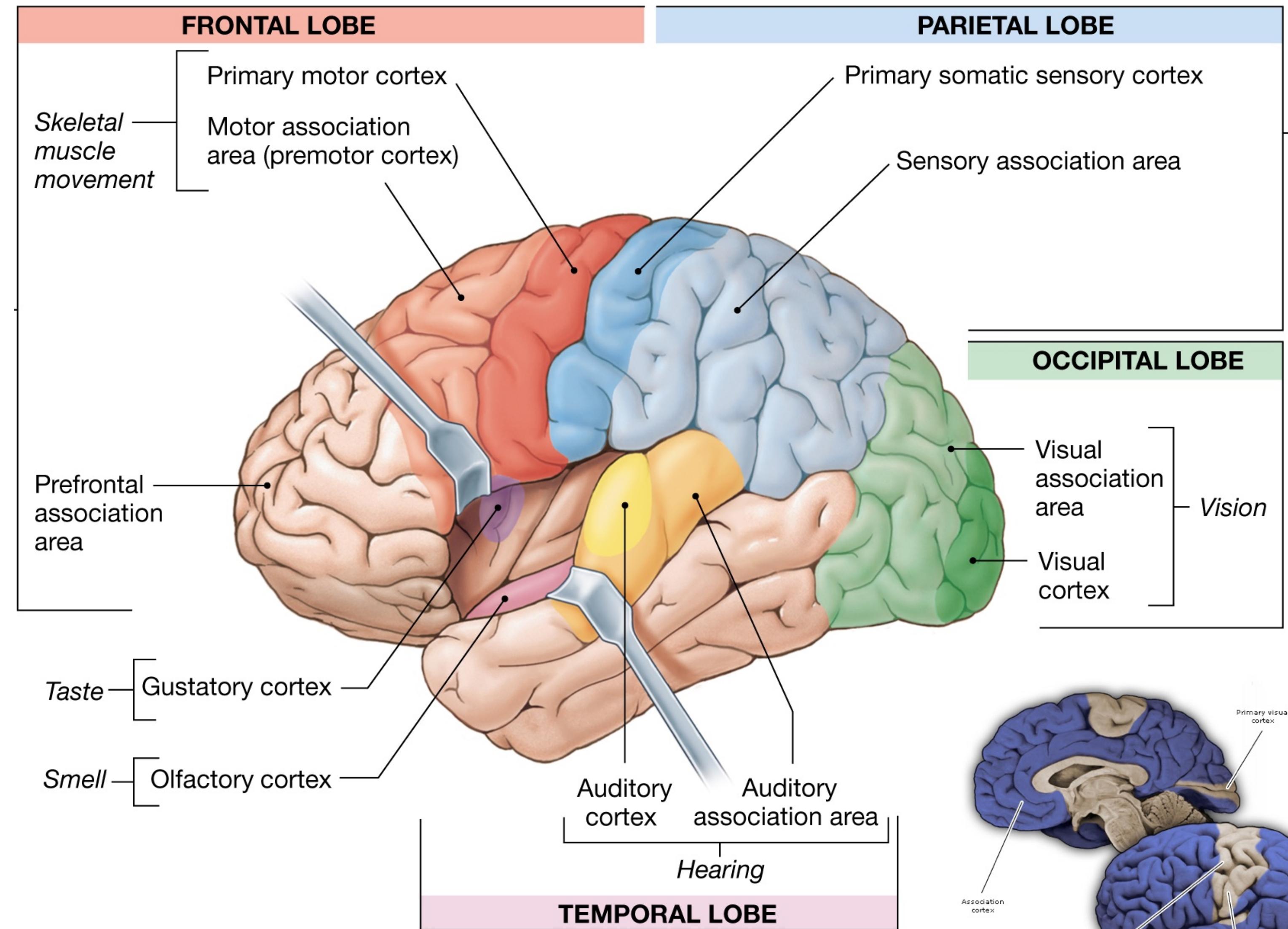
The cerebral cortex contains sensory areas for perception, motor areas that direct movement, and association areas that integrate information.



LEARNING OBJECTIVE: IDENTIFY GENERAL FUNCTIONS FOR ASSOCIATION CORTICES IN EACH LOBE

ASSOCIATION CORTICES

- ▶ “Everything else in the cerebral cortex”
- ▶ Helps make sense of the input from primary sensory cortices
- ▶ Helps drive output from primary motor cortex
- ▶ Each lobe has a different general function

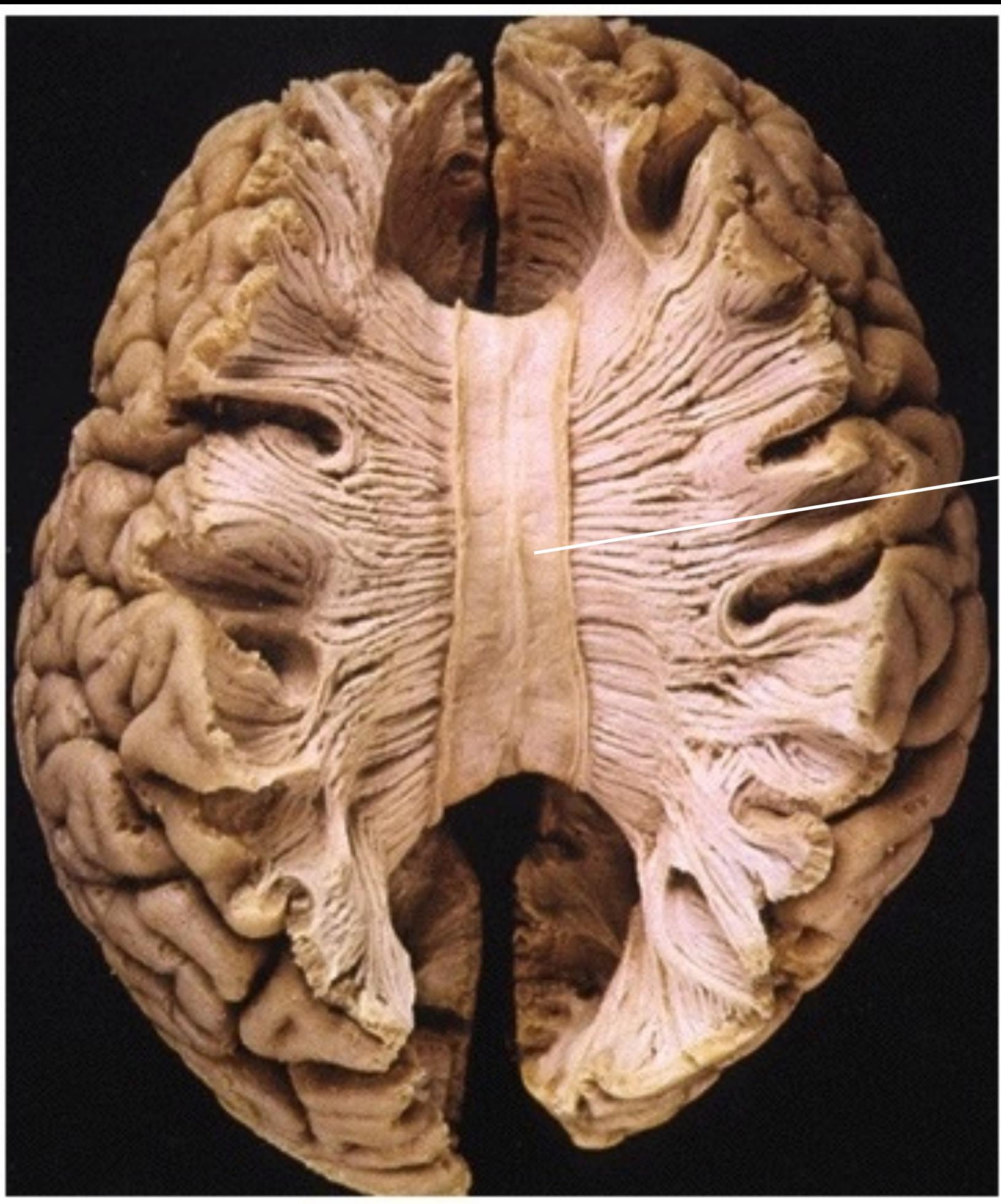


ASSOCIATION CORTEX

CORPUS CALLOSUM CONNECTS THE HEMISPHERES

Massive connectivity
between between
hemispheres

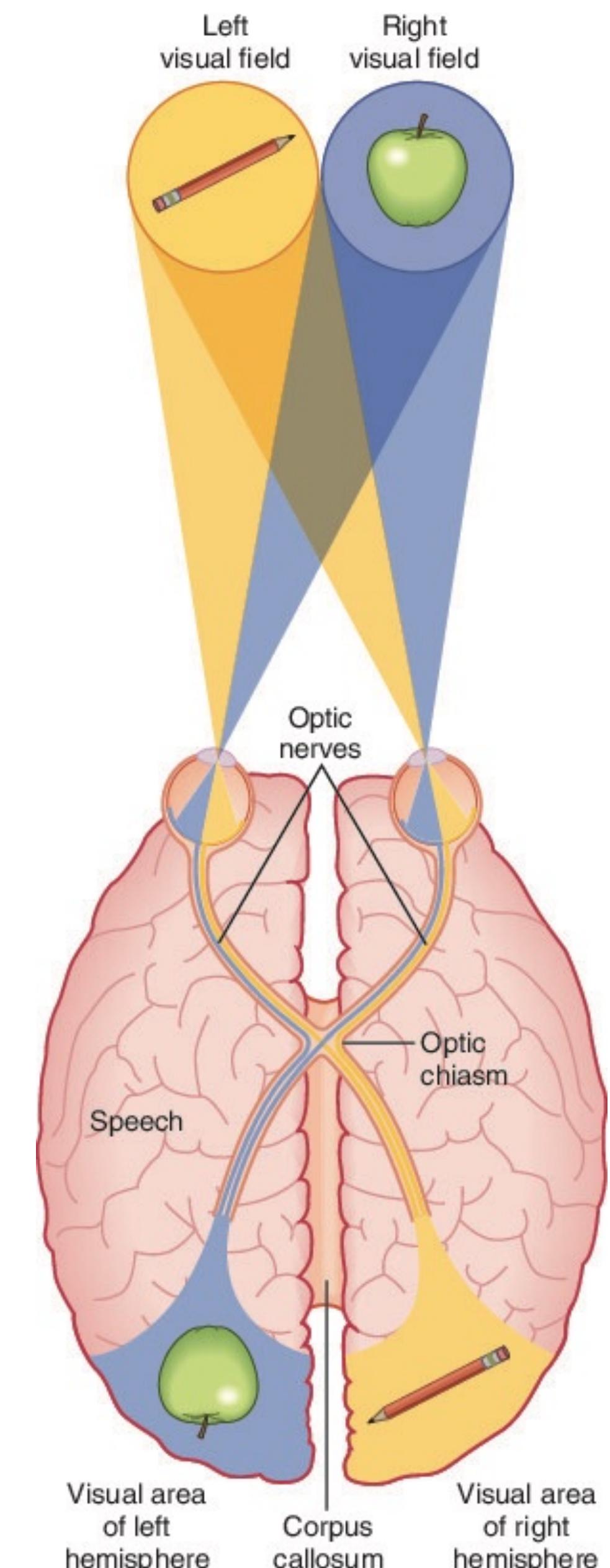
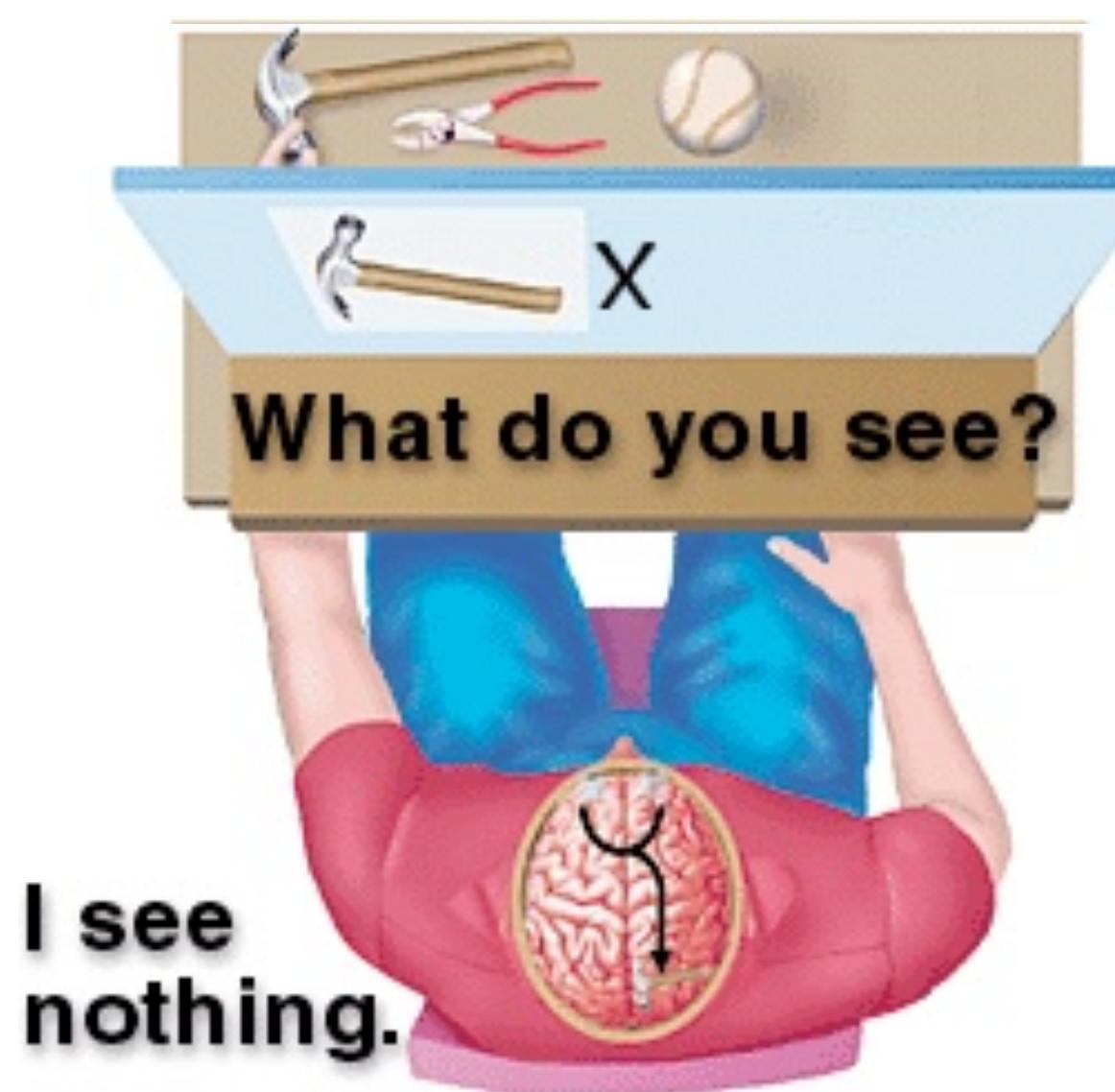
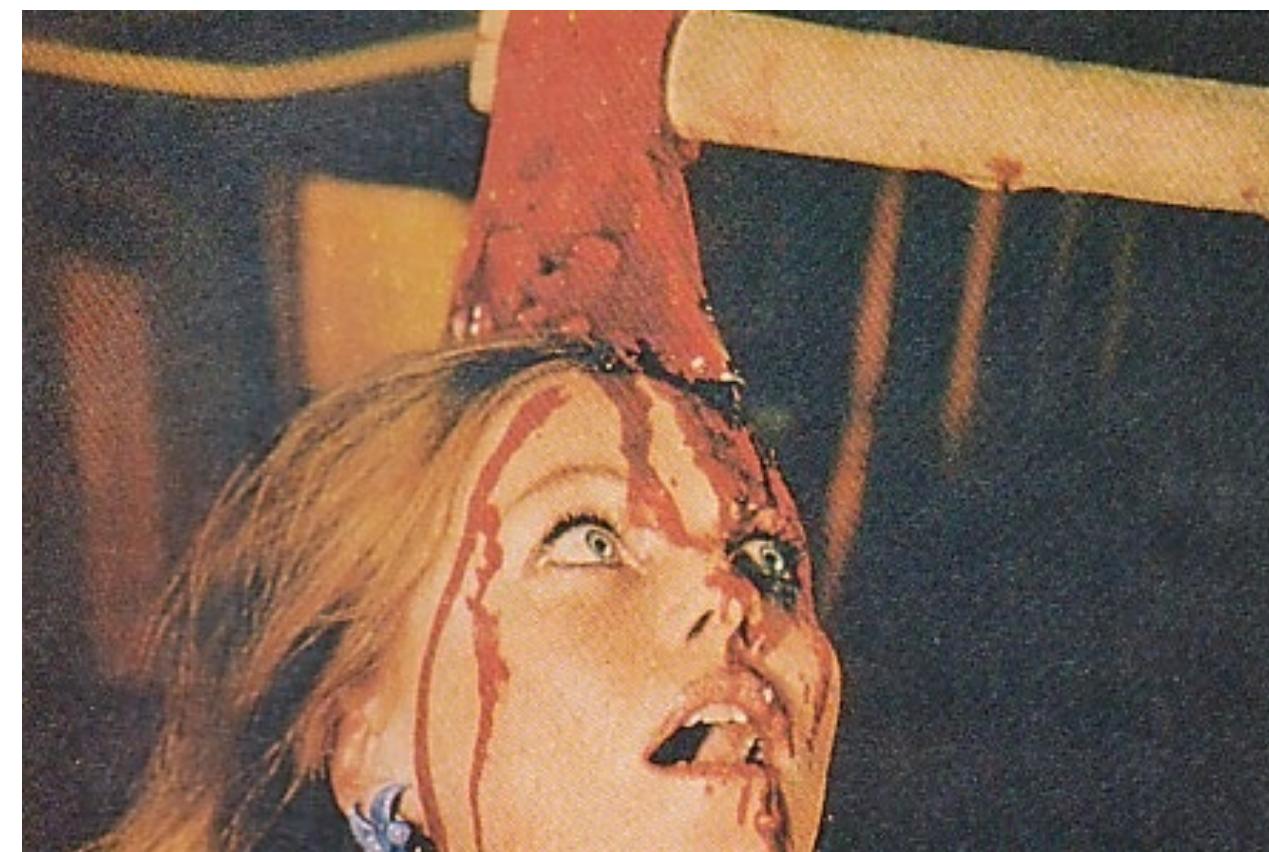
Courtesy of Terrence Williams, University of Iowa



SPLIT BRAIN EXPERIMENTS

- ▶ 1960: Vogel and Bogen
- ▶ Could they reduce or cure epilepsy by cutting the corpus callosum?
- ▶ They could! Epileptic Patients stopped having seizures and were surprisingly normal
- ▶ But...
 - ▶ Could only verbally report on objects flashed into their right visual field (and not the left field)
 - ▶ Could only identify by touch objects flashed into their left visual hemifield

Why do we need a corpus callosum?



PLANNING NEURONS

FRONTAL LOBE

FRONTAL LOBE CONTAINS EXECUTIVE FUNCTION

- ▶ Primary Cortex - Movement and speech
- ▶ **Association Cortex - Executive Functions**
 - ▶ Planning
 - ▶ Moderating social behavior
 - ▶ reasoning
 - ▶ inhibiting emotional impulses
 - ▶ Focus
 - ▶ "Planning" Neurons



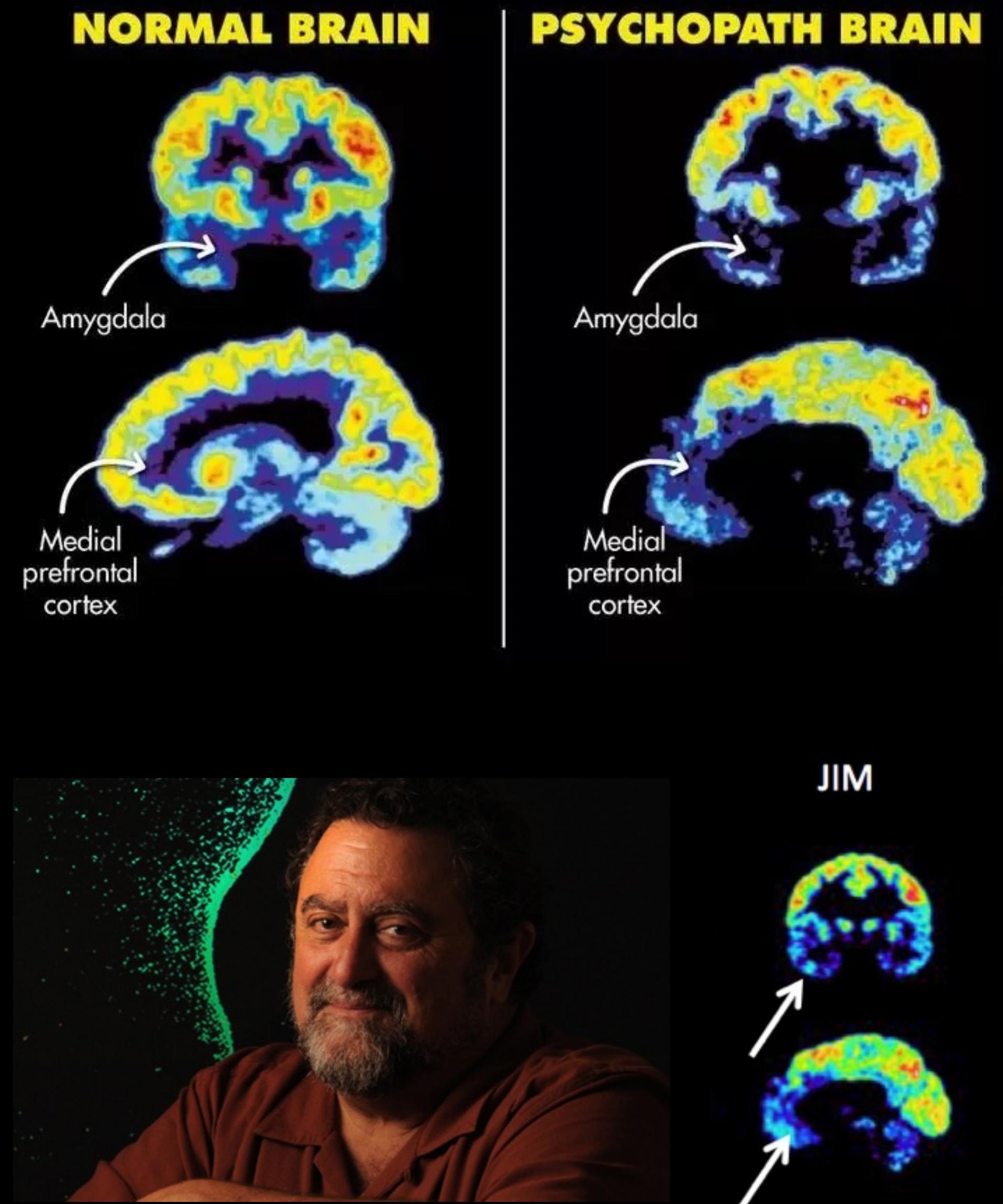
PHINEAS GAGE AND HIS BLOWED UP FRONTAL LOBE



Personality changed
after accident

PSYCHOPATHS HAVE INACTIVE FRONTAL LOBES

- ▶ James Fallon - UC Irvine
- ▶ Discovered a PET Scan pattern in serial killers
- ▶ Inactivity or damage to the orbitofrontal cortex (and some temporal lobe)
- ▶ MAO-A gene (serotonin)
- ▶ Warrior gene
- ▶ Has the pattern himself

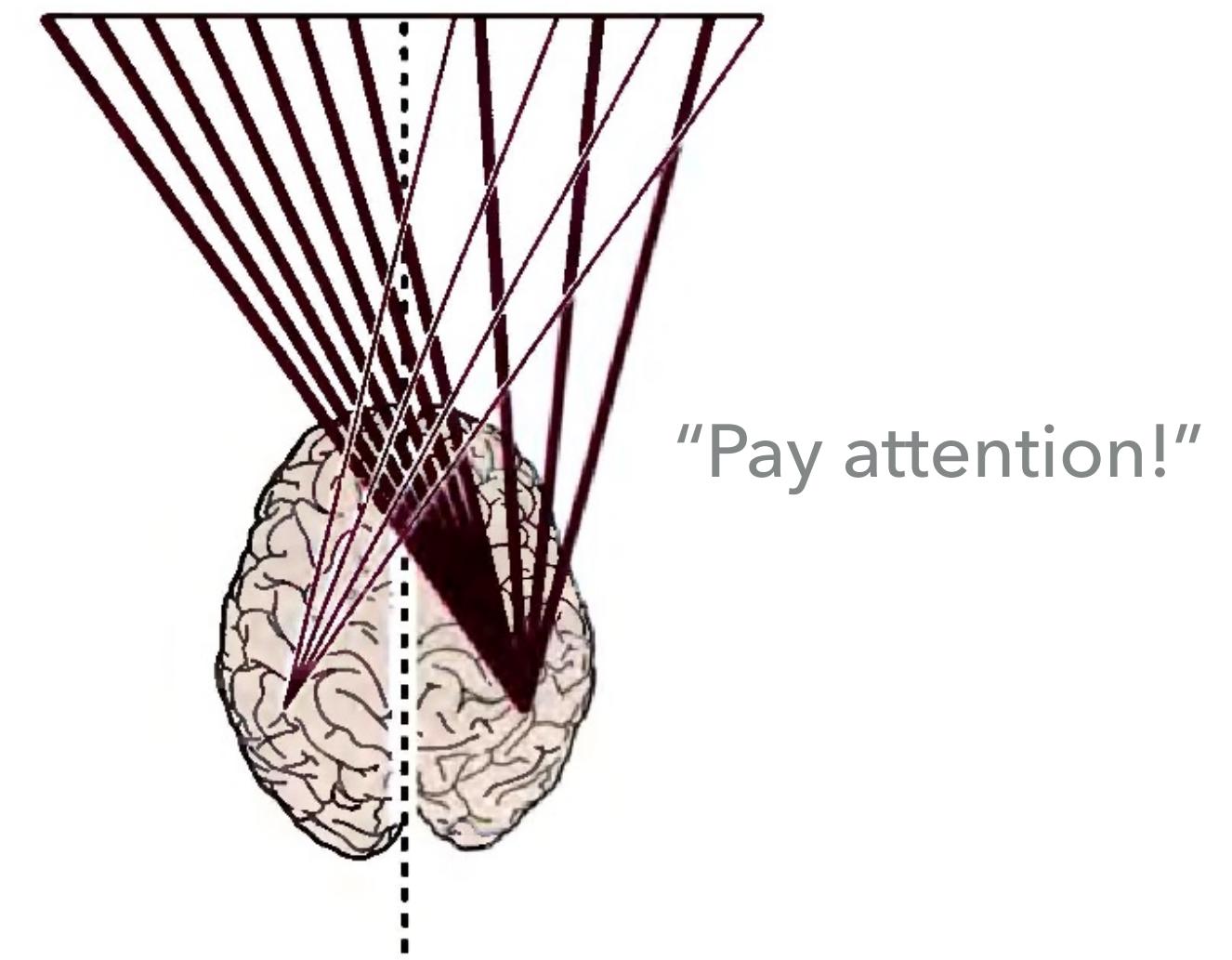
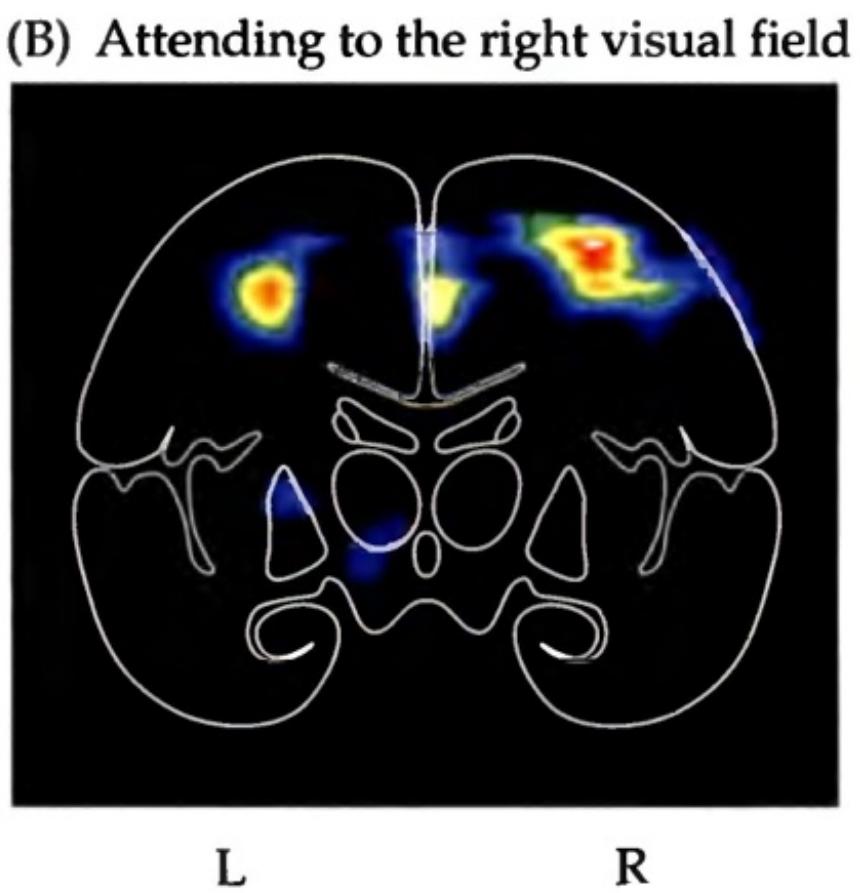
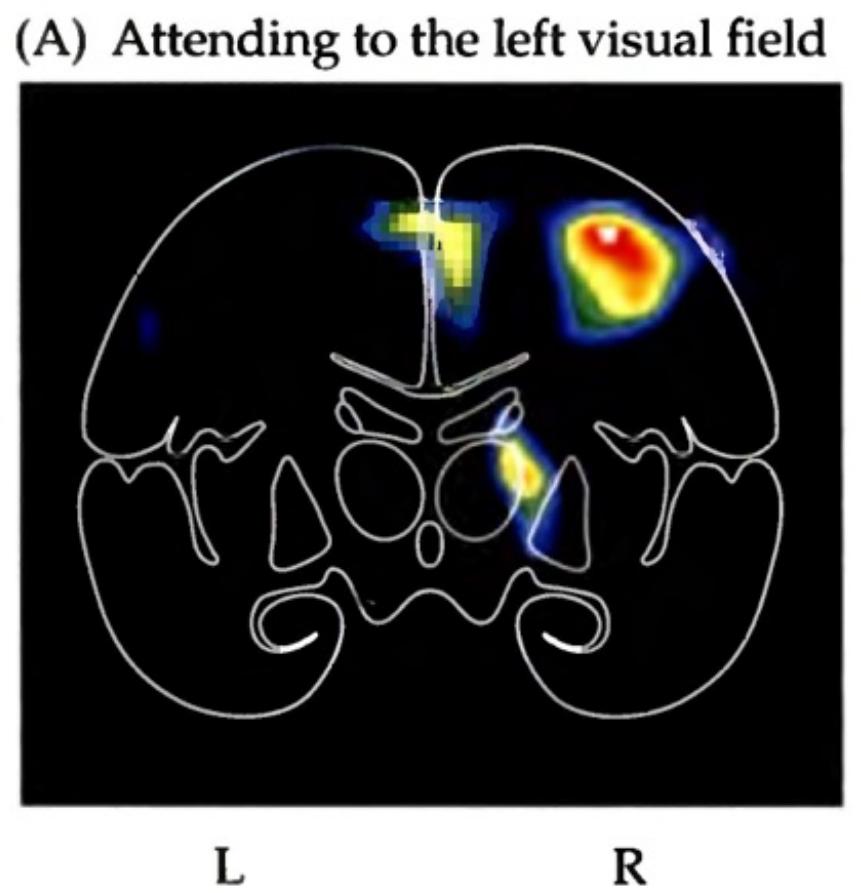
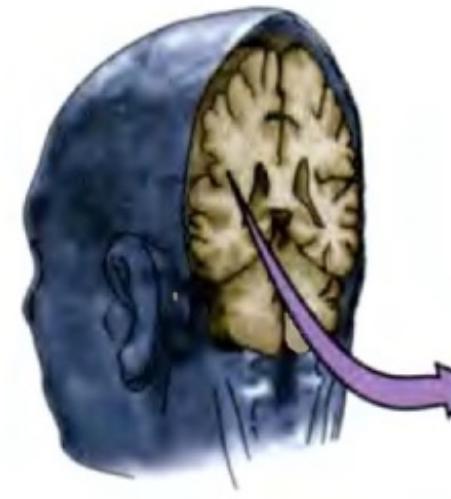




