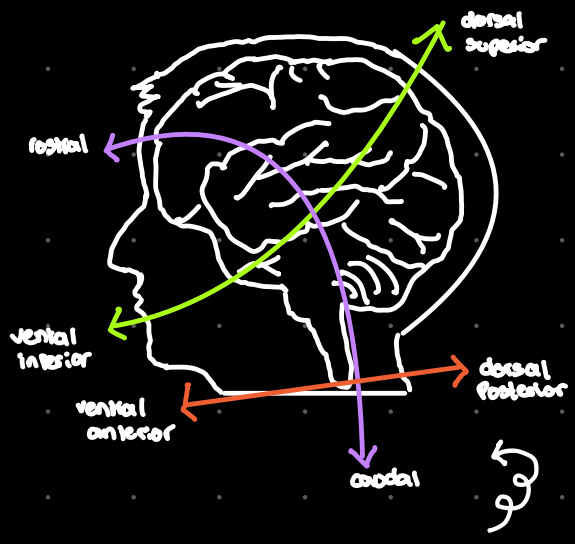
neuroanatomy

Directional terms

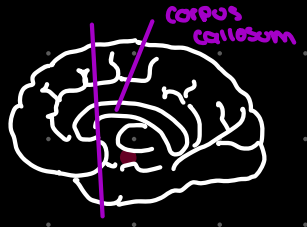
- Rostral (anterior) - 'toward the beak'
- Caudral (posterior) - 'toward the tail'
- Dorsal (superior) - 'toward the back'
- Ventral (inferior) - 'toward the belly'



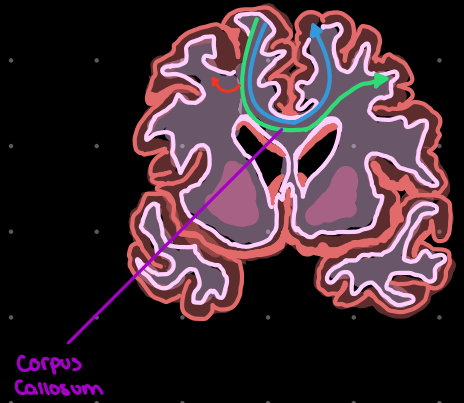
(the human neural axis bends because the head is perpindicular to the back)

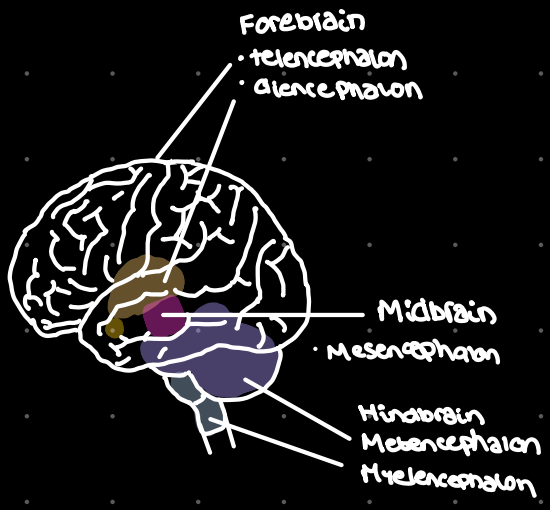
- Lateral - toward the side
- Medial - toward the middle
- Ipsilateral - on the same side of midline
- Contralateral - on the opposite side of midline

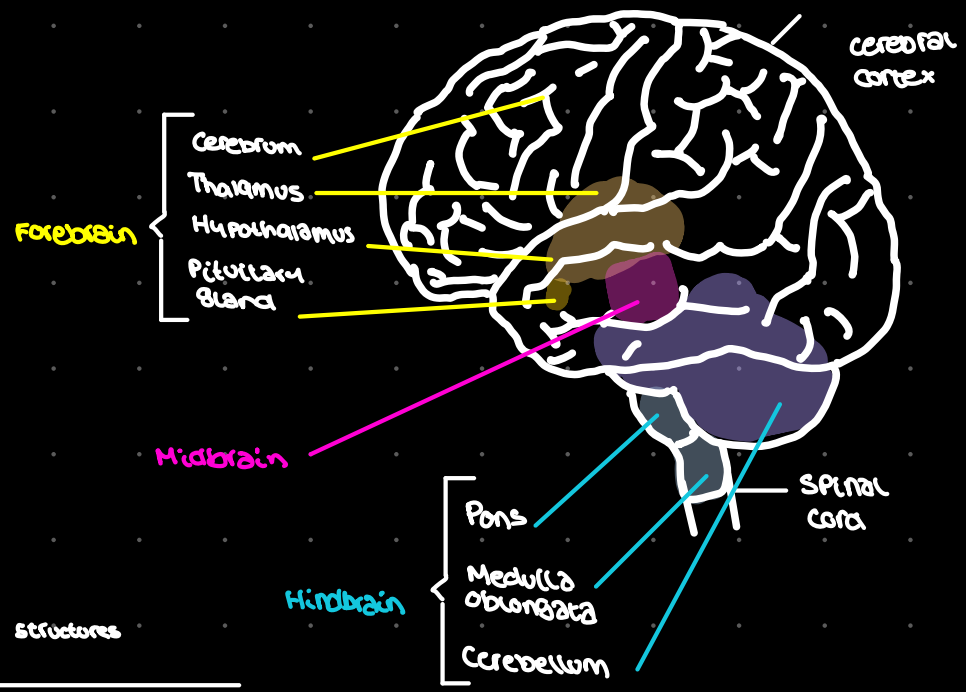
Corpus Callosum:



- consists of a bundle of axons that connect 2 hemisphere
  - Homotic connects complementary region of other hemisphere
  - Heterotopic communicates to different brain regions
  - Ipsilateral is on the same side
- Callostomy ~ procedure to cut corpus callosum to stop severe epileptic seizures
- Prevents communication between hemispheres.



