511-2018-09-05-anatomy-II

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2018-09-05 13:24:30

Prelude

Today's Topics

- Web resources
- Wrap up on the forebrain
- White matter tracts
- The peripheral nervous system

Web resources

- Harvard Whole Brain Atlas
  - Whole Brain Atlas Top 100 Brain Structures List
- Normal Anatomy
  - Linked list of structures

Organization of the brain

Major division	Ventricular Landmark	Embryonic Division	Structure
Forebrain	Lateral	Telencephalon	Cerebral cortex
			Basal ganglia
			Hippocampus, amygdala
	Third	Diencephalon	Thalamus
			Hypothalamus
Midbrain	Cerebral Aqueduct	Mesencephalon	Tectum, tegmentum

Organization of the brain

Major division	Ventricular Landmark	Embryonic Division	Structure
Hindbrain	4th	Metencephalon	Cerebellum, pons
	–	Mylencephalon	Medulla oblongata

Cerebral Cortex

Cerebral hemispheres

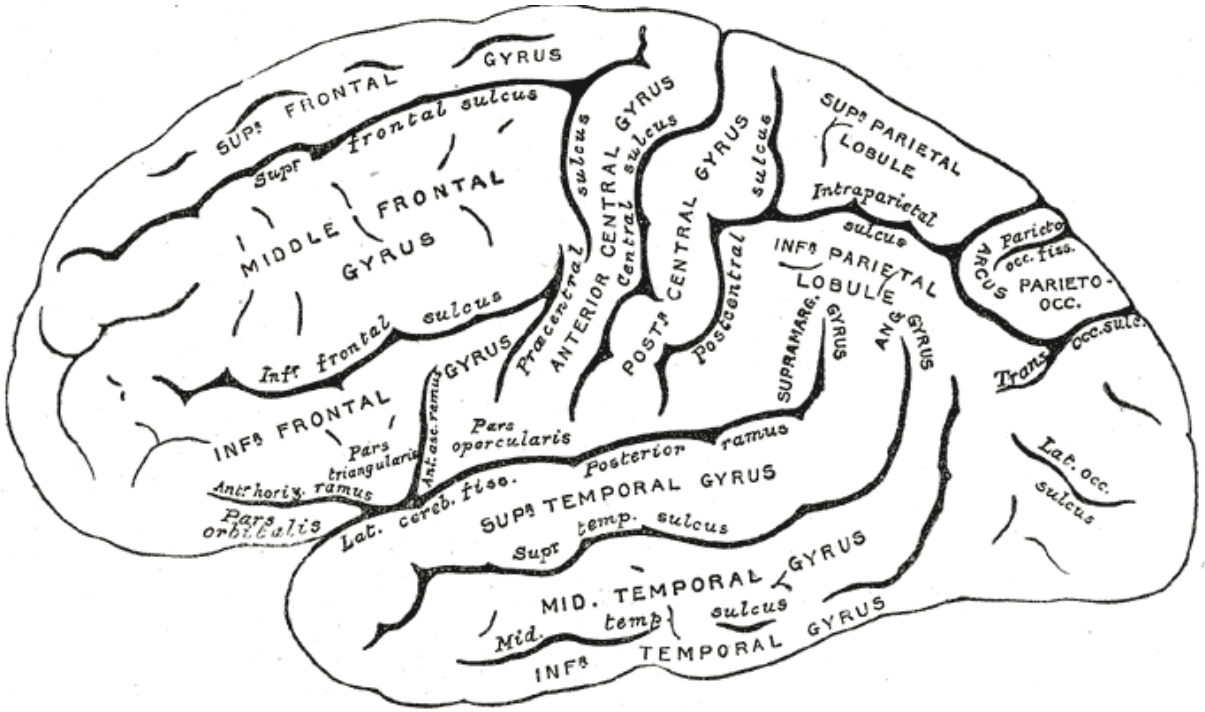
Groove (sulcus or sulci)

Bumps (gyrus or gyri)

Grey vs.white matter

Lobes

Cortical Gyri – Lateral



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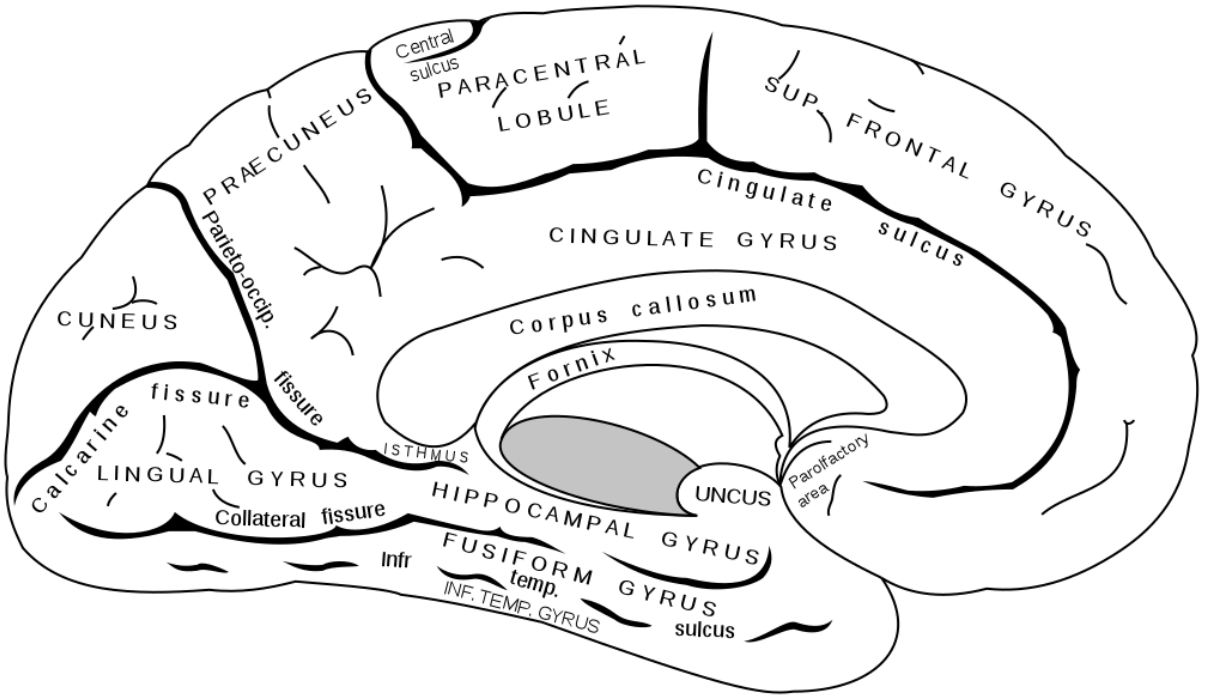
Cortical Gyri – Medial



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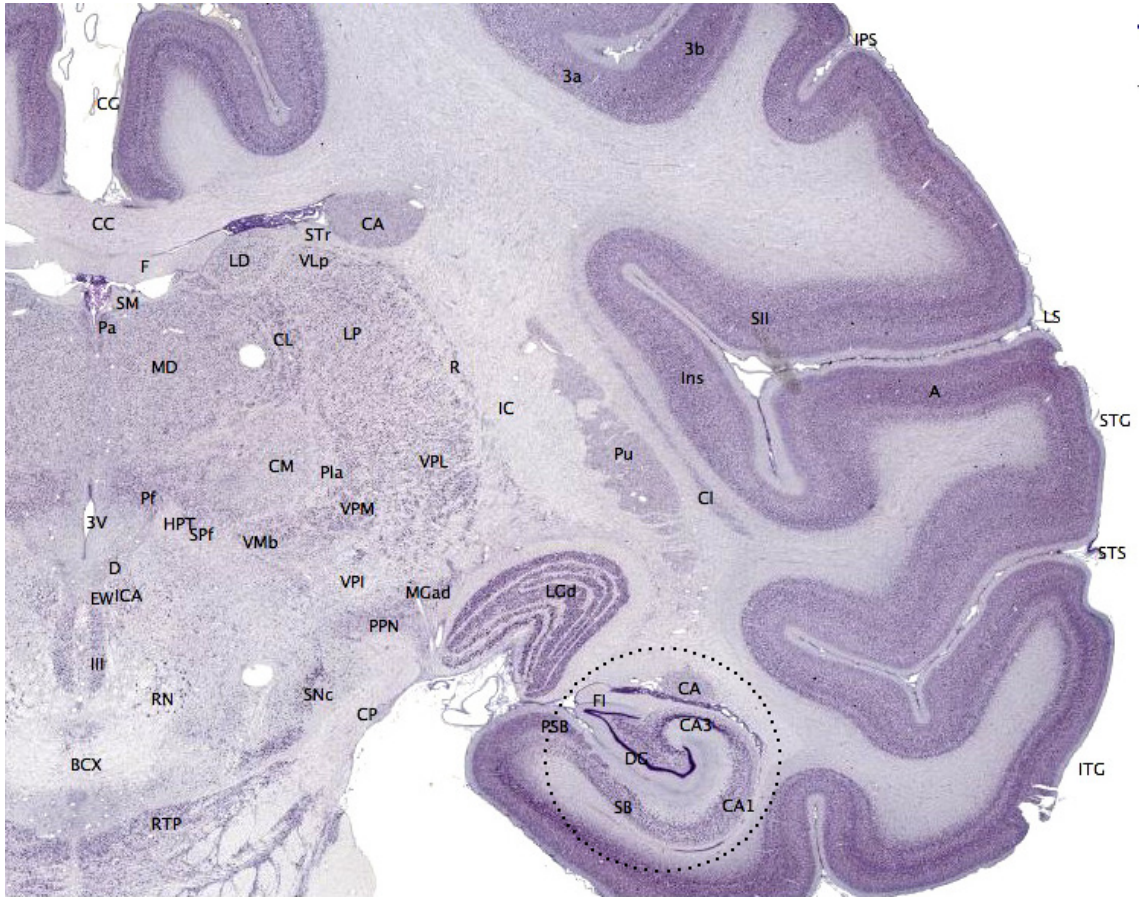
Gray vs. White Matter



https://upload.wikimedia.org/wikipedia/commons/9/9a/Brainmaps-macaque-hippocampus.jpg