ATTENTION NEURONS

PARIETAL LOBE

ATTENTION NEURONS IN THE PARIETAL LOBE

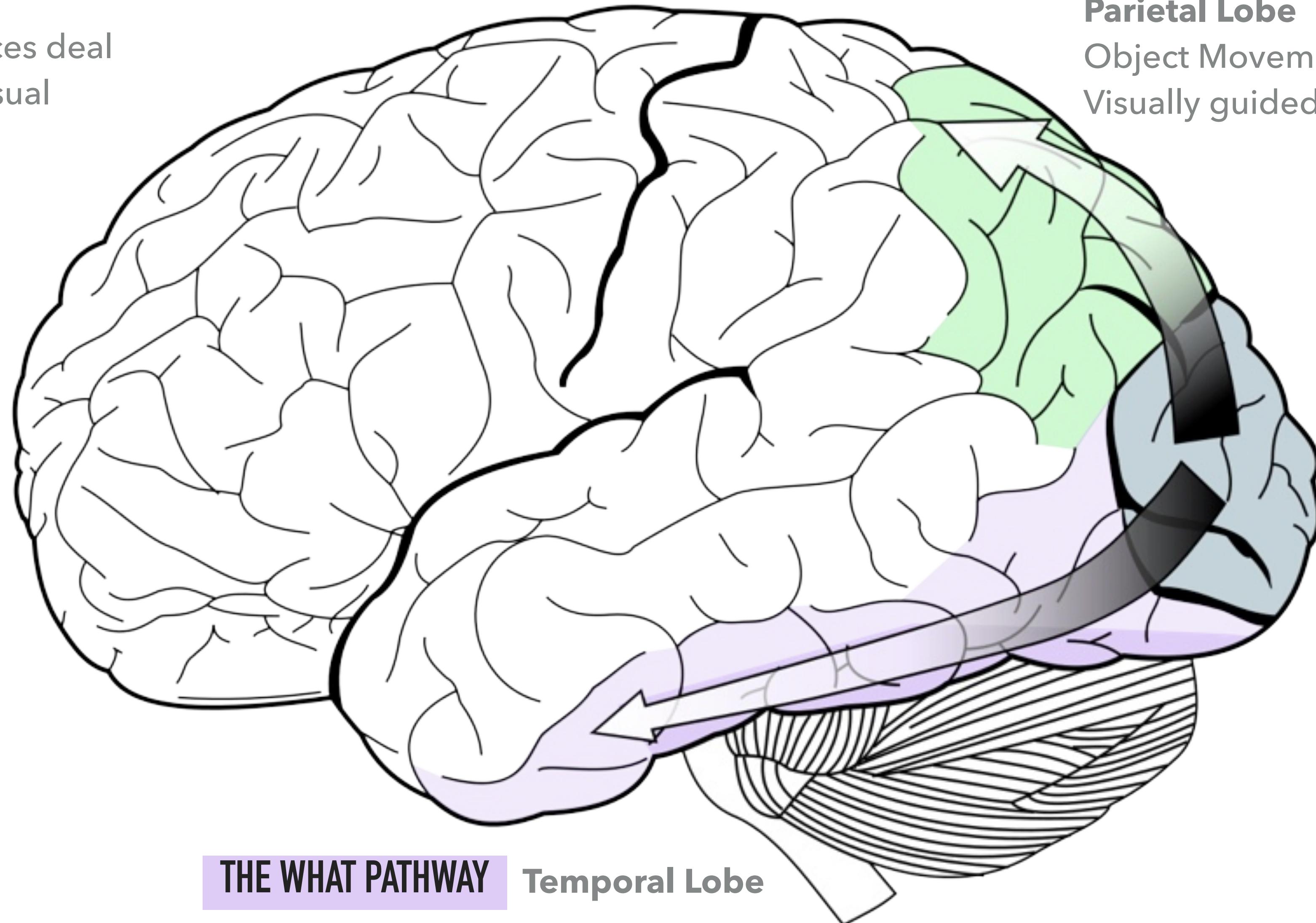


- ▶ Region of the brain that lights up when you're paying attention to something (not just seeing, but focusing your attention)
- ▶ Red color in brain slices indicates high activity
- ▶ Lateralization
 - ▶ left hemisphere lights up when paying attention to right visual fields
 - ▶ right hemisphere lights up when paying attention to BOTH left and right visual fields

VENTRAL - DORSAL MODEL OF V1 TRANSMISSION

THE WHAT VS WHERE ASSOCIATION CORTICES

Different Association Cortices deal with different aspects of Visual Processing



THE WHERE PATHWAY

Parietal Lobe

Object Movement - important for Visually guided behavior

V1

Primary V1 visual information

THE WHAT PATHWAY Temporal Lobe

For Recognizing and IDing objects

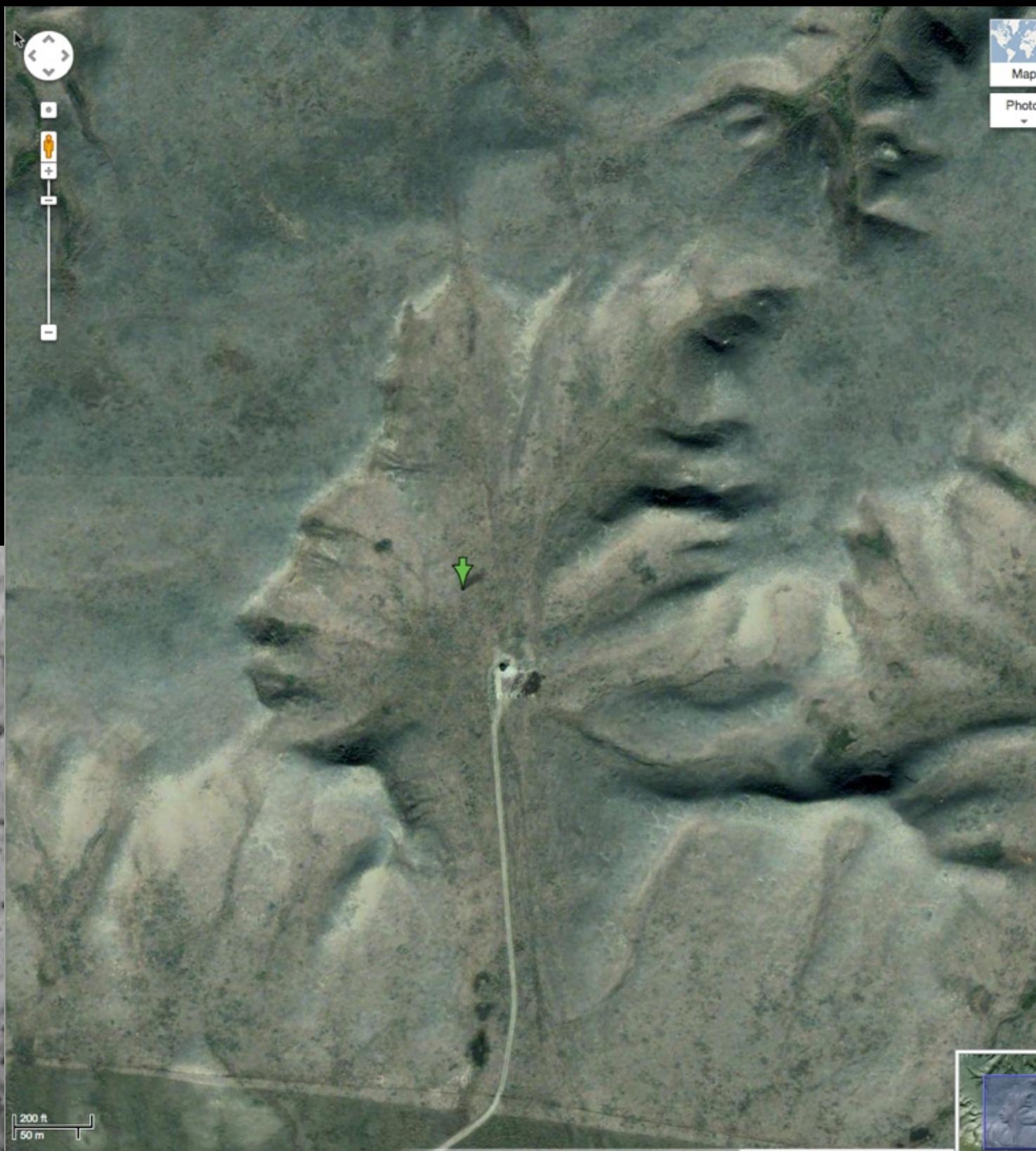
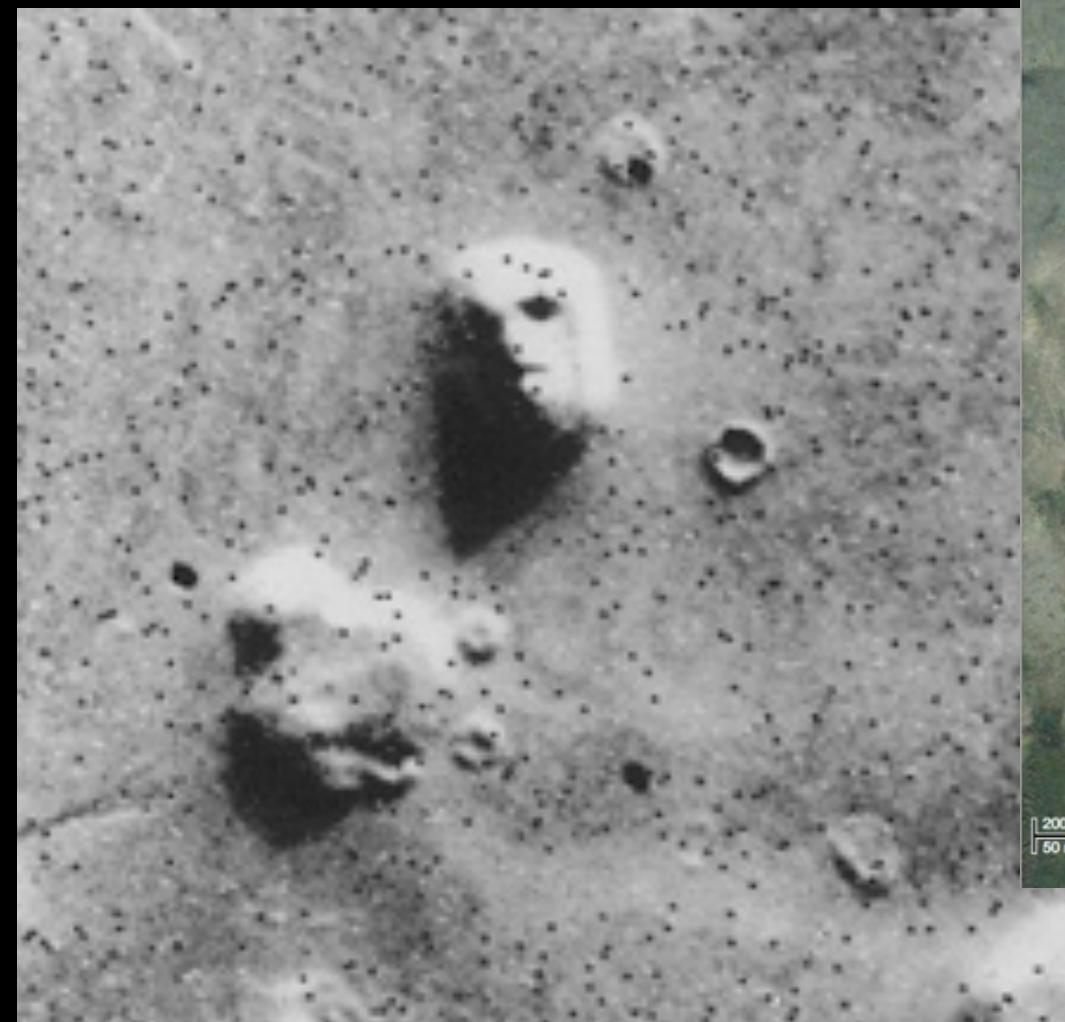


RECOGNITION NEURONS

TEMPORAL LOBE

TEMPORAL LOBE

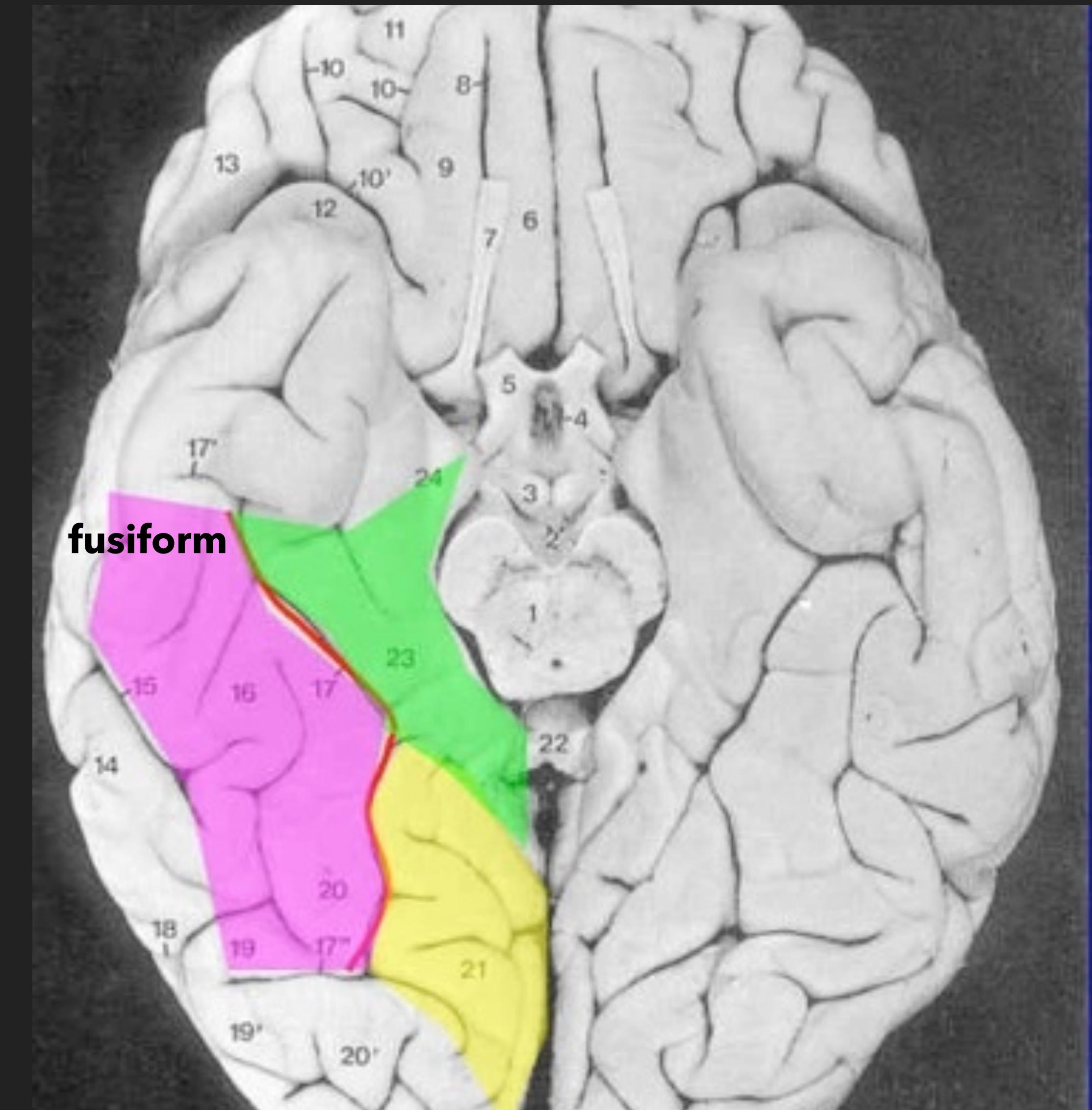
PAREIDOLIA - SEEING FACES



TEMPORAL LOBE - ASSOCIATION CORTEX

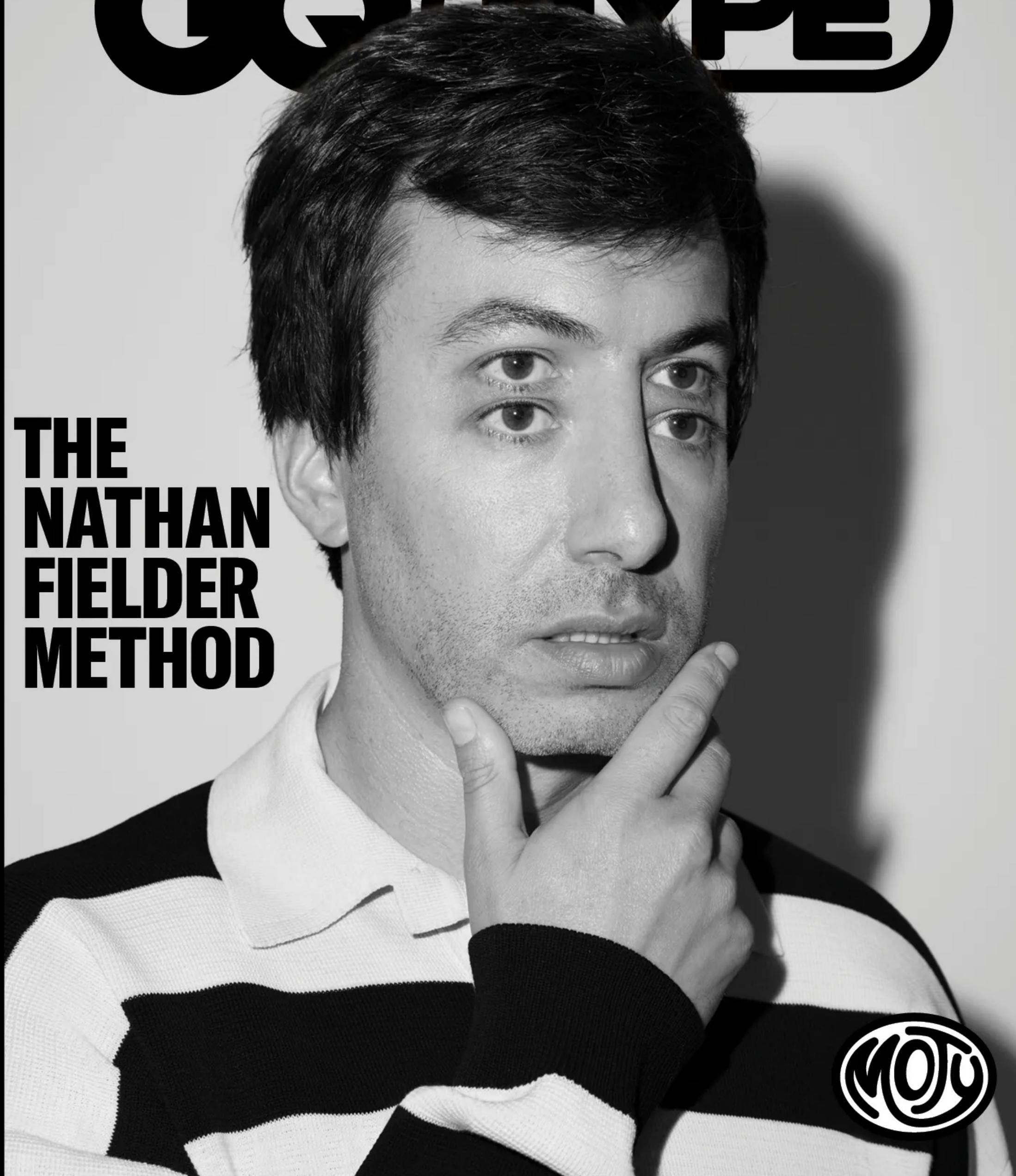
FUSIFORM GYRUS RECOGNIZES STUFF

- ▶ In temporal lobe
- ▶ Face Area of the Brain
 - ▶ recognizes faces
 - ▶ Prosopagnosia - inability to recognize faces
 - ▶ Dr. Oliver Sacks, Brad Pitt



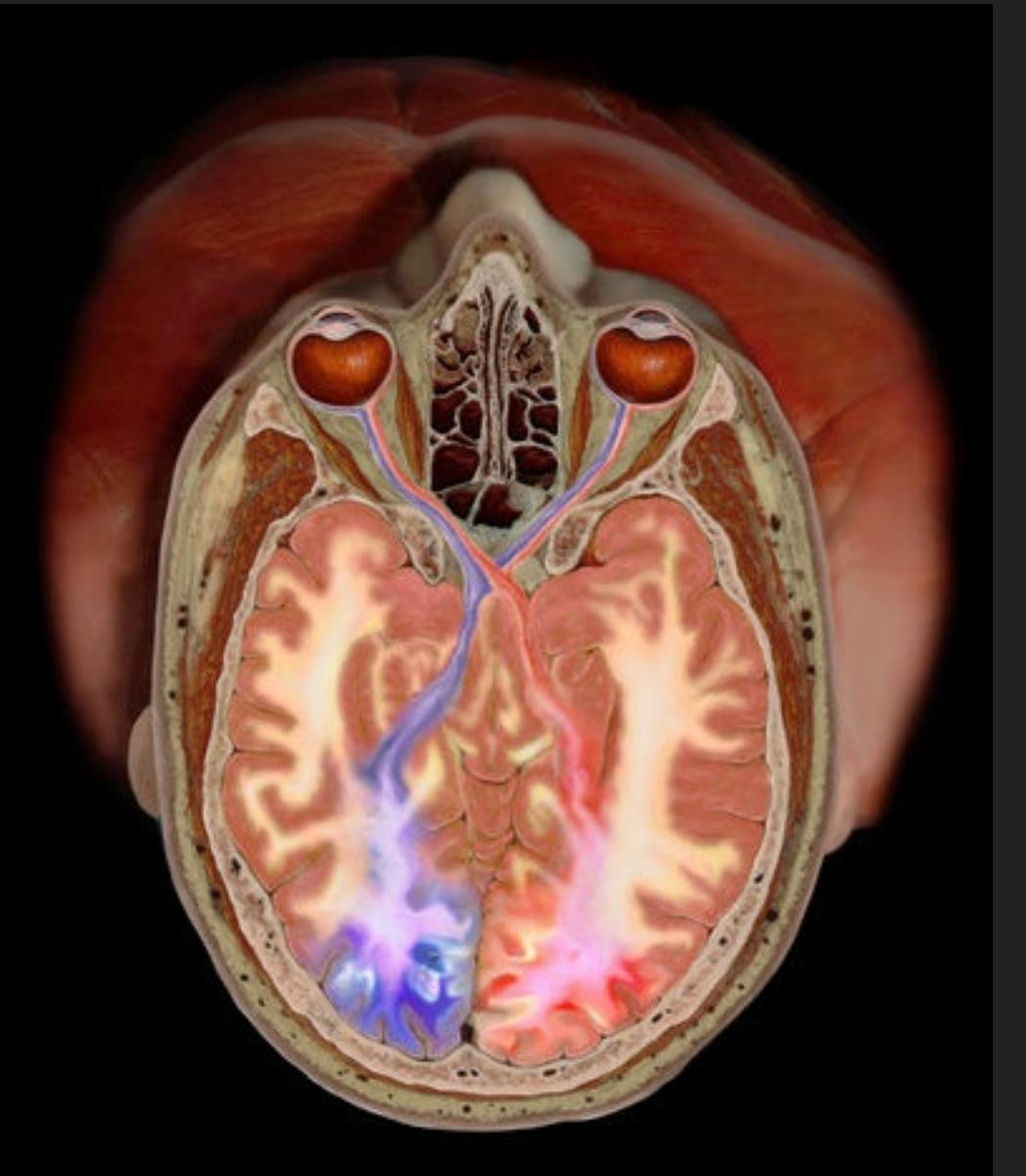
GQ LYPE

**THE
NATHAN
FIELDER
METHOD**



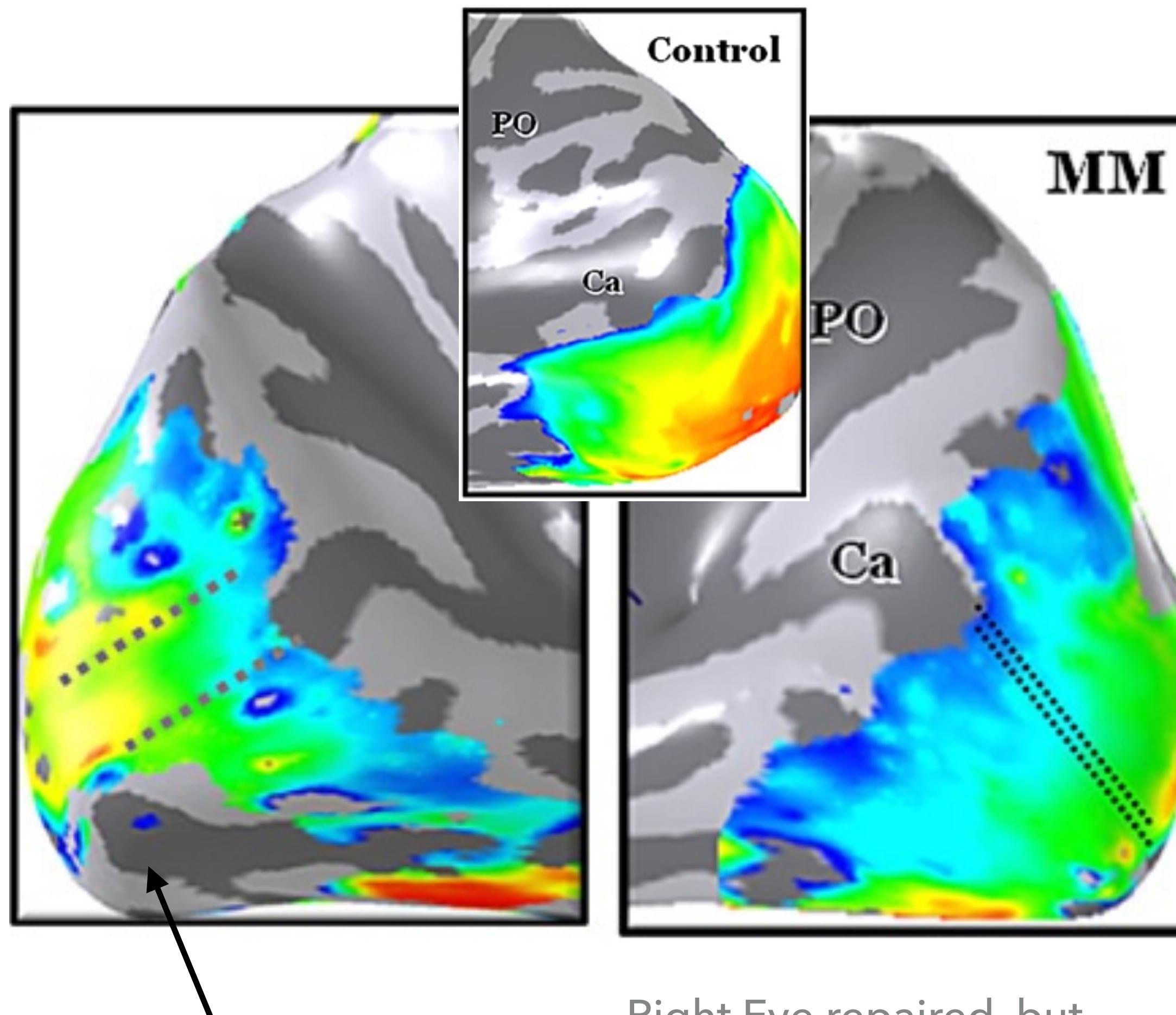
SUCCESSFUL BUSINESS MAN GETS VISION RESTORED

- ▶ Mike May
- ▶ Chemical Explosion burned out left eye and blinded right one at age 3
- ▶ visual cortex not fully developed
- ▶ Blind for 43 years
 - ▶ Holds record for fastest blind, down hill skier (65 mph)
- ▶ 2000 - surgery repaired his right eye