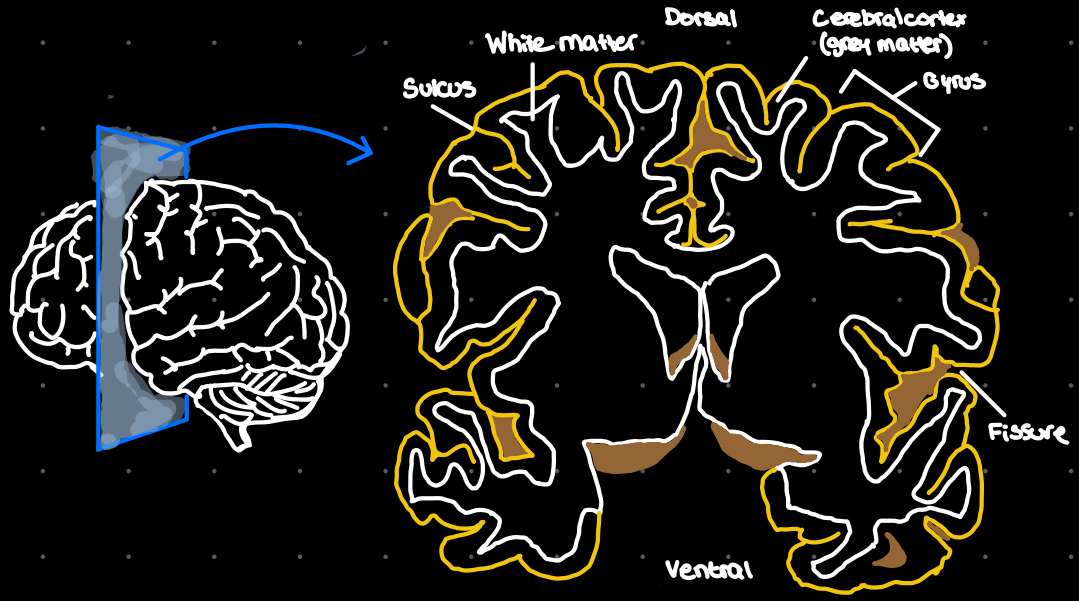




Major division	Subdivision	Structures
Forebrain	telencephalon	cerebral cortex
		basal ganglia
		limbic system
	diencephalon	thalamus
		hypothalamus
Midbrain	Mesencephalon	tectum / tegmentum
Hindbrain	Metencephalon	cerebellum
		pons
	myelencephalon	medulla oblongata

Covered in this lesson.

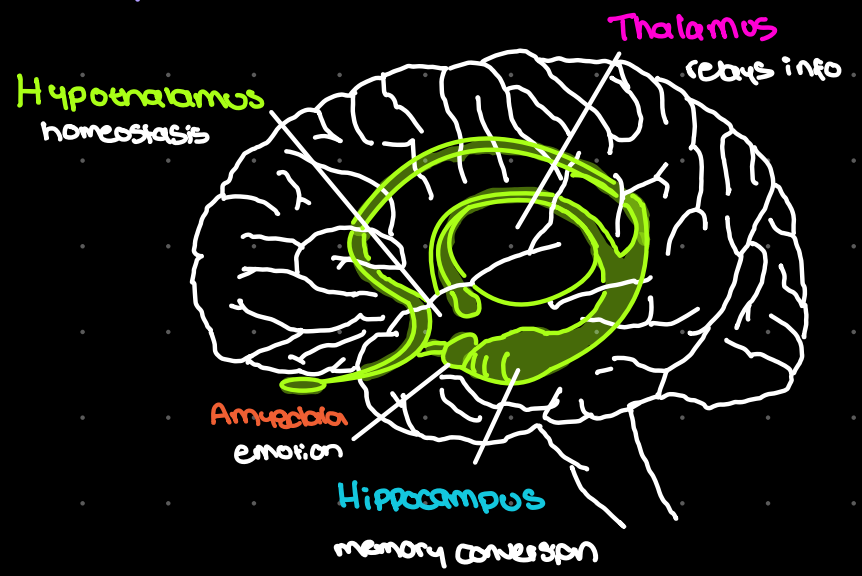
- **Telencephalon ~ cerebral cortex**
  - the telencephalon is a subdivision of the forebrain & consists of the limbic system, Basal ganglia & Cerebral cortex
  - the cerebral cortex, the largest structure of the human brain, is divided into 2 cerebral hemispheres



  - inner 'white' matter (axon fibres w/ myelin sheath)
  - outer 'grey' matter (neurons & synapses connect)

• Telencephalon ~ Limbic System

- in 1937 James Papez proposed an emotion circuit in the brain
- in 1949 Paul Mclean coined the 'Papez circuit' including the hypothalamus, thalamus, cingulate gyrus, fornix, hippocampus, amygdala, orbitofrontal cortex & some nuclei of the basal ganglia.

