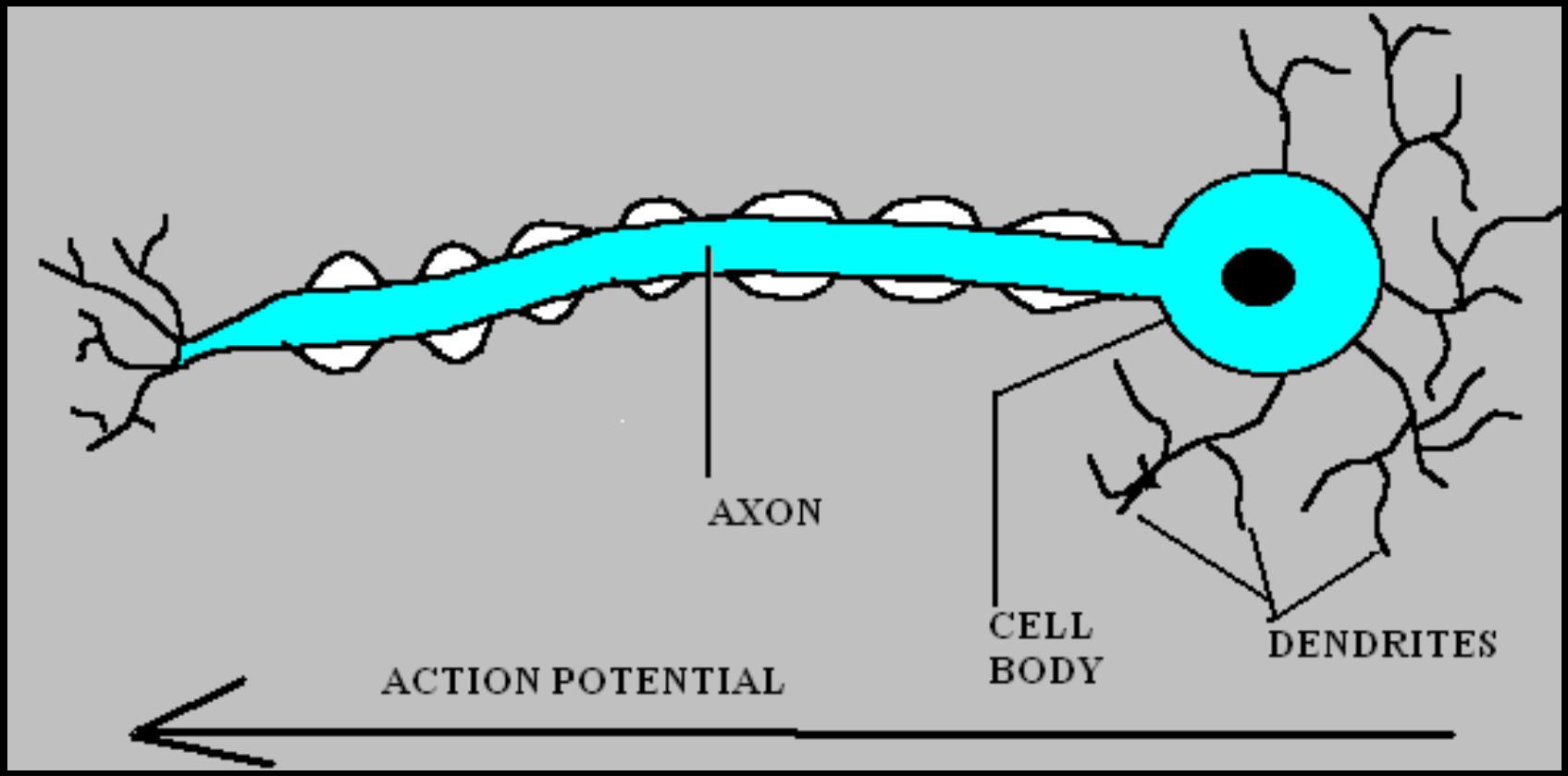
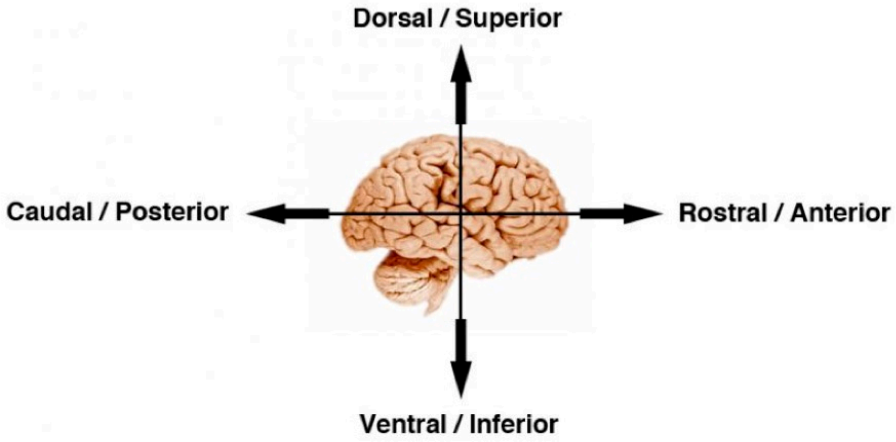
ELL788

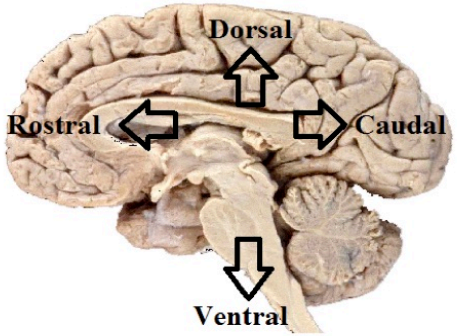
Lecture6, Date: 17th Aug2016

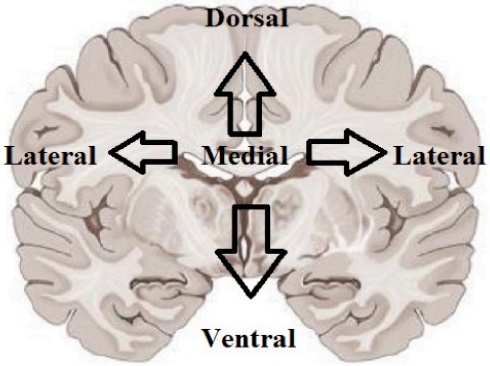
Recap…….

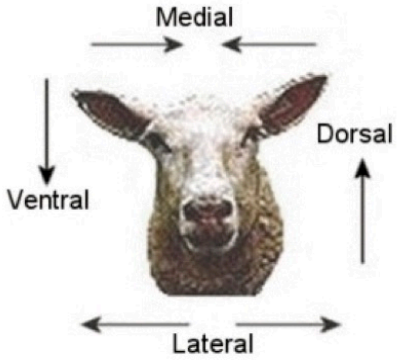
The Nerve Impulse.

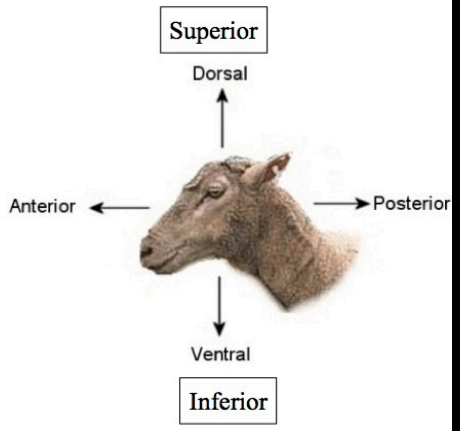












Directional terms

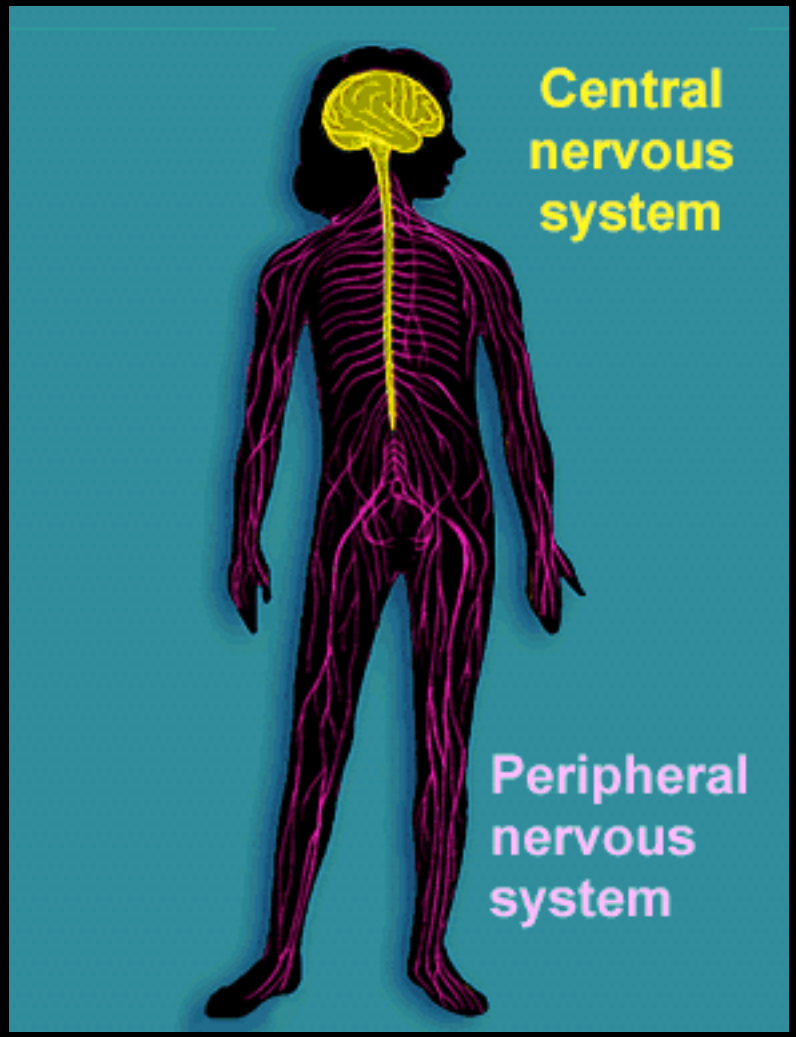
TABLE 3.1 Anatomical Terms Referring to Directions