VISUAL CORTEX

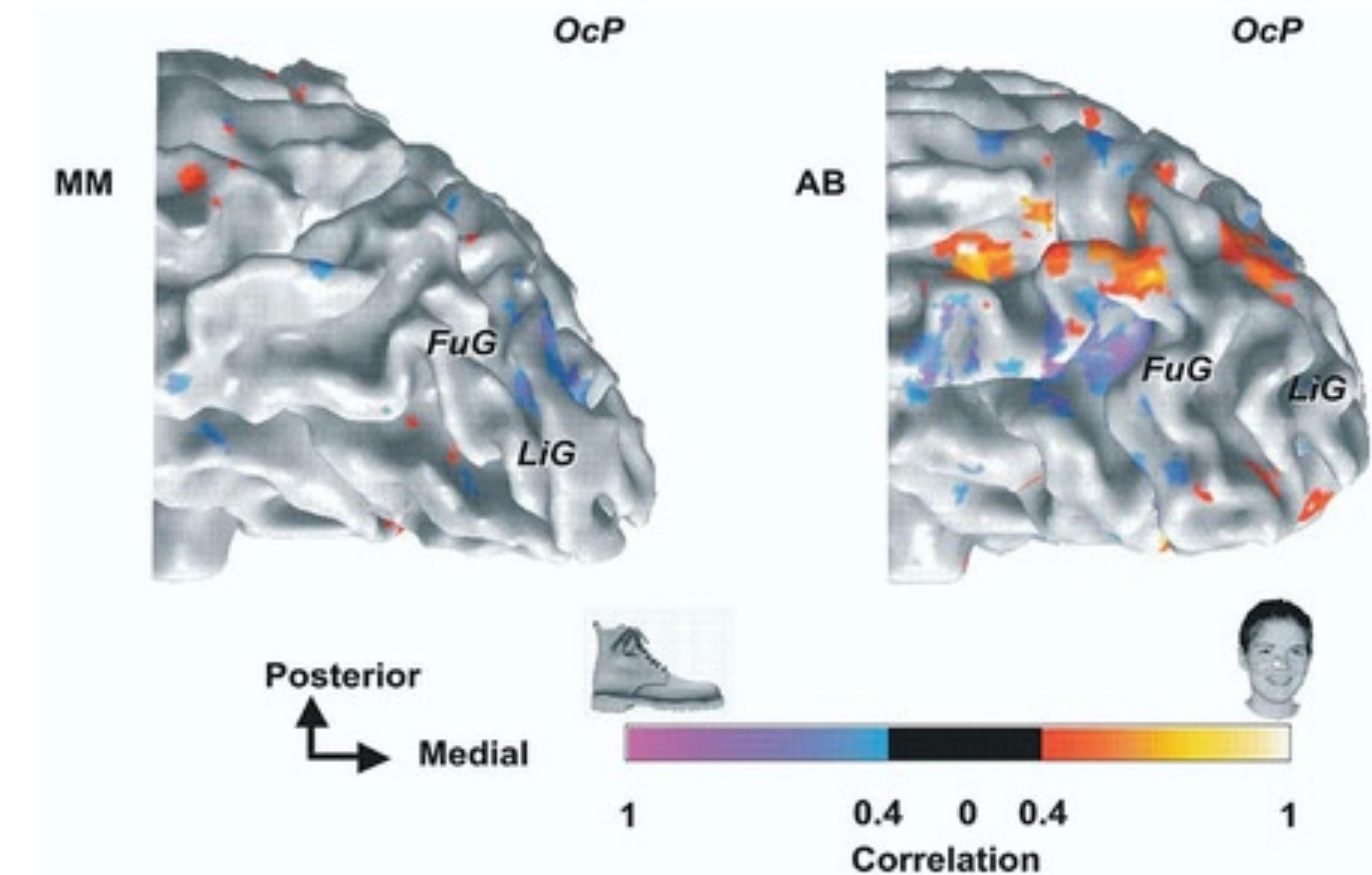
MICHAEL MAY



Left Eye still missing,
so no activity here

Right Eye repaired, but
retinotopic map
disorganized

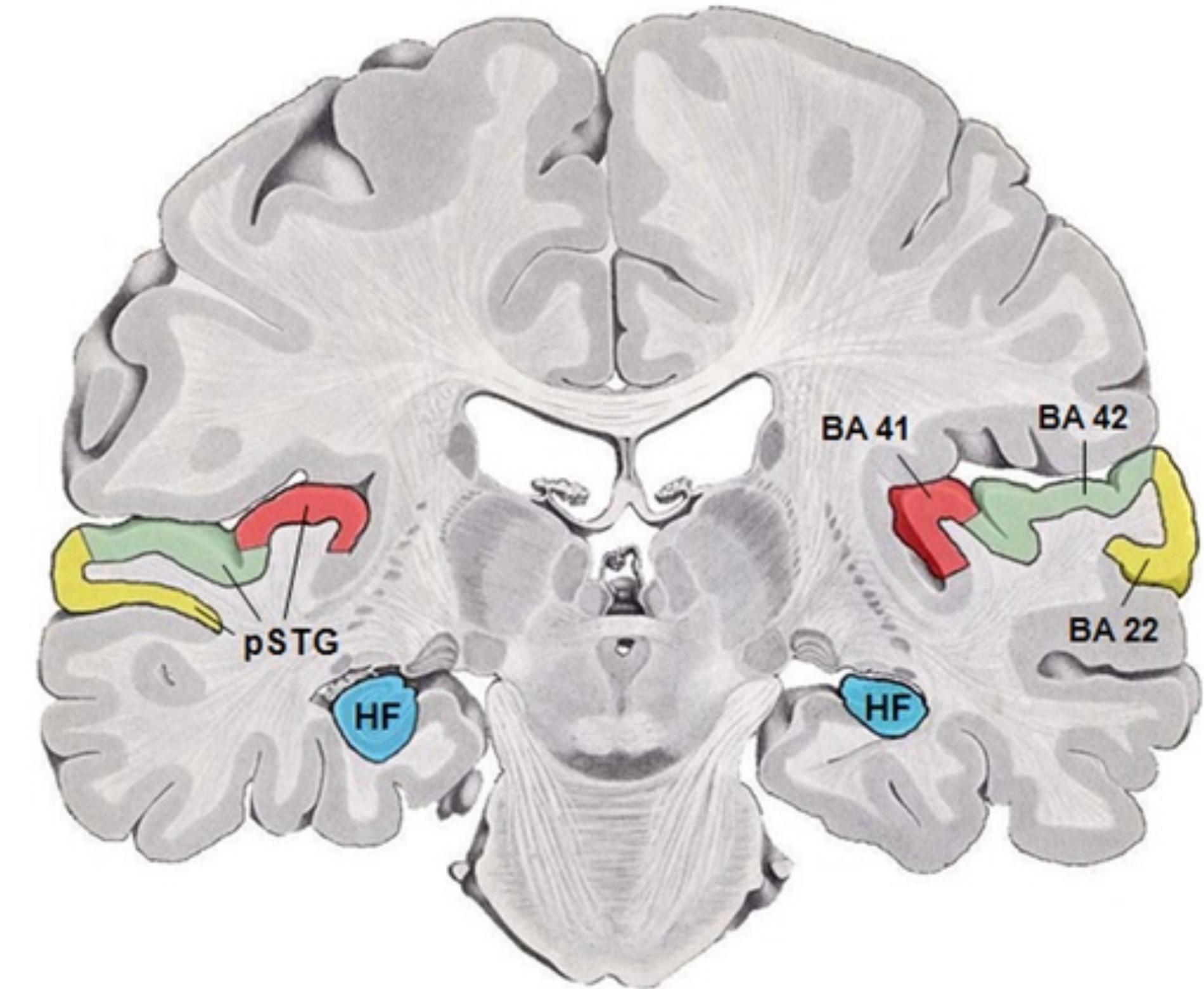
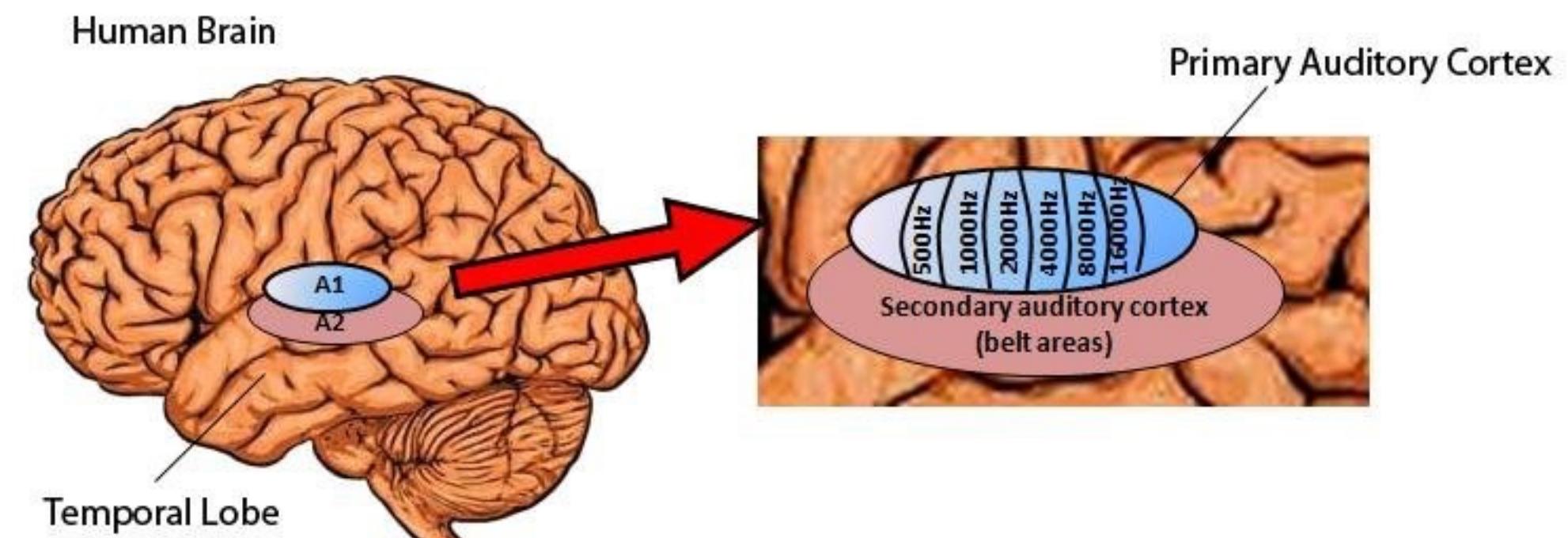
Function analysis of Object recognition shows low activity
in MM Brain (not recognizing objects)



TEMPORAL LOBE

TEMPORAL LOBE AND RECOGNIZING WORDS

- ▶ Stronger Reading associated with a increased cortical thickness in Posterior Superior Temporal Gyrus
- ▶ Contains Auditory cortex (red and green)
- ▶ Phonological awareness - pairing letters with sounds
- ▶ Dyslexia - thinning of this region of the brain



pSTG = poster Superior Temporal Gyrus

HF(blue) - hippocampus

MCGURK EFFECT



<https://www.britannica.com/video/249396/demonstration-McGurk-effect-linguistics>

TEMPORAL LOBE - ASSOCIATION CORTICES

LEFT SUPERIOR TEMPORAL SULCUS CRITICAL FOR AUDIOVISUAL INTEGRATION DURING SPEECH PERCEPTION

A. Congruent



Percept: "ba"

B. Non-McGurk Incongruent



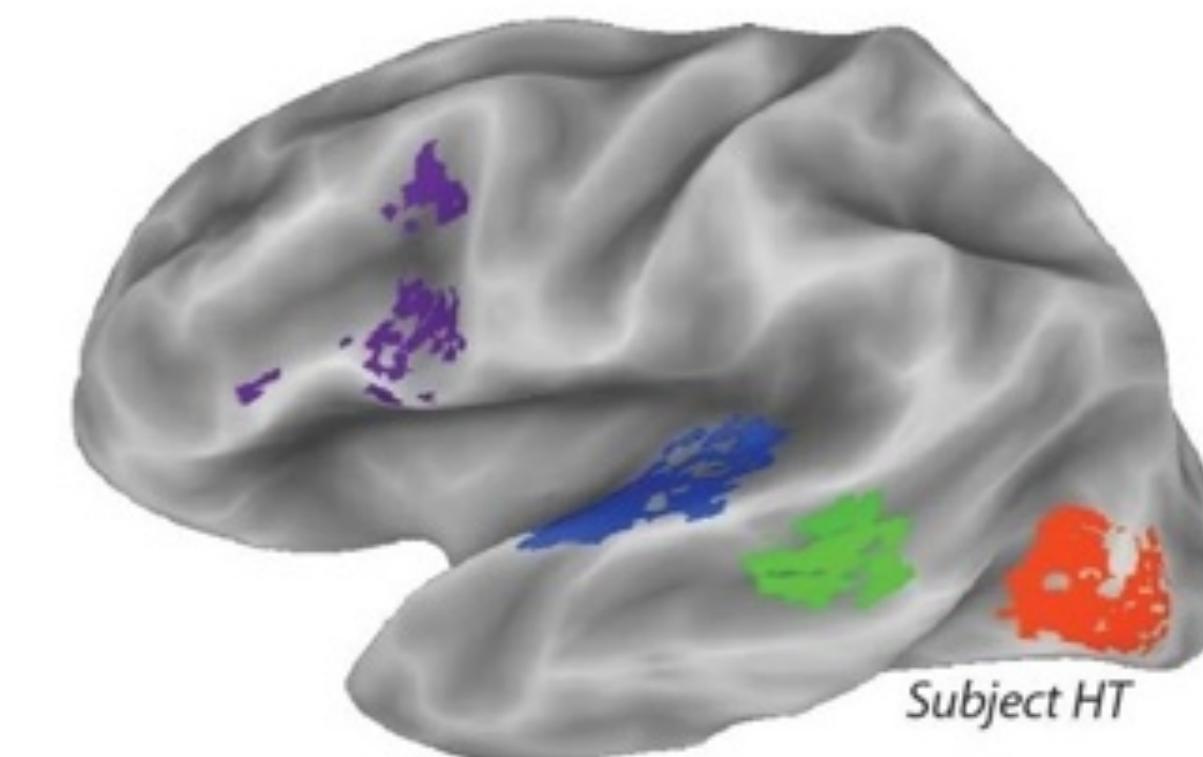
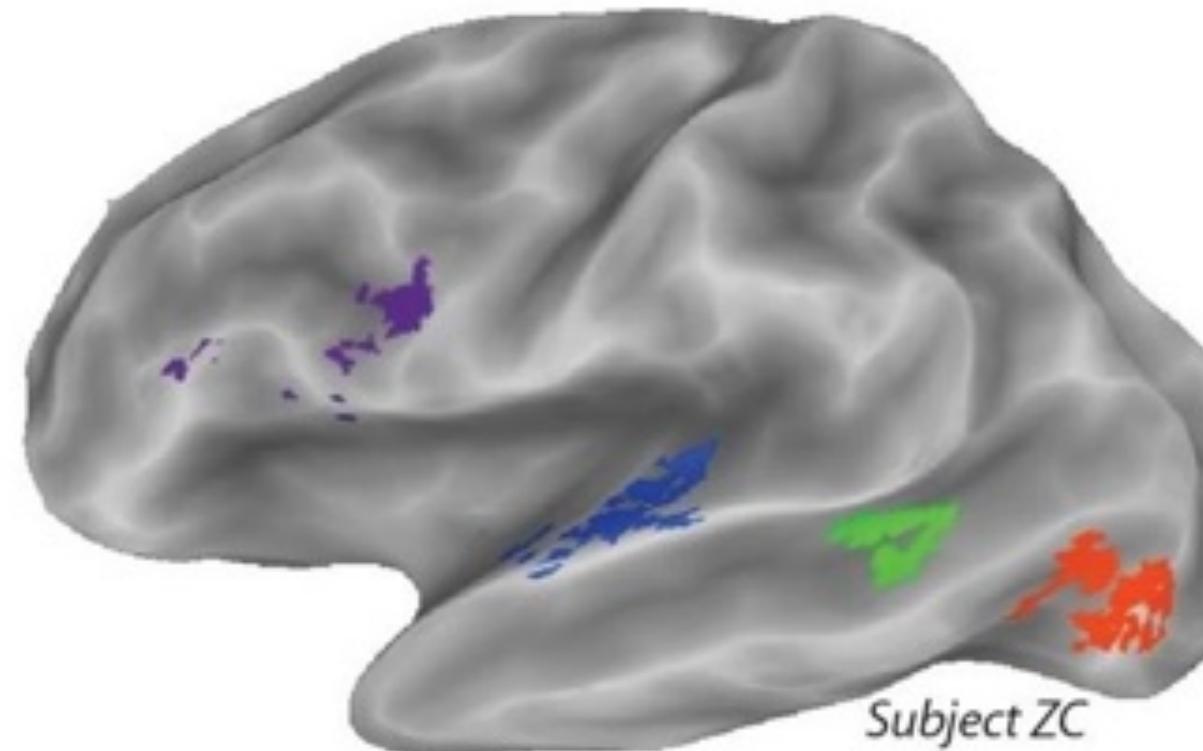
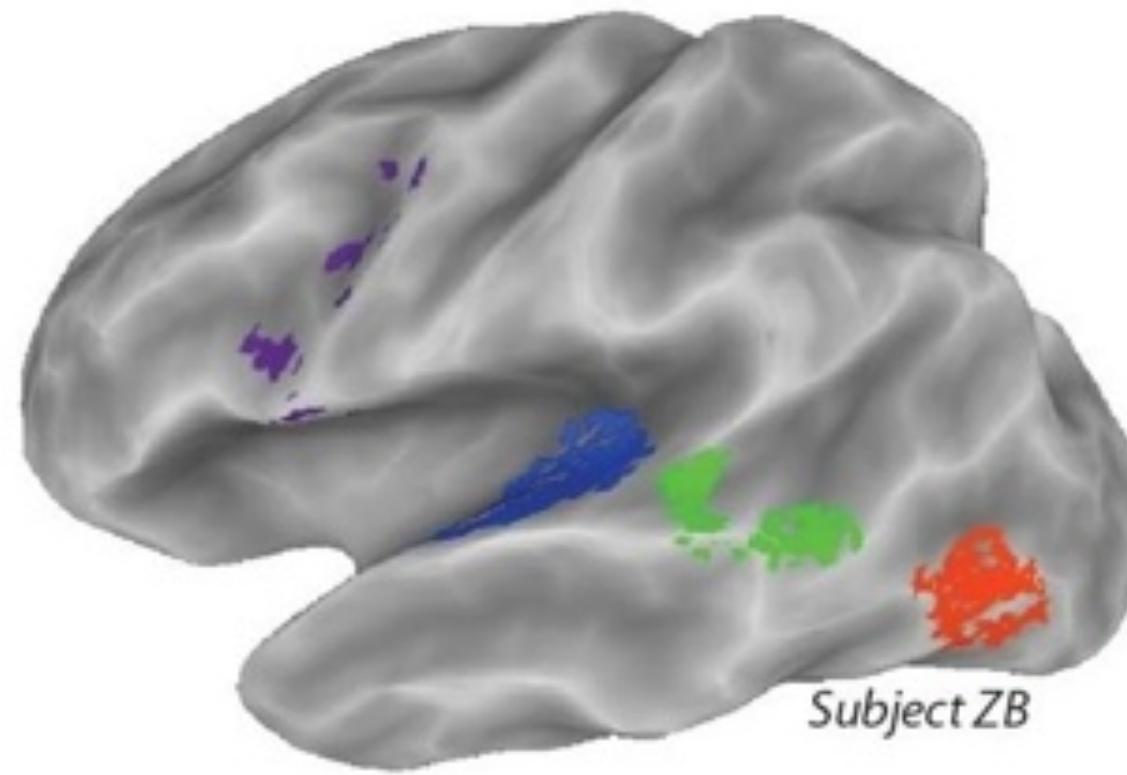
Percept: "ga"

C. McGurk Incongruent



"da" in perceivers
"ba" in non-perceivers

D. Four left hemisphere ROIs in three representative subjects



left superior temporal sulcus

<http://www.ncbi.nlm.nih.gov/pmc/articles/PMC3196040/>

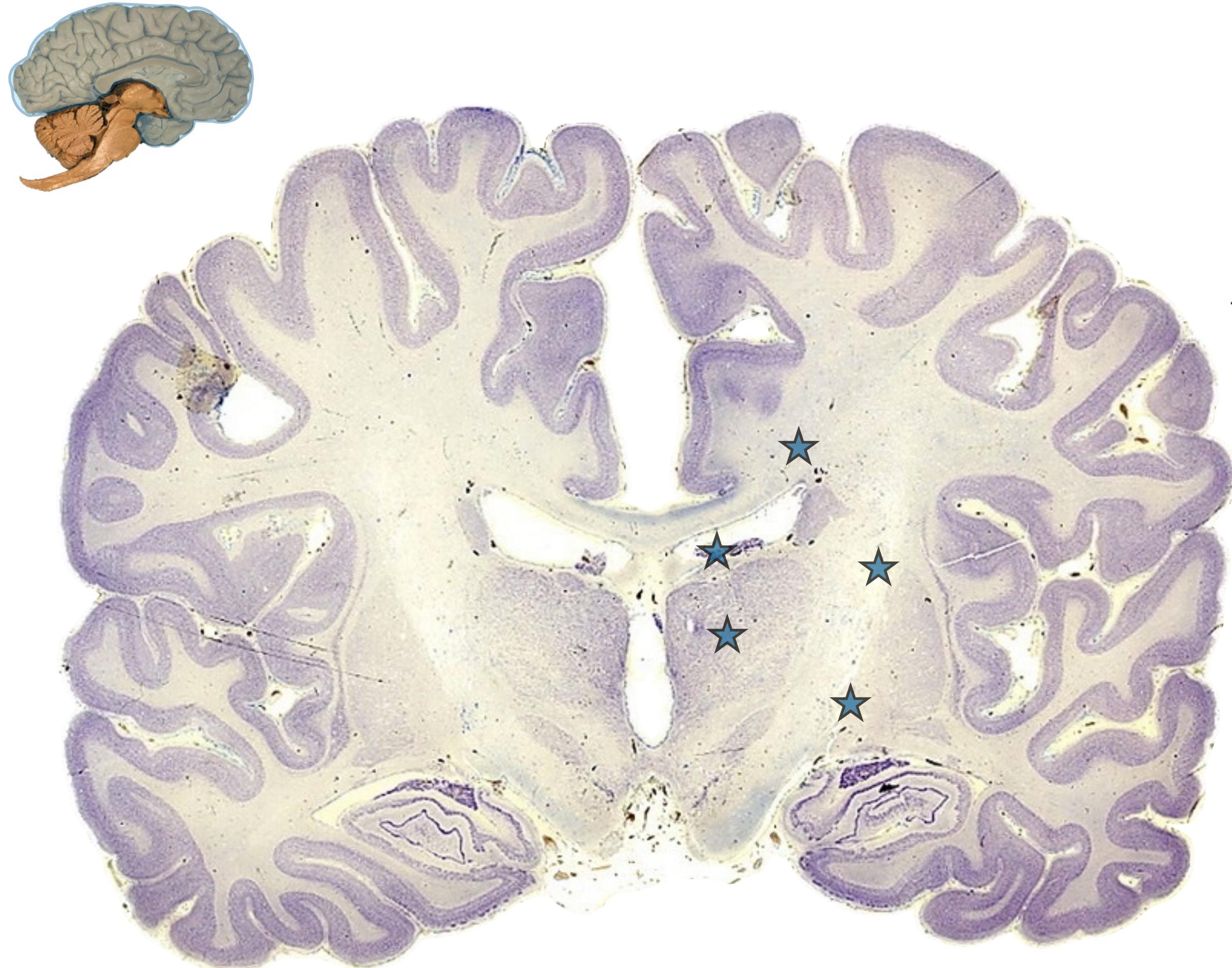
auditory cortex ROI (blue)

visual cortex ROI (red)

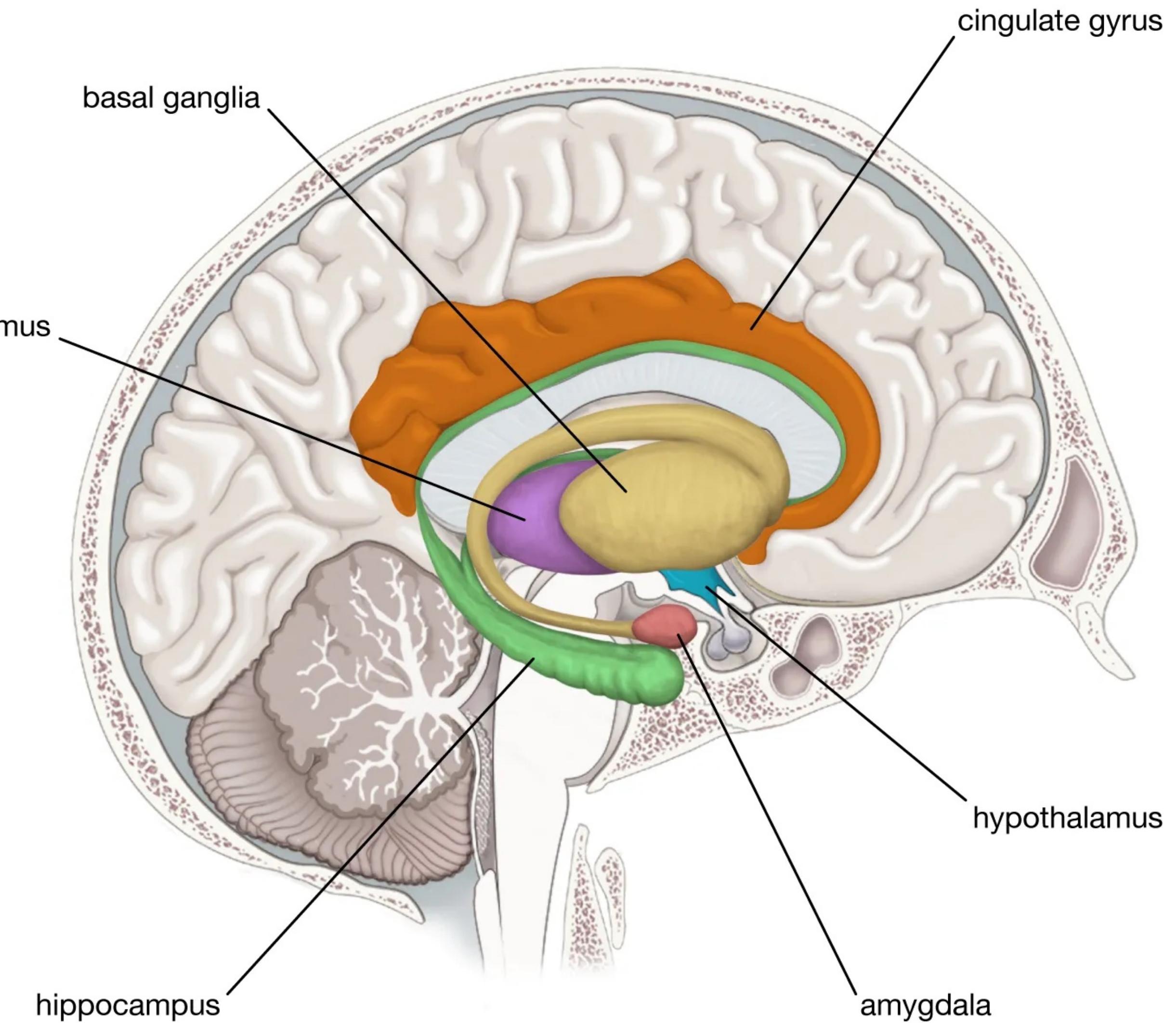
inferior frontal gyrus (purple)