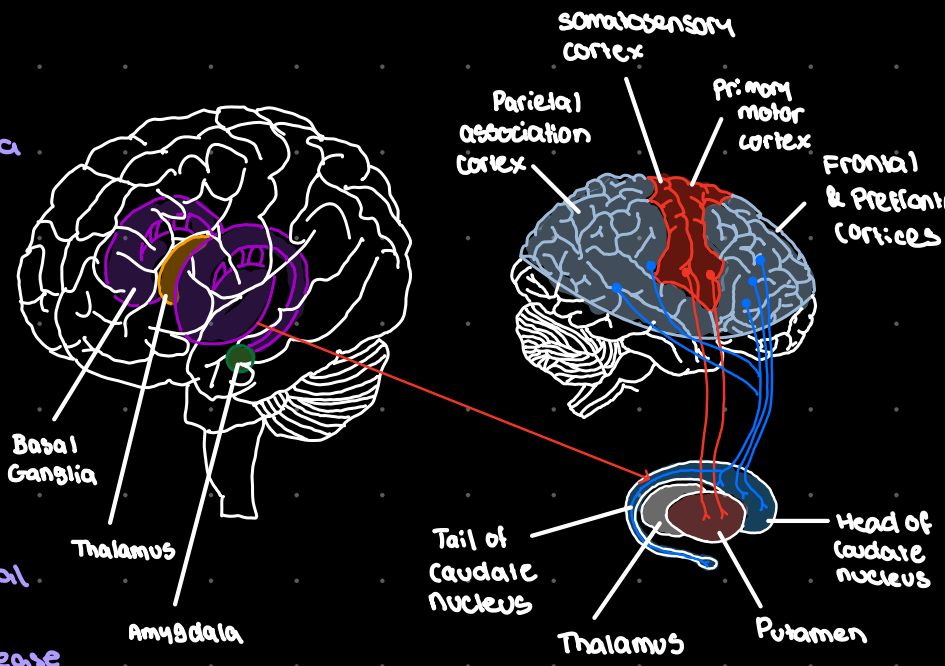


- important to note that while the amygdala plays a crucial role in emotion, it is now known that hippocampus & parts of surrounding cortex are related in learning & memory.

• Telencephalon ~ Basal Ganglia

- the nuclei of the basal ganglia (including the caudate nucleus & Putamen, are responsible for involuntary, highly automized movement
- the basal ganglia are disfunctional in patients with Parkinsons disease

→ difficulty initiating movement, tremors, poor balance, etc



• Diencephalon ~ thalamus & hypothalamus

- Thalamus:

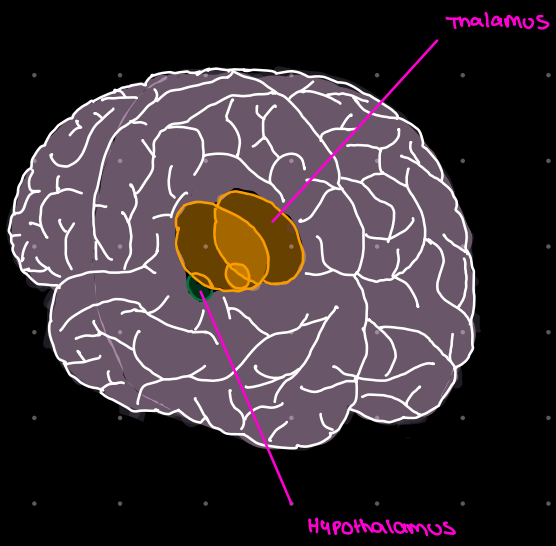
> major relay station for sensory inputs to cerebral cortex

> divided into several nuclei

- Hypothalamus:

> controles endocrine & autonomic NS

> regulates survival behaviours (fighting, fleeing, feeding, mating.



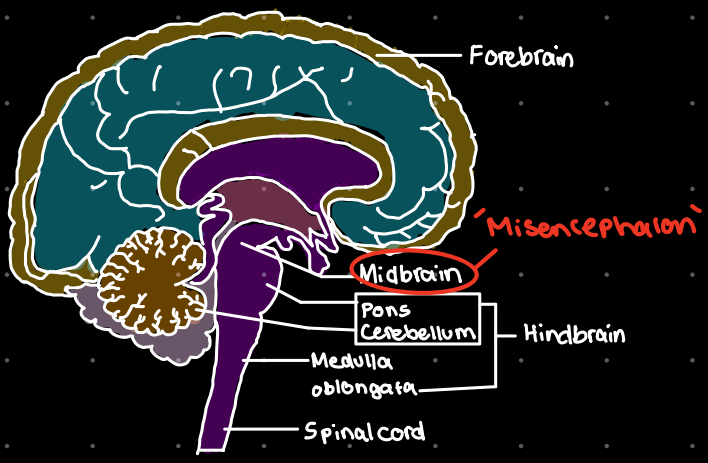
• Midbrain ~ Misencephalon

- the midbrain (and hindbrain) are located in the brainstem

- the midbrain (or misencephalon) is @ the topmost region of the brainstem & sits directly above the hindbrain.