Lobes of the cerebral cortex

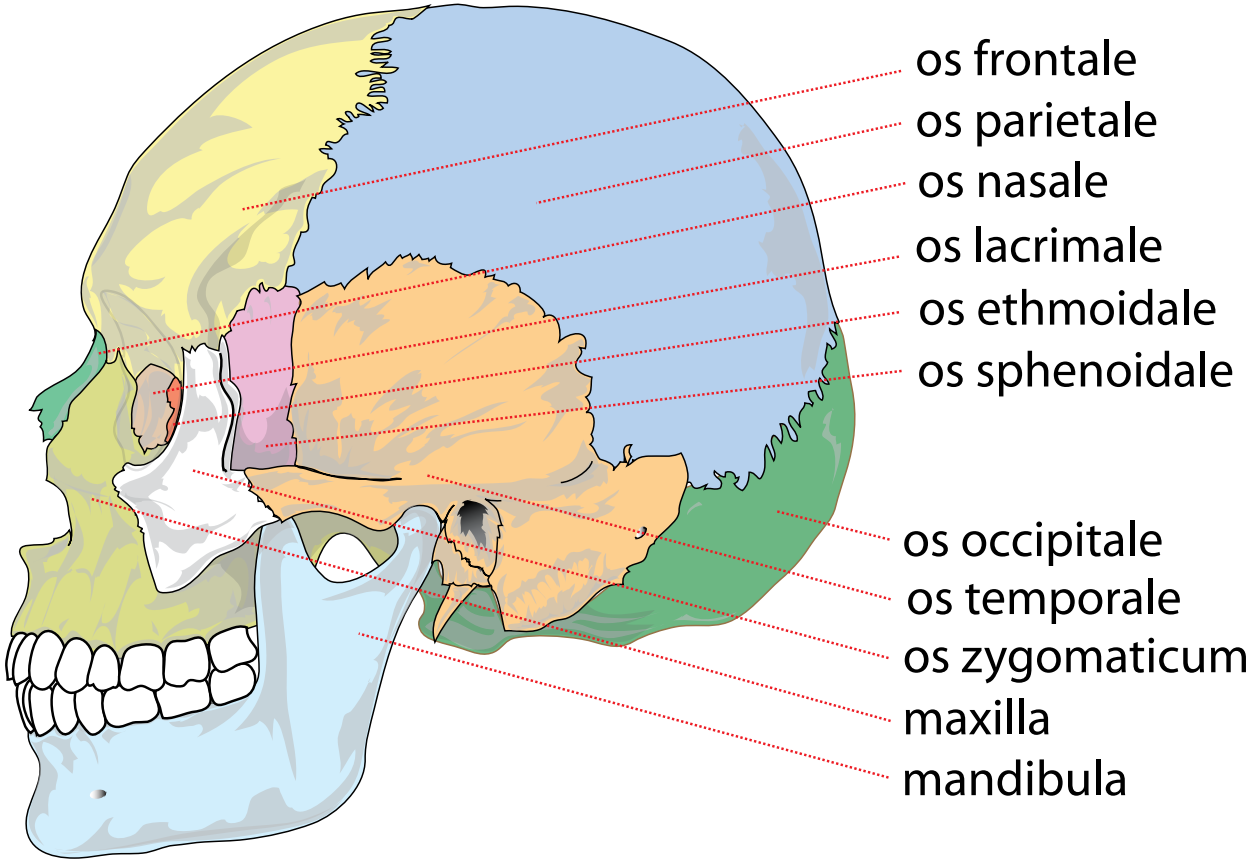
Frontal

Temporal

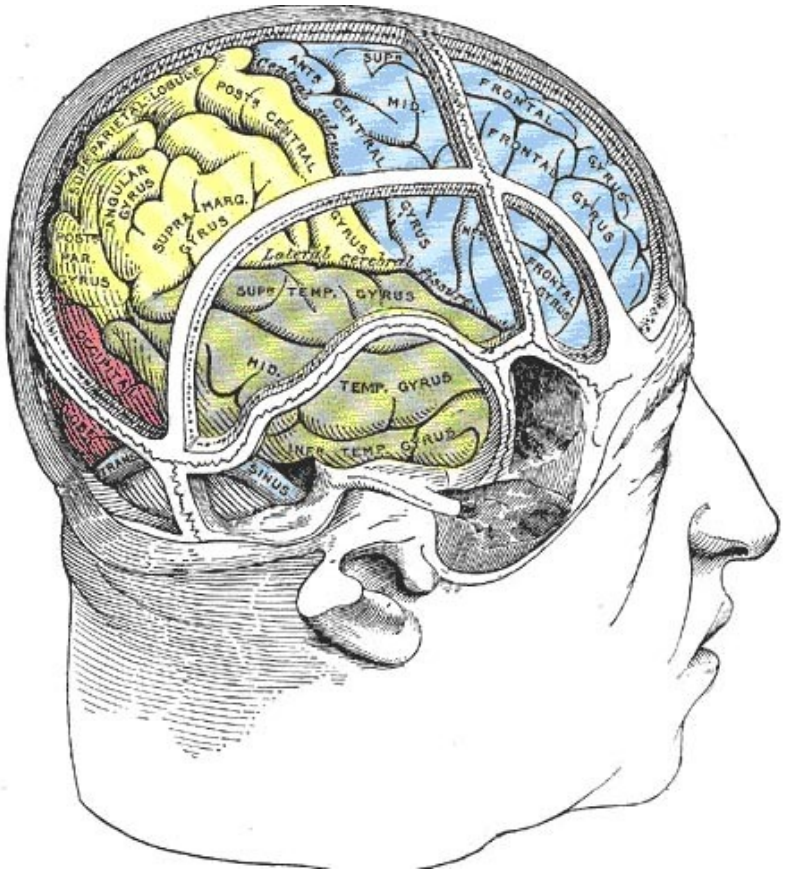
Parietal

Occipital

Bones of the skull



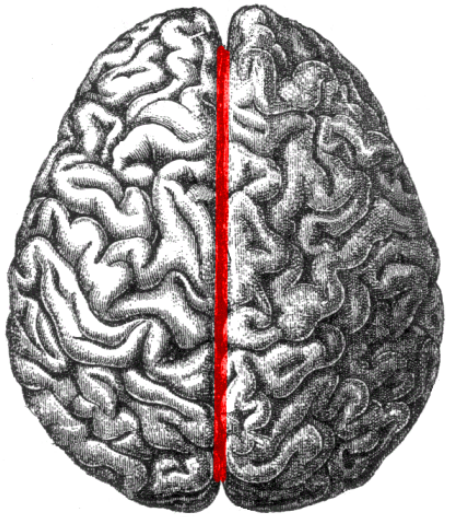
Lobes



http://40.media.tumblr.com/tumblr_m1kpkr7Wsq1rn6pqko1_500.jpg

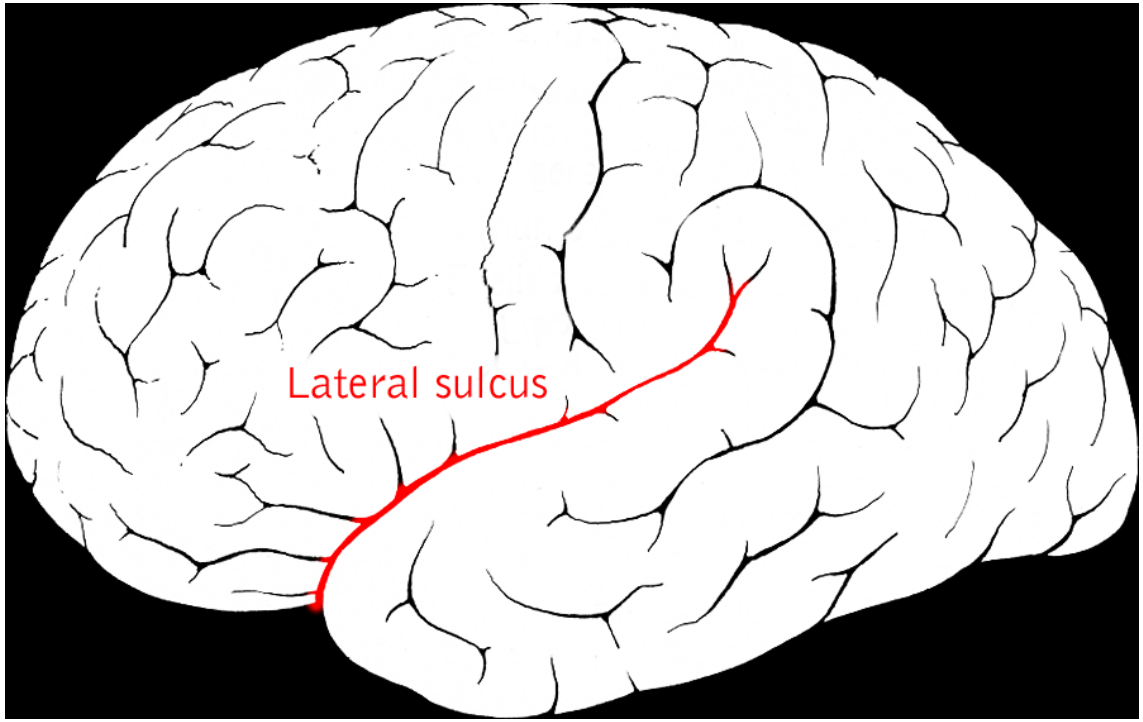
Landmarks of the cortex

Longitudinal fissure



https://upload.wikimedia.org/wikipedia/commons/0/04/Human_brain_long

Lateral sulcus/fissure



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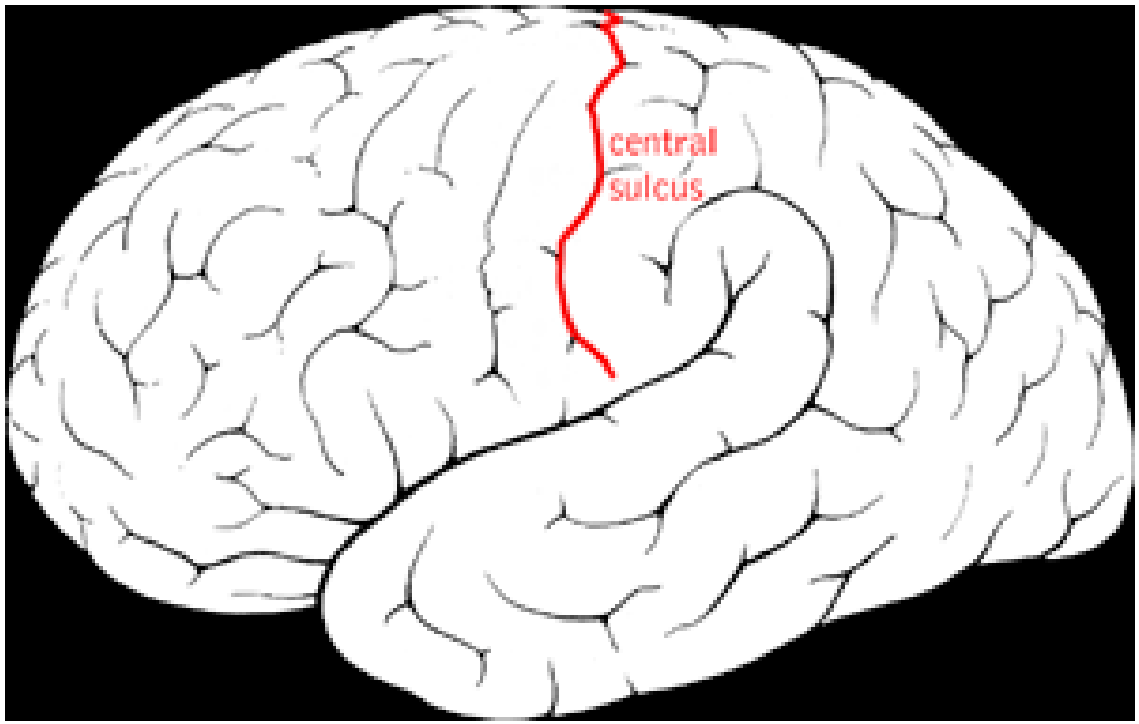
Central sulcus