STRUCTURAL ORGANIZATION

TELENCEPHALON DEEP STRUCTURES



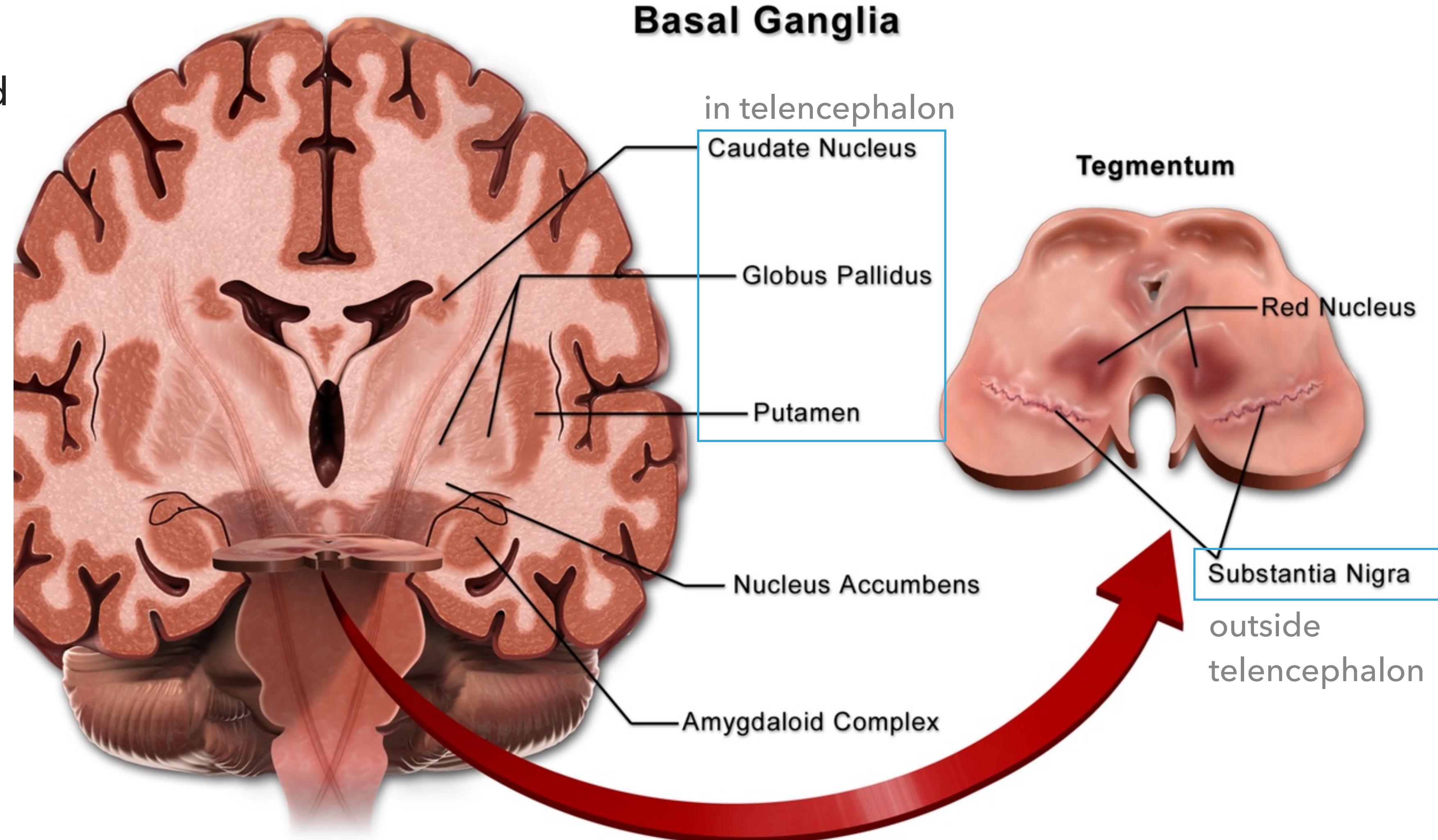
Subcortical Nuclei - Groups of Somas in the cerebrum that are not in the cerebral cortex



TELENCEPHALON

BASAL GANGLIA INITIATE MOVEMENT

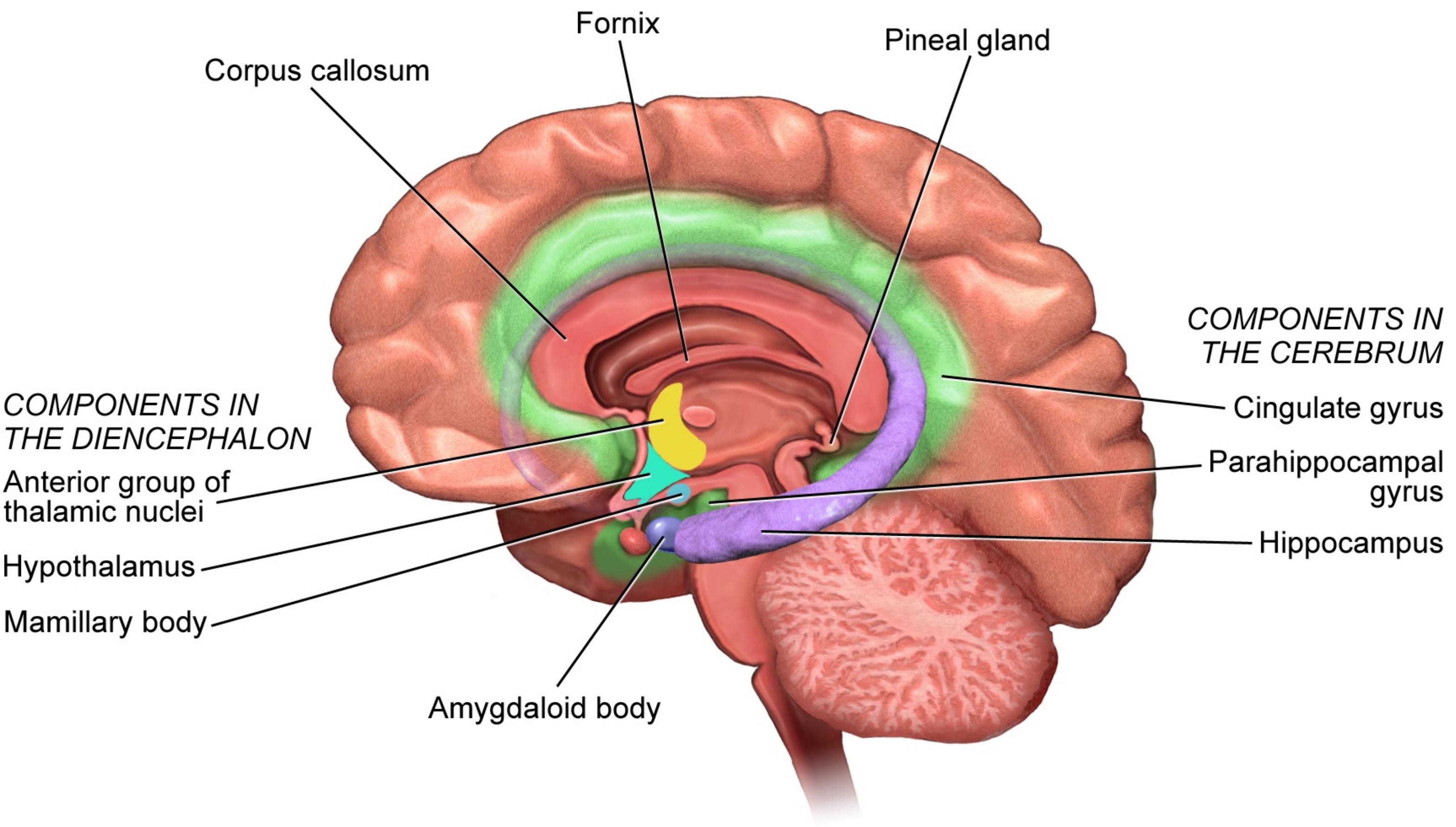
- ▶ A group of nuclei that play a pivotal role in movement and some memory
- ▶ Five different groups of nuclei
 - ▶ Caudate, Globus Pallidus, Putamen
 - ▶ not just in Telecephalon
 - ▶ Substantia Nigra
 - ▶ Subthalamic Nuclei



Not technically a 'ganglion': can also be called Basal Nucleus, but rarely is.

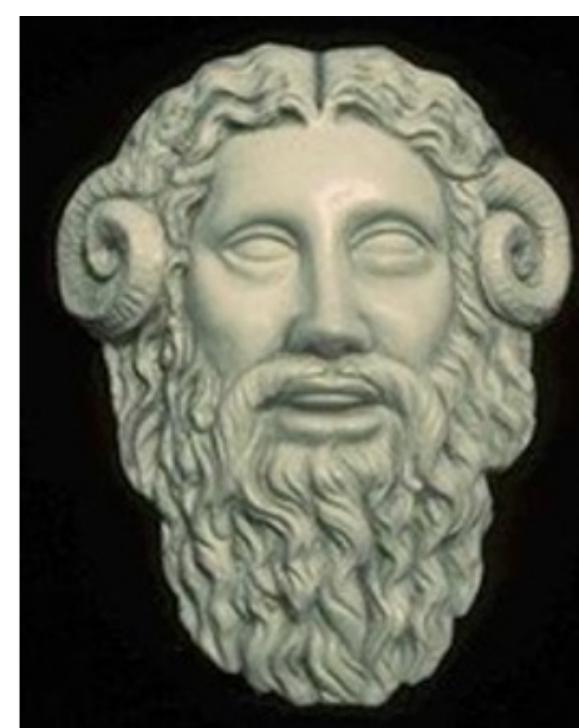
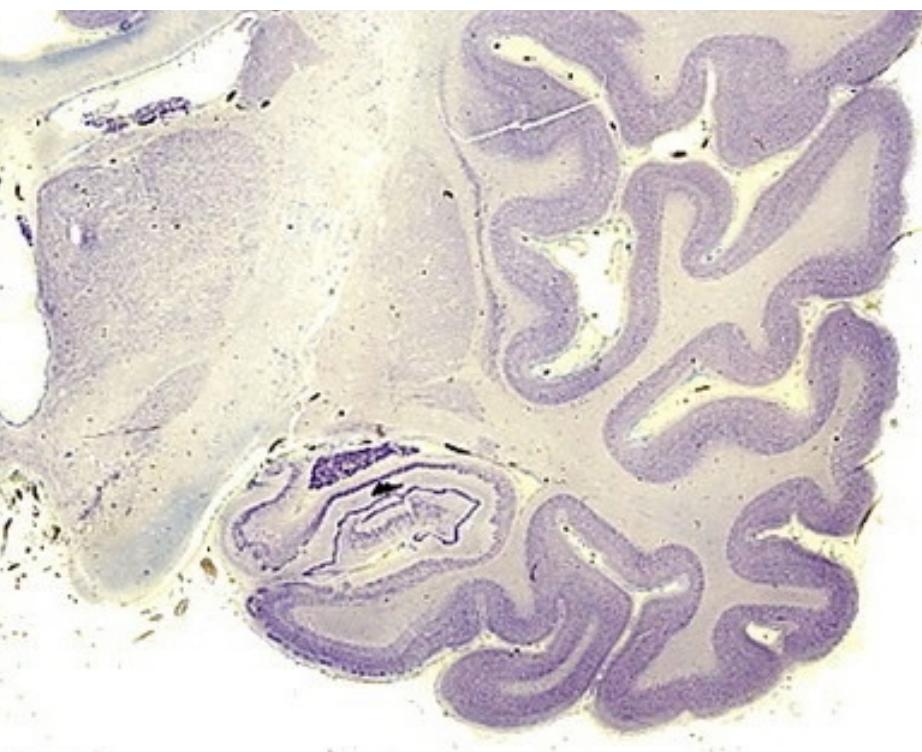
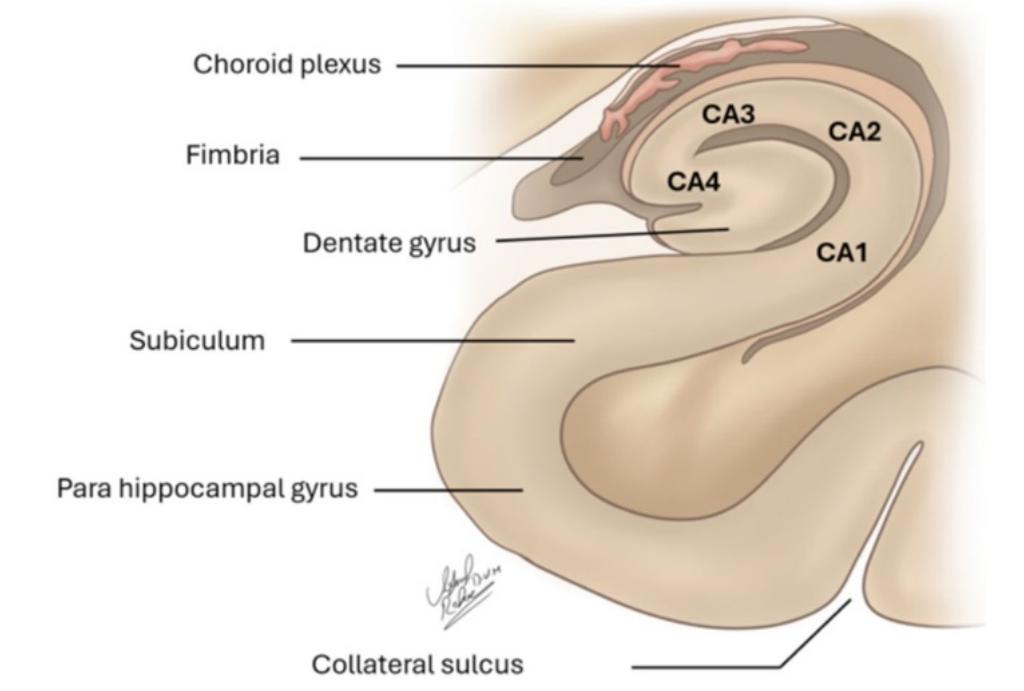
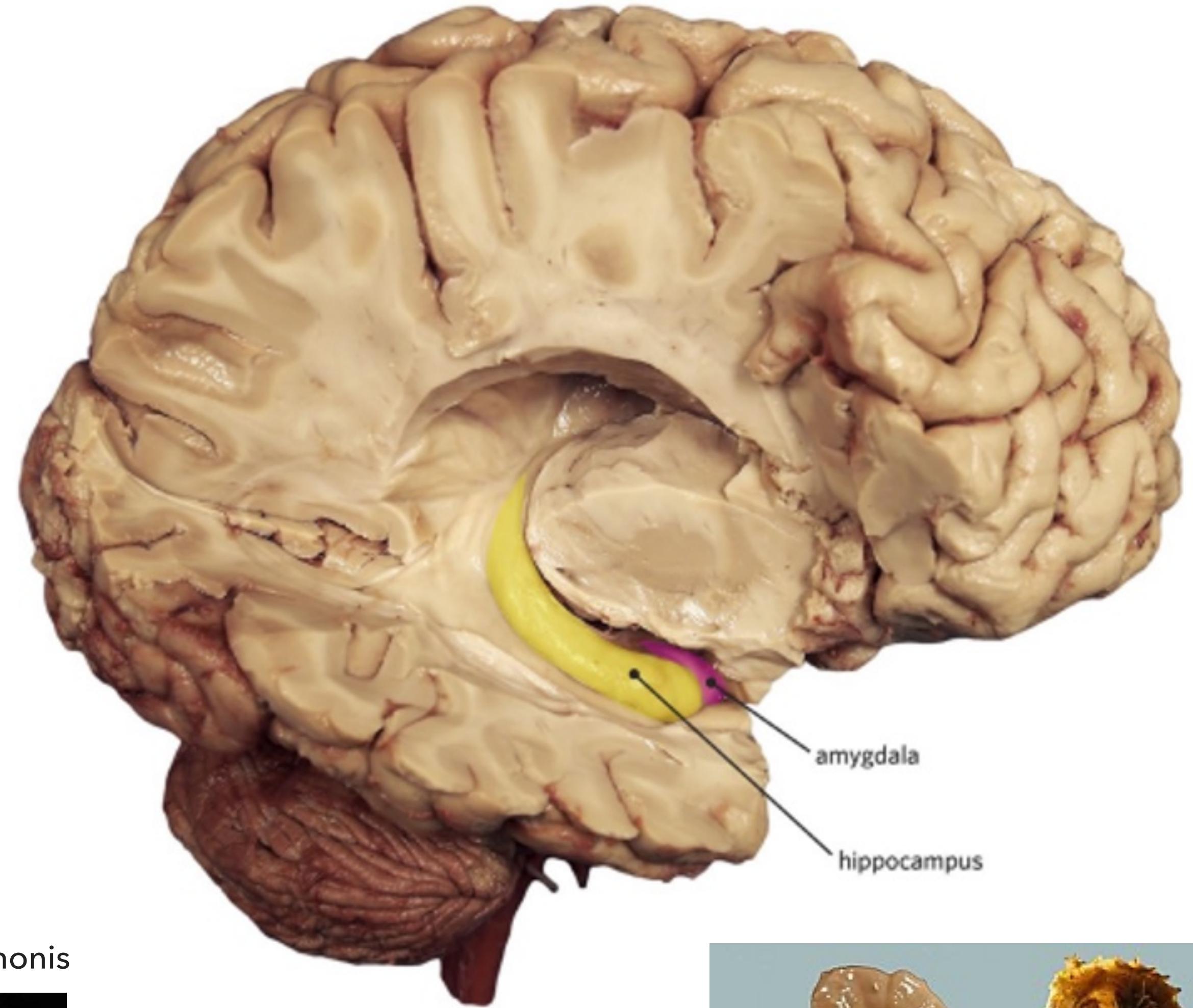
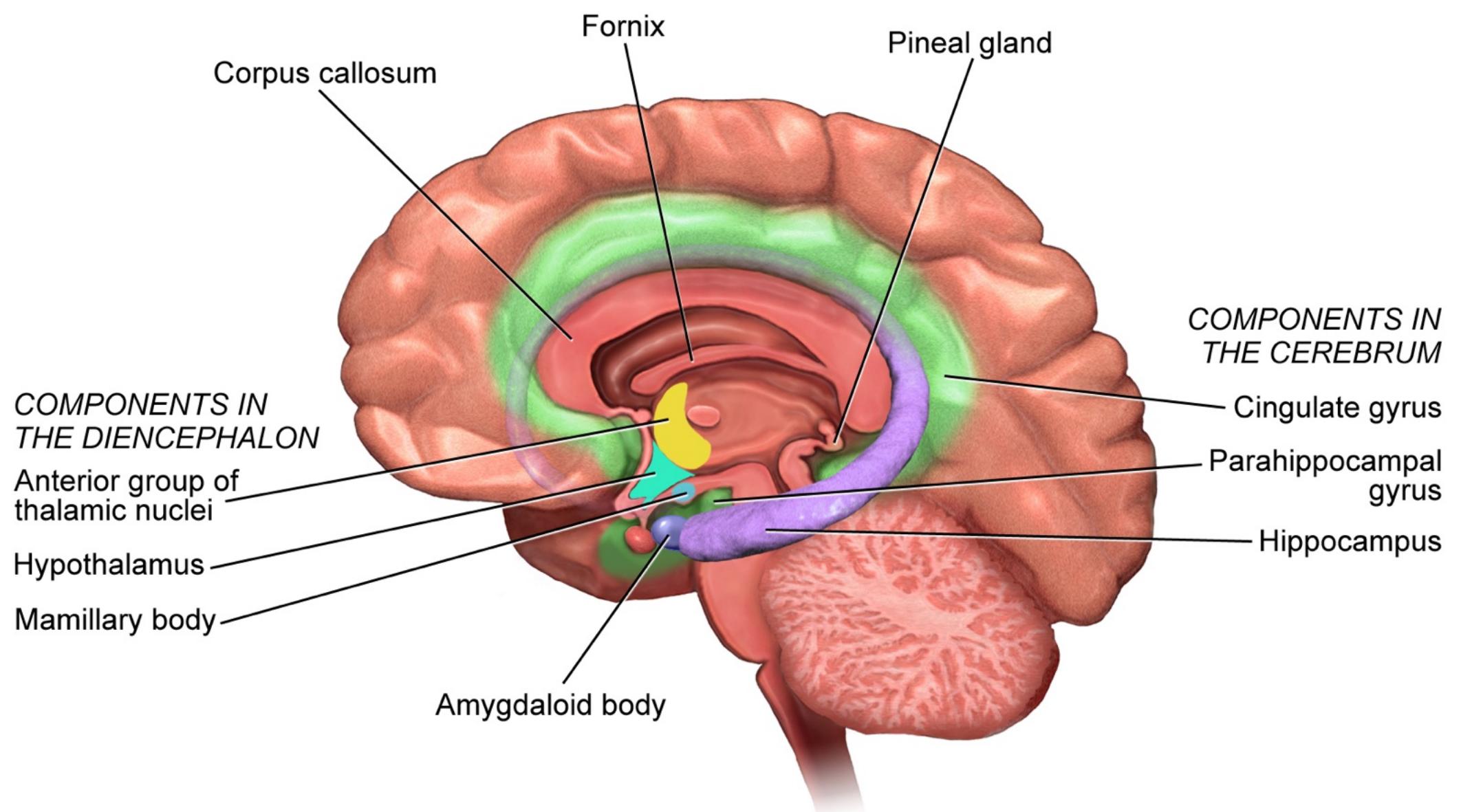
LIMBIC SYSTEM – HOUSES EMOTIONS AND MEMORY

- ▶ a 'old brain' instinct center
- ▶ also includes (Outside Telencephalon)
 - ▶ mammillary bodies
 - ▶ Anterior Nucleus
- ▶ Adds context to primary info
 - ▶ memory and emotion

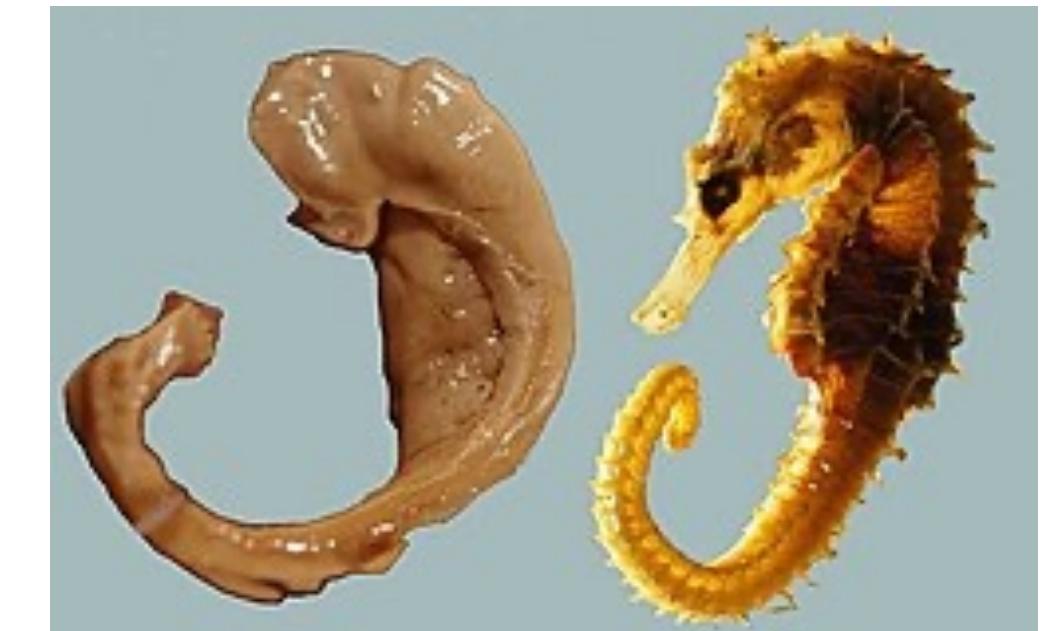


HIPPOCAMPUS

Where short-term memories are made



CA - Cornu Ammonis



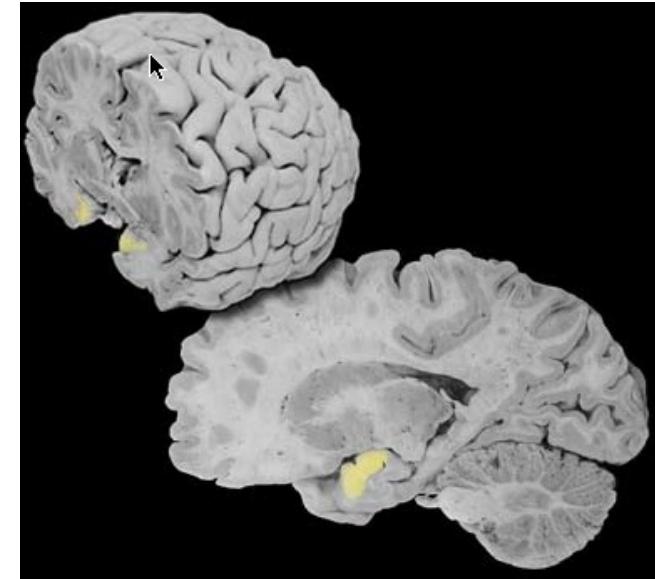
Latin for Seahorse

HIPPOCAMPAL SIZE CORRELATES TO MEMORY

- ▶ London Cabbies
 - ▶ Must spend 2-4 years memorizing locations and traffic patterns of London's 25,000 streets and 1,400 landmarks
 - ▶ Pass the Knowledge, a comprehensive and daunting certifying exam - 30% pass rate
 - ▶ Cabbies have increased gray matter volume in the right posterior hippocampus
 - ▶ Only cabbies who passed have larger hippocampuses
- ▶ Clarks Nutcracker can remember 6000 different places to hide seeds
 - ▶ Lose this ability without a hippocampus



AMYGDALA - FEELINGS CENTER



- Processes and contextualizes Emotions
 - Particularly with unpleasant, aversive stimuli and situations
 - Helps identify threats in the environment and activate the relevant limbic response
 - e.g. going to see the dentist
- Made up of distinct sub-nuclei and cortical regions
 - Medial group
 - Central group
 - Basolateral group

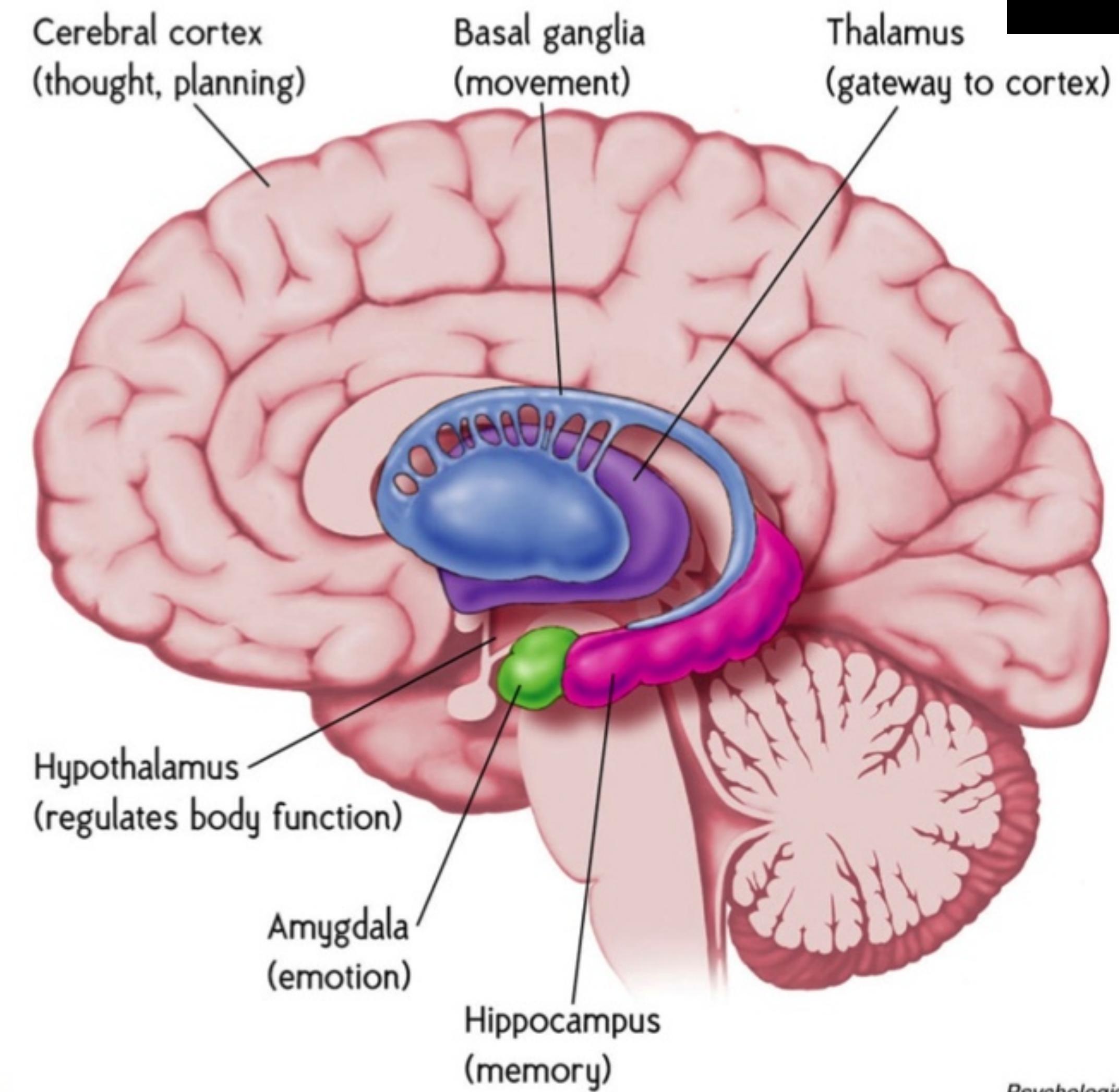
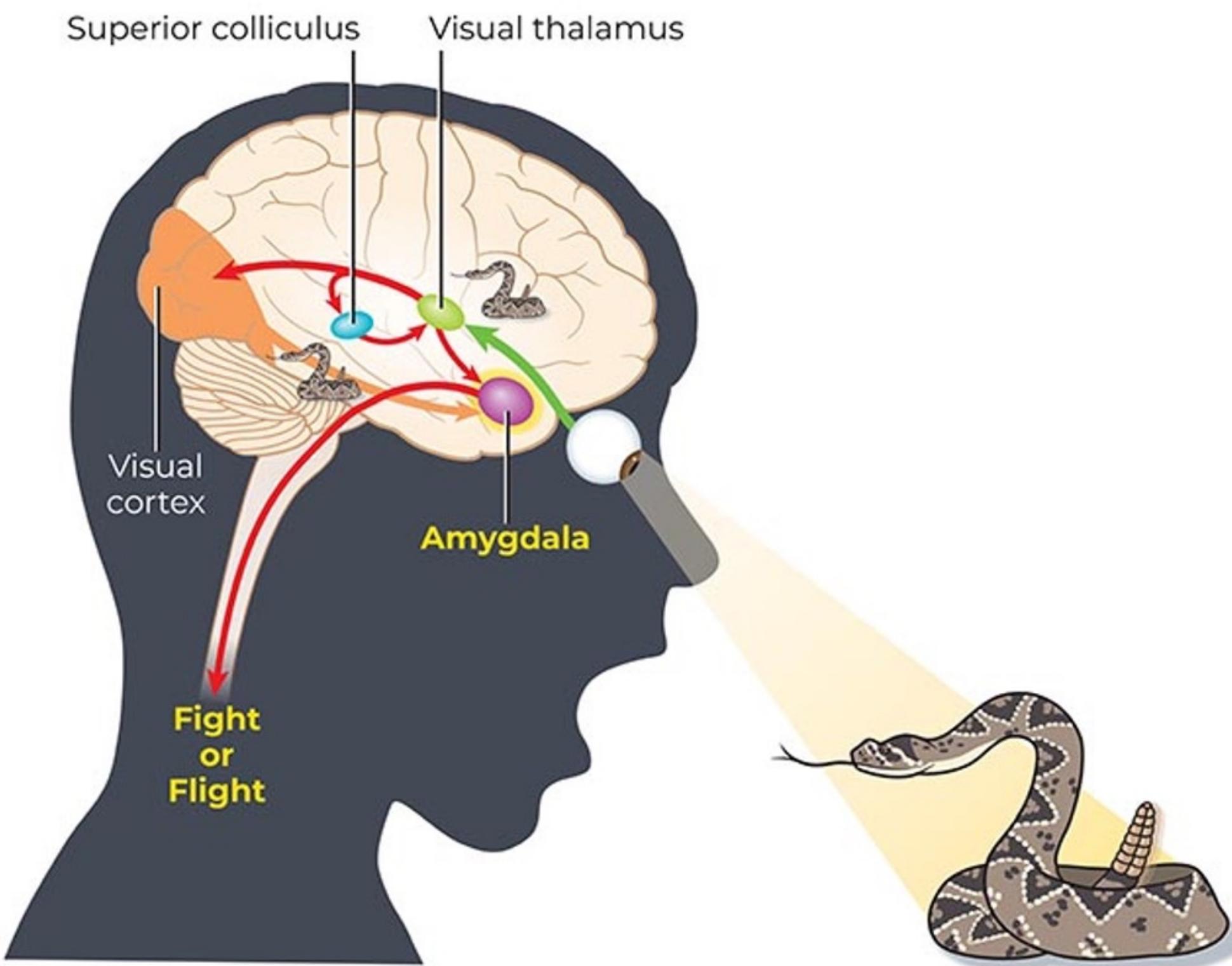