- connects pons & cerebellum w/ forebrain.

- plays important role in motor movement, particularly of the eye, and in auditory & visual processing.



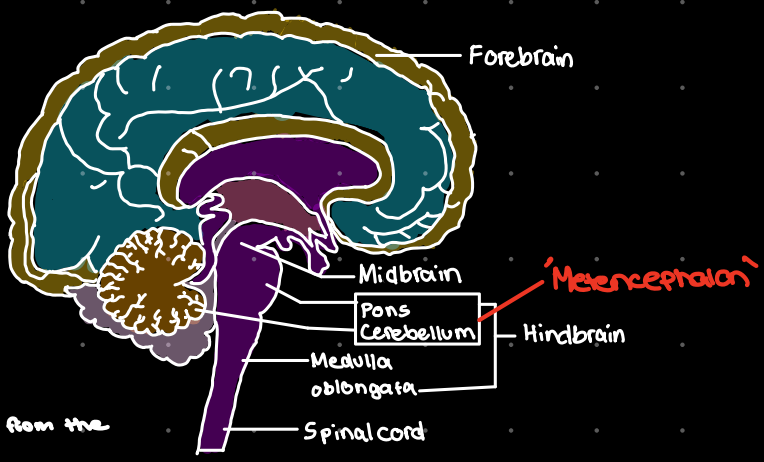
• Hindbrain ~ metencephalon

- contains cerebellum

> recieves info from vestibular, somatosensory, auditory & visual systems → helps coordination of movement

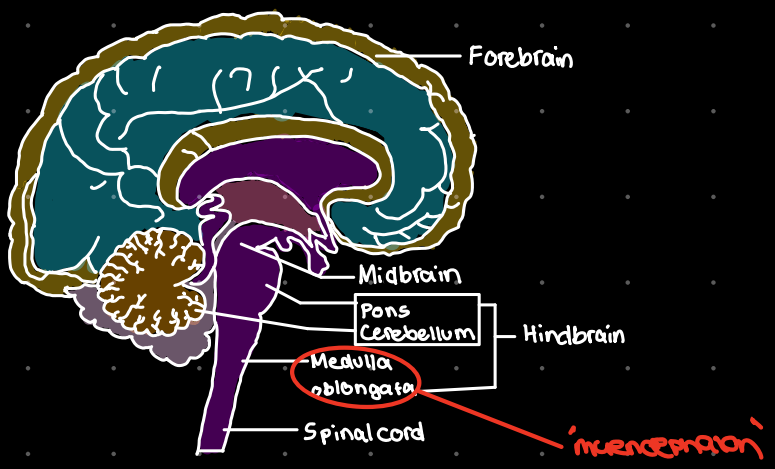
> damage leads to jerky movement + balance issues

- Pons contains nuclei that regulate arousal & relays info from the cerebral cortex → cerebellum.

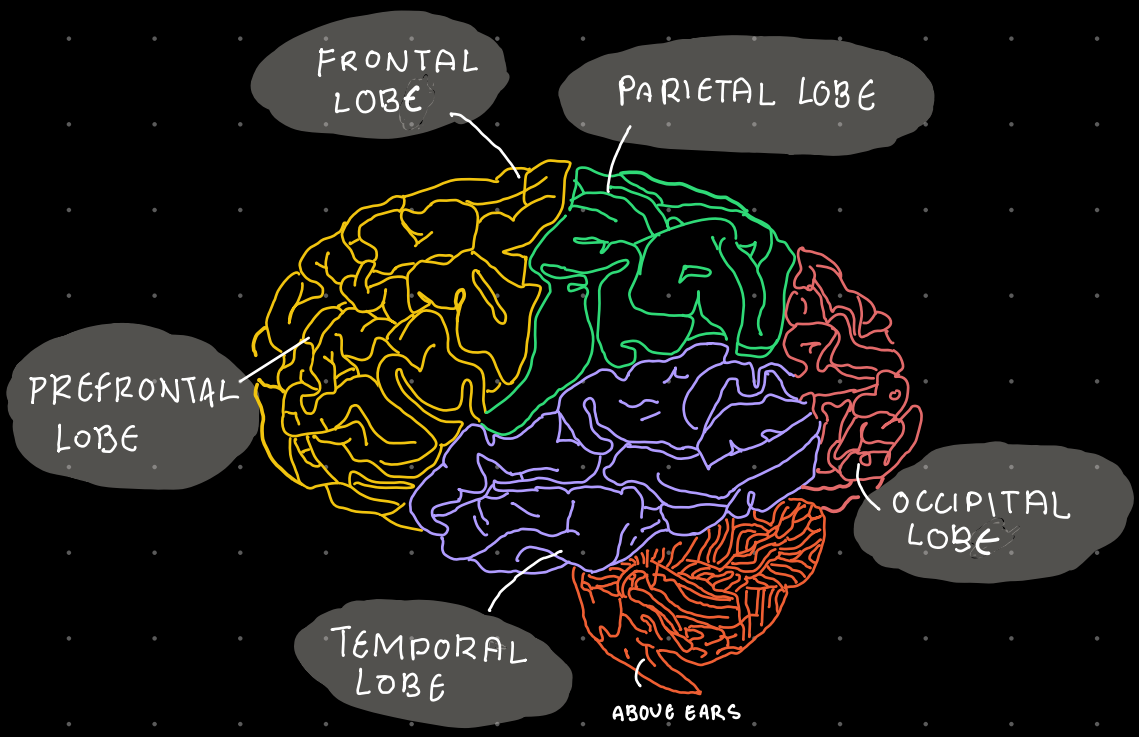


- **Hindbrain ~ Myencephalon**

  - The myencephalon, or medulla oblongata, links the hindbrain to the spinal cord & contains neurons important for autonomic functions like respiration & heart rate.