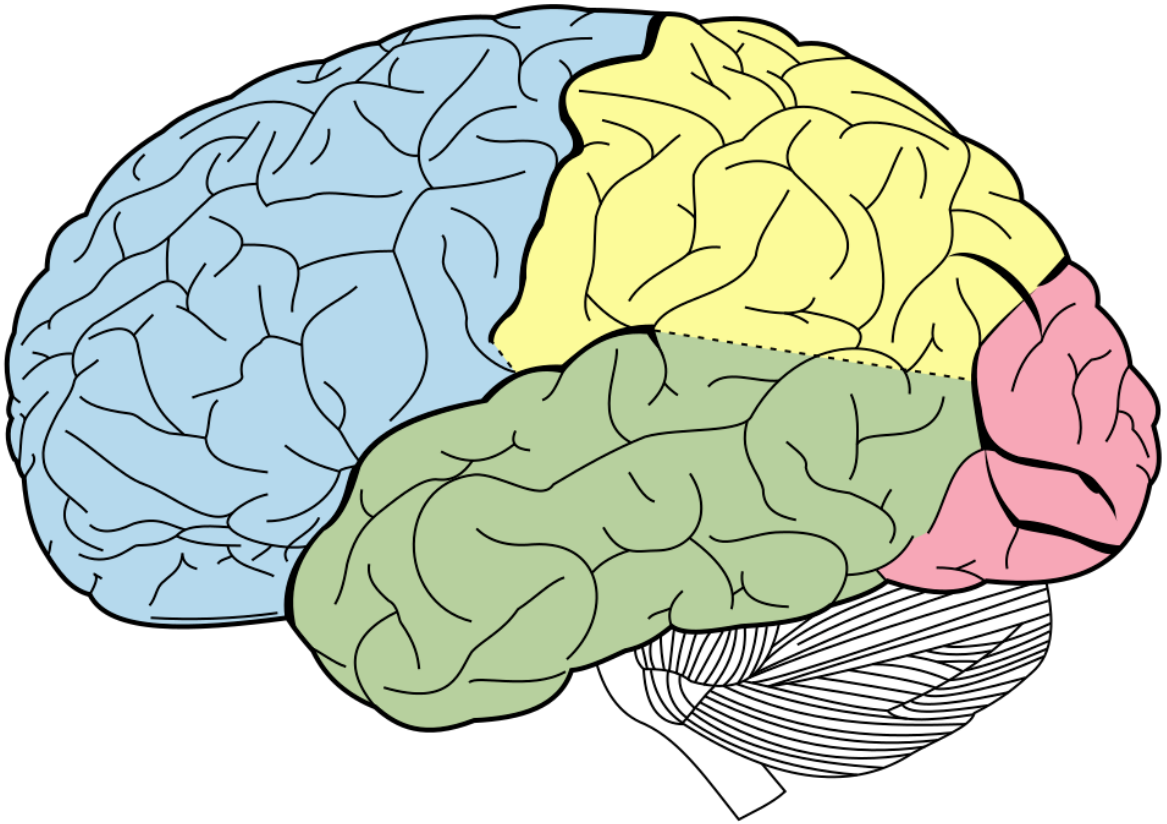
https://upload.wikimedia.org/wikipedia/commons/8/88/Central_sulcus_diagram.png

Frontal lobe

Where is it?

- Anterior to central sulcus
- Superior to lateral fissure
- Dorsal to temporal lobe

Lobes of the Cerebral Cortex



https://upload.wikimedia.org/wikipedia/commons/thumb/0/0e/Lobes_of_the_brain_NL.svg/1024px-Lobes_of_the_brain_NL.svg.png

Frontal lobe

What does it do?

- Primary motor cortex (M1)
  - Supplementary motor cortex
  - Frontal eye fields (FEF)
- Prefrontal cortex
  - Planning, problem solving, working memory…?

Frontal lobe

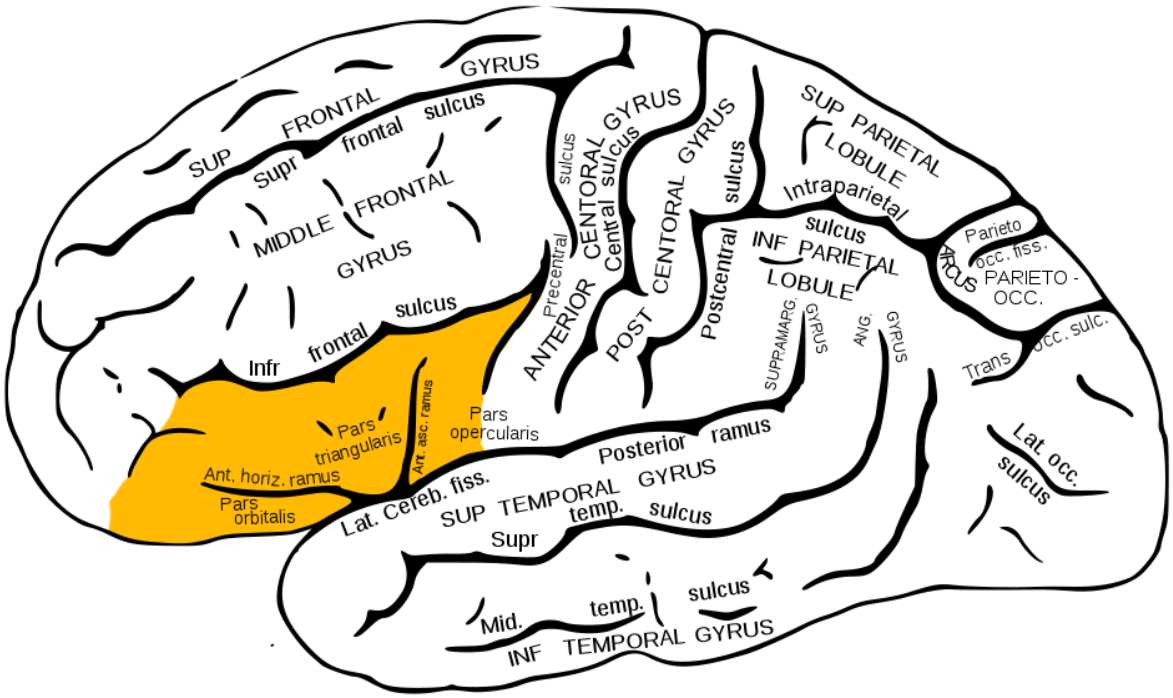
What does it do?

- Basal forebrain
  - Nucleus accumbens (NAcc), part of ventral striatum
- Anterior cingulate cortex (ACC)
- Primary olfactory cortex

Cingulate Gyrus

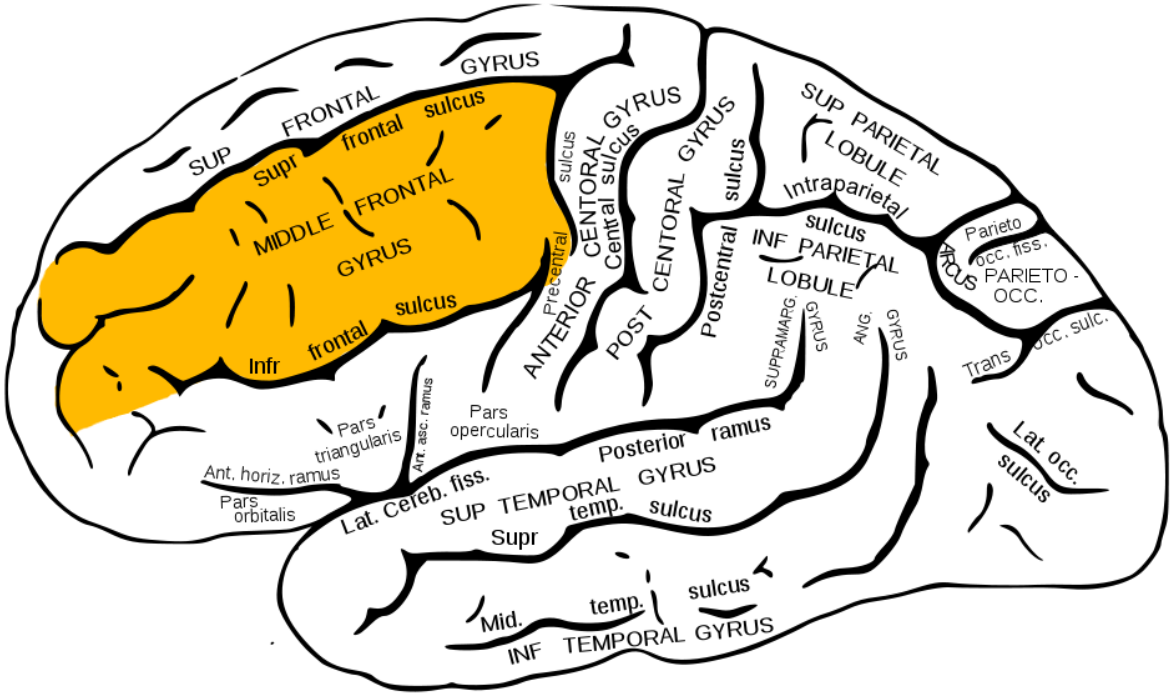
http://cis.jhu.edu/data.sets/cortical_segmentation_validation/photos/cinggyrus75.jpg

Inferior Frontal Gyrus (IFG)



https://upload.wikimedia.org/wikipedia/commons/b/b2/Gray726_inferior_frontal_gyrus.png

Middle Frontal Gyrus (MFG)



https://upload.wikimedia.org/wikipedia/commons/7/7f/Gray726_middle_frontal_gyrus.png

Temporal lobe

Where is it?