Term	Definition
Dorsal	Toward the back, away from the ventral (stomach) side. The top of the brain is considered dorsal because it has that position in four-legged animals.
Ventral	Toward the stomach, away from the dorsal (back) side
Anterior	Toward the front end
Posterior	Toward the rear end
Superior	Above another part
Inferior	Below another part
Lateral	Toward the side, away from the midline
Medial	Toward the midline, away from the side
Proximal	Located close (approximate) to the point of origin or attachment
Distal	Located more distant from the point of origin or attachment
Ipsilateral	On the same side of the body (e.g., two parts on the left or two on the right)
Contralateral	On the opposite side of the body (one on the left and one on the right)
Coronal plane (or frontal plane)	A plane that shows brain structures as seen from the front
Sagittal plane	A plane that shows brain structures as seen from the side
Horizontal plane (or transverse plane)	A plane that shows brain structures as seen from above

TABLE 3.2 Terms Referring to Parts of the Nervous System

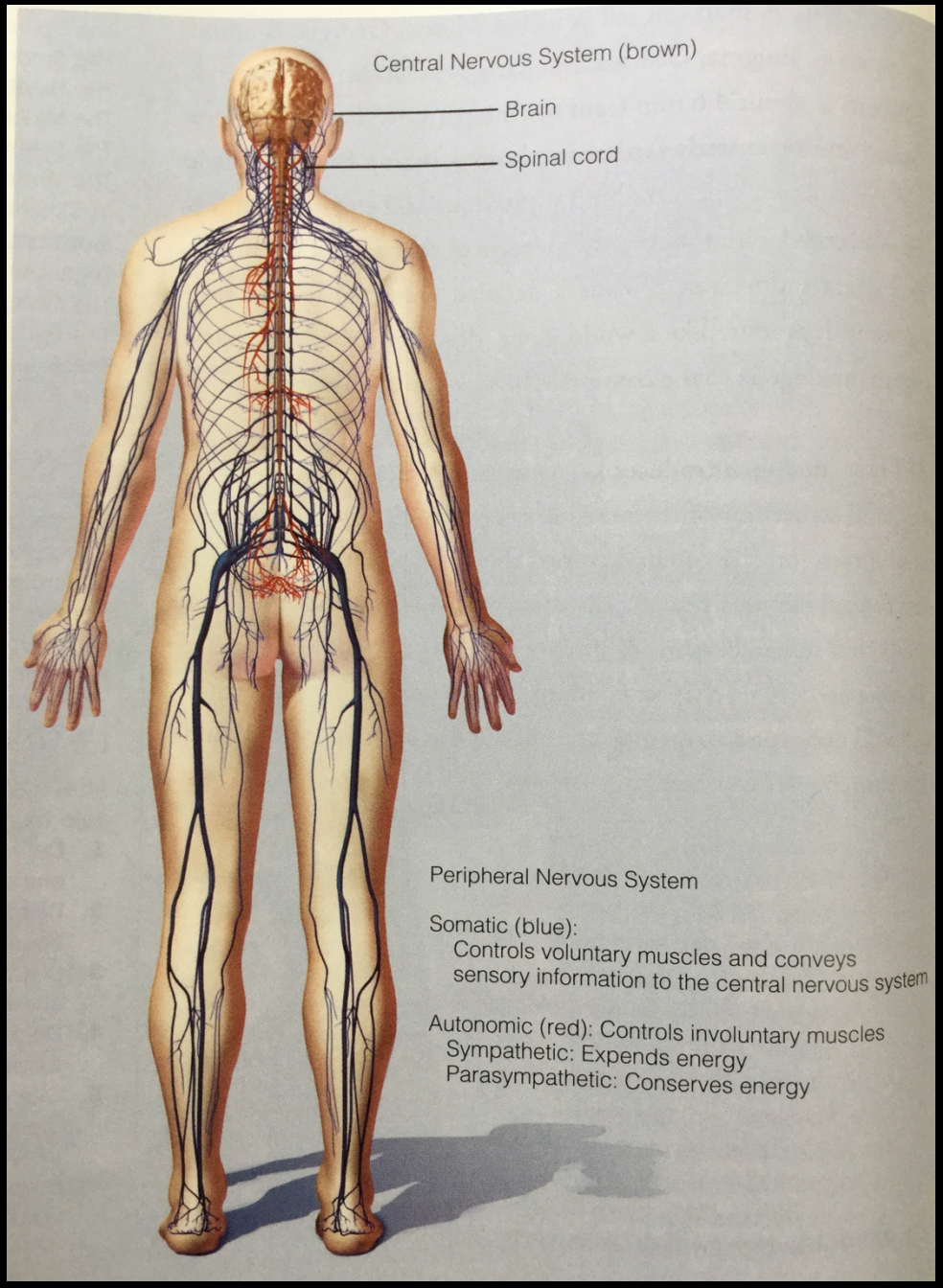
Term	Definition
Lamina	A row or layer of cell bodies separated from other cell bodies by a layer of axons and dendrites
Column	A set of cells perpendicular to the surface of the cortex, with similar properties
Tract	A set of axons within the CNS, also known as a *projection*. If axons extend from cell bodies in structure A to synapses onto B, we say that the fibers "project" from A onto B.
Nerve	A set of axons in the periphery, either from the CNS to a muscle or gland or from a sensory organ to the CNS
Nucleus	A cluster of neuron cell bodies within the CNS
Ganglion	A cluster of neuron cell bodies, usually outside the CNS (as in the sympathetic nervous system)
Gyrus (pl.: gyri)	A protuberance on the surface of the brain
Sulcus (pl.: sulci)	A fold or groove that separates one gyrus from another
Fissure	A long, deep sulcus

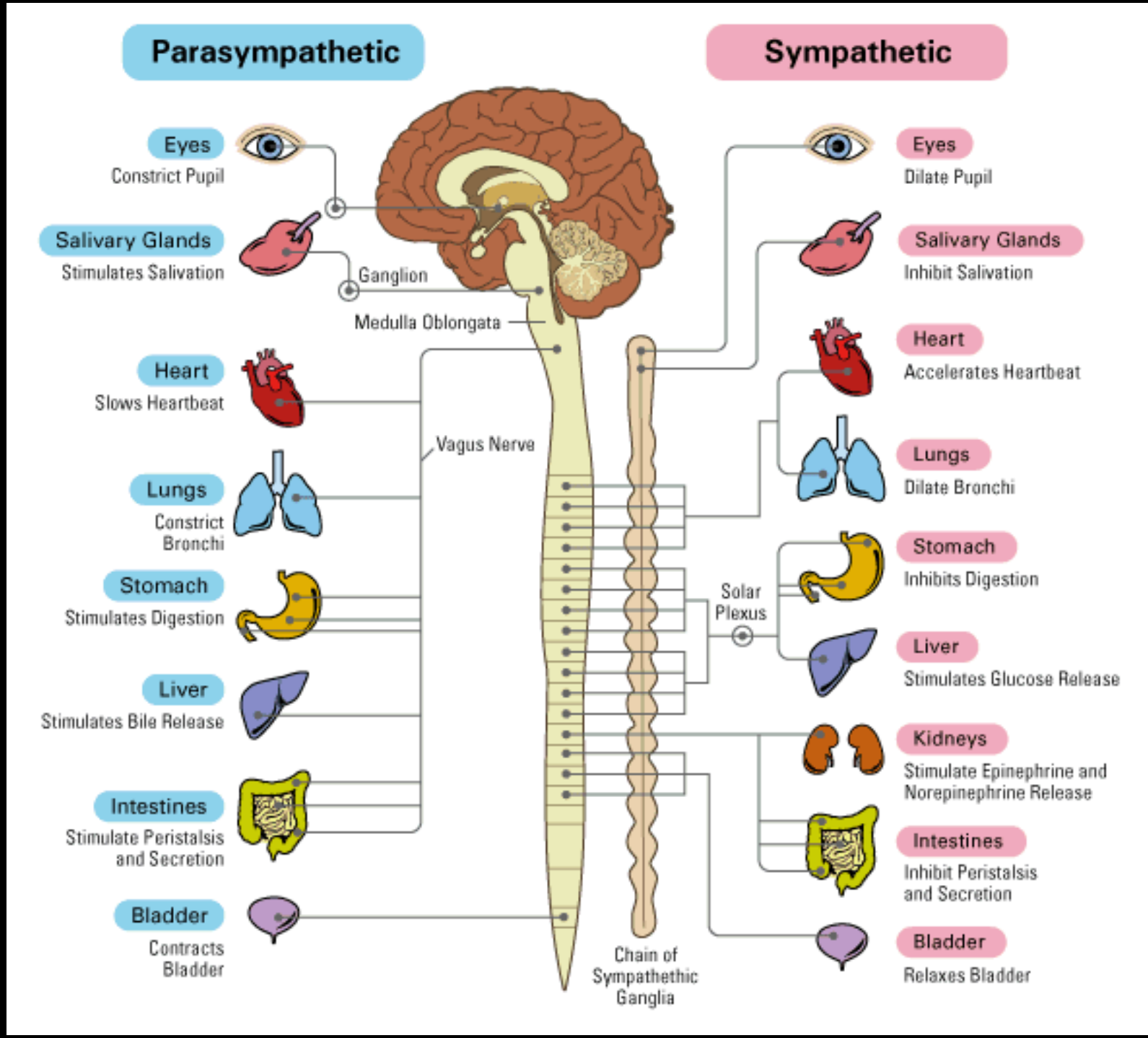
Organization of the Nervous System



"gross anatomical convenience"-Swanson

- CNS (neural plate)
  - Brain
  - Spinal cord
- PNS (neural crest)
  - Somatic
  - Autonomic
    - Sympathetic
    - Parasympathetic
    - Enteric
      - Gut motility and secretion