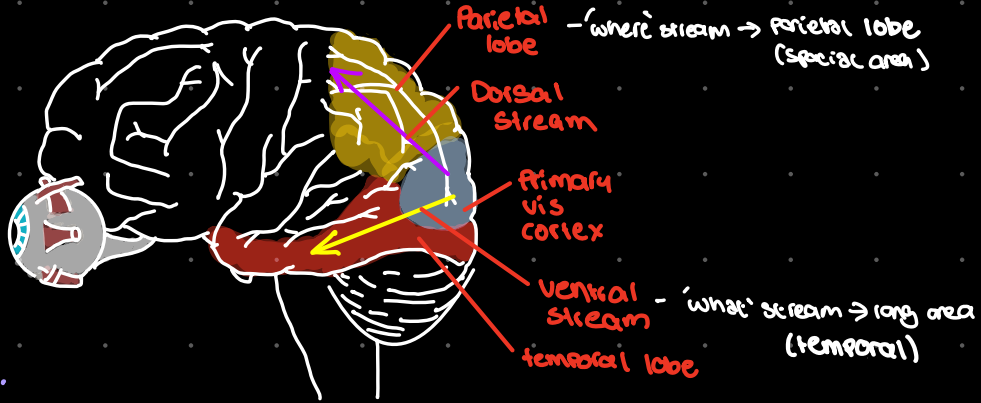


LOBES OF THE CEREBRAL CORTEX

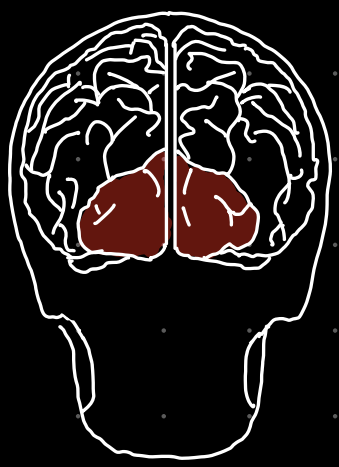


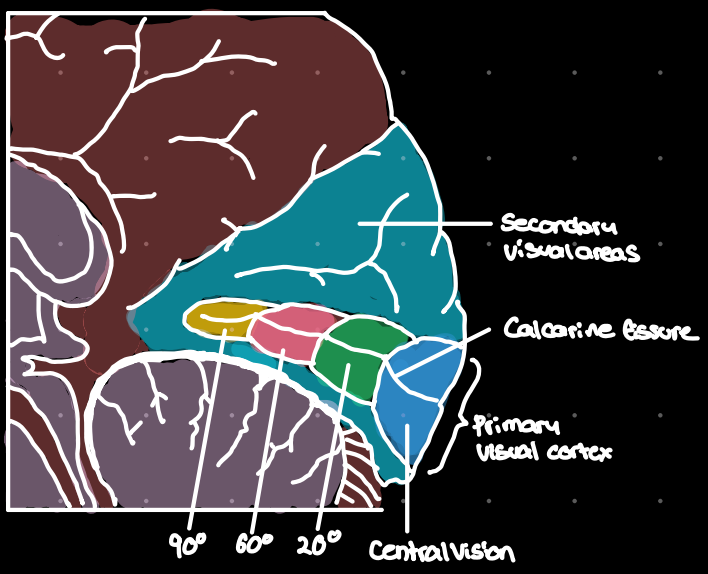
Primary visual cortex:

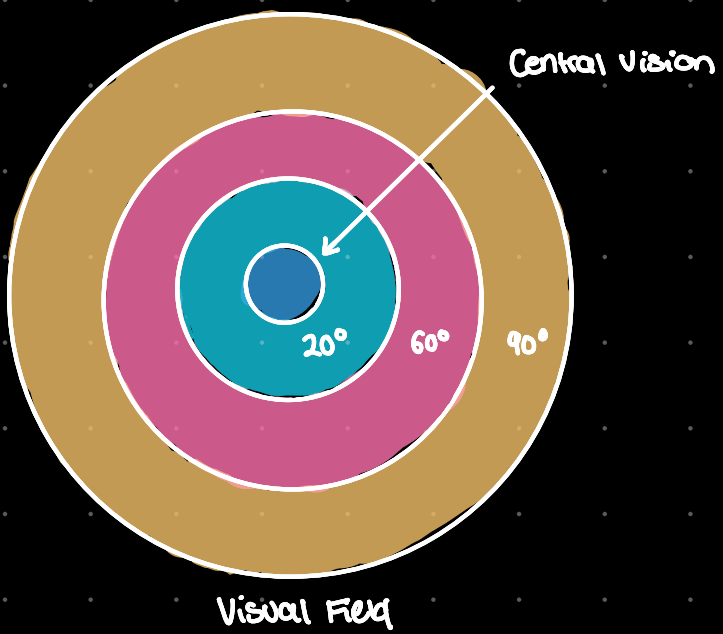
- occupies the medial & lateral parts of the occipital cortex / lobes @ posterior part of brain.
- recieves sensory info from retina.