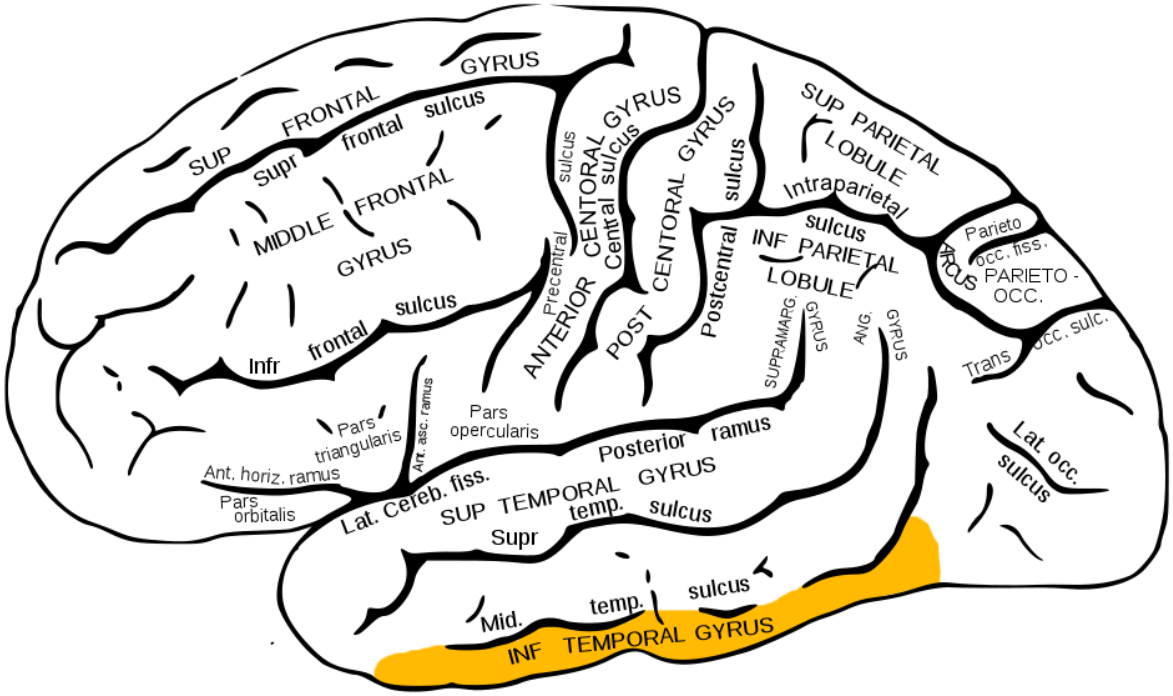
- Ventral to frontal, parietal lobes
- Inferior to lateral fissure

Temporal lobe

What does it do?

- Primary auditory cortex
- Object, face recognition
- Storage of memories about events, objects
- Amygdala, hippocampus

Inferior Temporal Gyrus (ITG)



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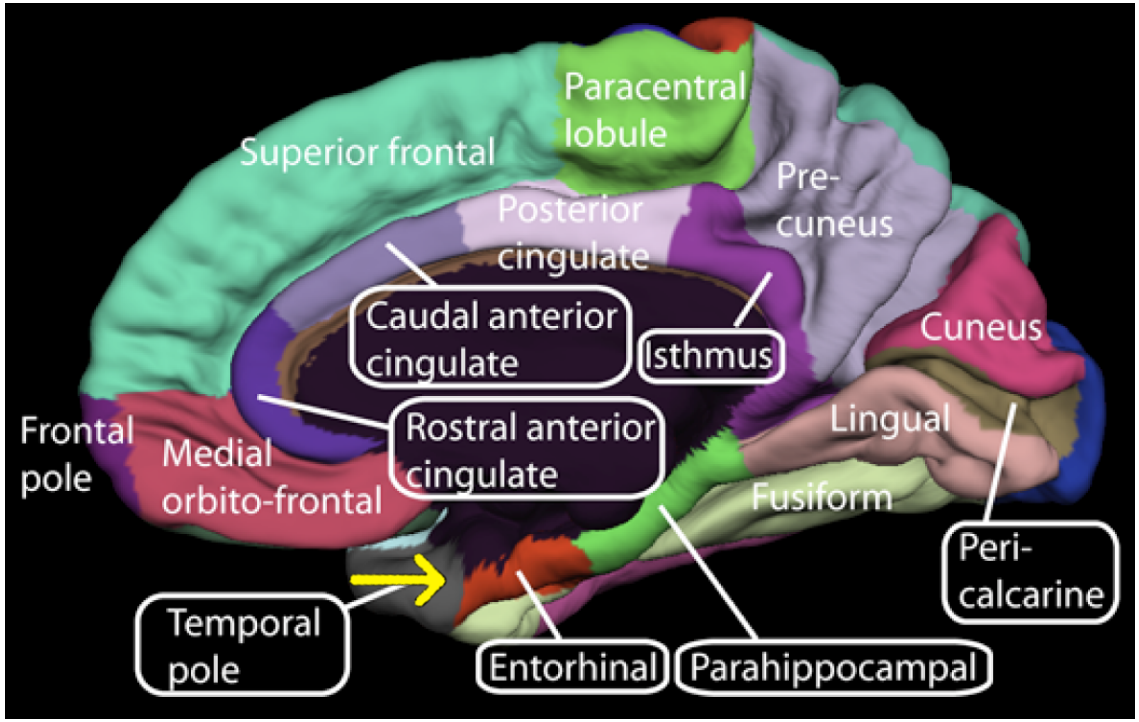
Entorhinal Cortex (ER)



https://upload.wikimedia.org/wikipedia/commons/1/15/Medial_surface_of_cerebral_cortex_-_entorhinal_cortex.png

Parietal lobe

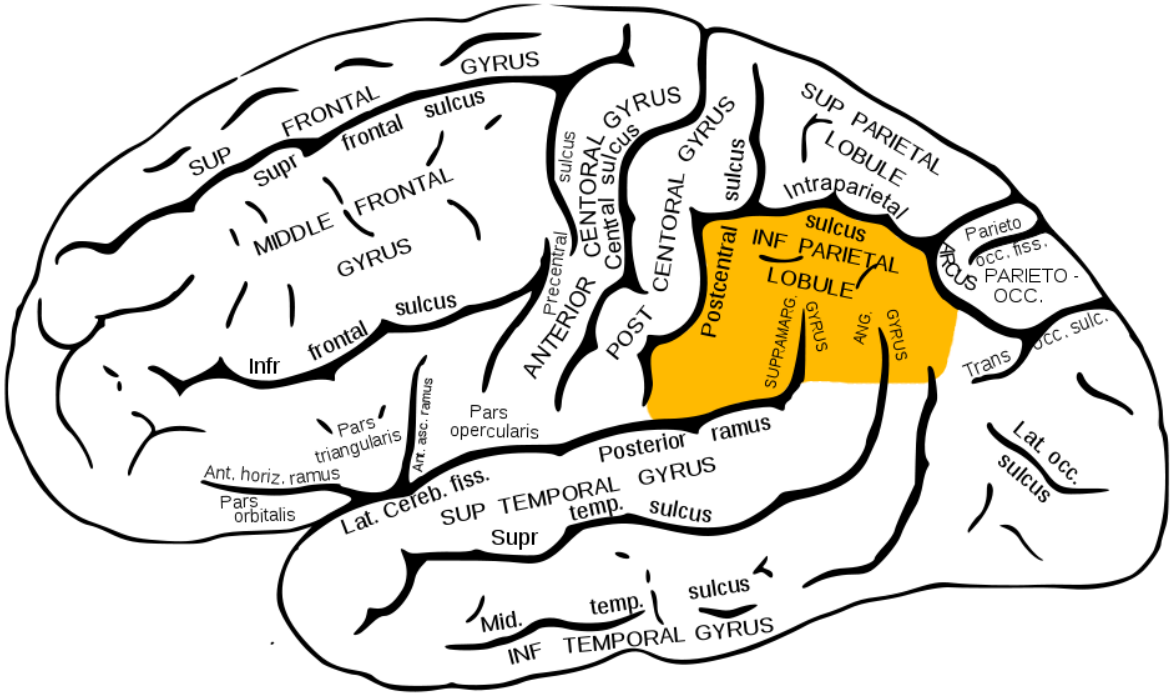
Where is it?

- Caudal to frontal lobe
- Dorsal to temporal lobe
- Posterior to central sulcus

What does it do?

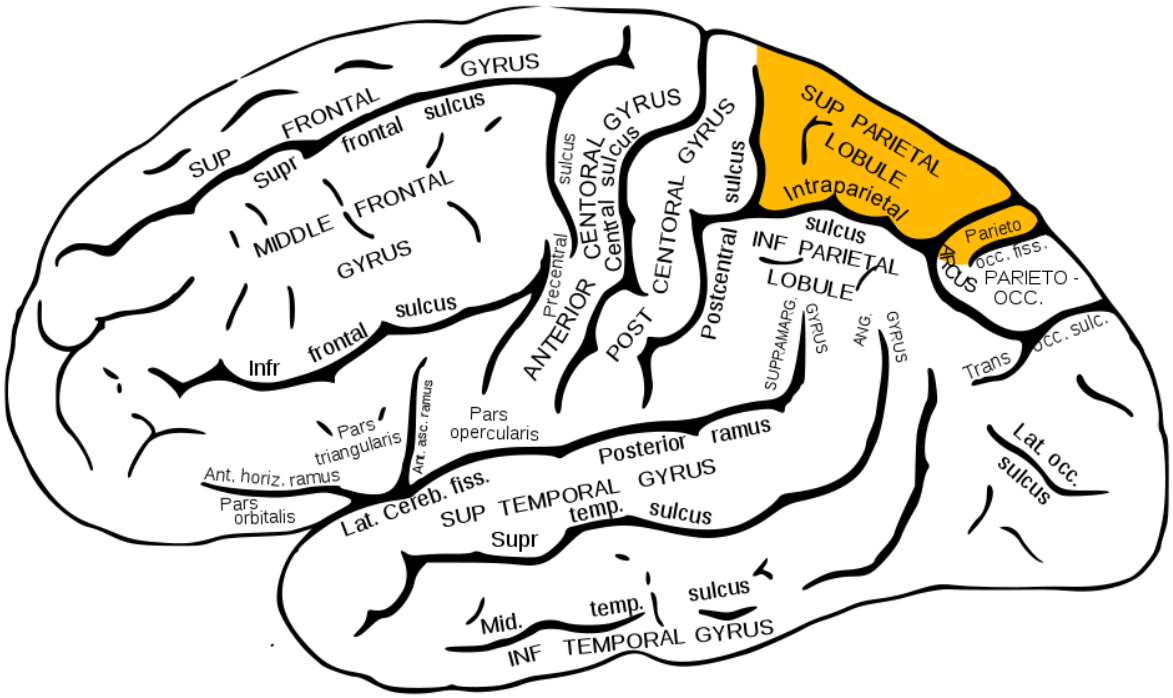
- Primary somatosensory cortex
- Perception of spatial relations, action planning