Central Nervous System (brown)
Brain
Spinal cord
Peripheral Nervous System
Somatic (blue):
Controls voluntary muscles and conveys sensory information to the central nervous system
Autonomic (red): Controls involuntary muscles
Sympathetic: Expends energy
Parasympathetic: Conserves energy


Parasympathetic
Sympathetic
Eyes
Constrict Pupil
Salivary Glands
Stimulates Salivation
Ganglion
Medulla Oblongata
Heart
Slows Heartbeat
Vagus Nerve
Lungs
Constrict Bronchi
Stomach
Stimulates Digestion
Liver
Stimulates Bile Release
Intestines
Stimulate Peristalsis and Secretion
Bladder
Contracts Bladder
Eyes
Dilate Pupil
Salivary Glands
Inhibit Salivation
Heart
Accelerates Heartbeat
Lungs
Dilate Bronchi
Stomach
Inhibits Digestion
Solar Plexus
Liver
Stimulates Glucose Release
Kidneys
Stimulate Epinephrine and Norepinephrine Release
Intestines
Inhibit Peristalsis and Secretion
Bladder
Relaxes Bladder
Chain of Sympathethic Ganglia

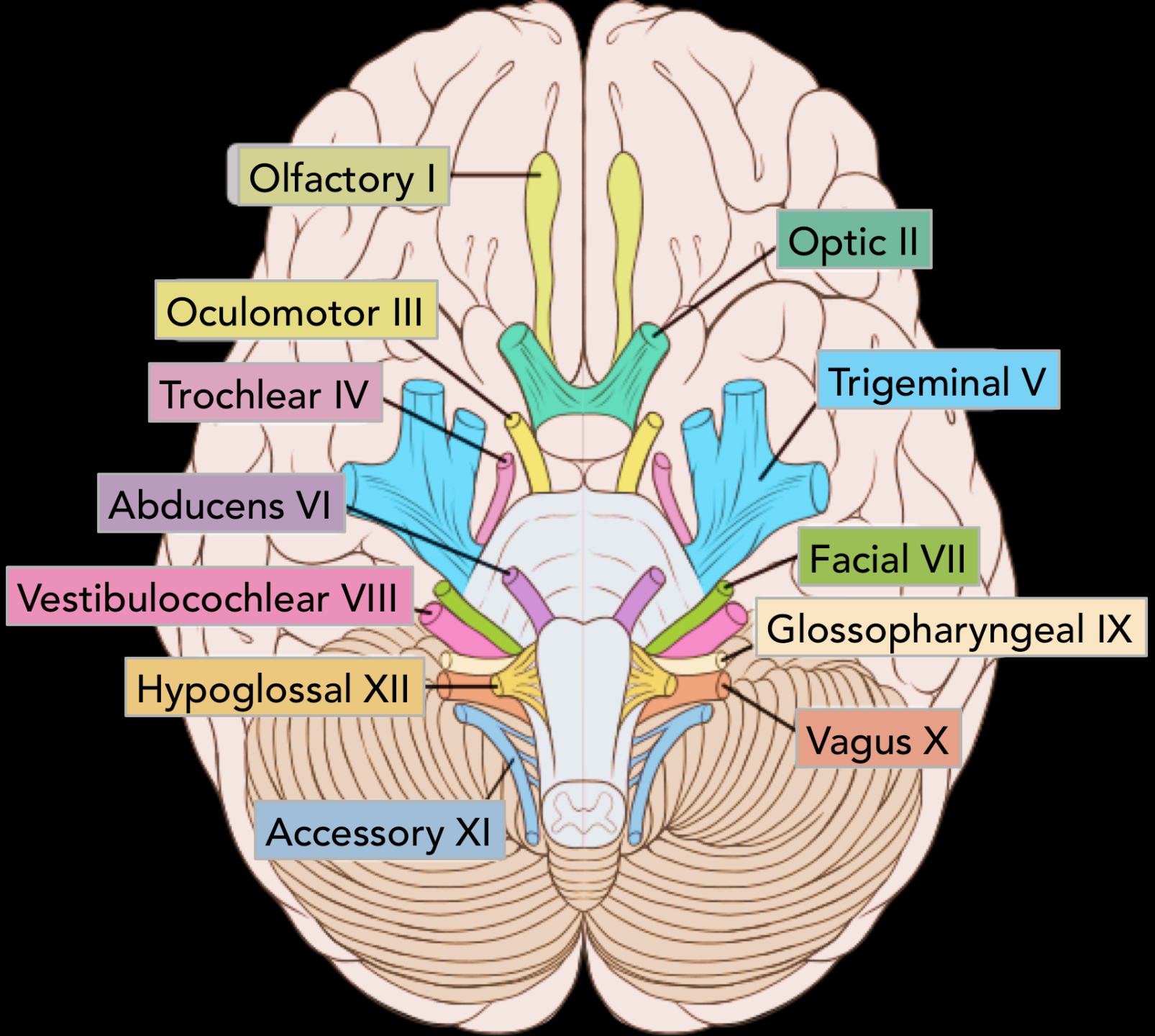

Olfactory I
Optic II
Oculomotor III
Trochlear IV
Trigeminal V
Abducens VI
Facial VII
Vestibulocochlear VIII
Glossopharyngeal IX
Hypoglossal XII
Vagus X
Accessory XI

TABLE 3.4 The Cranial Nerves

Number and Name	Major Functions
I. Olfactory	Smell
II. Optic	Vision
III. Oculomotor	Control of eye movements; pupil constriction
IV. Trochlear	Control of eye movements
V. Trigeminal	Skin sensations from most of the face; control of jaw muscles for chewing and swallowing
VI. Abducens	Control of eye movements
VII. Facial	Taste from the anterior two thirds of the tongue; control of facial expressions, crying, salivation, and dilation of the head's blood vessels
VIII. Statoacoustic	Hearing; equilibrium
IX. Glossopharyngeal	Taste and other sensations from throat and posterior third of the tongue; control of swallowing, salivation, throat movements during speech
X. Vagus	Sensations from neck and thorax; control of throat, esophagus, and larynx; parasympathetic nerves to stomach, intestines, and other organs
XI. Accessory	Control of neck and shoulder movements
XII. Hypoglossal	Control of muscles of the tongue