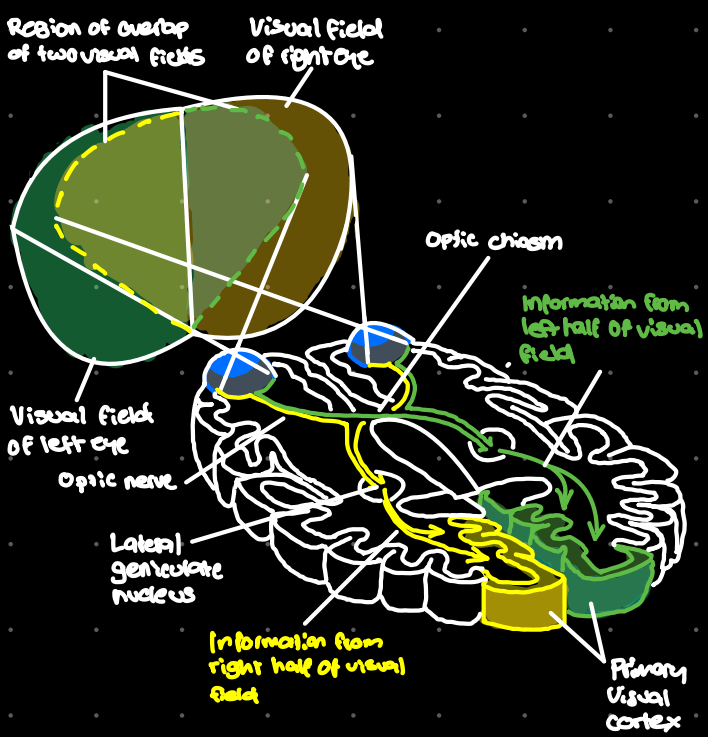
- Different regions of the retina are represented by different areas within the primary visual cortex.
- Areas further out in the peripheral vision are processed by areas of the visual cortex that extend into the calcarine fissure



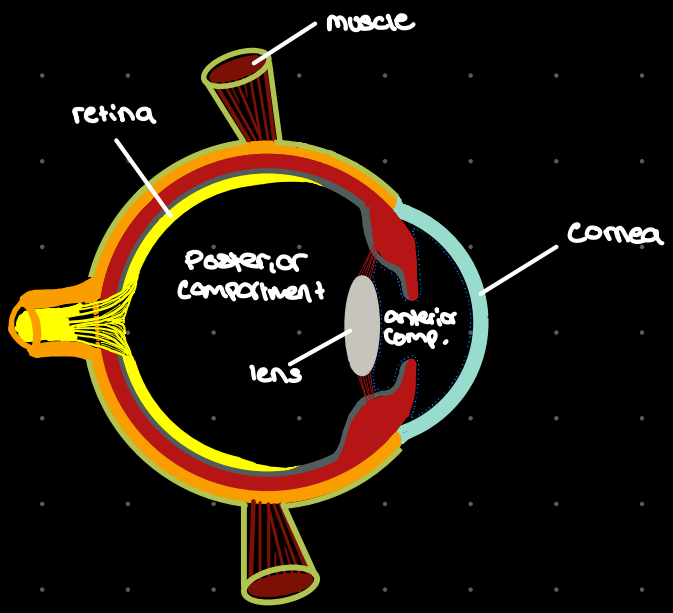


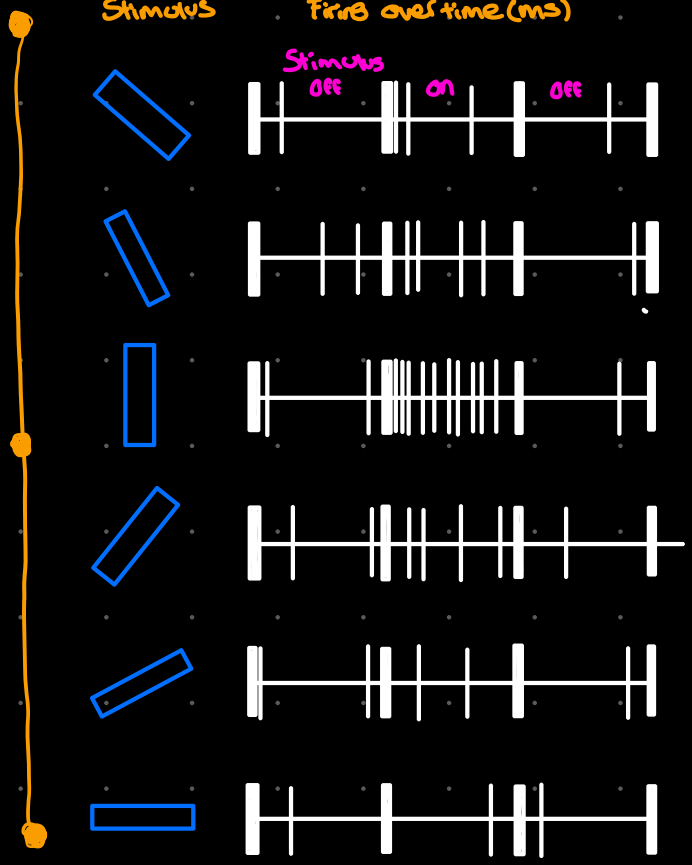


- The left & right visual field are each projected to the contralateral hemisphere.
- light stimuli from external environment from both visual fields stimulate the corresponding area of the retina within each eye
- From the retina, sensory data is transmitted to the LGN through the optic nerve to the primary visual cortex