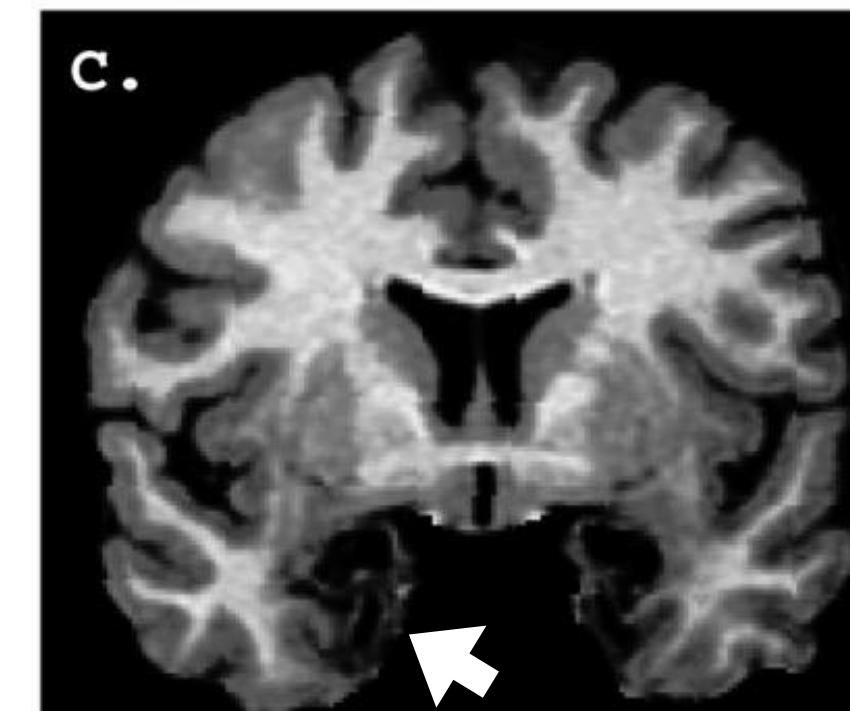
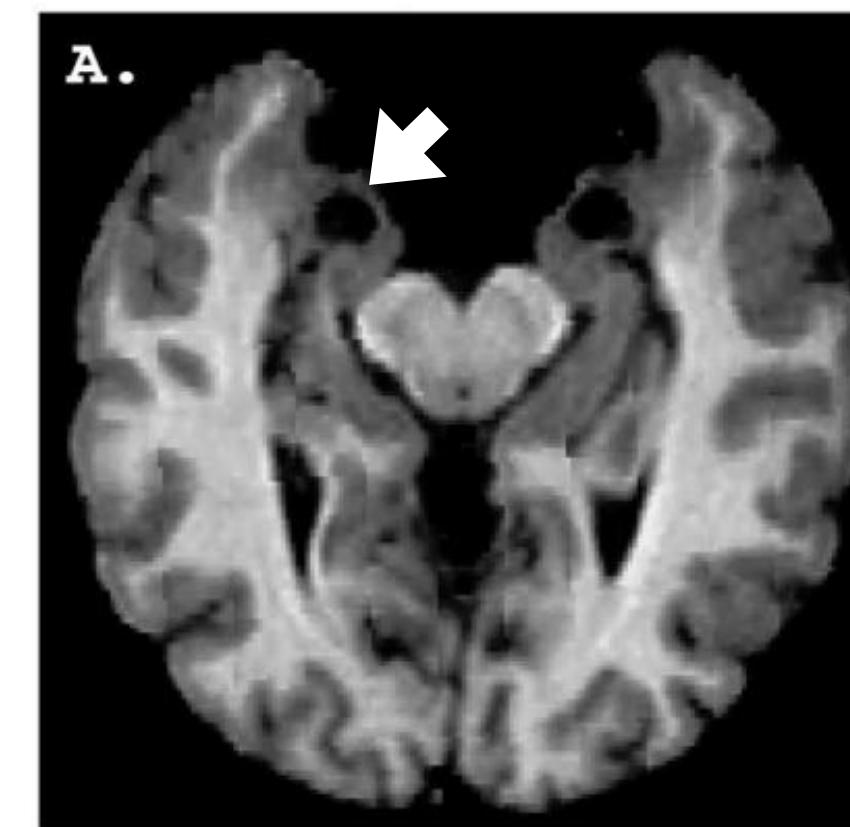
FIGURE 4.6

AMYGDALA

Site Where Fearful Learning Occurs



- ▶ Genetic atrophy of Amygdala
- ▶ No fear of external events
- ▶ Can't recognize fear in others



Urbach-Wiethe Disease



QUESTIONS

- ▶ Alzheimer's Disease is typically characterized by forgetfulness in the early stages of the disease. Which of the following Brain Structure most likely degenerates first in AD?
Hippocampus, Amygdala, or Substantia Nigra?
- ▶ In later stages, AD can be characterized personality changes. The degeneration of which lobe would explain personality changes? **Frontal, Parietal, Occipital or Temporal?**
- ▶ Parkinson's is a movement disorder characterized by tremors. Which structure is mostly likely affected? **Hippocampus, Amygdala, or Substantia Nigra?**
- ▶ The innate fear of snakes is mediated by which structure? **Hippocampus, Amygdala, or Basal Ganglia**

MAJOR COMPONENTS OF THE TELENCEPHALON

CEREBRAL CORTEX

- Gray Matter & White Matter
- Central & Lateral Sulci
- Pre-central and Post-central Gyri

Lobes

- 4 Outer Lobes: Frontal, Temporal
Parietal, Occipital
- 2 Inner Lobes: Insula and Cingulate

White Matter Tracts

- Commissures
- Association Fibers
- Projection Fibers

LIMBIC CENTERS

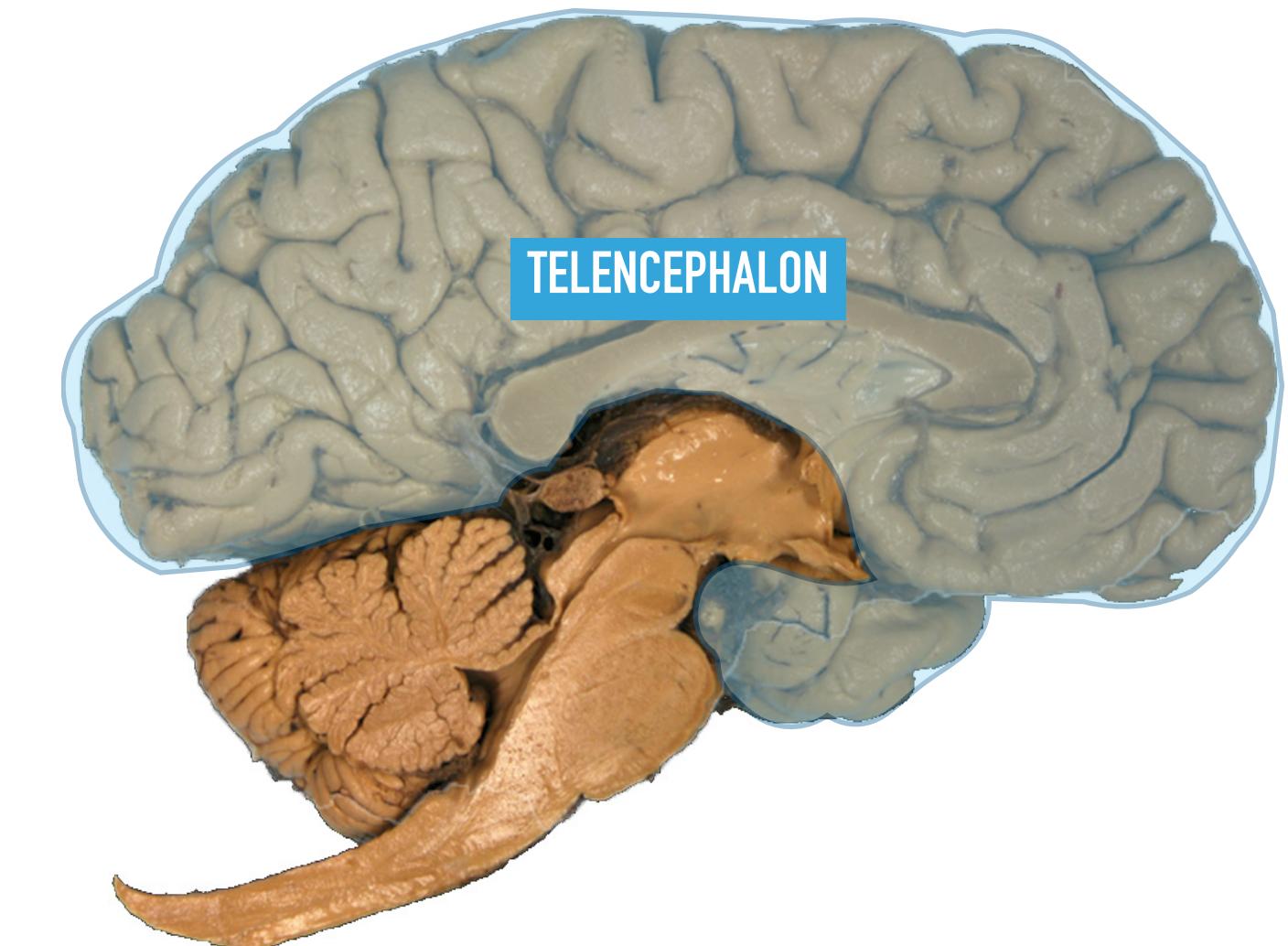
- Amygdala, Hippocampus, Fornix,
Mammillary Bodies, Anterior Thalamic
Nuclei, Cingulate Gyrus

BASAL GANGLIA

- Caudate, Putamen, Globus Pallidus

Functional Domains

- Primary Cortex: Auditory, Visual, Motor &
Somatosensory ("homunculi")
- Association Cortices
- Speech Centers: Broca's Area &
Wernicke's Area



IMPORTANT Terminology

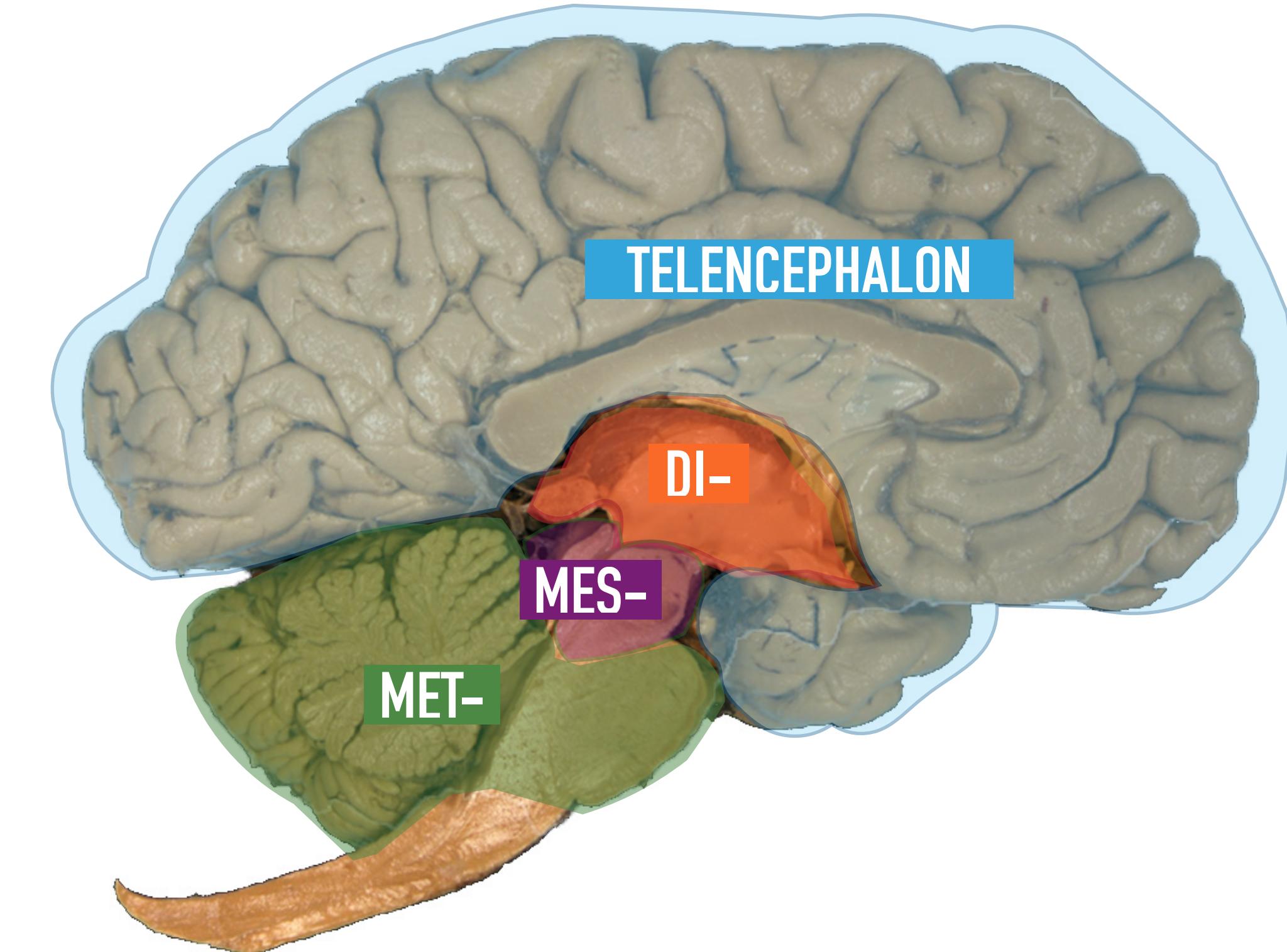
Cerebrum = telencephalon

Forebrain = telencephalon +
diencephalon

CEPHALONS

DIENCEPHALON

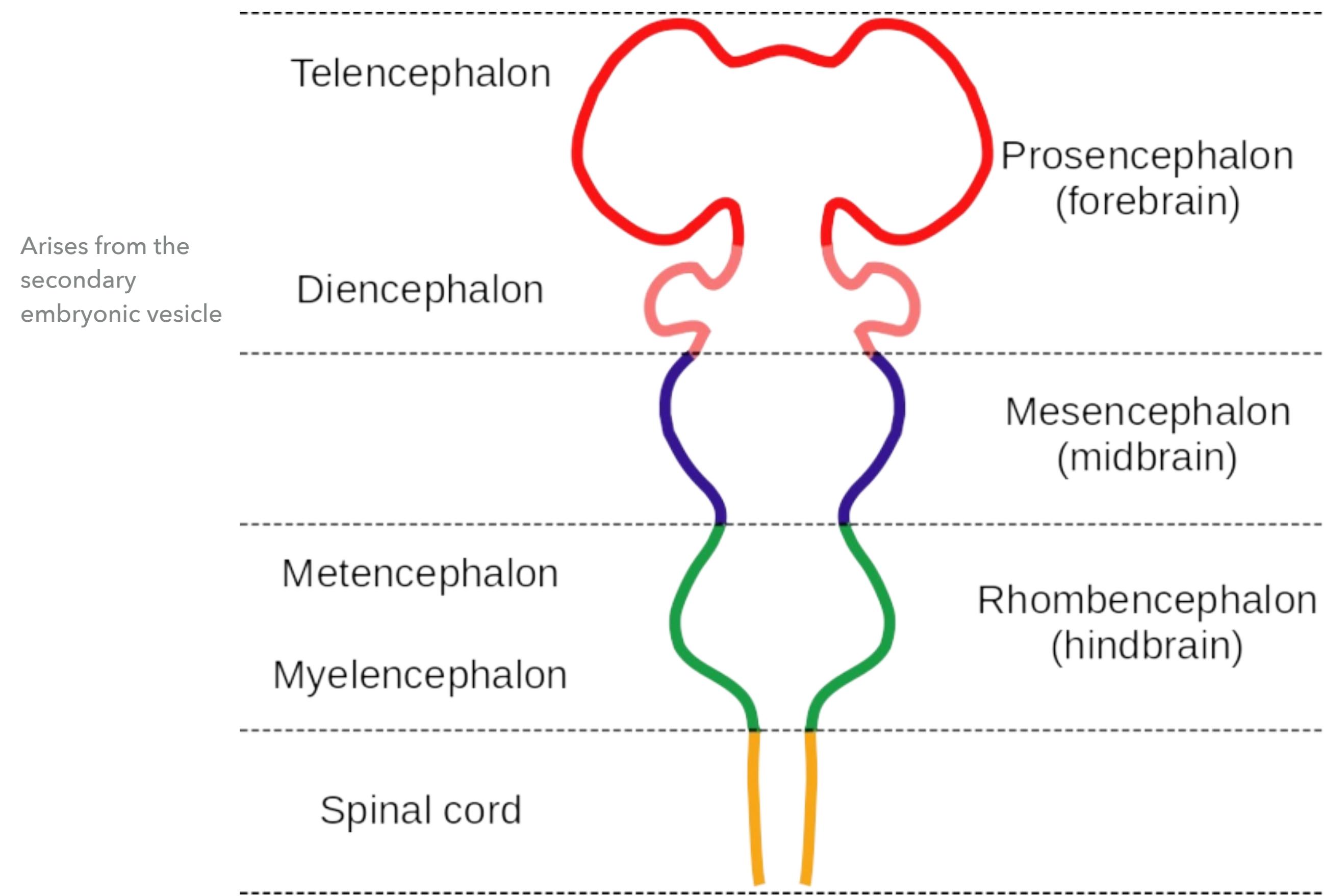
"Die inside, middle part"



DIENCEPHALON

'TWEEN' BRAIN

- ▶ Between the Cerebrum and the brain stem



ALL THEM THALAMI

1. Thalamus

◆ Gr: *thálamos*, "an inner chamber, a bedroom, a bed"

2. Hypothalamus

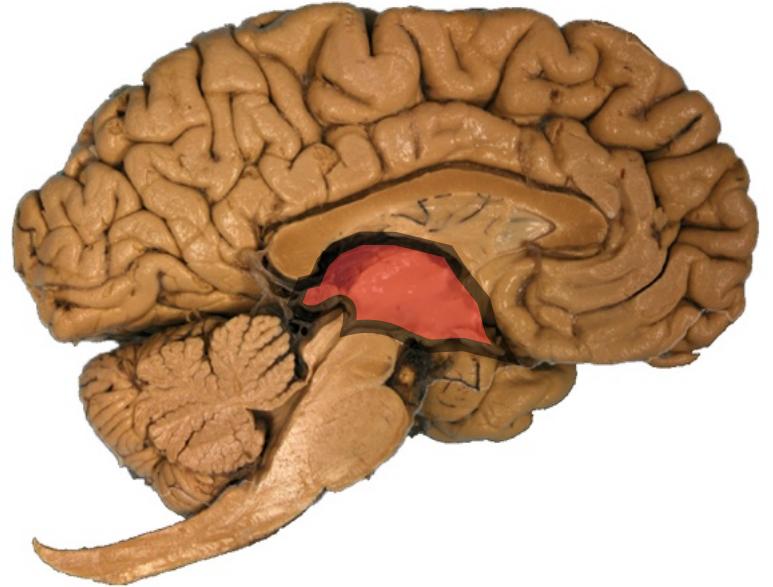
3. Epithalamus:

◆ pineal body & habenular nucleus

4. Subthalamus

◆ subthalamic nuclei of basal ganglia

◆ Posterior Pituitary Gland



DIENCEPHALON

COMPONENTS AND COUNT

1. Thalamus

- a pair of bilateral structures
- Gr: thálamos, "an inner chamber, a bedroom, a bed"

2. Hypothalamus

- one midline structure

3. Posterior Pituitary

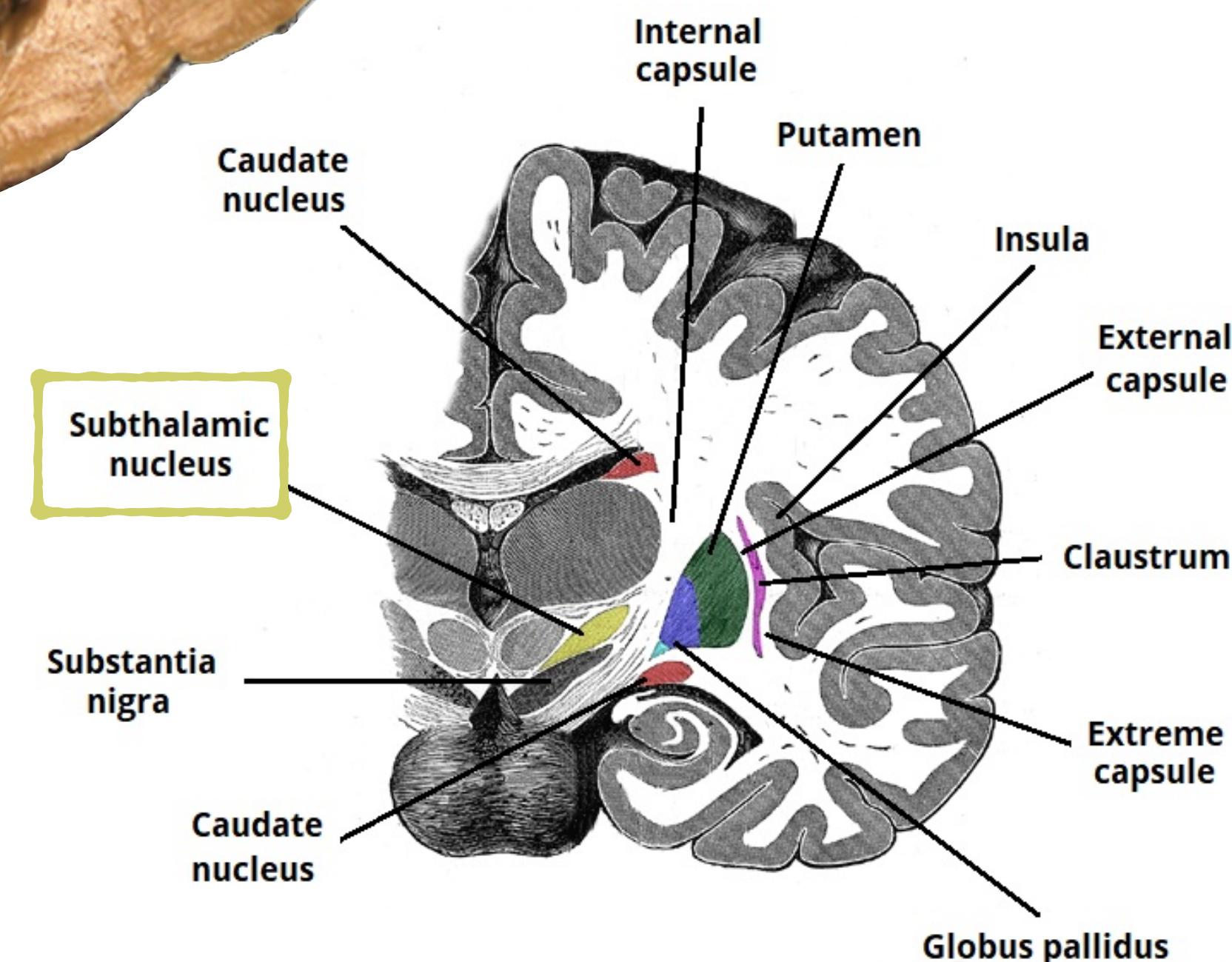
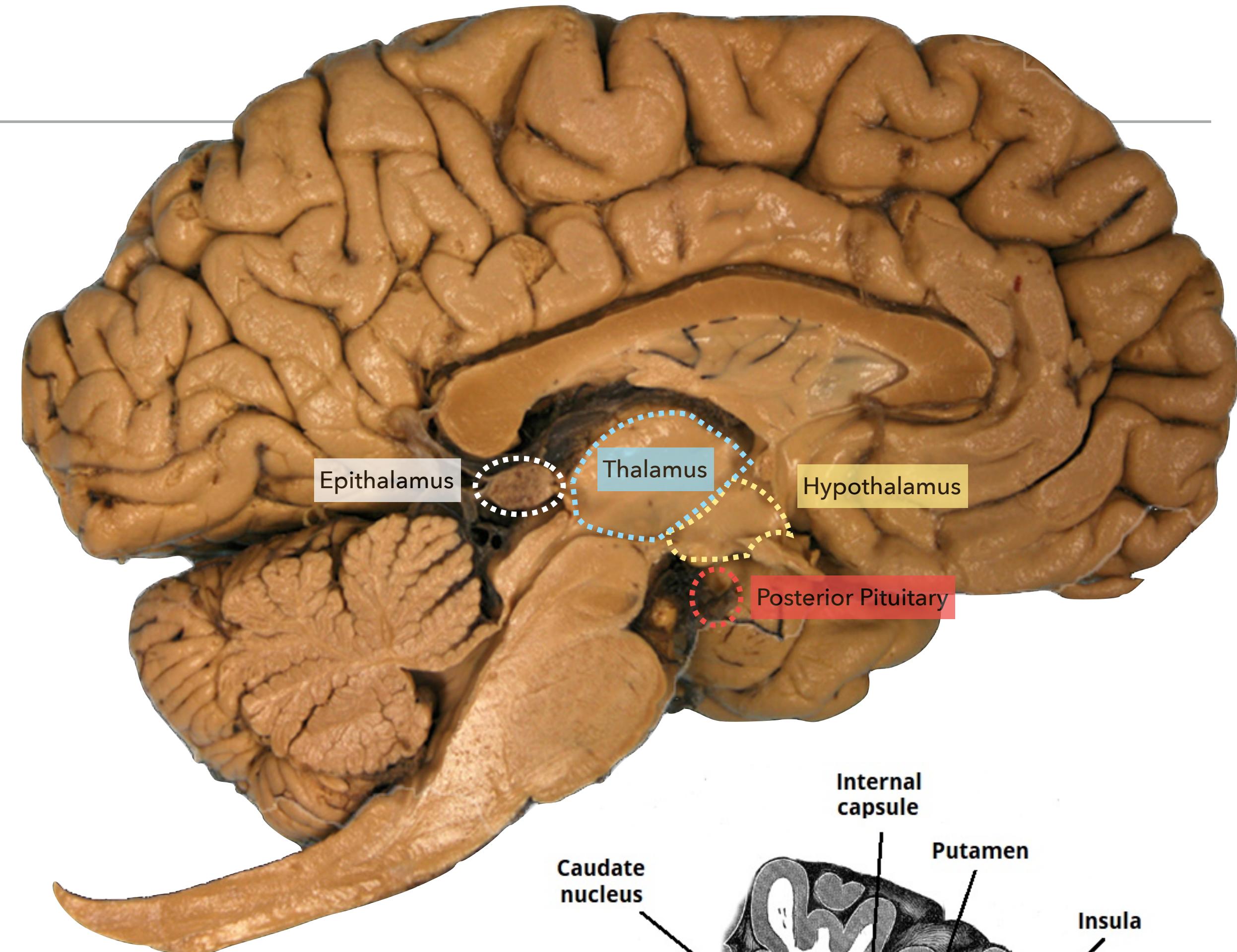
- one midline structure
- missing here due to specimen preparation