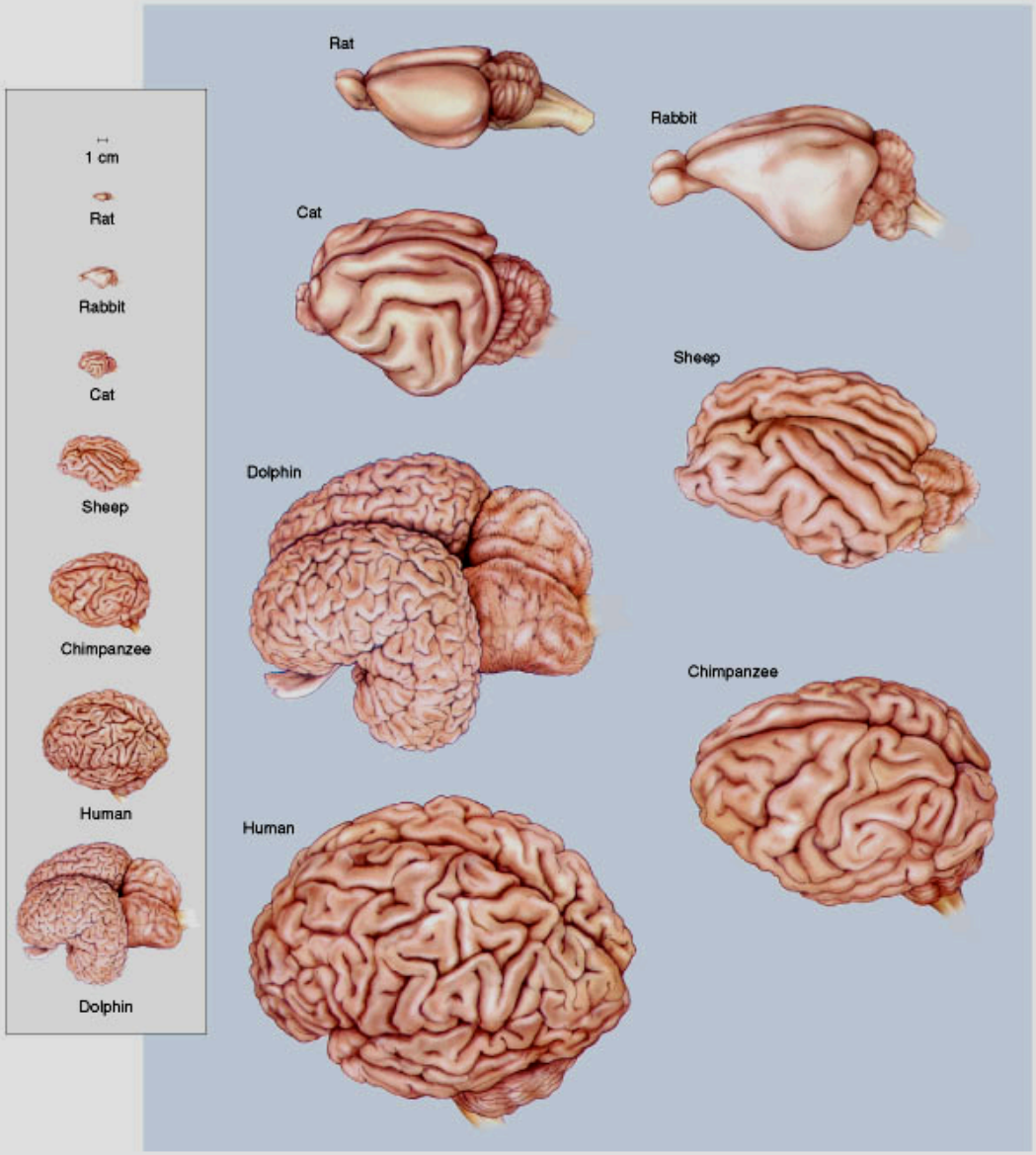
Cranial nerves III, IV, and VI are coded in red to highlight their similarity: control of eye movements. Cranial nerves VII, IX, and XII are coded in green to highlight their similarity: taste and control of tongue and throat movements. Cranial nerve VII has other important functions as well. Nerve X (not highlighted) also contributes to throat movements, although it is primarily known for other functions.

No.	Name	Sensory, motor, or both	Origin/Target	Exit Foramen	Function
0	Terminal	Purely sensory	Lamina terminalis	Located in the cribriform plate of the ethmoid bone.	Animal research indicates that the terminal nerve is involved in the detection of pheromones.[1]
I	Olfactory	Purely sensory	Telencephalon	Located in the olfactory foramina in the cribriform plate of the ethmoid bone.	Transmits the sense of smell from the nasal cavity.[2]
II	Optic	Sensory	Retinal ganglion cells	Located in the optic canal.	Transmits visual signals from the retina of the eye to the brain.[3]
III	Oculomotor	Mainly motor	Anterior aspect of Midbrain	Located in the superior orbital fissure.	Innervates the levator palpebrae superioris, superior rectus, medial rectus, inferior rectus, and inferior oblique, which collectively perform most eye movements. Also innervates the sphincter pupillae and the muscles of the ciliary body.
IV	Trochlear	Motor	Dorsal aspect of Midbrain	Located in the superior orbital fissure.	Innervates the superior oblique muscle, which depresses, rotates laterally, and intorts the eyeball.

V	Trigeminal	Both sensory and motor	Pons	Three Parts: V_1 (ophthalmic nerve) is located in the superior orbital fissure V_2 (maxillary nerve) is located in the foramen rotundum V_3 (mandibular nerve) is located in the foramen ovale.	Receives sensation from the face and innervates the muscles of mastication.
VI	Abducens	Mainly motor	Nuclei lying under the floor of the fourth ventricle Pons	Located in the superior orbital fissure.	Innervates the lateral rectus, which abducts the eye.
VII	Facial	Both sensory and motor	Pons (cerebellopontine angle) above olive	Located in and runs through the internal acoustic canal to the facial canal and exits at the stylomastoid foramen.	Provides motor innervation to the muscles of facial expression, posterior belly of the digastric muscle, stylohyoid muscle, and stapedius muscle. Also receives the special sense of taste from the anterior 2/3 of the tongue and provides secretomotorinnervation to the salivary glands (except parotid) and the lacrimal gland.

VIII	Vestibulocochlear (also *auditory*,[4] *acoustic*,[4] or *auditory-vestibular*)	Mostly sensory	Lateral to CN VII (cerebellopontine angle)	Located in the internal acoustic canal.	Mediates sensation of sound, rotation, and gravity (essential for balance and movement). More specifically, the vestibular branch carries impulses for equilibrium and the cochlear branch carries impulses for hearing.
IX	Glossopharyngeal	Both sensory and motor	Medulla	Located in the jugular foramen.	Receives taste from the posterior 1/3 of the tongue, provides secretomotor innervation to the parotid gland, and provides motor innervation to the stylopharyngeus. Some sensation is also relayed to the brain from the palatine tonsils. This nerve is involved together with the vagus nerve in the gag reflex.
X	Vagus	Both sensory and motor	Posterolateral sulcus of Medulla	Located in the jugular foramen.	Supplies branchiomotorinnervation to most laryngeal and pharyngeal muscles (except the stylopharyngeus, which is innervated by the glossopharyngeal). Also provides parasympathetic fibers to nearly all thoracic and abdominal viscera down to the splenic flexure. Receives the special sense of taste from the epiglottis. A major function: controls muscles for voice and resonance and the soft palate. Symptoms of damage:dysphagia (swallowing problems), velopharyngeal insufficiency. This nerve is involved (together with nerve IX) in the pharyngeal reflex or *gag reflex*.
XI	Accessory Sometimes: *cranial accessory* *spinal accessory*	Mainly motor	Cranial and Spinal Roots	Located in the jugular foramen.	Controls the sternocleidomastoid and trapezius muscles, and overlaps with functions of the vagus nerve (CN X). Symptoms of damage: inability to shrug, weak head movement.
XII	Hypoglossal	Mainly motor	Medulla	Located in the hypoglossal canal.	Provides motor innervation to the muscles of the tongue (except for the palatoglossal muscle, which is innervated by the vagus nerve) and other glossal muscles. Important for swallowing (bolus formation) and speech articulation.

Figure 7.1
Mammalian brains. Despite differences in complexity, the brains of all of these species have many features in common. The brains have been drawn to appear approximately the same size; their relative sizes are shown in the inset on the left.



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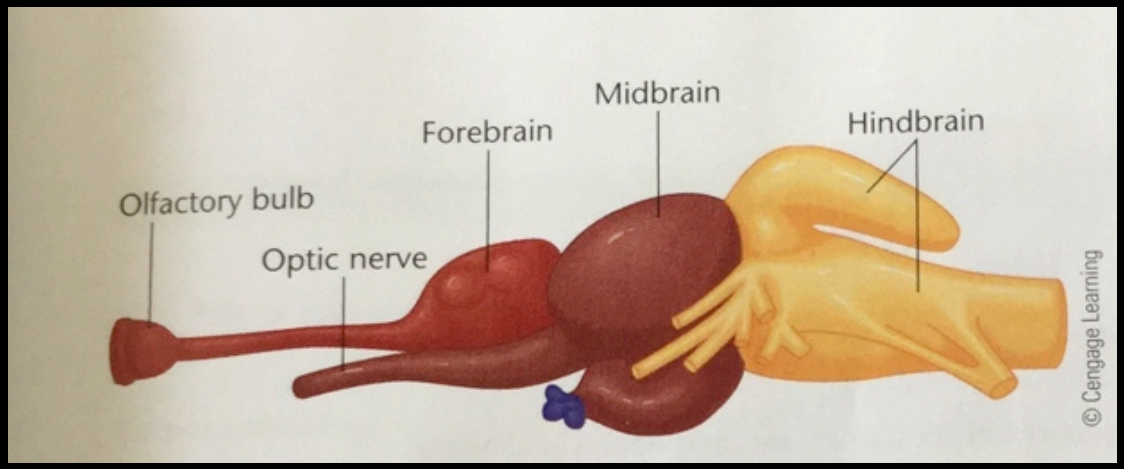


TABLE 3.3 Major Divisions of the Vertebrate Brain

Area	Also Known as	Major Structures
Forebrain	Prosencephalon ("forward-brain")	
	Diencephalon ("between-brain")	Thalamus, hypothalamus
	Telencephalon ("end-brain")	Cerebral cortex, hippocampus, basal ganglia
Midbrain	Mesencephalon ("middle-brain")	Tectum, tegmentum, superior colliculus, inferior colliculus, substantia nigra
Hindbrain	Rhombencephalon (literally, "parallelogram-brain")	Medulla, pons, cerebellum