Inferior Parietal Lobule



https://upload.wikimedia.org/wikipedia/commons/e/e3/Gray726_inferior_parietal_lobule.png

Superior Parietal Lobule



https://upload.wikimedia.org/wikipedia/commons/9/9d/Gray726_superior_parietal_lobule.png

Occipital lobe

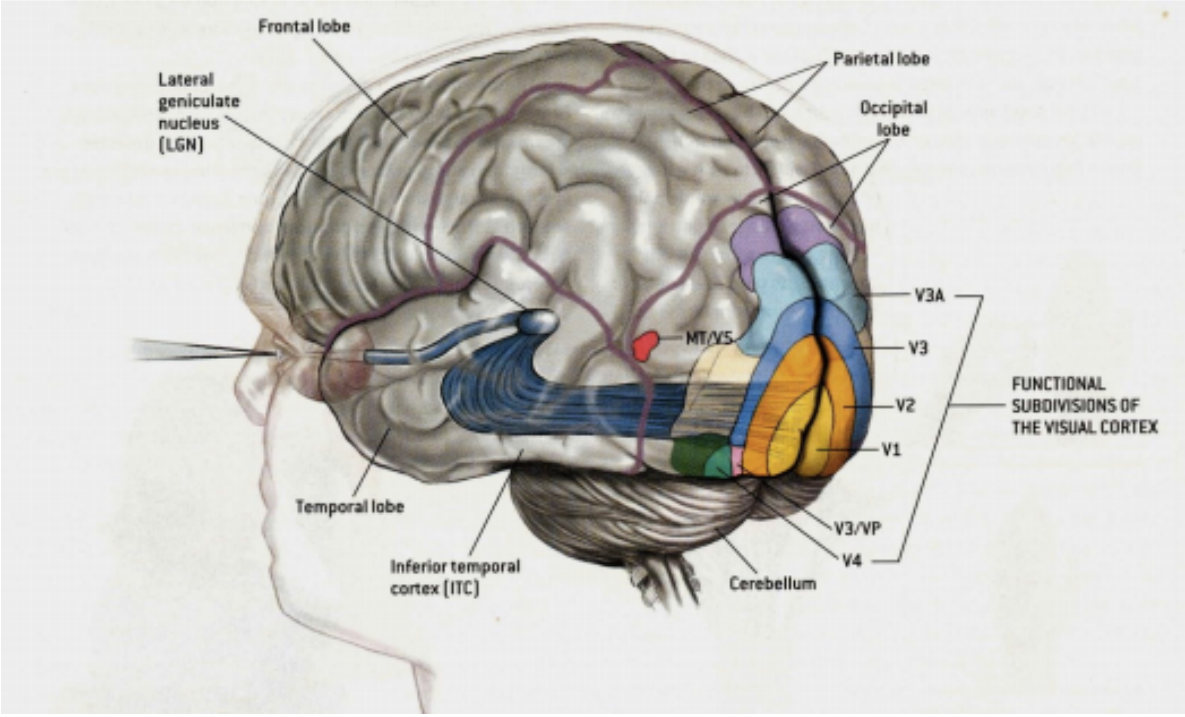
Where is it?

- Caudal to parietal & temporal lobes

What does it do?

- Primary visual cortex (V1)

Visual Cortex



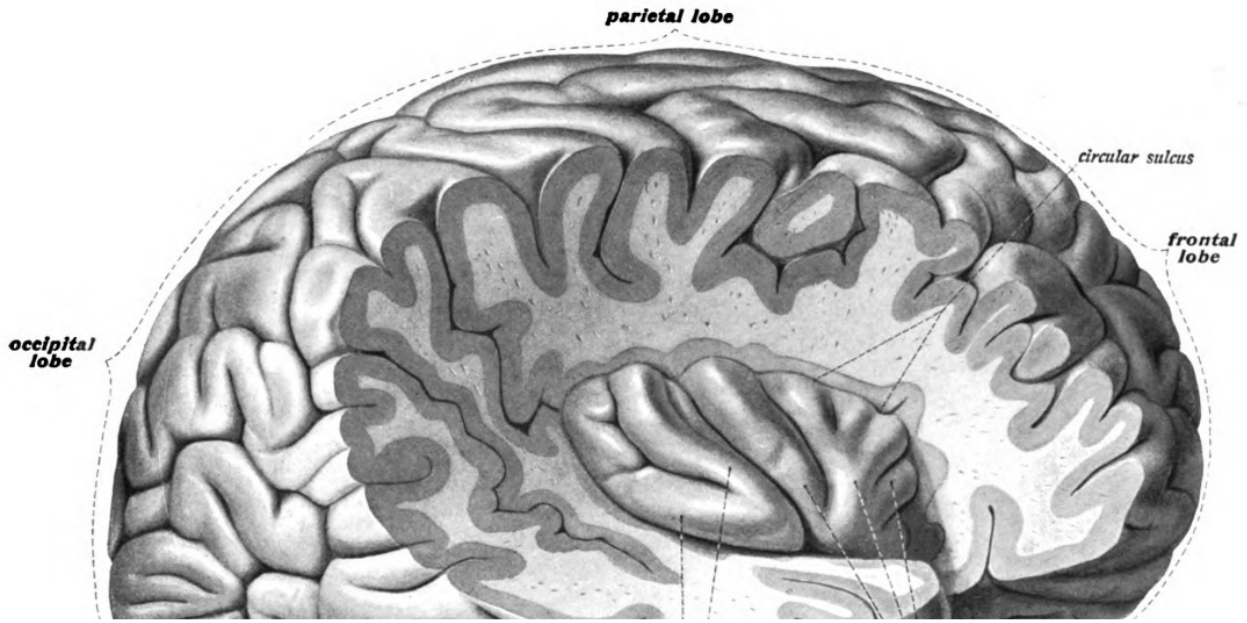
http://bethycotter.wdfiles.com/local–files/introducingtheeye/Screen%20Shot%202012-08-24%20at%2011.36.20%20PM.png

Insular cortex (insula)

Where is it?

- medial to temporal lobe
- deep inside lateral fissure

Insula



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Insula

What does it do?

- Primary gustatory cortex
- self-awareness, interpersonal experiences, motor control