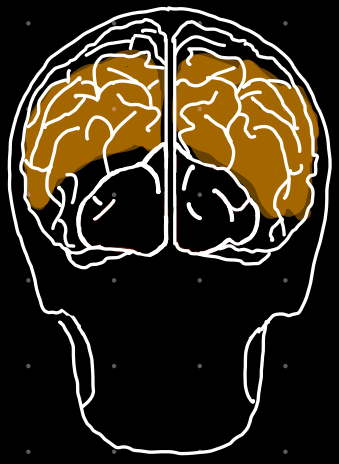
- within the Primary visual cortex, neurons show 'orientation selectivity'
- Hubert & Wiesel won the Nobel Prize in 1981 for this work.





Parietal Lobe / Parietal Cortex

- involved in attention & spacial awareness
- sits on the dorsal surface of the cortex & is referred to as part of the dorsal stream as the 'where' pathway for its role in spacial localisation.



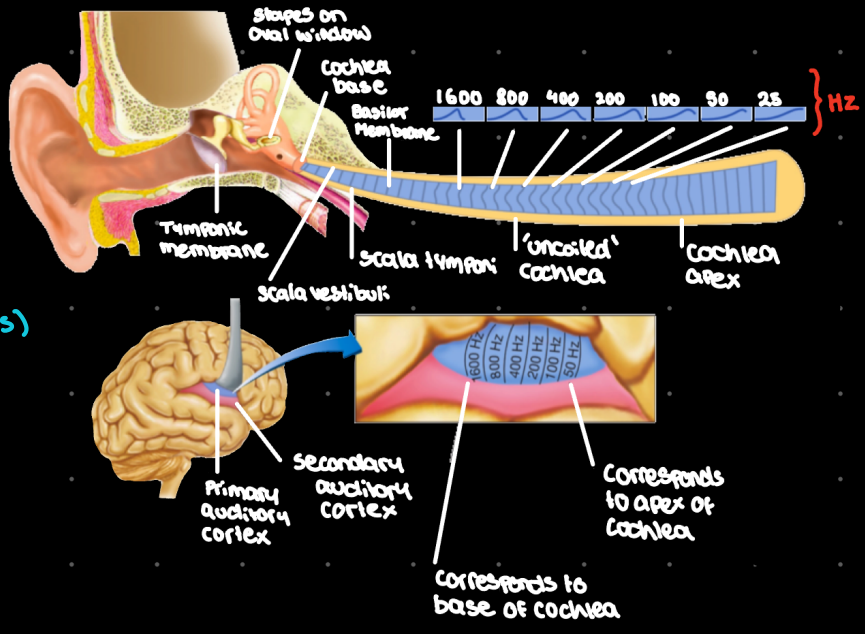
Temporal Lobe / Temporal Cortex:

- important in auditory processing
- also involved in more complex visual processing (faces & complex object recognition)
- sits on ventral surface of the cortex & is part of the ventral stream & the 'what' pathway, named for its role in complex object recognition.

Primary auditory cortex:

- occupies the superior part of the temporal cortex, as well as a portion of cortex that is buried within the sylvian fissure. It recieves auditory sensory info from the cochlea

- Sounds of varying frequencies (low v high tones) are represented by different areas within the primary auditory cortex, forming a tonotopic map

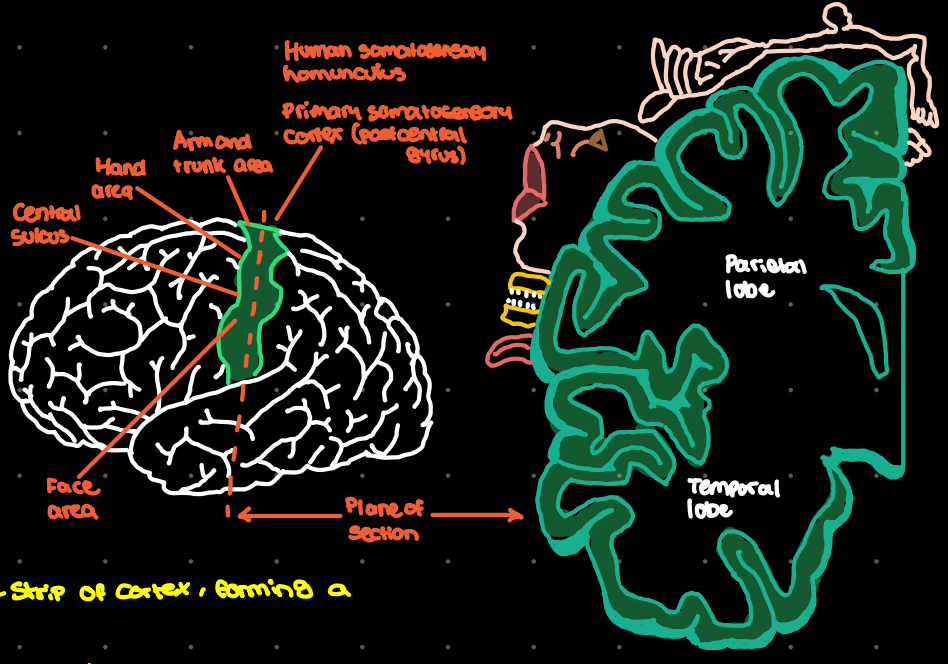


Primary somatosensory cortex:

- located immediately posterior to the central sulcus

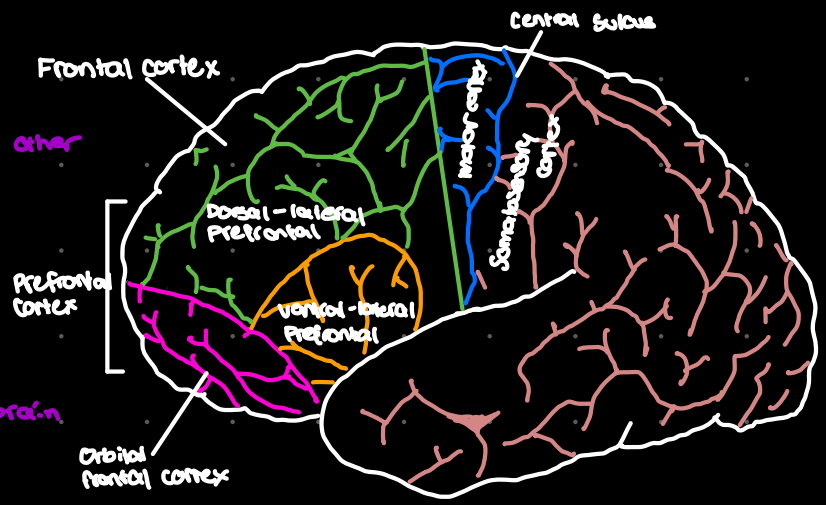
- recieves sensory info from skin (temp, pressure & pain)

- different regions of skin surface represented by different areas along the strip of cortex, forming a 'somatotopic map' (face + hands overrepresented.)



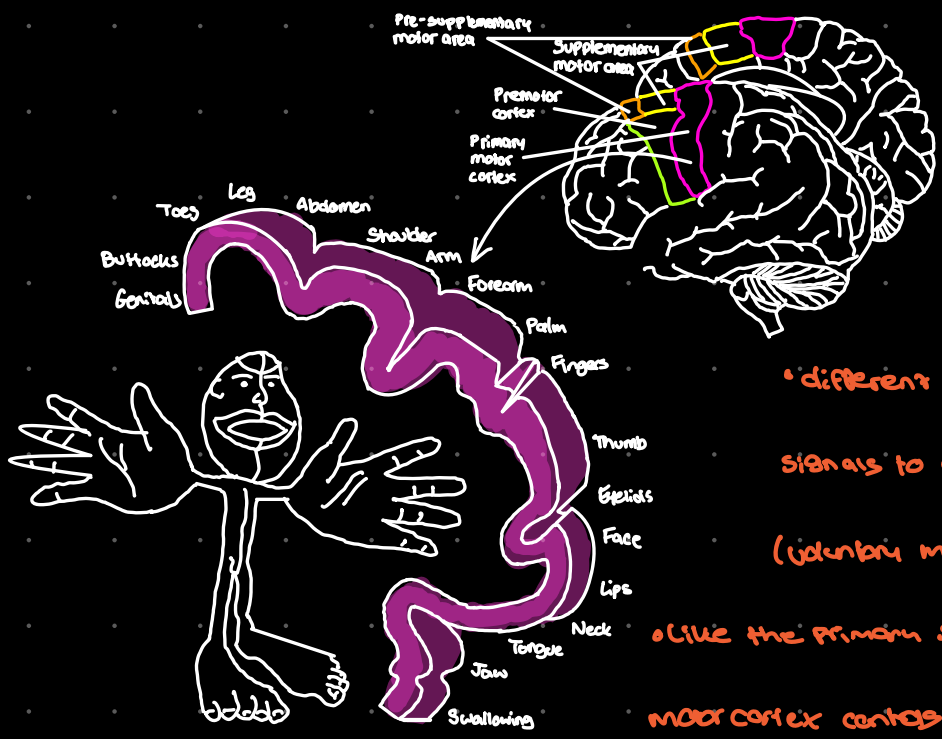
Frontal Lobe:

- The human frontal cortex is different from other animals'
  - relatively larger than non-primates
  - higher level of connectivity w/ rest of the brain (compared to other apes)



- Higher order functions of the frontal lobe:
  - voluntary, controlled behaviours
  - impulse control & emotional regulation.
  - abstract reasoning & Planning
  - social cognition
  - language

Comparative frontal lobe size



Primary motor cortex:

- Located on the precentral gyrus, immediately anterior to central sulcus
- different parts of primary motor cortex send signals to control different parts of the body (voluntary muscles)
- Like the primary sensory cortices, the primary motor cortex controls muscles on the contralateral side of body.