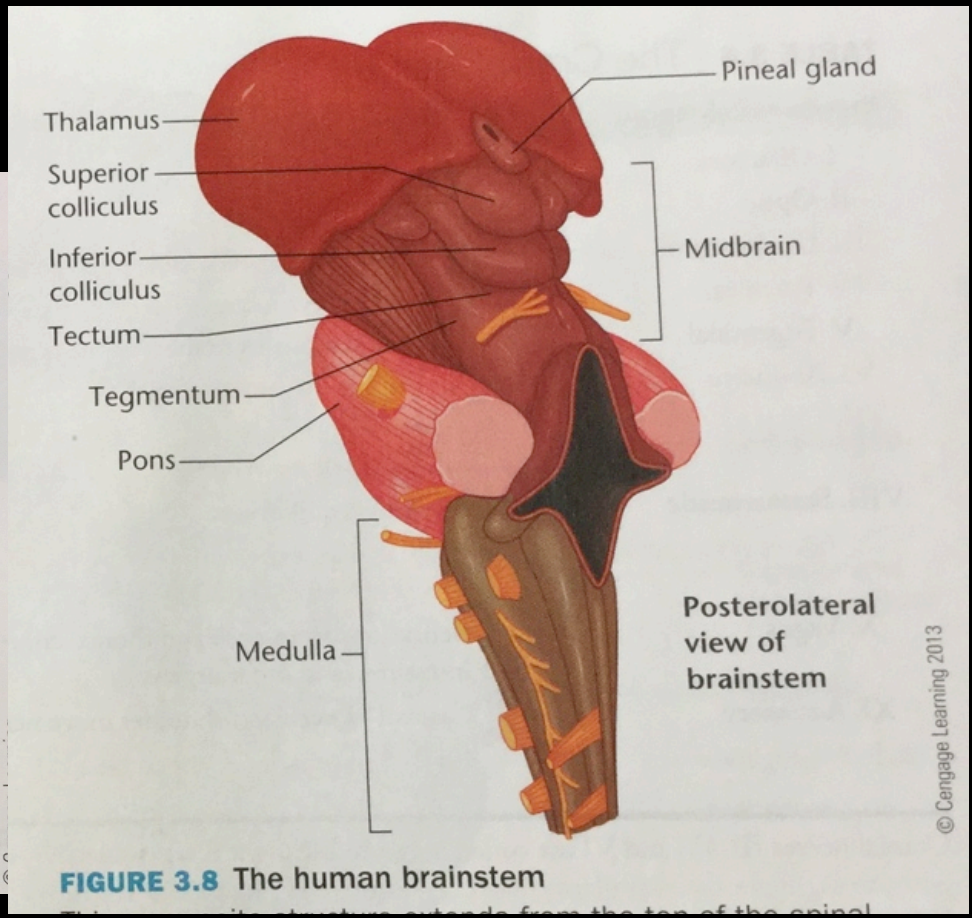
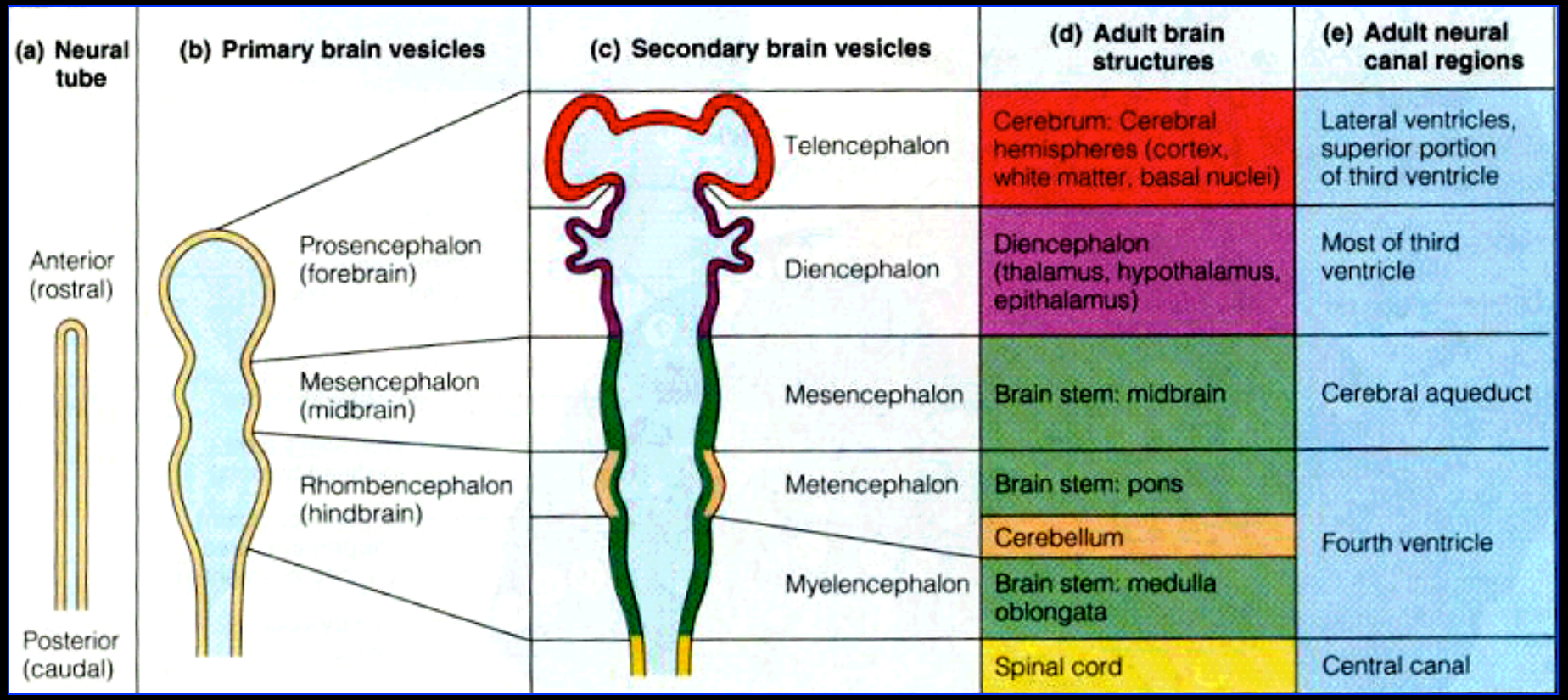
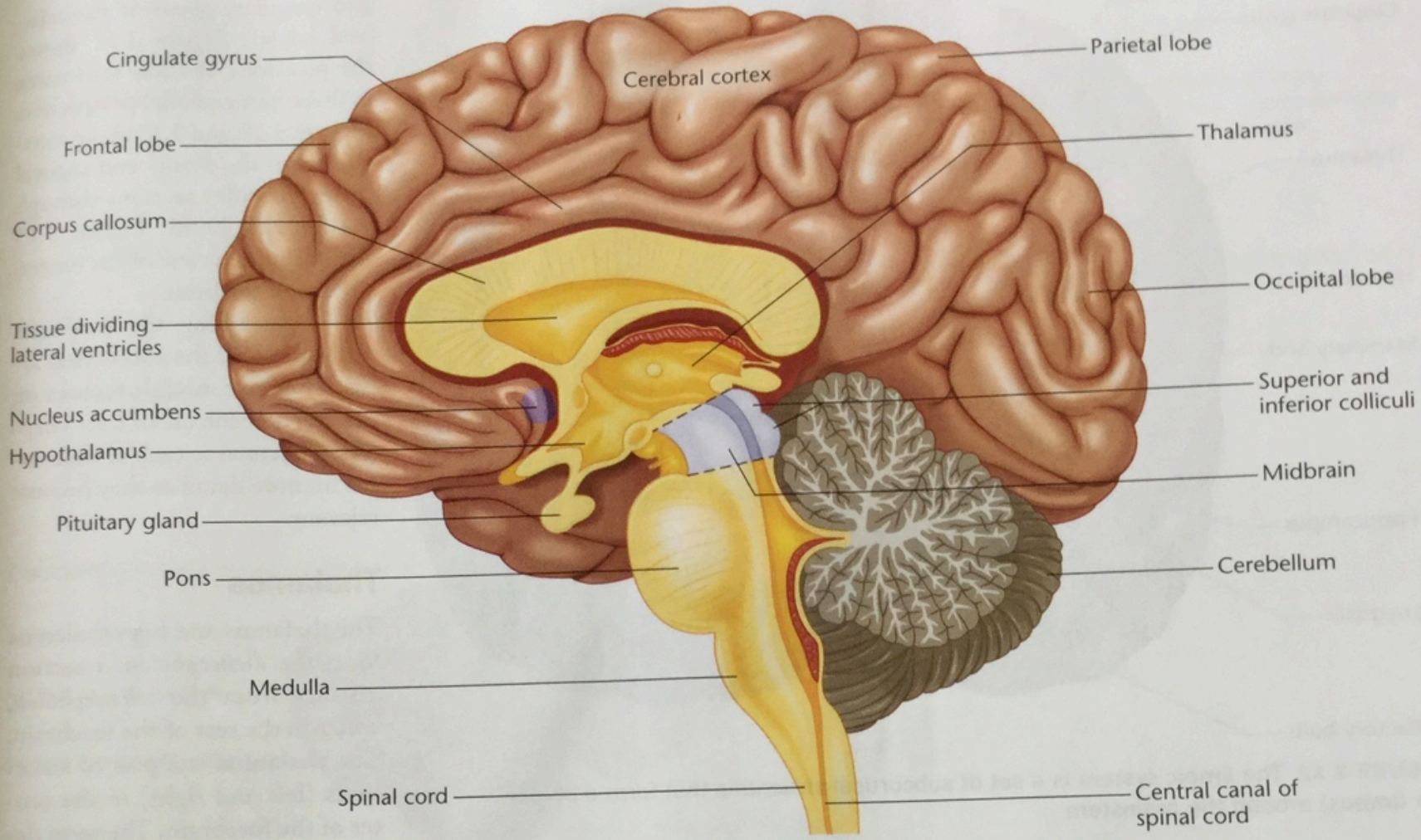