4. Epithalamus

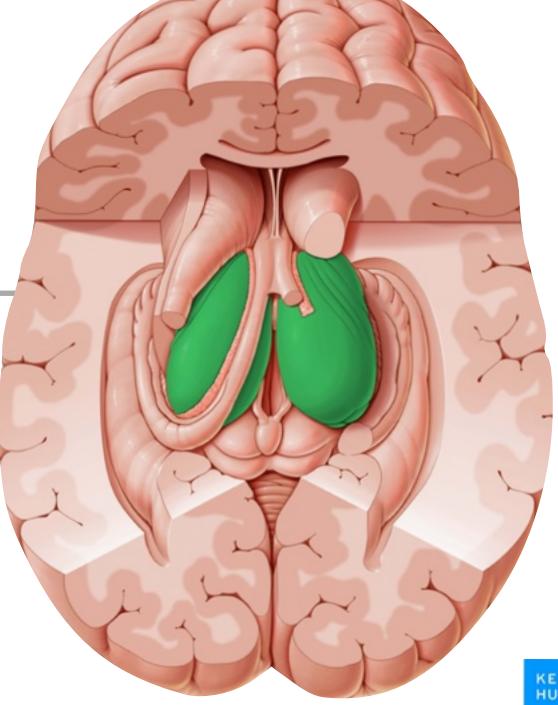
- Pineal Gland - midline structure (looks like a pine cone)
- Habenular Nuclei - bilateral pair, lateral to the pineal gland

5. Subthalamic Nuclei

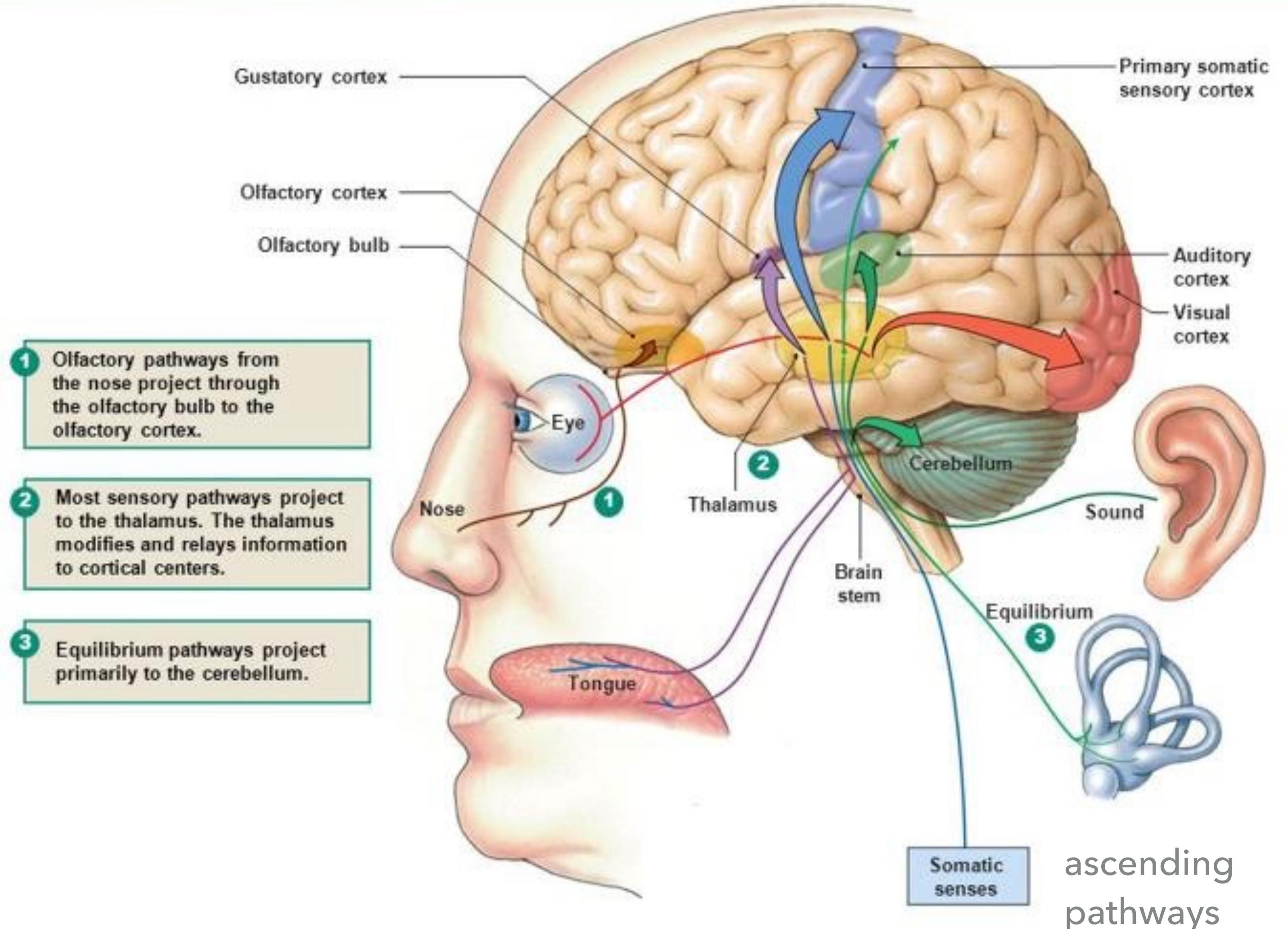
- bilateral pair



THALAMUS - THE GATEWAY TO THE CEREBRAL CORTEX

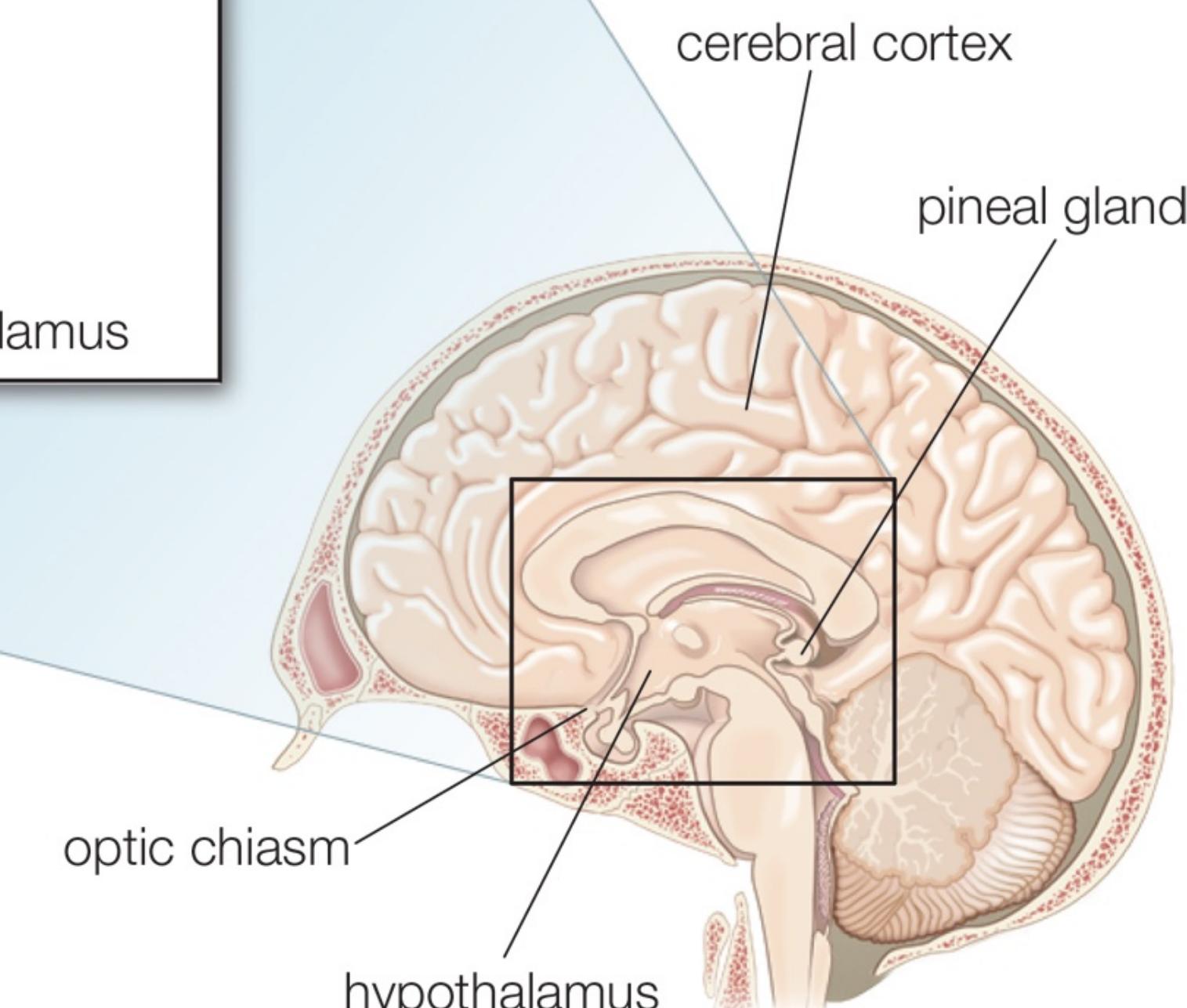
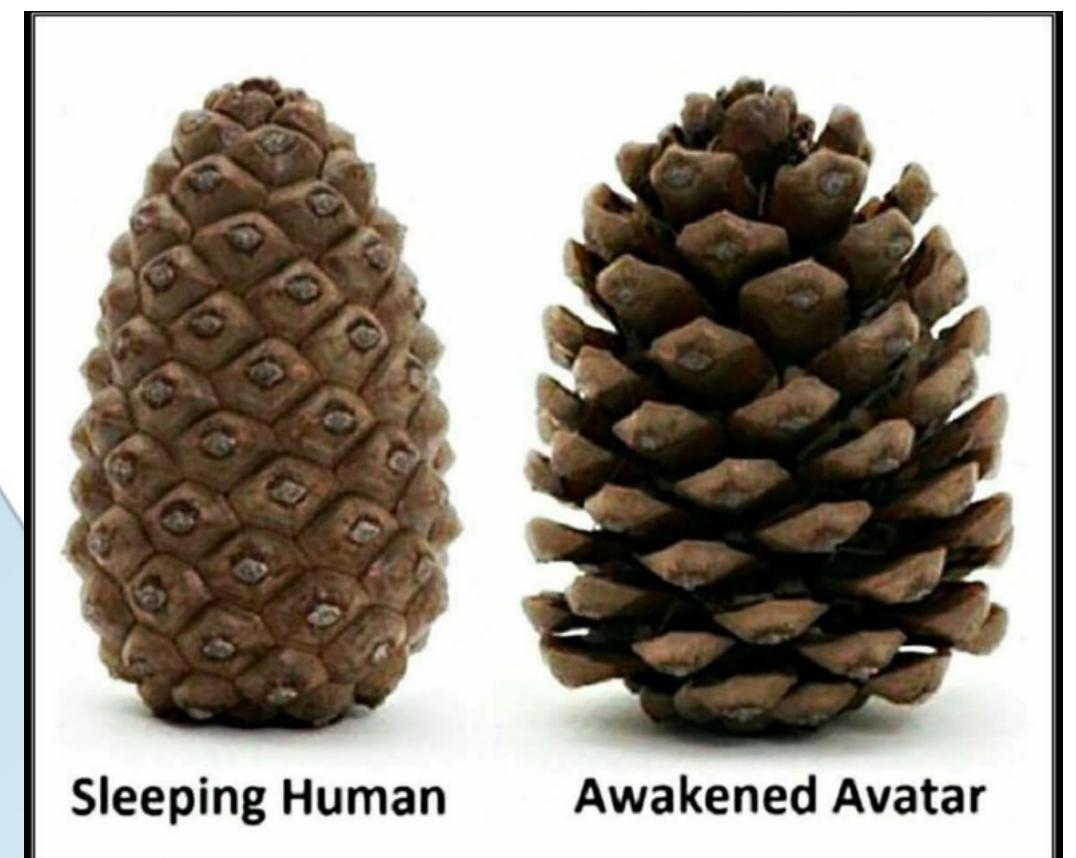
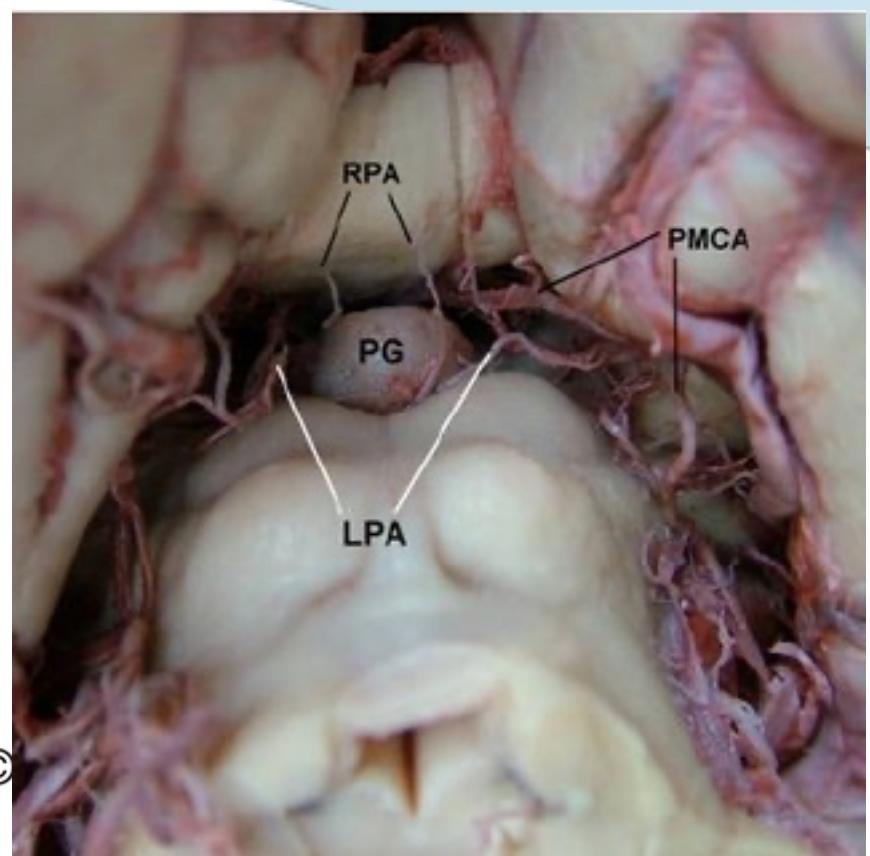
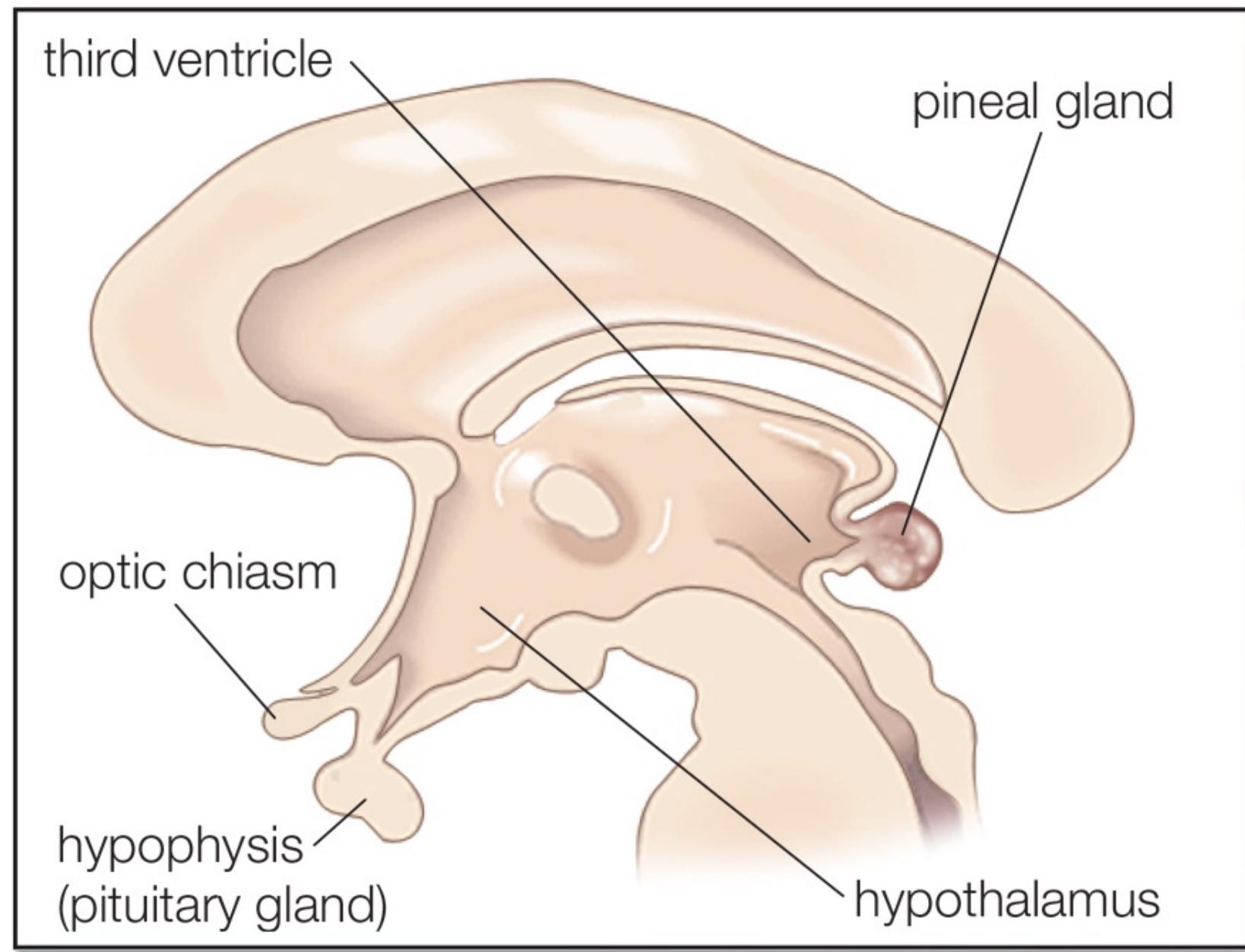


- ▶ Two Bilateral Thalami (left and right)
- ▶ Each thalamus deals with the contralateral body and ipsilateral cortex
- ▶ Grand Central Station!
 - ▶ Relays sensory, motor, and limbic info (except Olfaction)
 - ▶ all connections are reciprocal



PINEAL GLAND PRODUCES MELATONIN

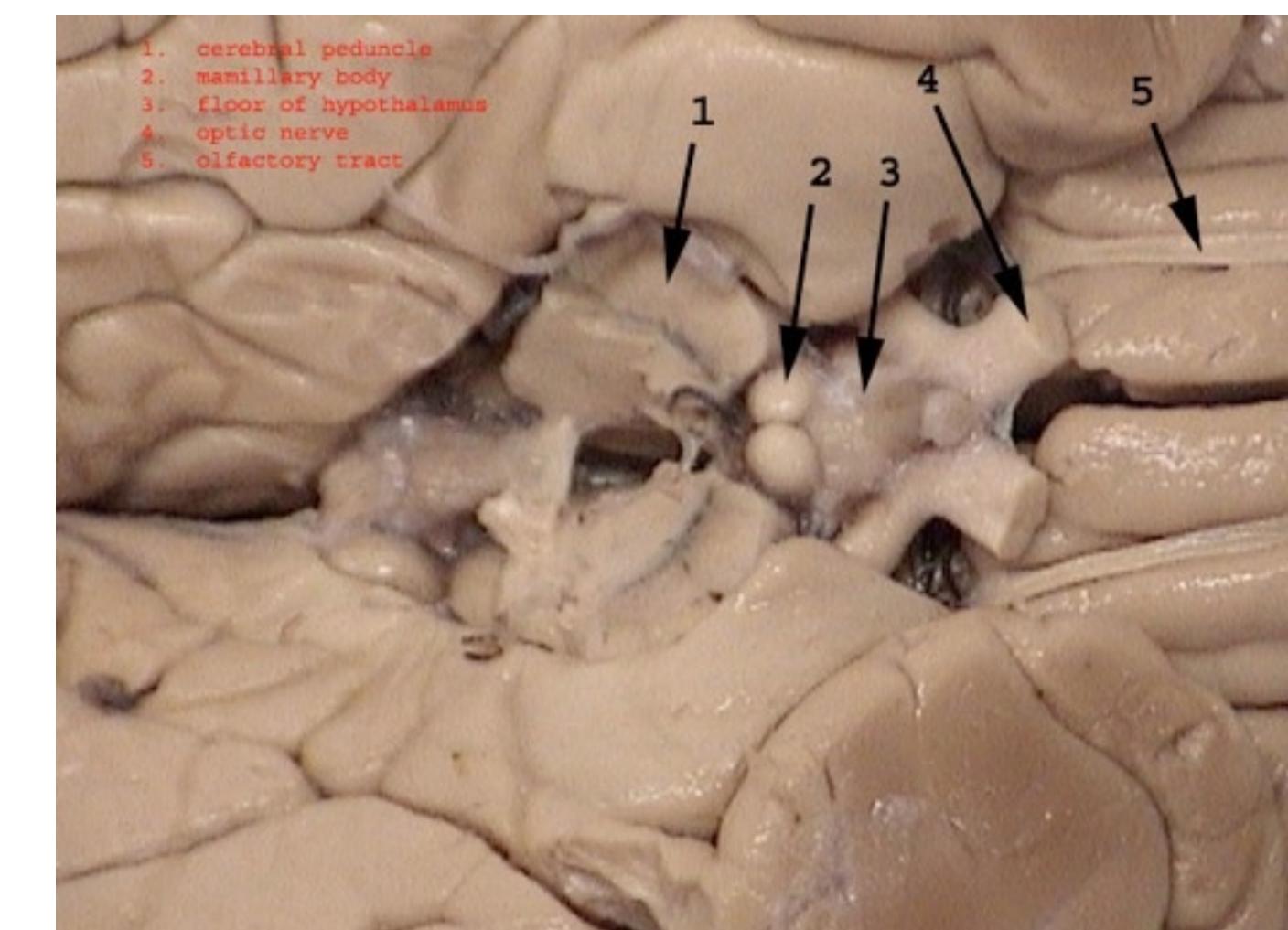
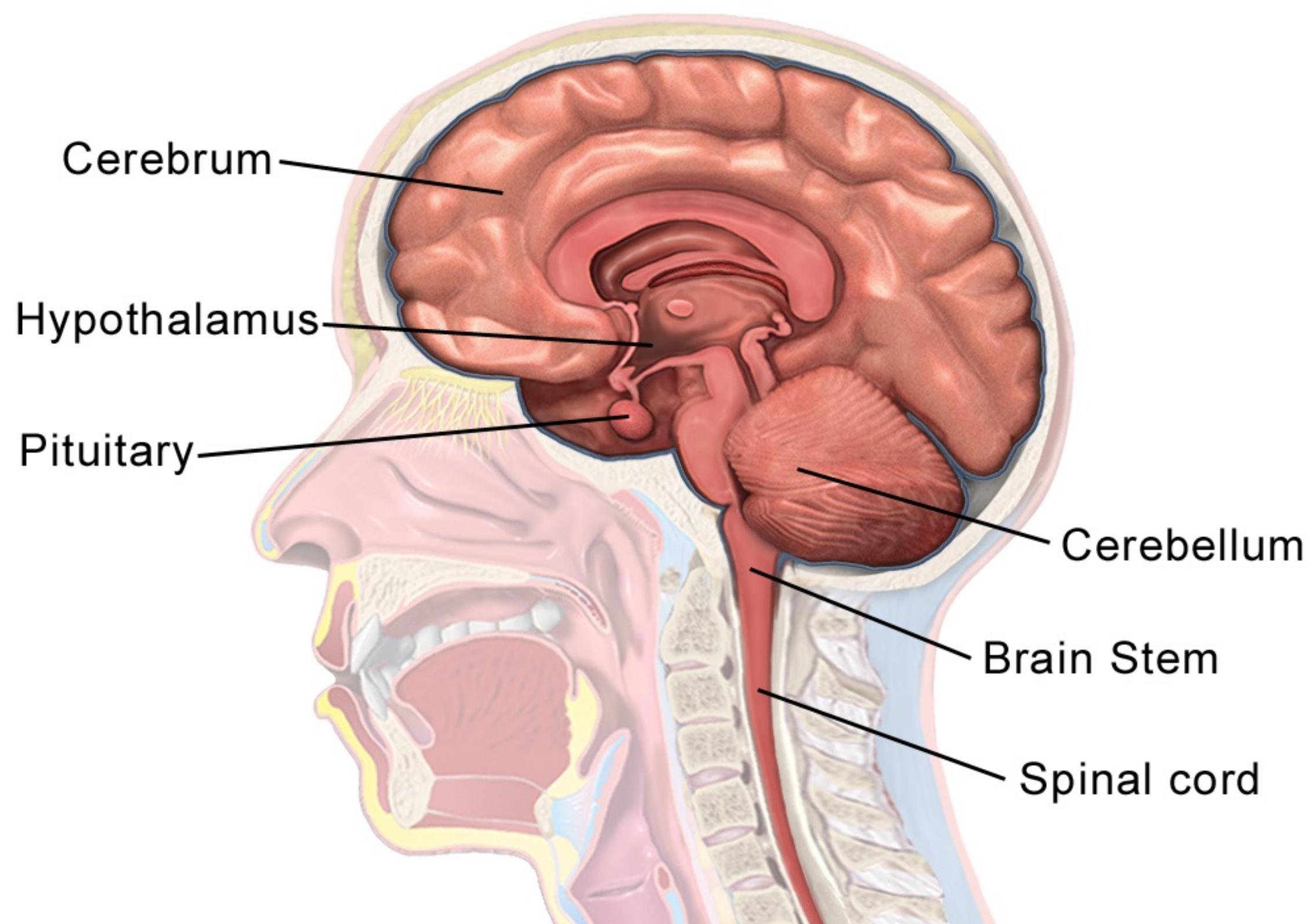
- ▶ Modulates sleep patterns
 - ▶ Helps synchronize sleep-wake cycles
- ▶ Looks like a Pine Cone
 - ▶ Pineal means pine-cone like
 - ▶ Since its sensitive to Light, it is a symbol of enlightenment
 - ▶ “third eye”



DIENCEPHALON

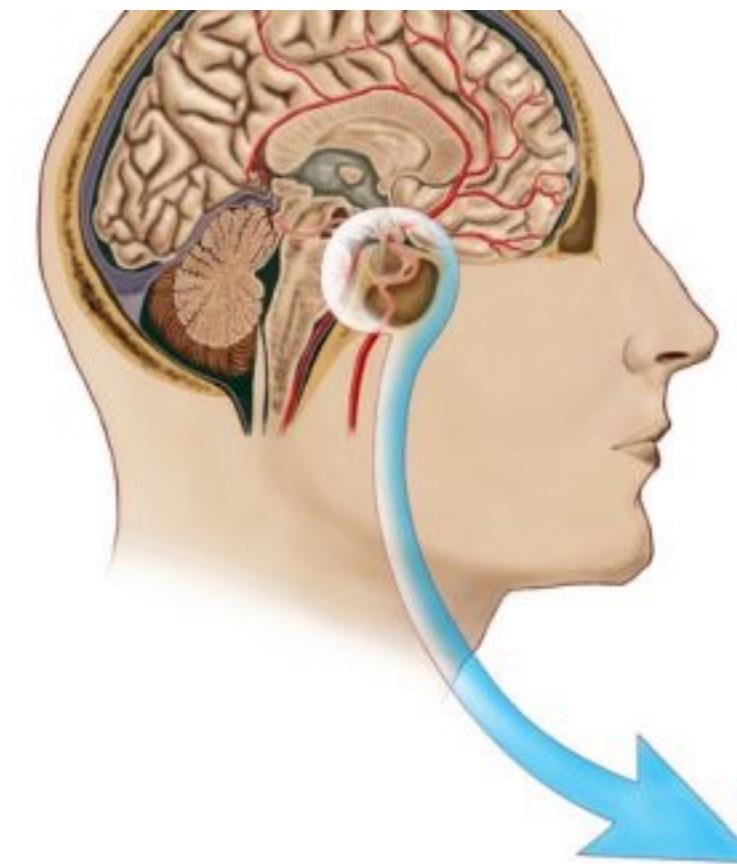
HYPOTHALAMUS - AUTONOMIC THERMOSTAT

- ▶ Regulates Visceral, somatic motor, neuroendocrine, and behavioral responses
- ▶ Homeostatic control of Sympathetic and Parasympathetic tone