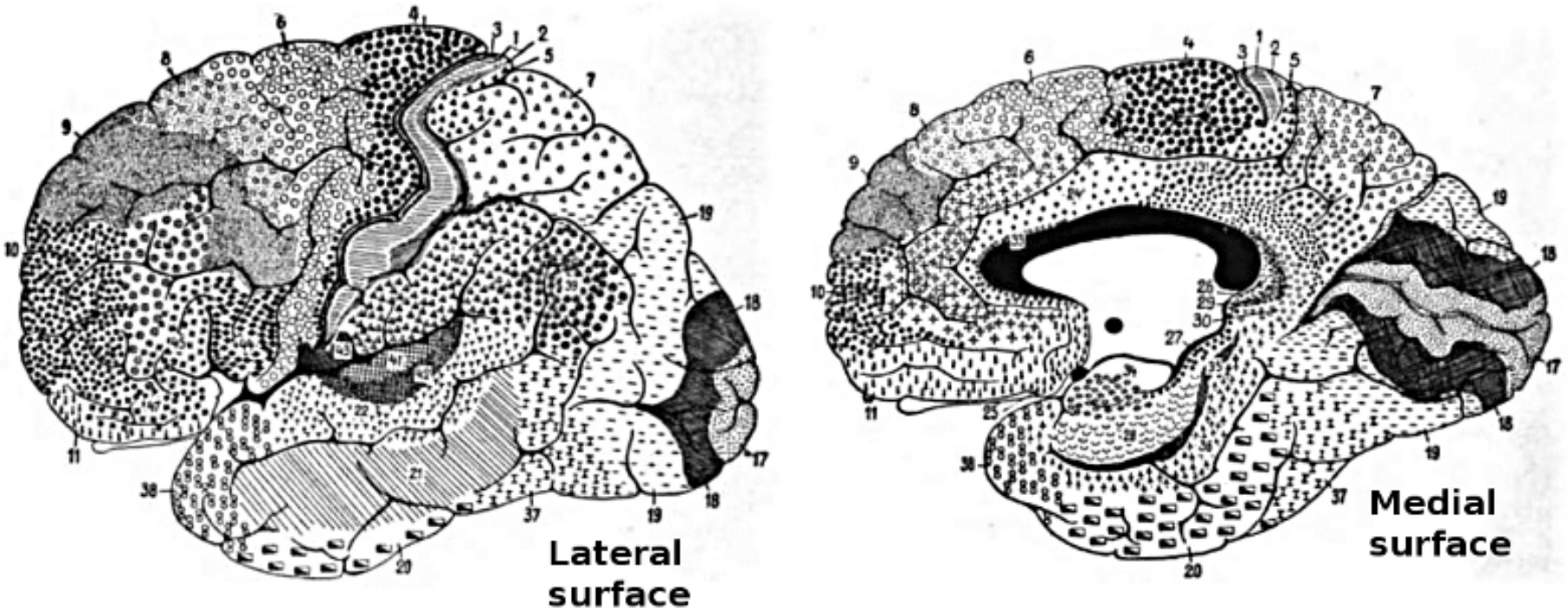
Brodmann Areas

Korbinian Brodmann

- Cytoarchitectonic differences in cerebral cortex

http://www.spektrum.de/lexika/images/bio/fff1209_w.jpg

Brodmann Areas



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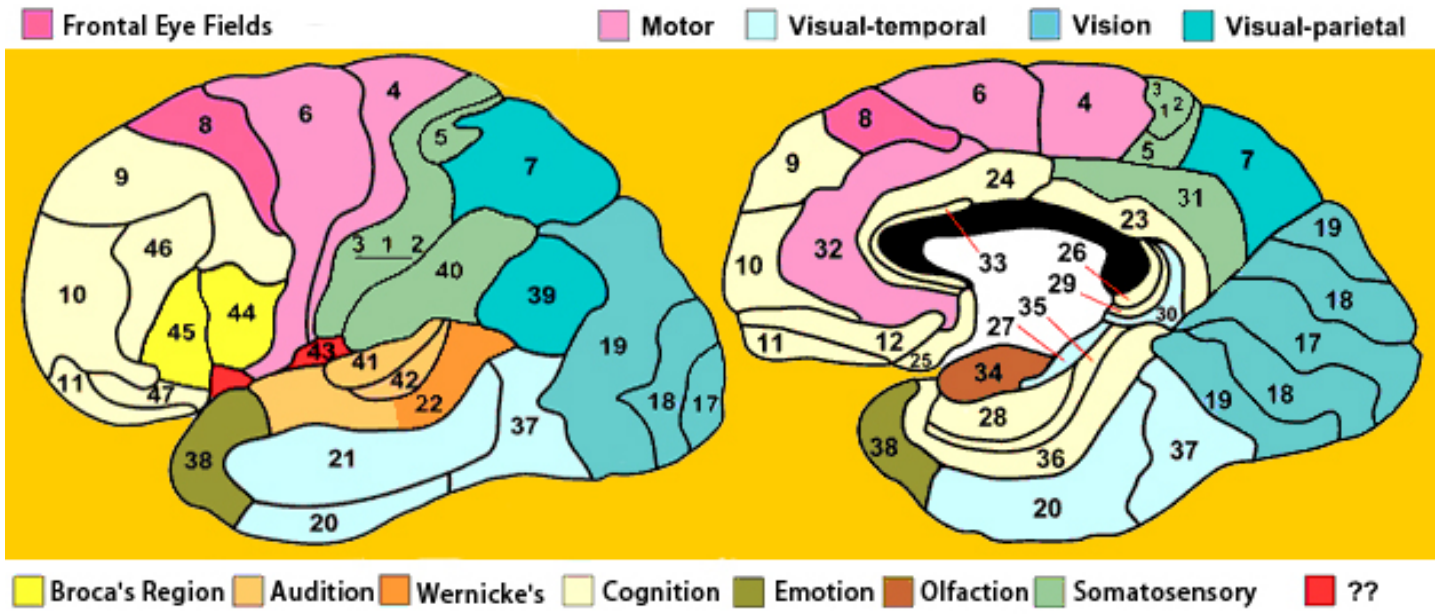
Brodmann Areas

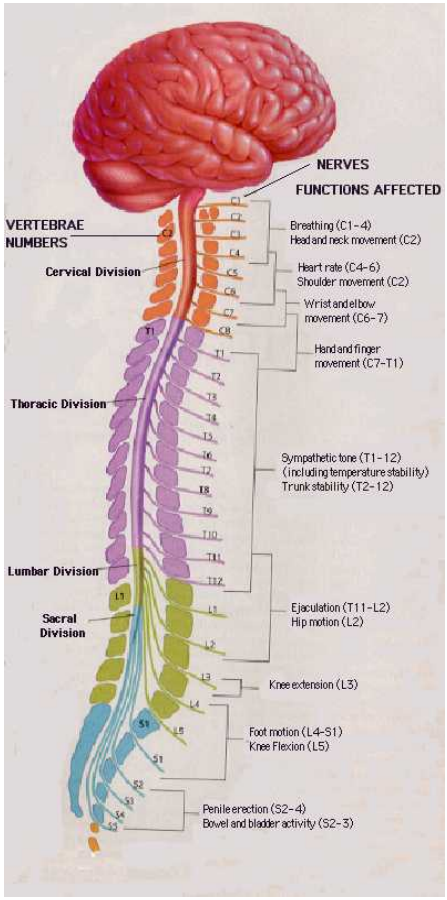


Spinal cord

Rostral/Caudal axis

- Spinal column w/ vertebrae
- Cervical (8), thoracic (12), lumbar (5), sacral (5), coccygeal (1)
- Spinal segments & 31 nerve pairs
- Cauda equina

Spinal cord



http://www.fauxpress.com/kimball/med/sensory/spinaldivisions.jpg

Spinal cord

Organization of the spinal cord

- Dorsal/Ventral
  - Dorsal root (sensory)
  - Ventral root (mostly motor)
- Grey (interior) vs. white matter (exterior)

Cross section of the spinal cord.

Organization of the PNS

Somatic division

Autonomic

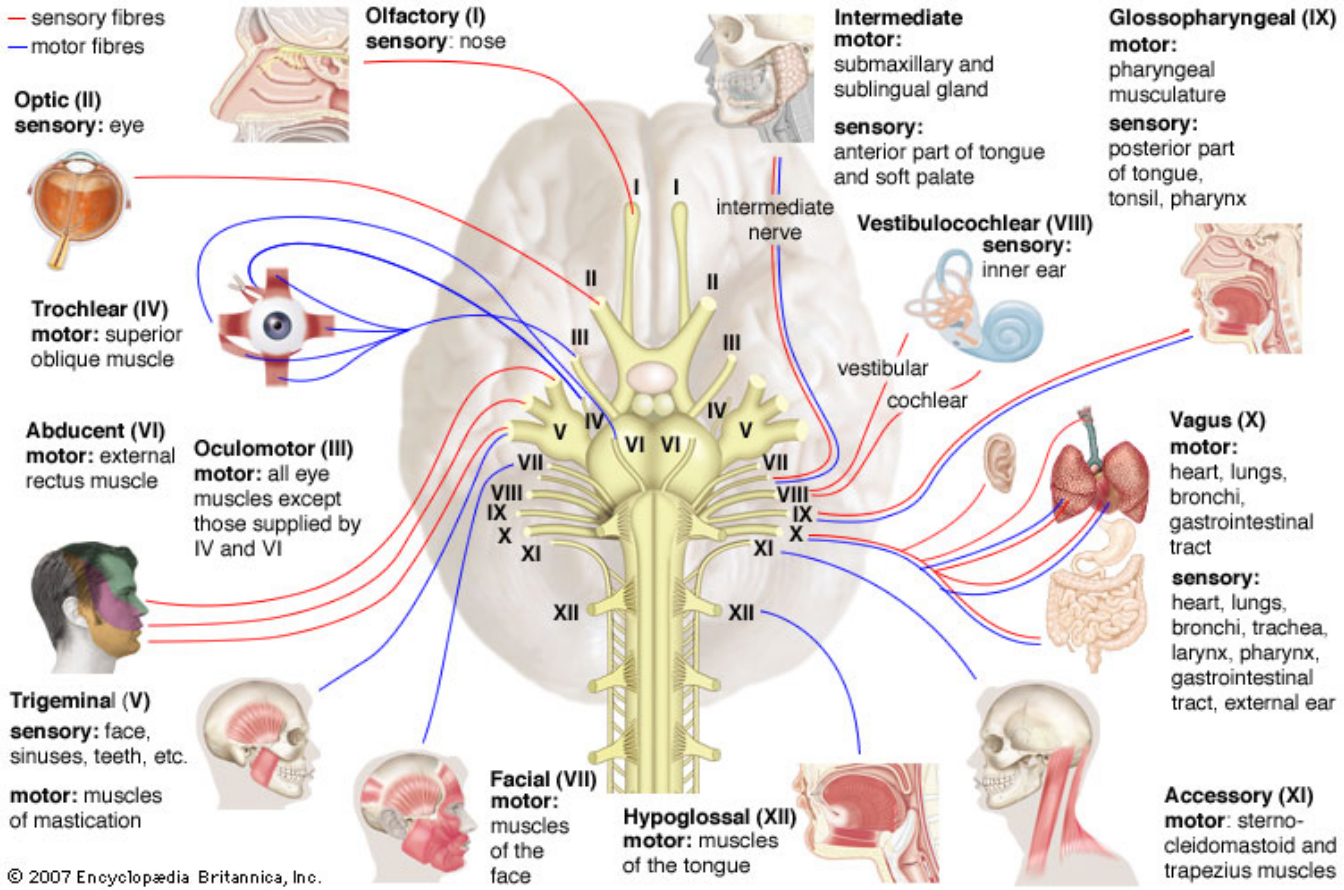
Cranial nerves

Spinal nerves

Cranial nerves

- Afferents (input), efferents (output), or mixed
- Innervate head and neck
- Olfactory (I), optic (II), (VIII) auditory, vagus (X), etc.
- Spinal nerves

Cranial nerves



http://media-1.web.britannica.com/eb-media/44/54244-004-892C5169.jpg

Major white matter pathways

Brainstem

Projection fibers

Association fibers

Commissural fibers

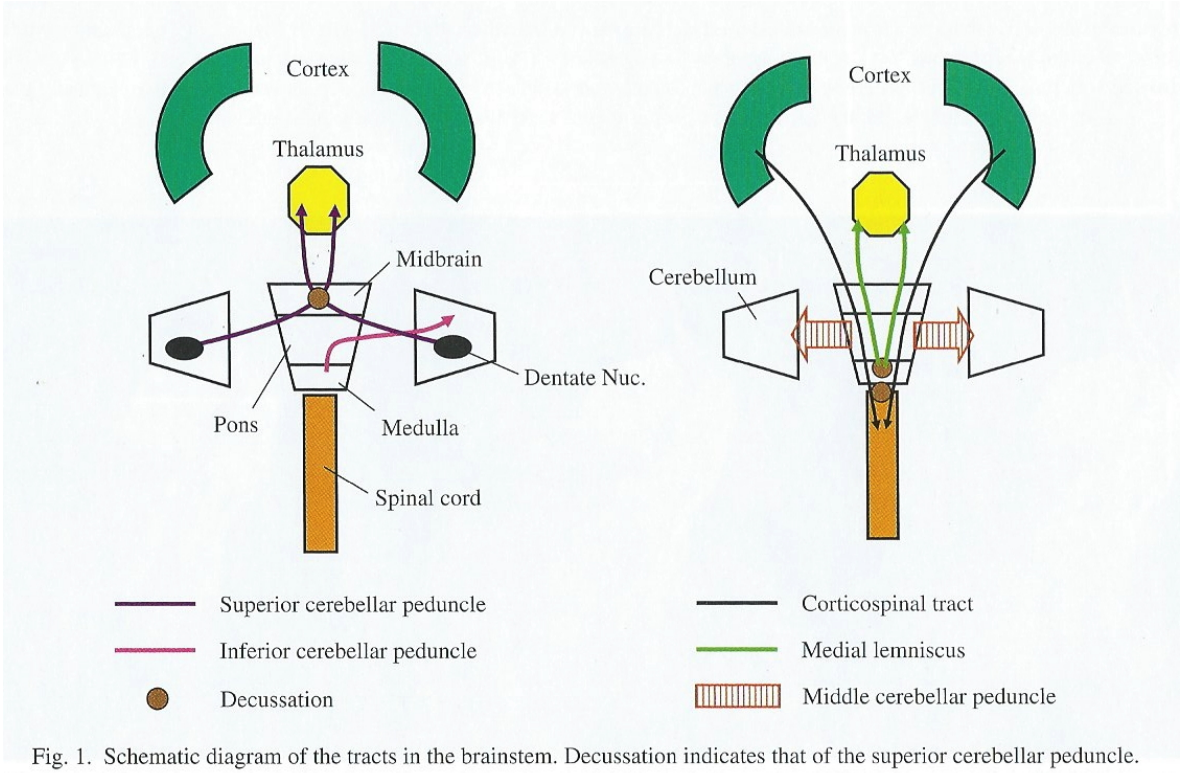


Fig. 1. Schematic diagram of the tracts in the brainstem. Decussation indicates that of the superior cerebellar peduncle.