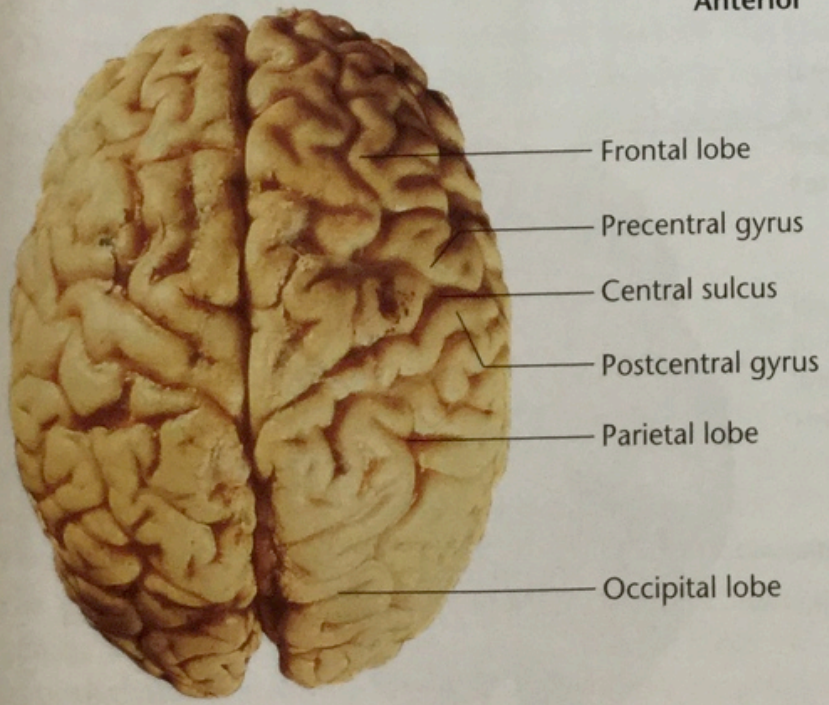
FIGURE 3.8 The human brainstem

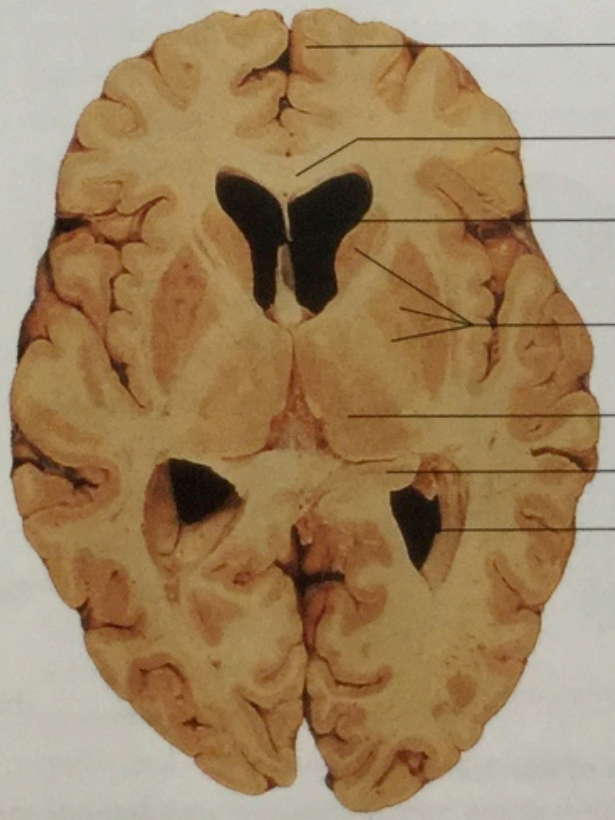
Divisions of the Brain



Embryonic vesicles form the fundamental regional brain divisions in the adult


Cingulate gyrus
Cerebral cortex
Parietal lobe
Frontal lobe
Thalamus
Corpus callosum
Occipital lobe
Tissue dividing lateral ventricles
Superior and inferior colliculi
Nucleus accumbens
Hypothalamus
Midbrain
Pituitary gland
Cerebellum
Pons
Medulla
Spinal cord
Central canal of spinal cord