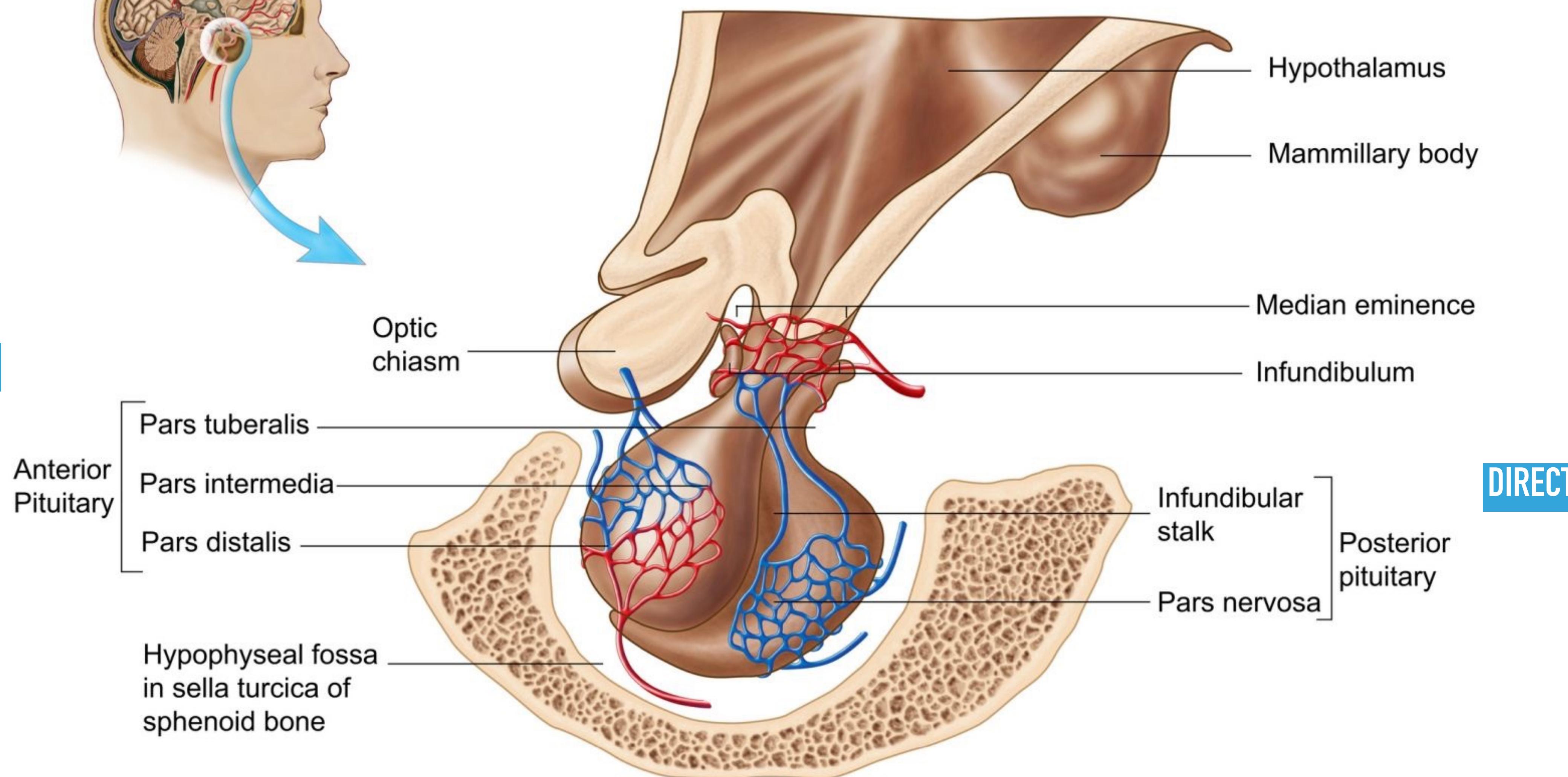


PITUITARY GLAND (HYPOPHYSIS)

Direct and Indirect control of the endocrine state of the body



INDIRECT





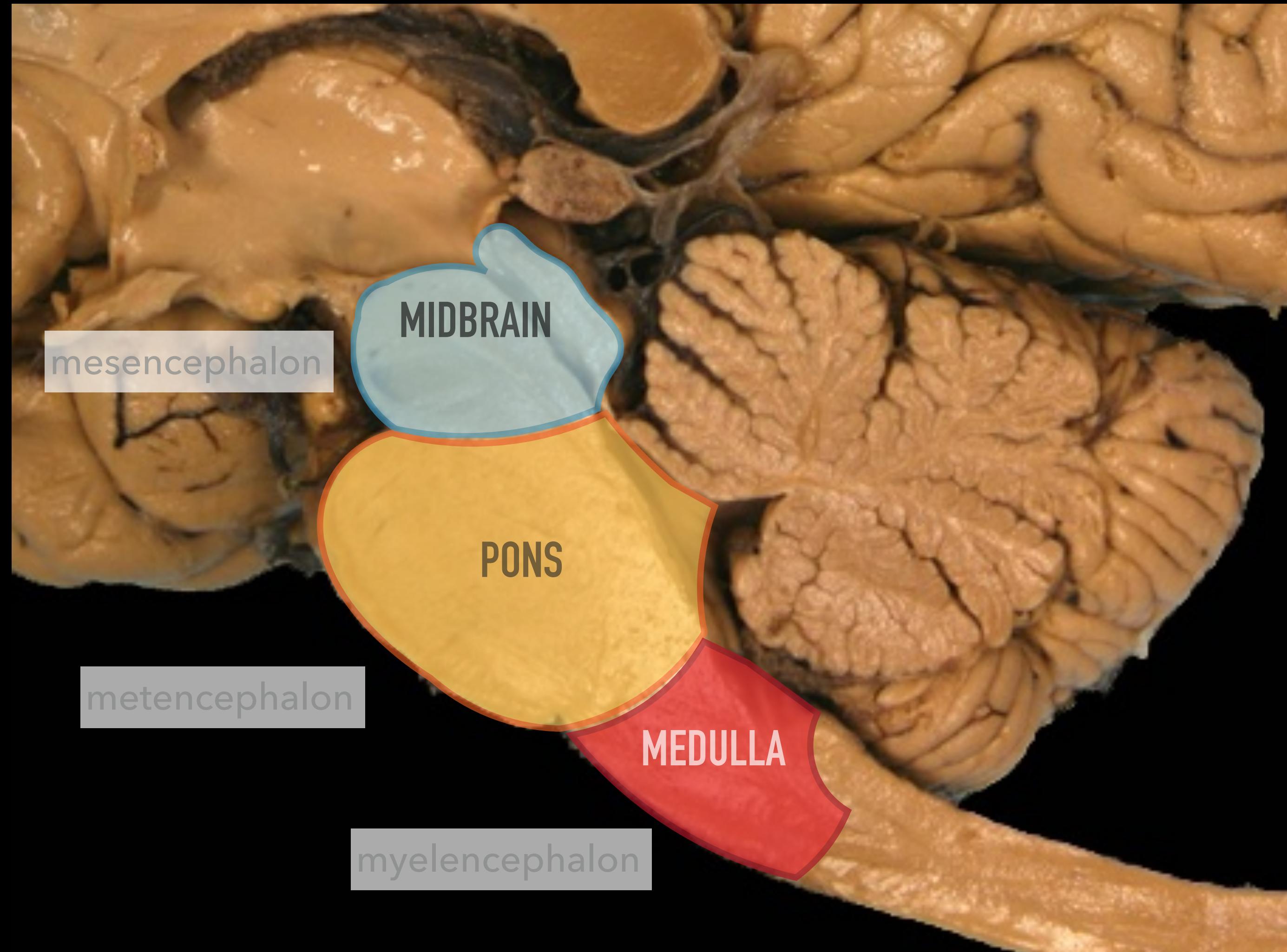
- a. MESENCEPHALON
 - b. METENCEPHALON
 - c. MYELENCEPHALON
-

BRAINSTEM

BRAINSTEM

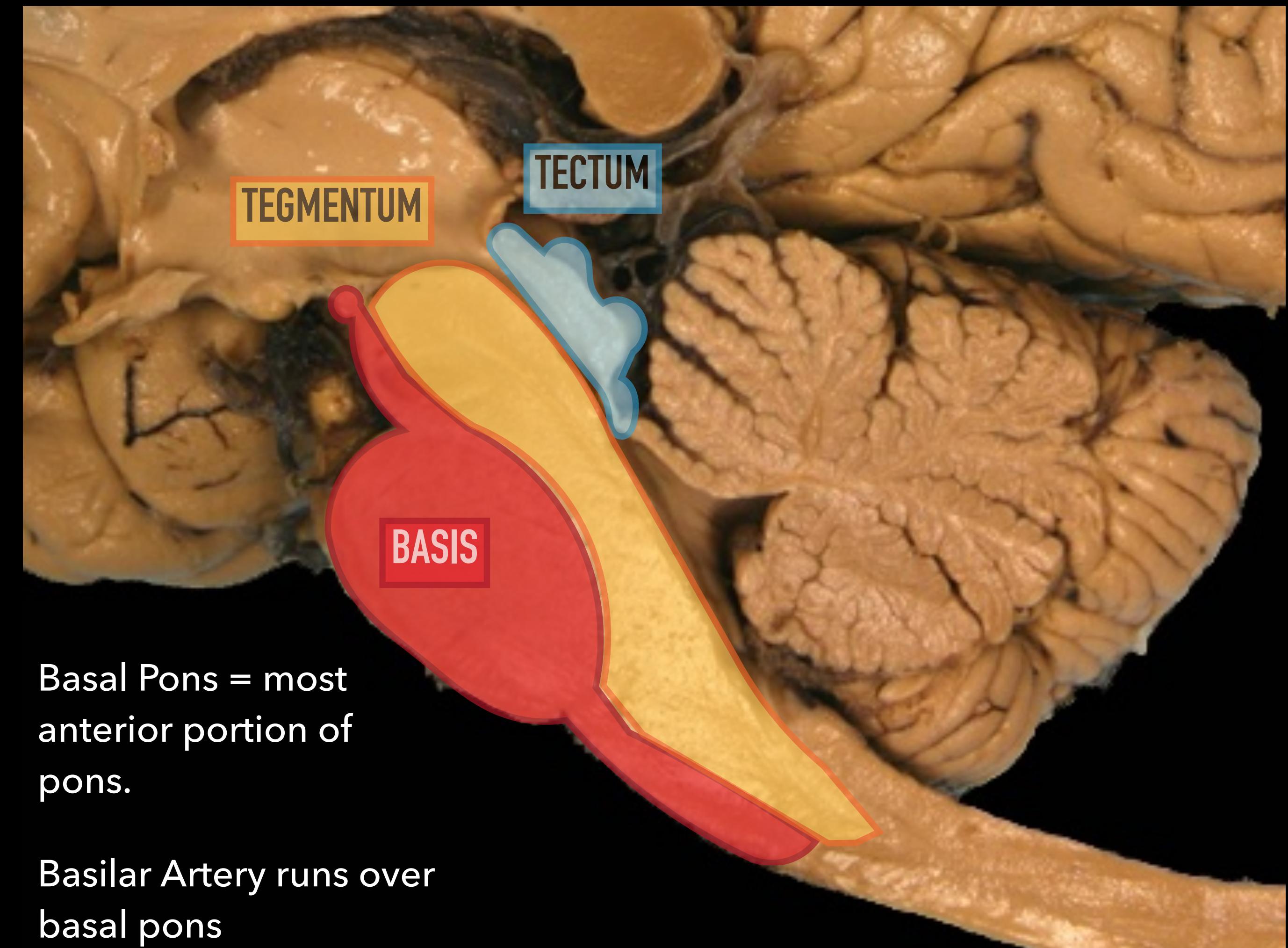
CLASSIC DIVISIONS OF THE BRAINSTEM

- ▶ Midbrain
 - ▶ vision, hearing, motor control, sleep and wakefulness, alertness, and temperature regulation
- ▶ Pons
 - ▶ sleep, respiration, swallowing, bladder control, hearing, equilibrium, taste, eye movement, facial expressions, facial sensation, and posture
- ▶ Medulla
 - ▶ Cardiovascular Center, Respiration, reflex center (eg. vomiting)



LONGITUDINAL DIVISIONS OF THE BRAINSTEM

- ▶ Tectum - contain colliculi: relay centers for vision and auditory tracts
- ▶ Tegmentum - reticular formation: loose network of neurons with varied function
- ▶ Basis: pontine fibers, descending tracts



tectum means 'roof'

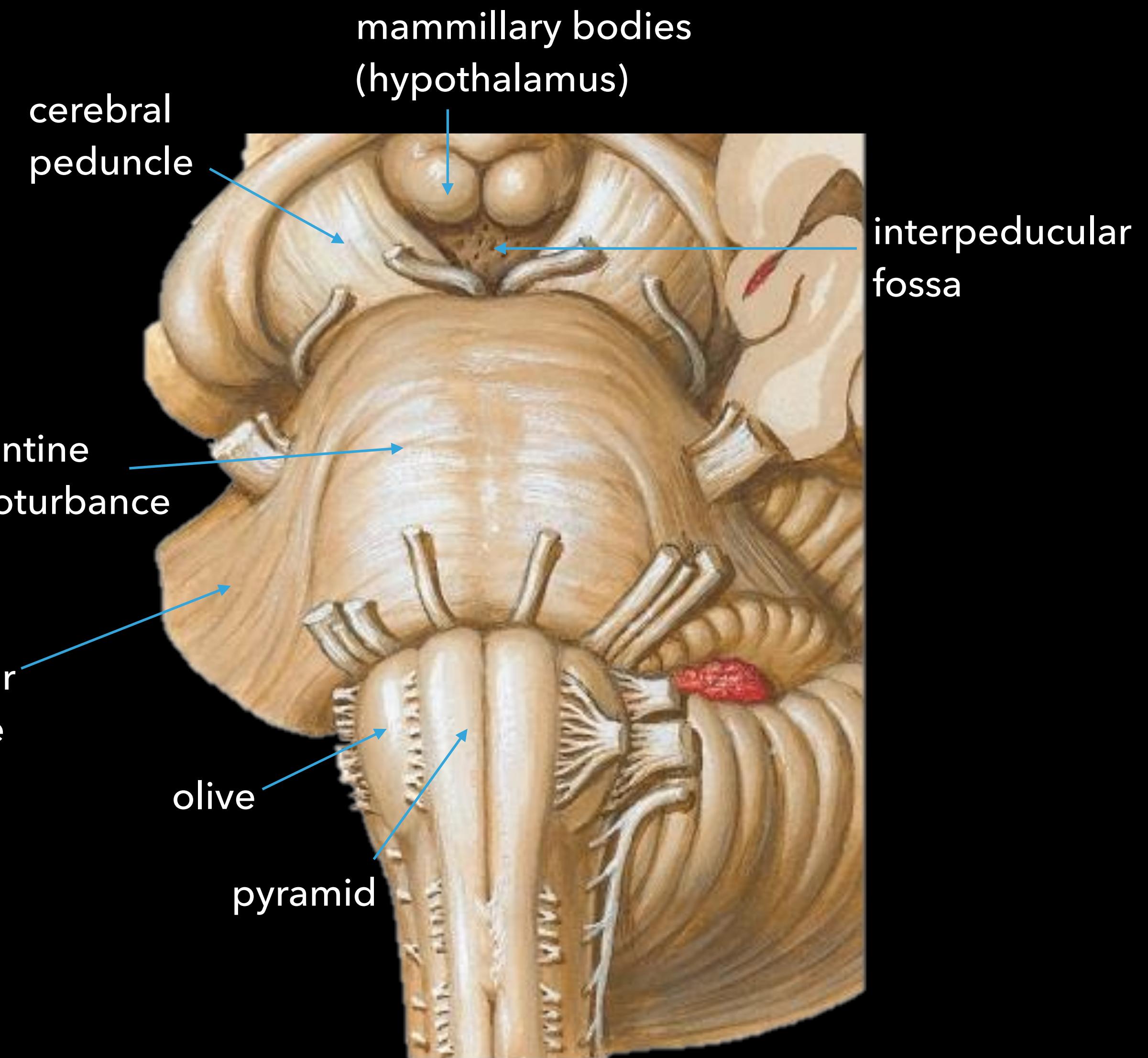
BRAINSTEM

VENTRAL SURFACE OF THE BRAINSTEM

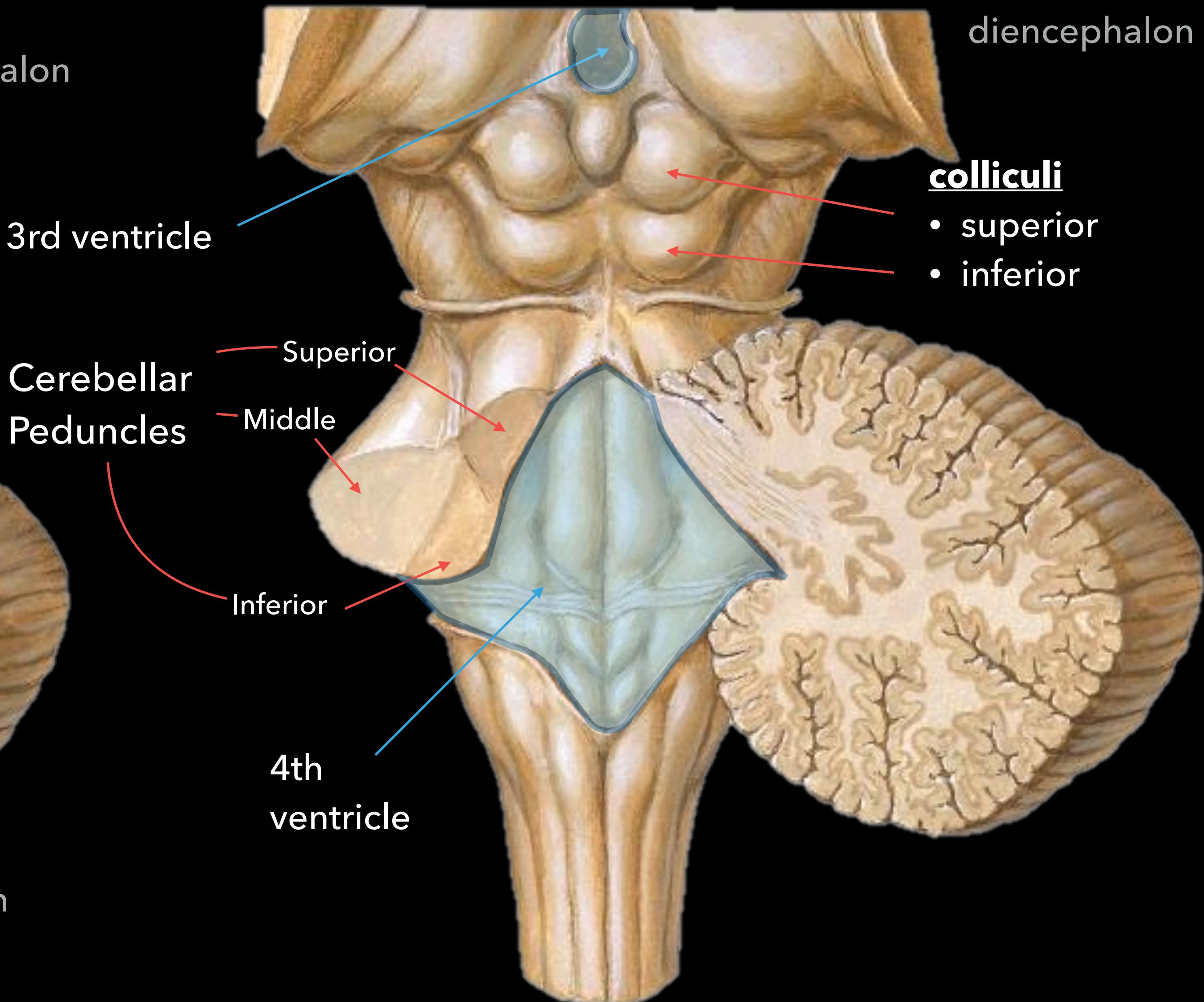
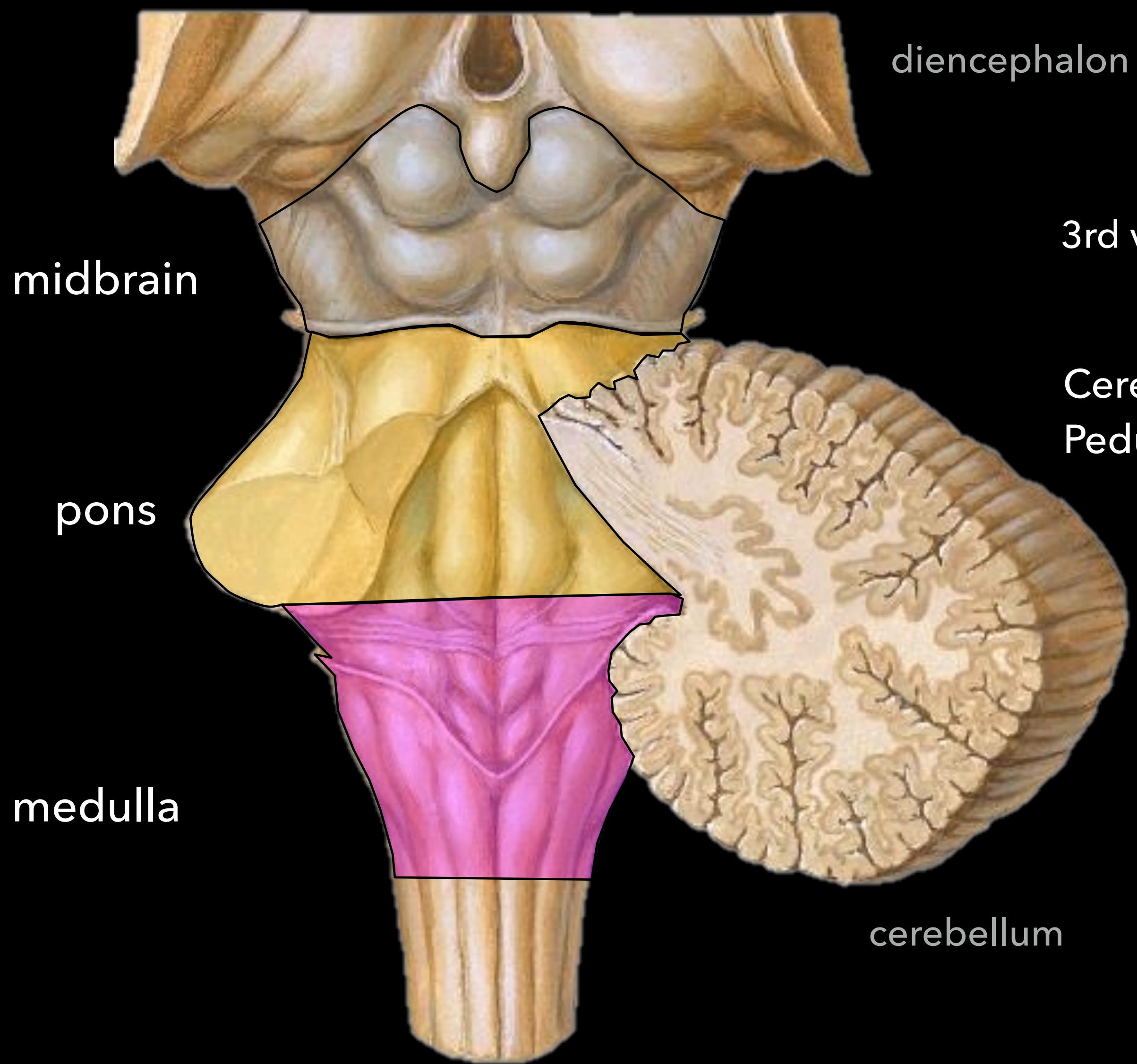
midbrain

pons

medulla



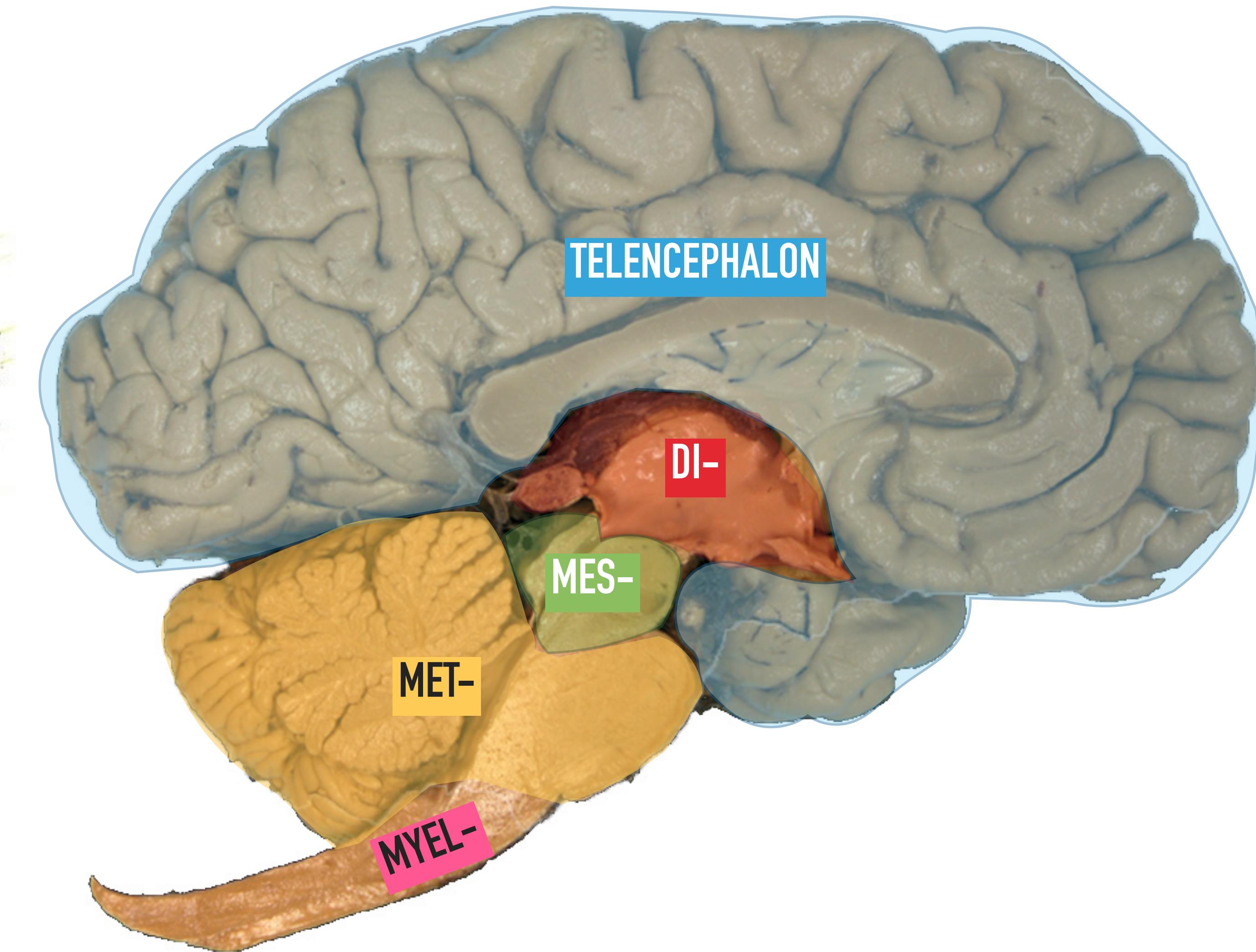
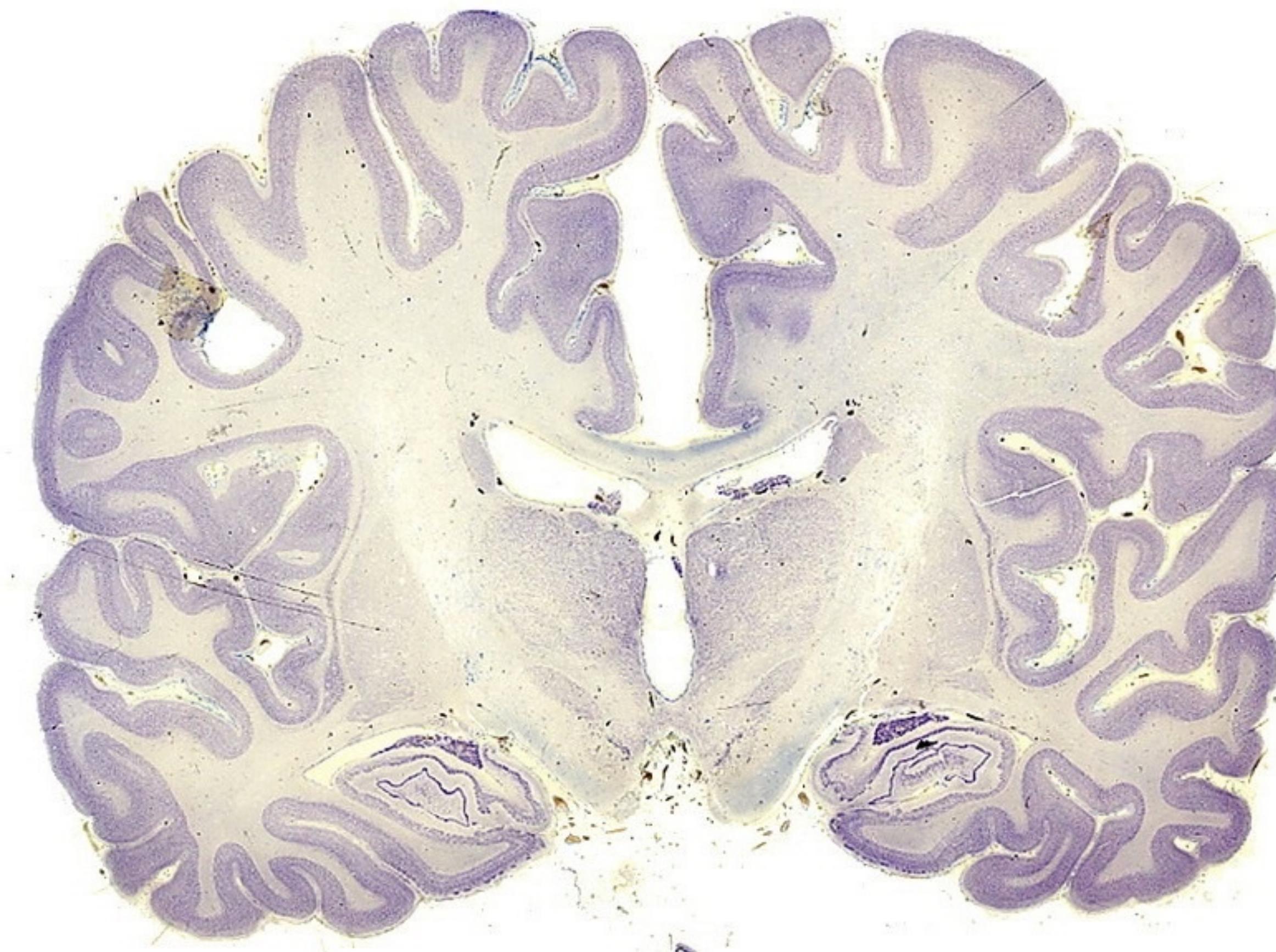
DORSAL SURFACE OF THE BRAINSTEM



IN CONCLUSION, . . .