(Oishi, Faria, Zijl, & Mori, 2010), Chapter 3, Figure 1.

Brainstem projections

- Corticospinal tract (descending/efferent)
- Dorsal column/medial lemniscus (ascending/afferent)
- Superior/inferior cerebellar peduncles (from/to cerebellum)

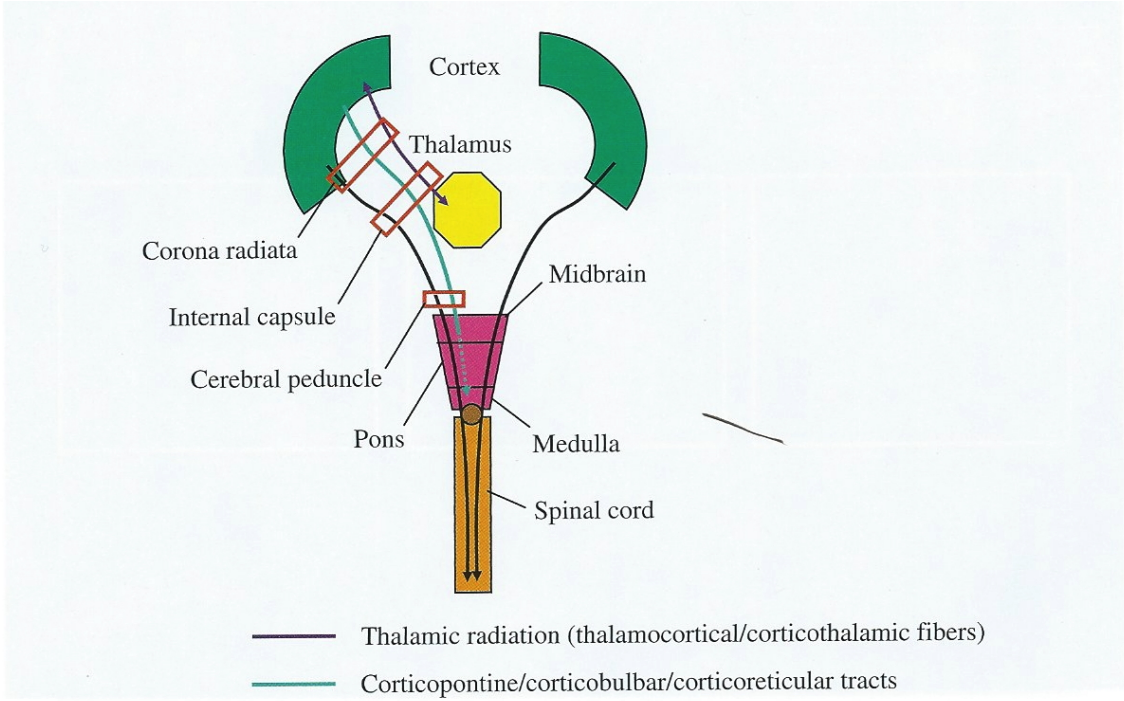


Fig. 8. A schematic diagram of trajectories of projection fibers reconstructed in this atlas. The decussation is that of the corticospinal tract.

(Oishi et al., 2010), Chapter 3, Figure 8.

Projection fiber tracts

- Internal capsule
  - Thalamic radiation
  - Cortico-{pontine, bulbar, reticular} tracts

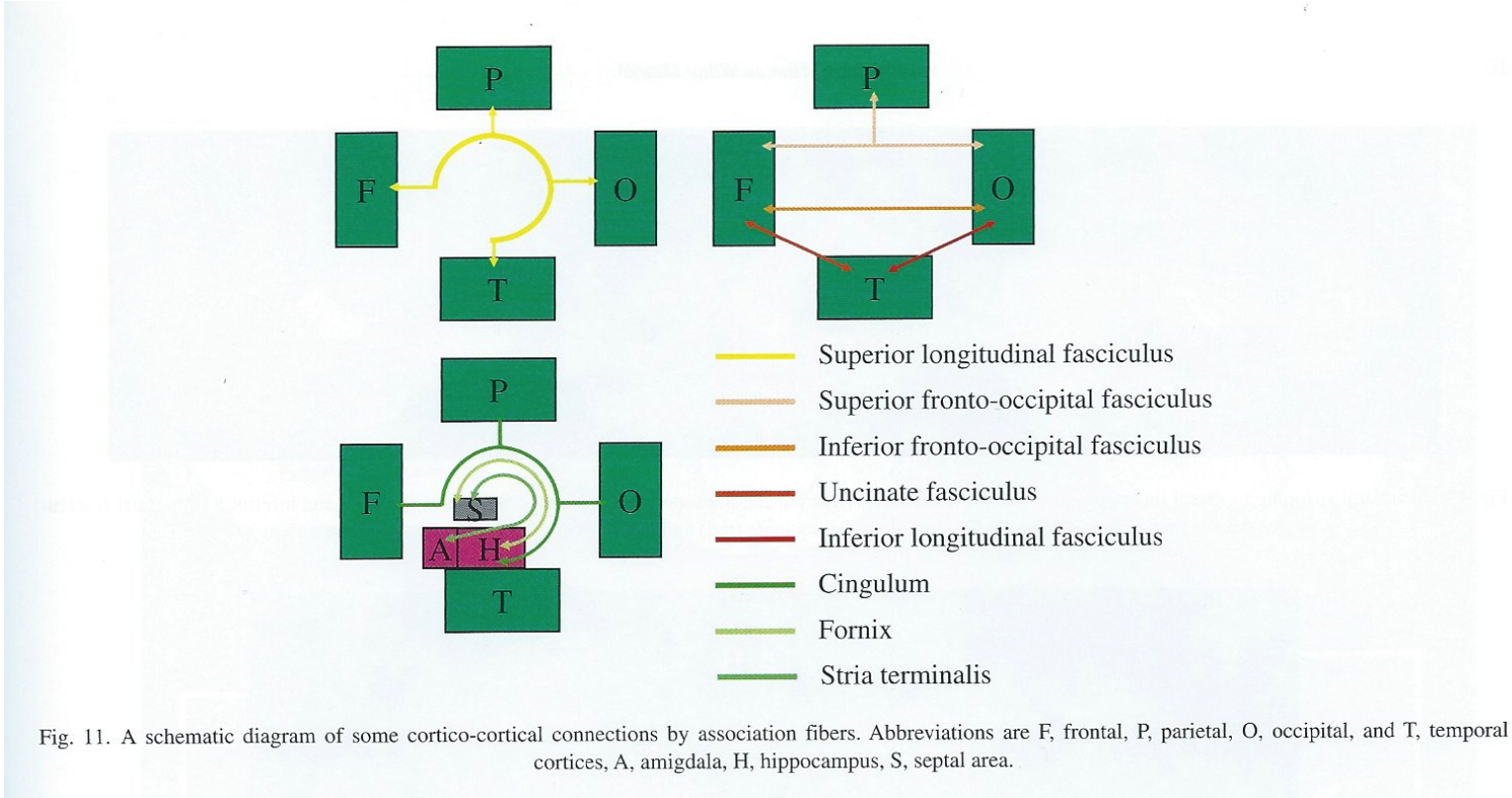


Fig. 11. A schematic diagram of some cortico-cortical connections by association fibers. Abbreviations are F, frontal, P, parietal, O, occipital, and T, temporal cortices, A, amigdala, H, hippocampus, S, septal area.

(Oishi et al., 2010), Chapter 3, Figure 11.

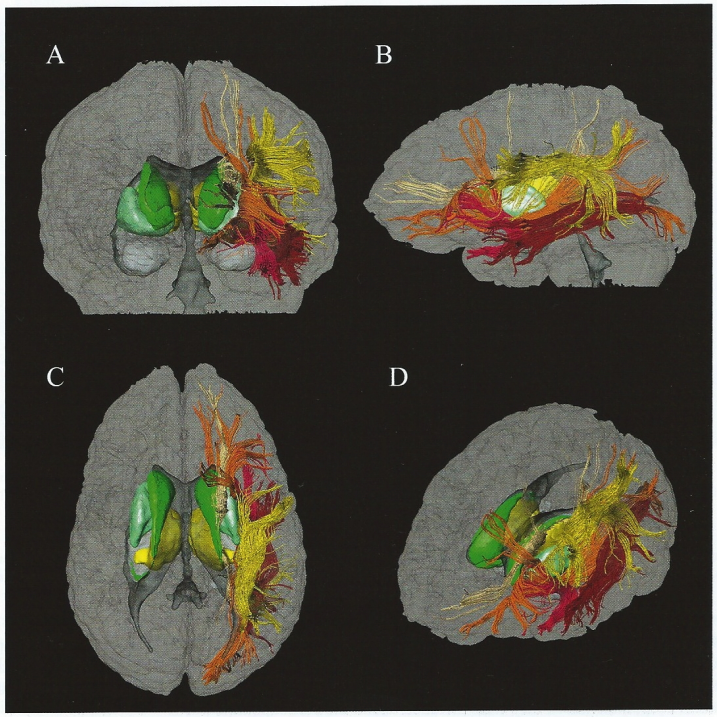


Fig. 12. 3D reconstruction results of some association fibers. Tracts are viewed from the anterior (A), left (B), superior (C), and oblique (left-antero-superior) (D) orientations. Color coding: slf is yellow, ifo is orange, unc is red, and ilf is brown. Cerebral hemispheres are delineated by semi-transparent gray. Thalami are yellow, ventricles are gray, caudate nuclei are green and lentiform nuclei are light green.