Photos courtesy of Dr. Dana Copeland

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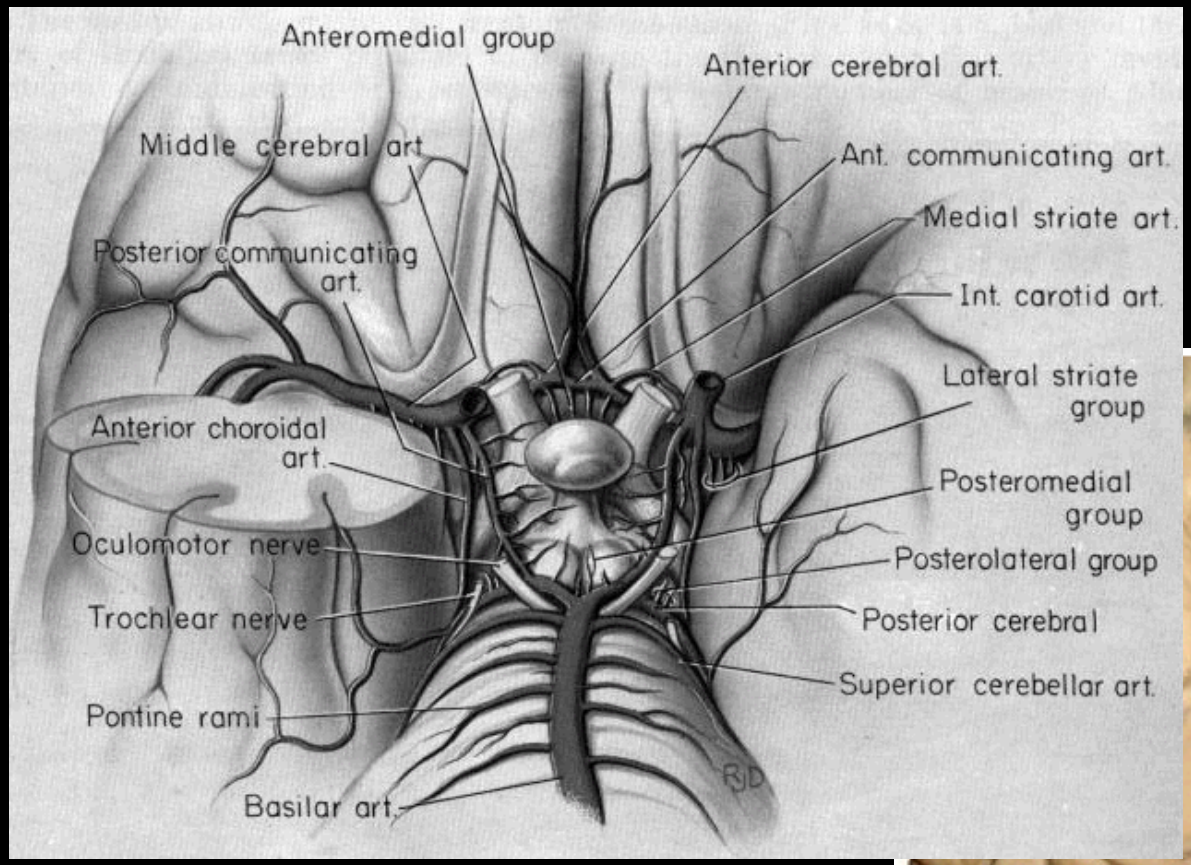
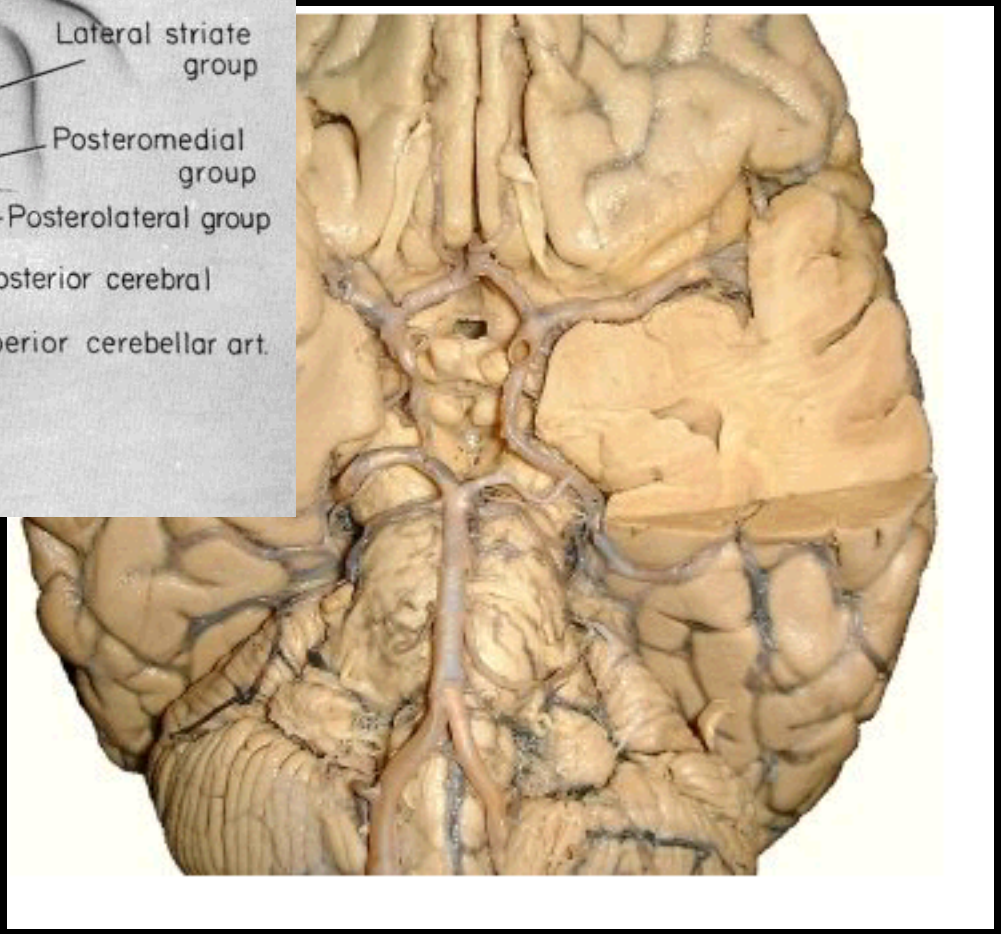
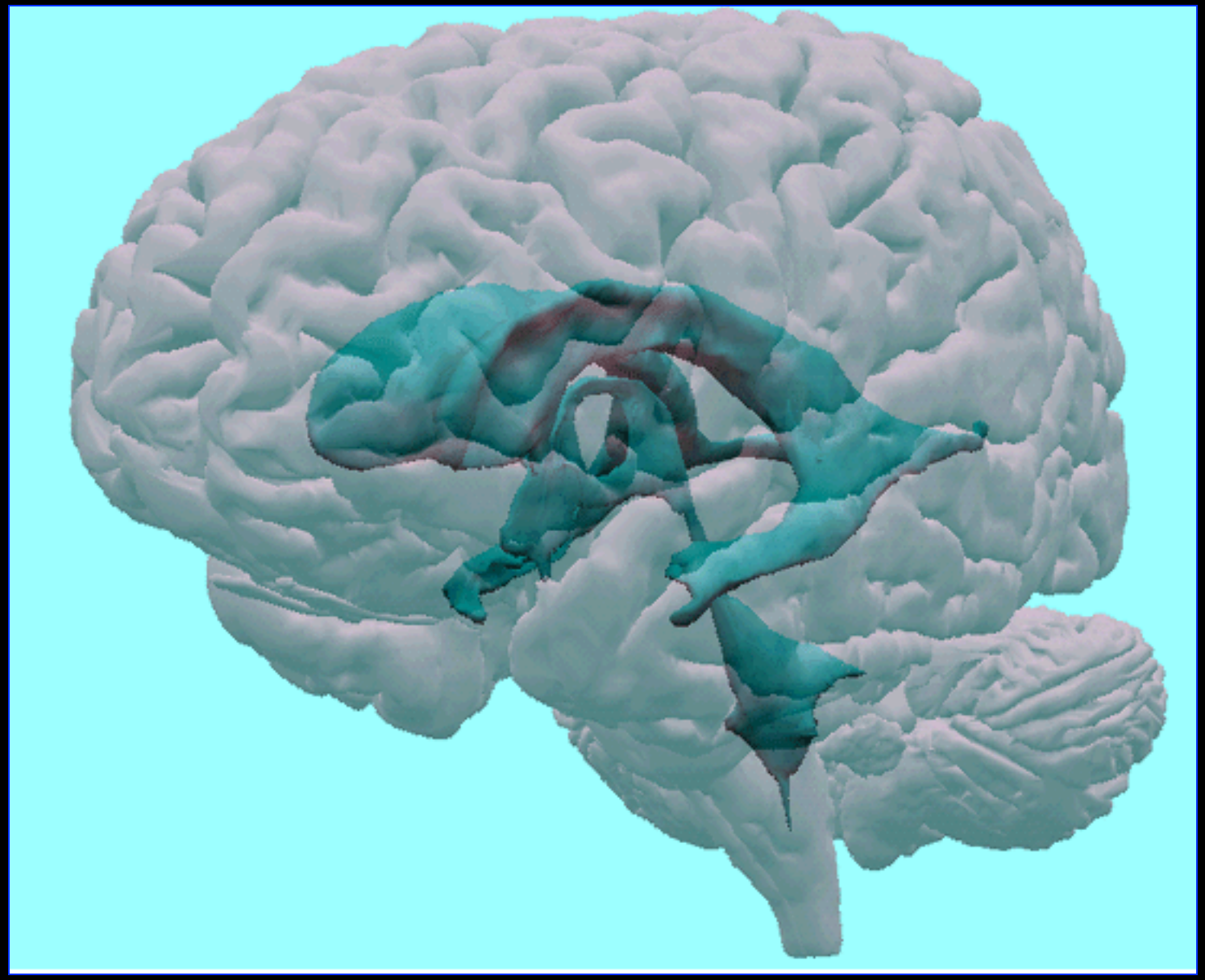
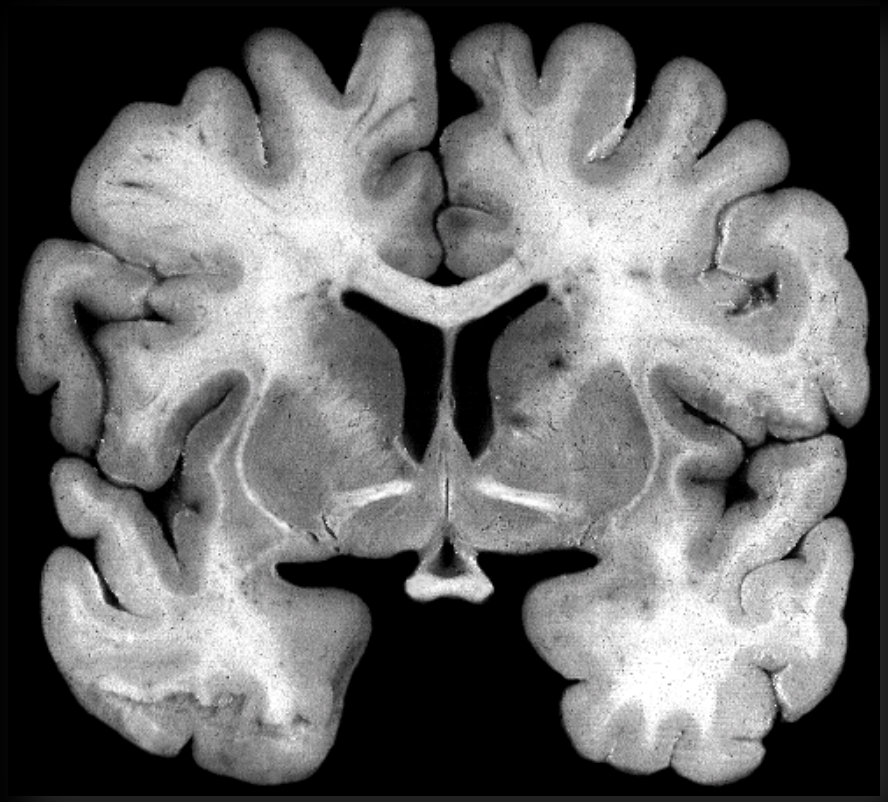
Cerebral Blood Supply