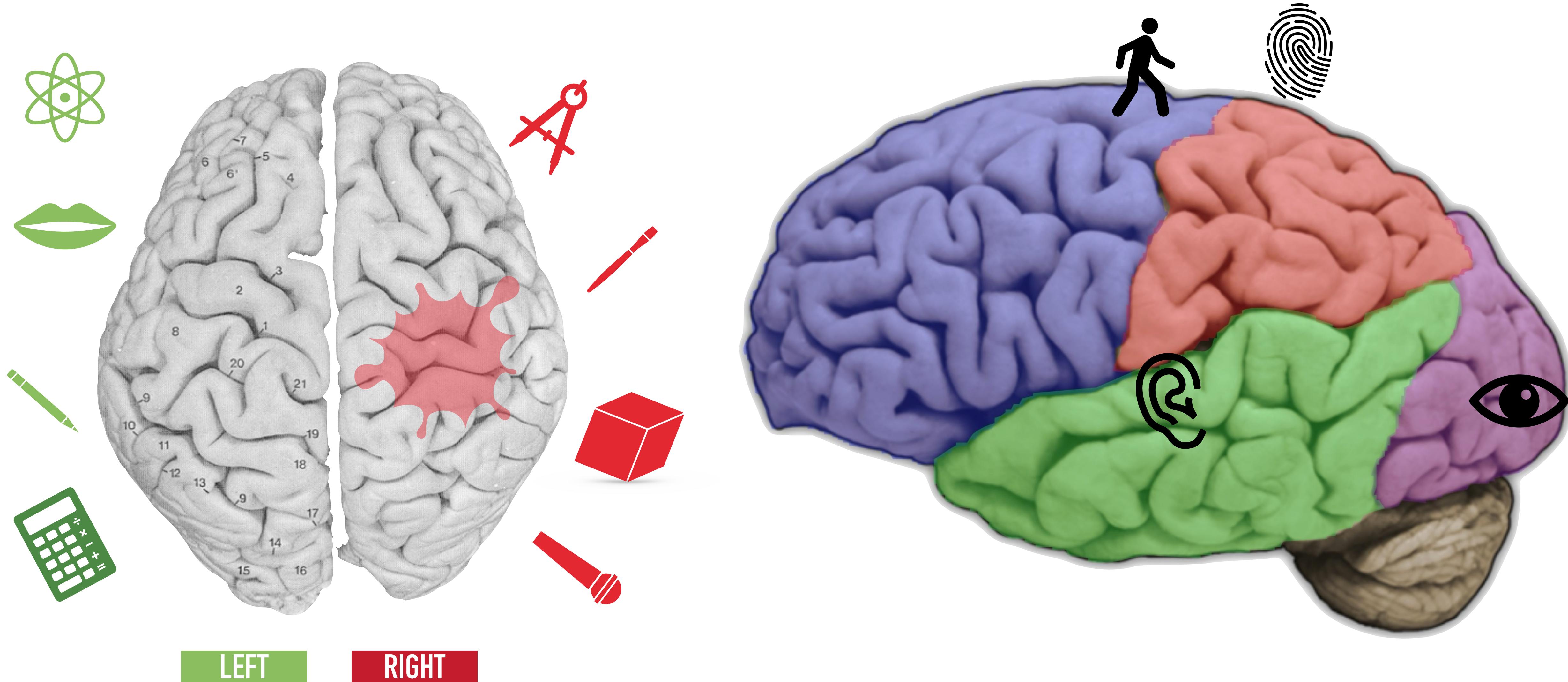
CEPHALONS

BRAINS HAVE STRUCTURE



SUMMARY

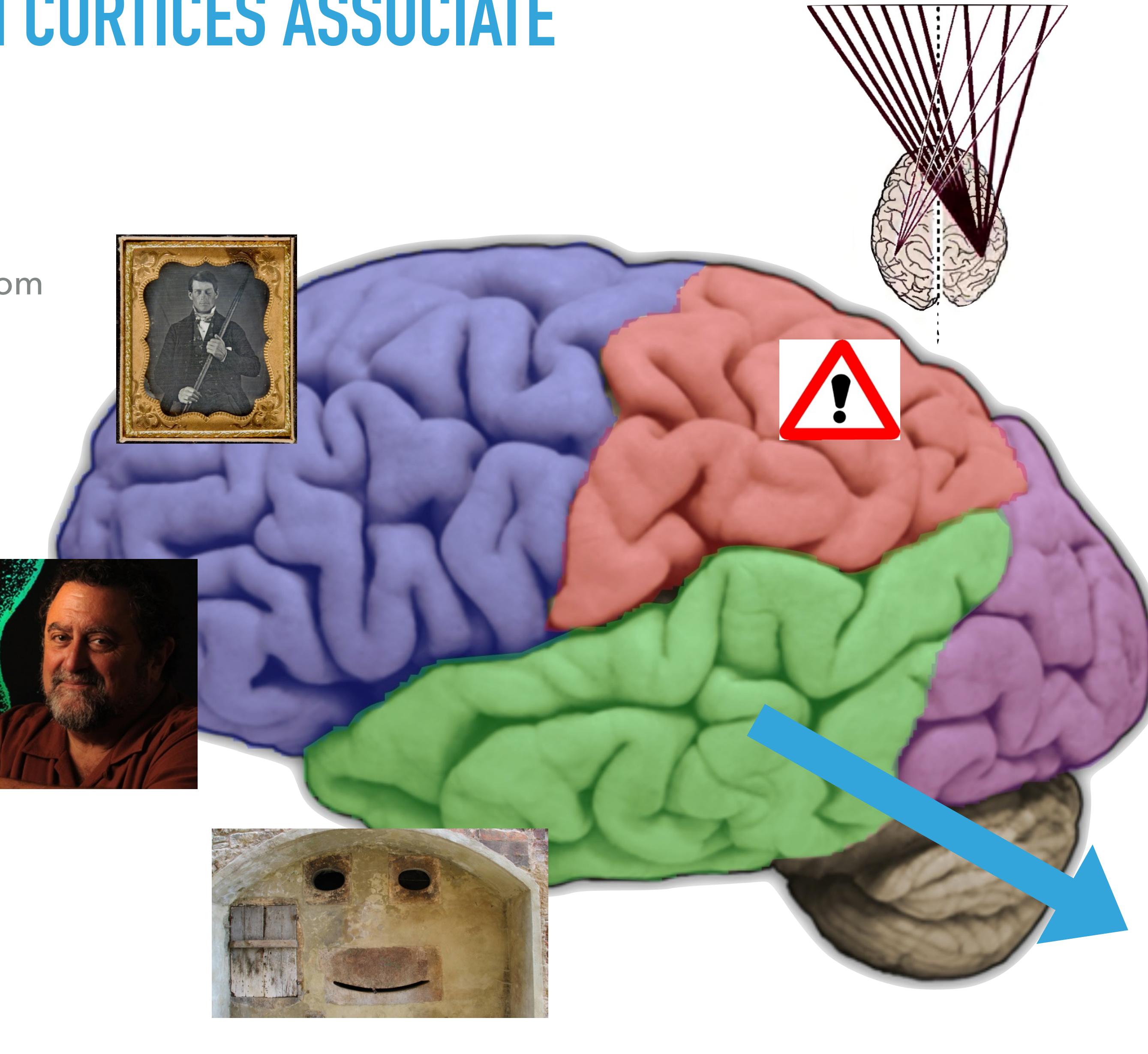
STRUCTURE ORGANIZES FUNCTION



SUMMARY

ASSOCIATION CORTICES ASSOCIATE

Put together input from
Primary cortices

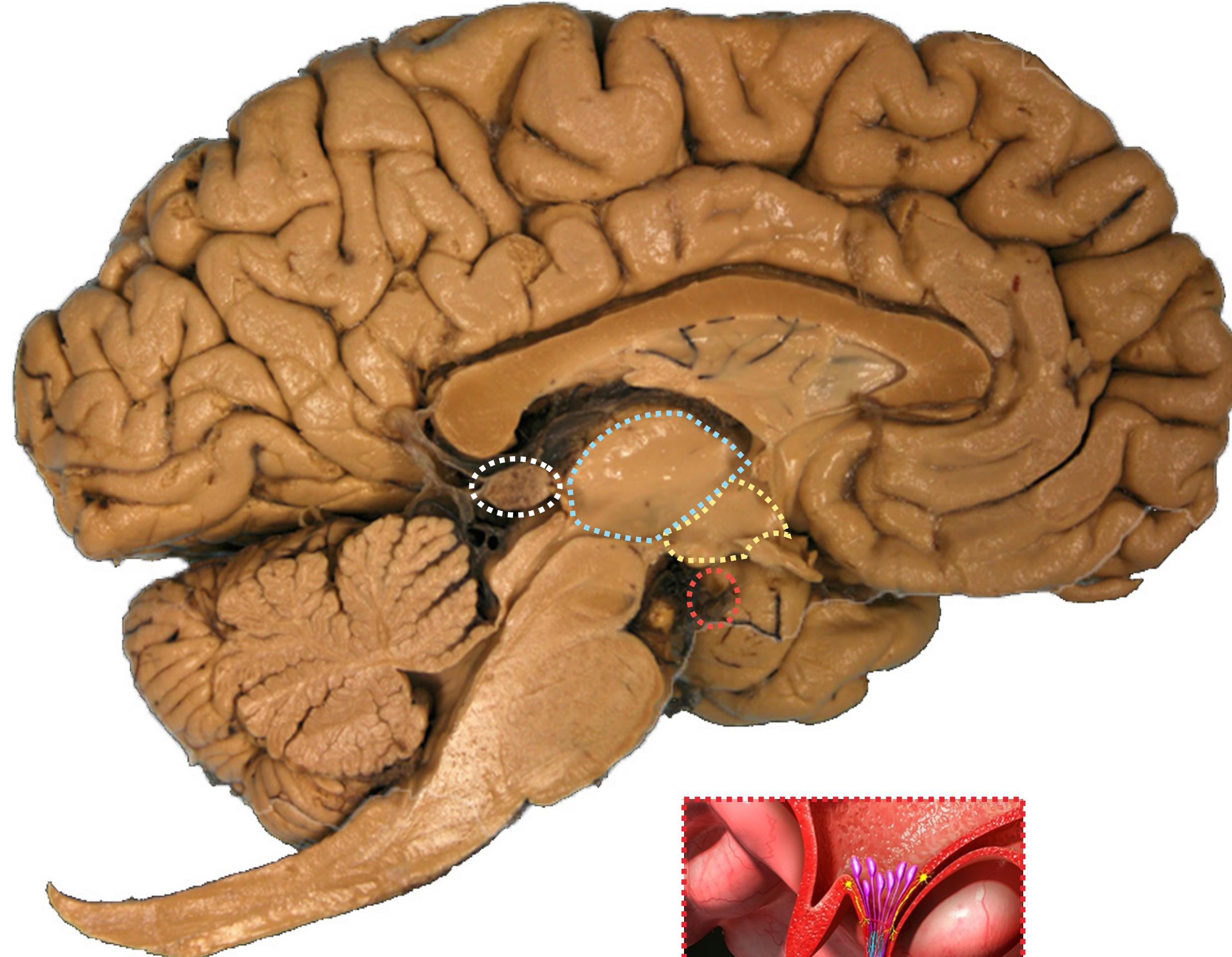


♪♪ I've got two chickens
to paralyze ♪♪

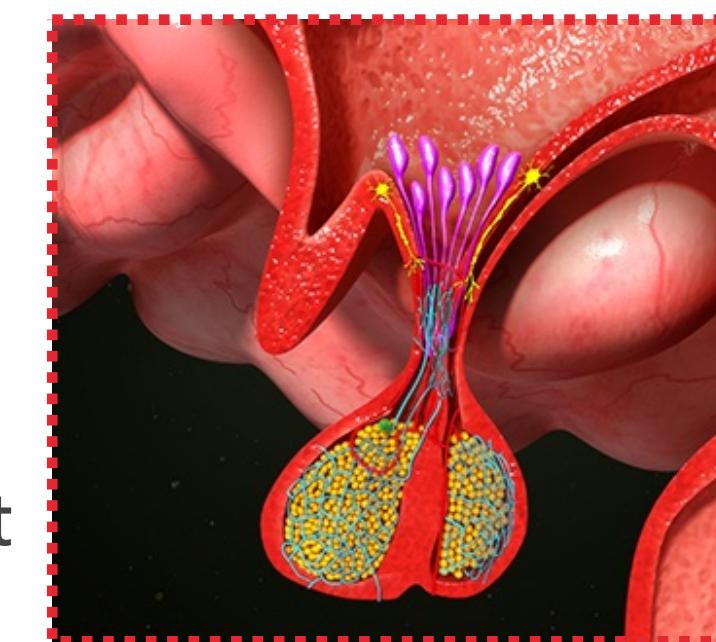


DIENCEPHALON

Epithalamus
melatonin

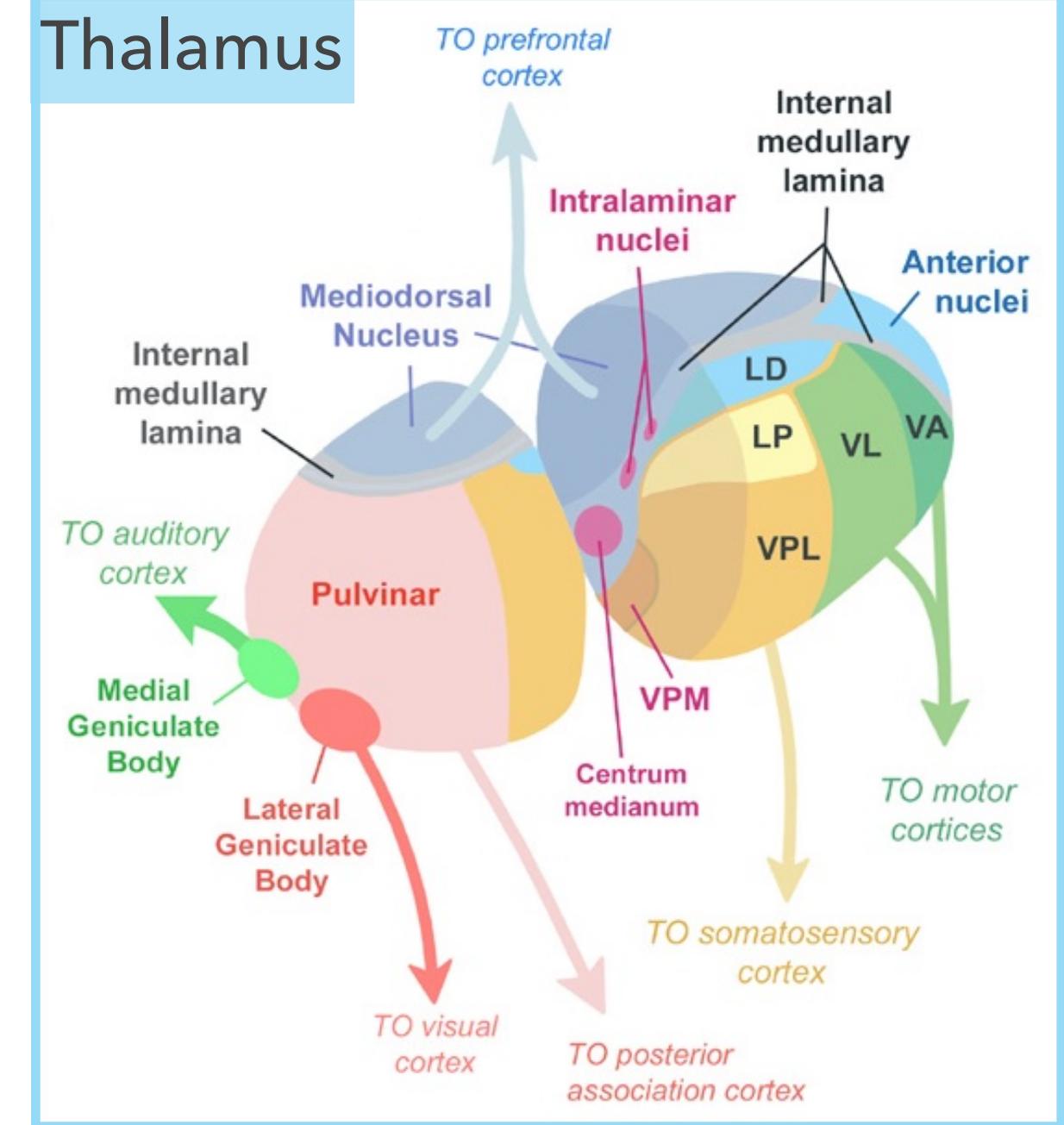


Direct



Indirect

Thalamus

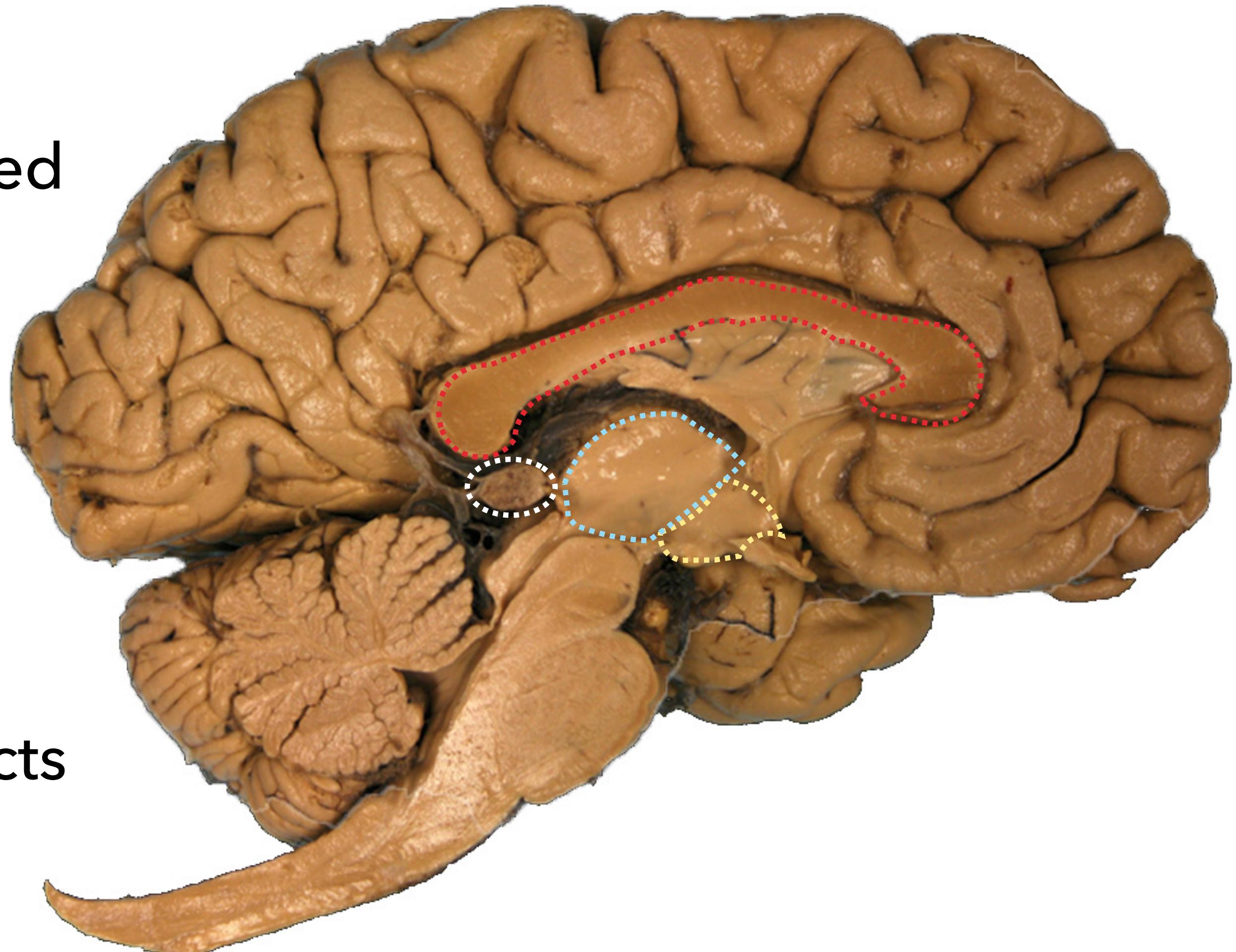


Hypothalamus

Visceral, somatic motor,
neuroendocrine, and
behavioral responses

NAME AND IDENTIFY THAT STRUCTURE

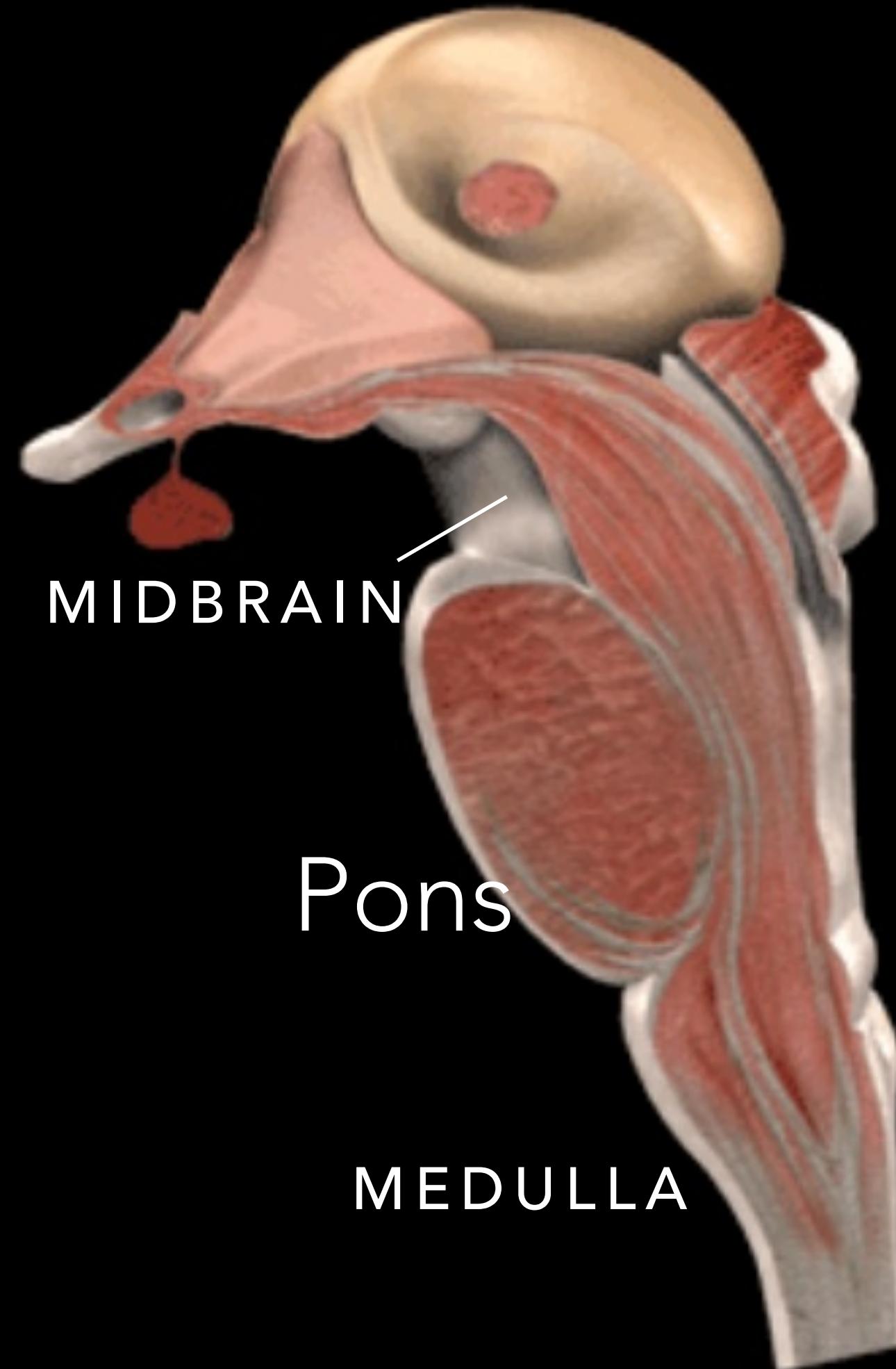
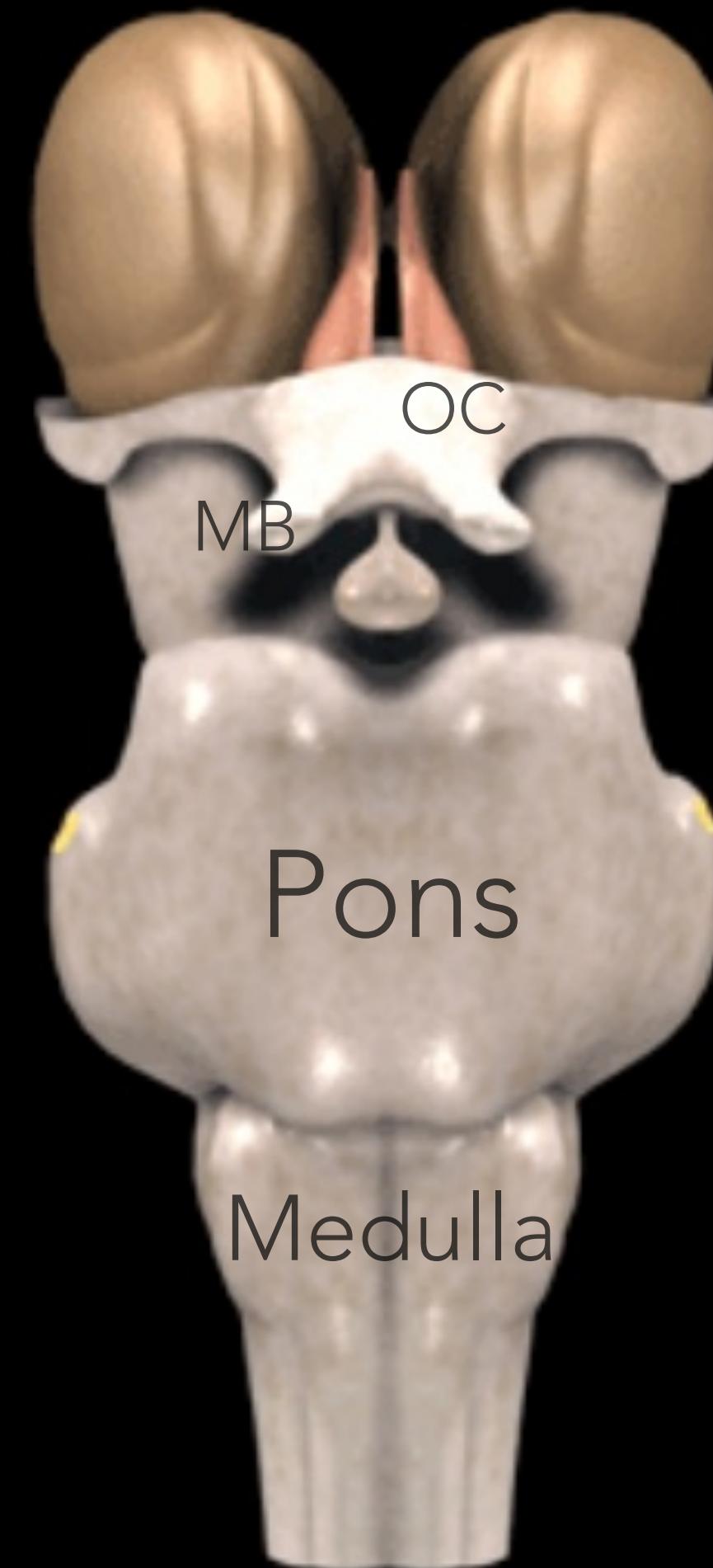
- ▶ Site where sensory information is relayed to cortex
- ▶ Homeostatic control of the autonomic nervous system
- ▶ Site where melatonin is produced
- ▶ Large band of white matter that connects the two hemispheres



SUMMARY

BRAINSTEM

Ventral (Anterior) Dorsal (Posterior) Lateral



SUMMARY

BRAINSTEM