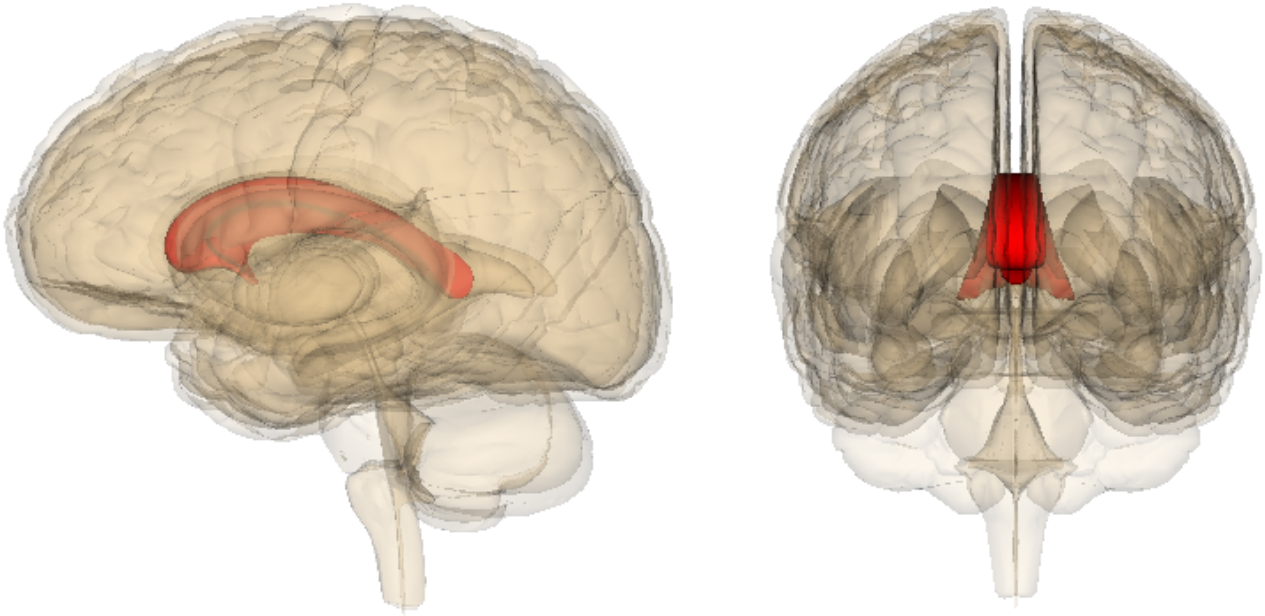
(Oishi et al., 2010), Chapter 3, Figure 11.

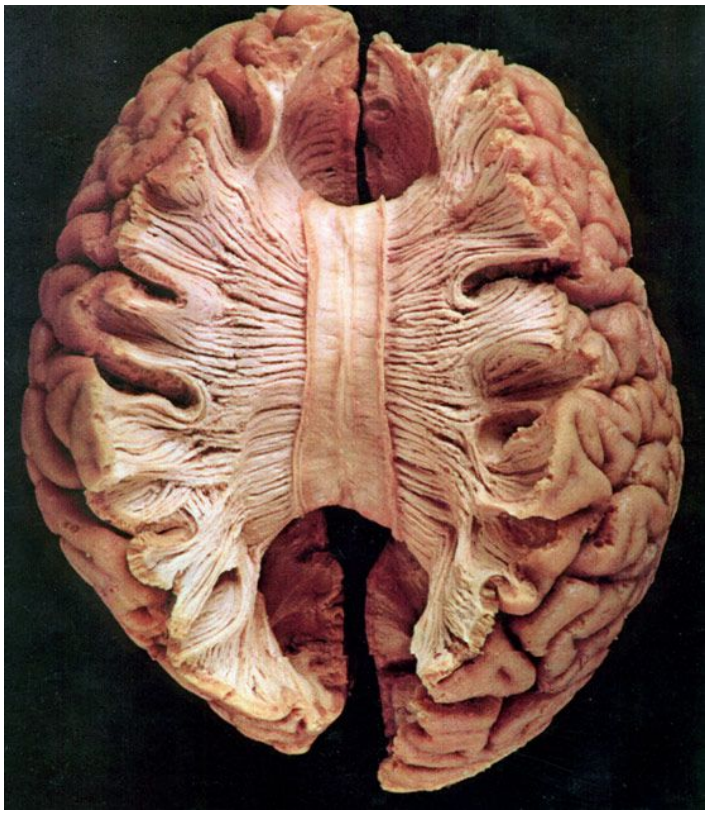
Cortical white matter tracts

- Superior/inferior longitudinal fasciculus
  - Arcuate fasciculus part of sup. long. f.
- Superior/inferior fronto-occipital fasciculus
- Cingulum, fornix (hyp-hip), stria terminalis (hyp-amyg)

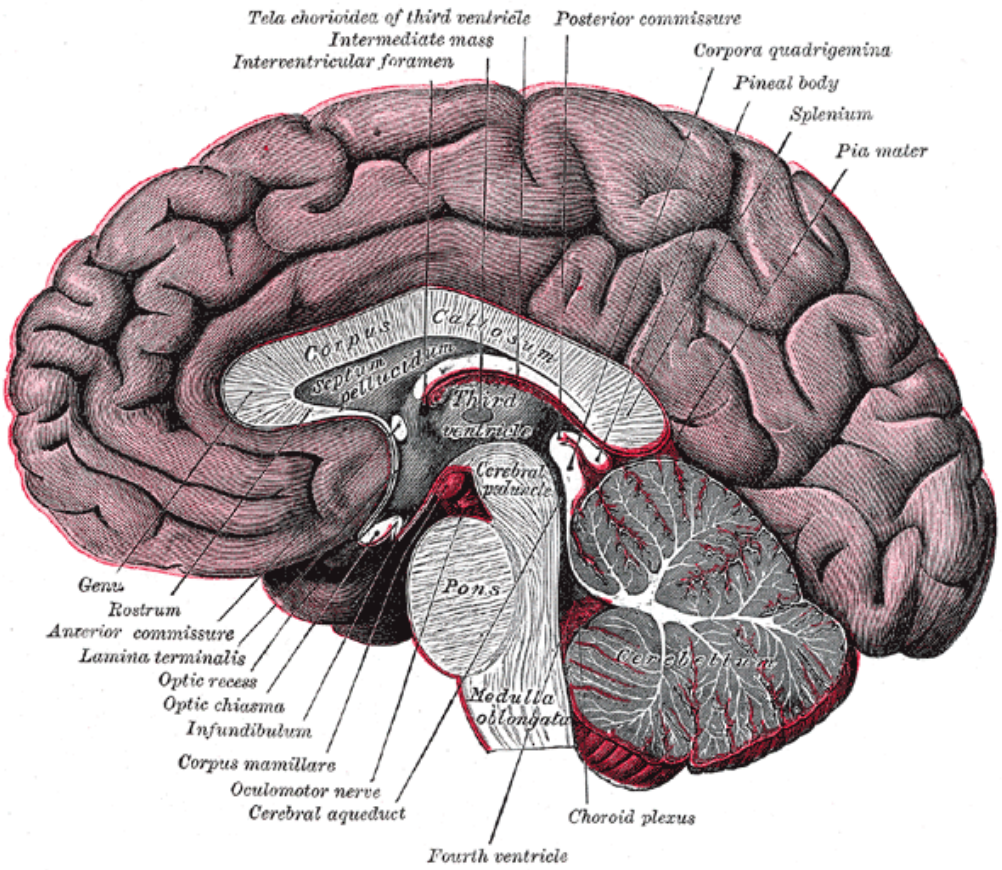
Commissural fibers

- Corpus callosum
- Anterior commissure (AC)
- Posterior commissure (PC)





Anterior, Posterior Commissures

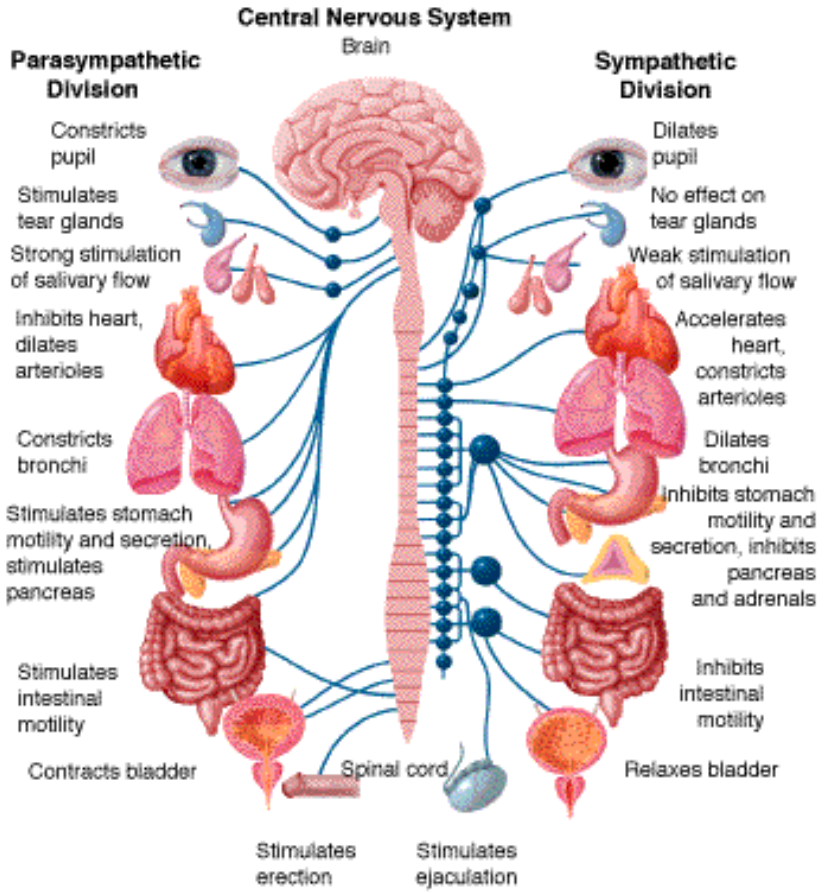


https://https://upload.wikimedia.org/wikipedia/commons/2/22/Gray720.png

Autonomic nervous system

- CNS & PNS components
- Controls “vegetative functions”
  - Limited voluntary control
- Two divisions
  - Sympathetic
  - Parasympathetic

ANS



https://4.bp.blogspot.com/_FBNLGBBprSE/TB5b9zkM11I/AAAAAAAAAHA/LBCT2HkOzvI/s400/PNS.GIF

Sympathetic division

- Prepares body for action
- “Fight or flight”
- Spinal cord
  - ganglion chain along spinal column to End organs
- NTs
  - Preganglionic: ACh
  - Post: NE

Parasympathetic division

- “Around” sympathetic
- Restorative function
- “Rest & digest”
- Spinal cord (or Vagus n.) -> ganglia near end organs -> end organ
    - NT: ACh

Next time

- Neuroanatomy lab

References

Oishi, K., Faria, A. V., Zijl, P. C. van, & Mori, S. (2010). *MRI atlas of human white matter*. Academic Press.