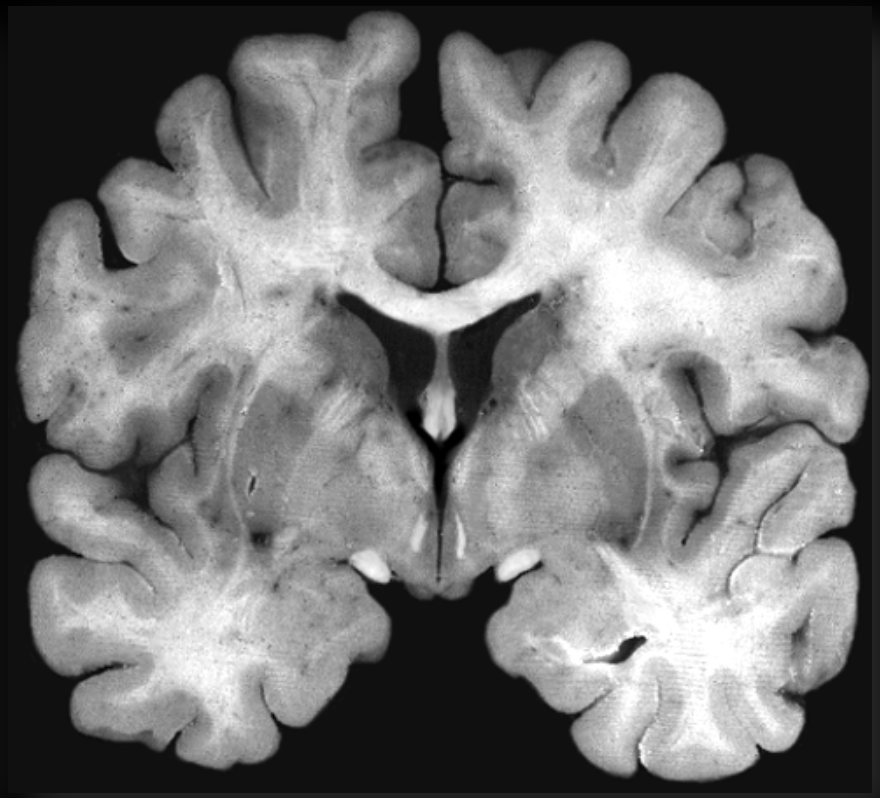




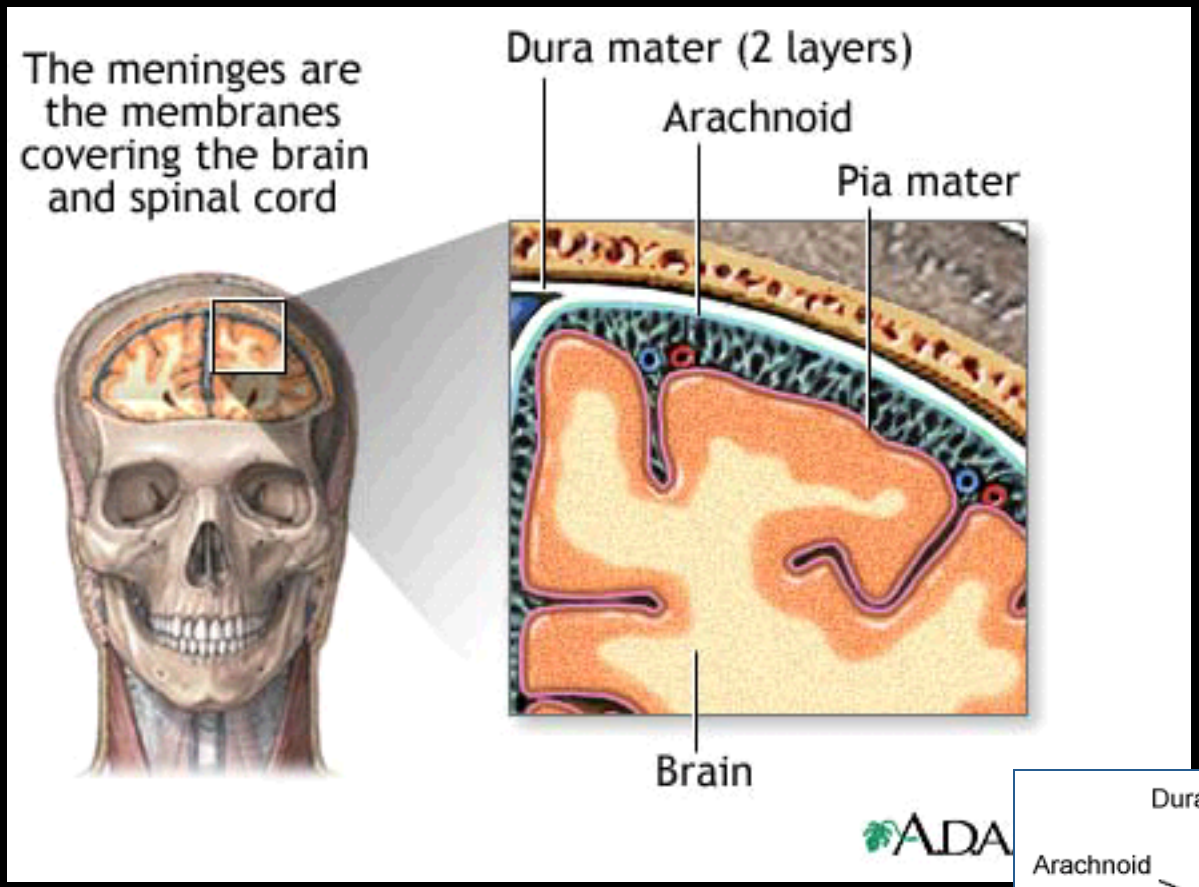
The Ventricles



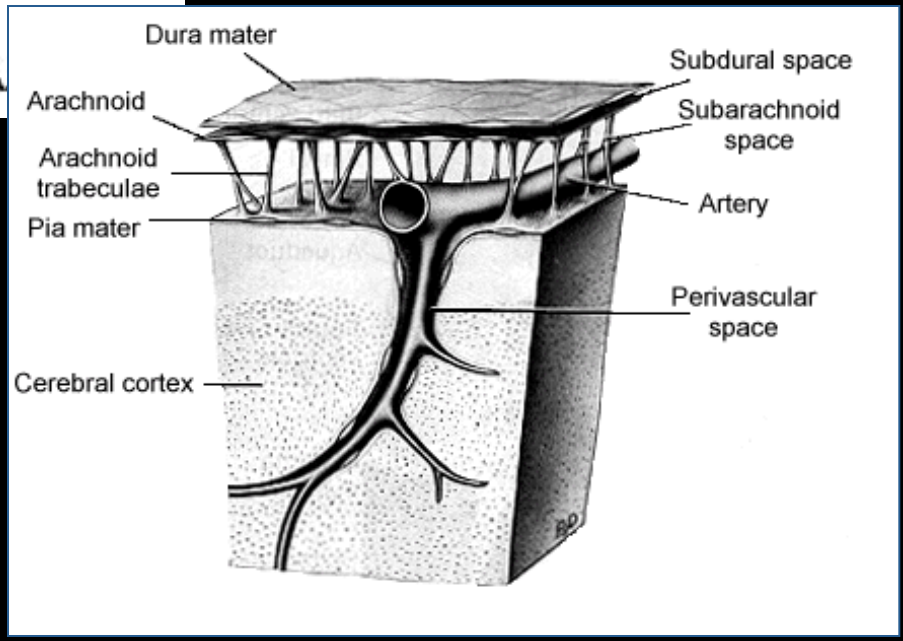




Meninges



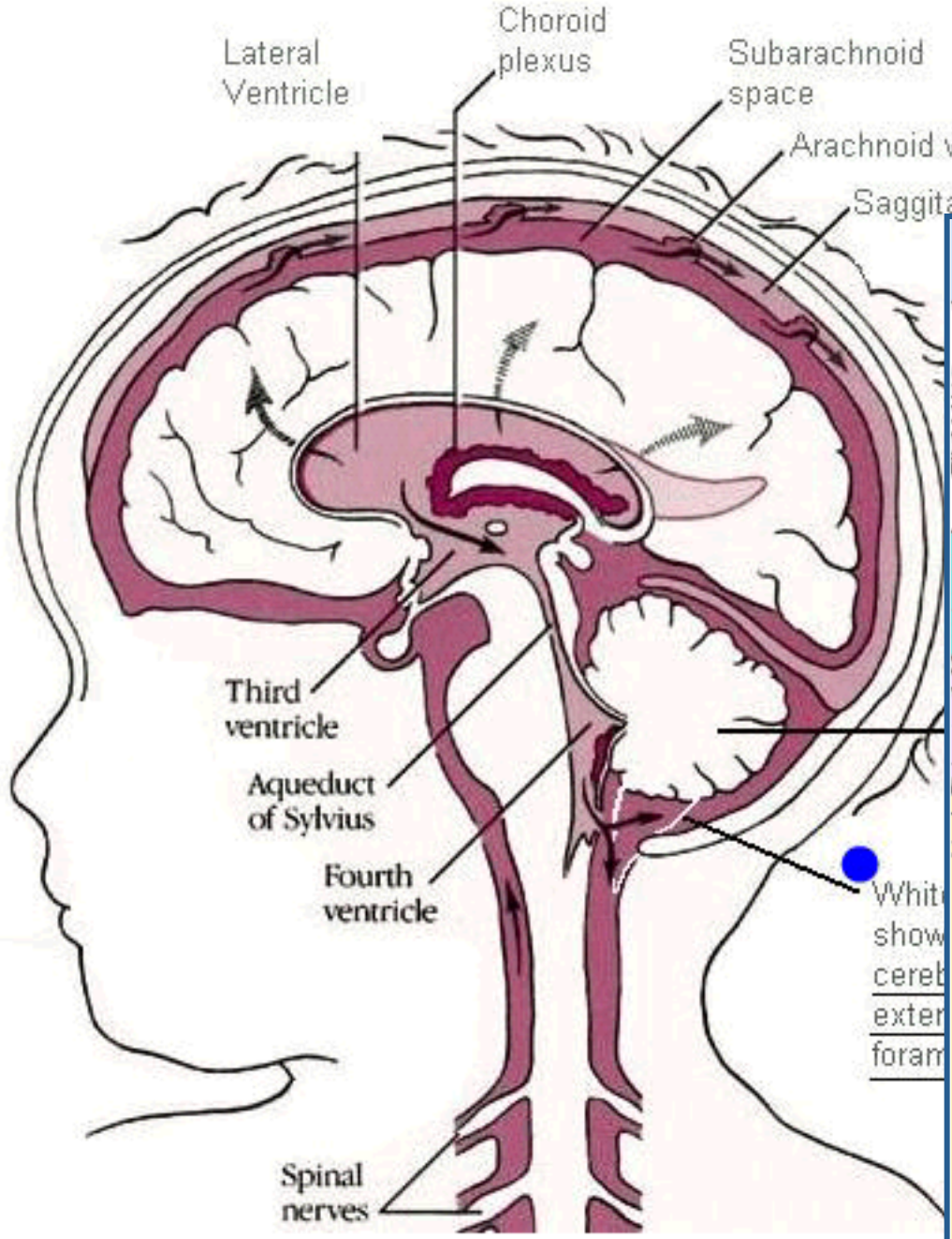
Pachymeninges=dura mater

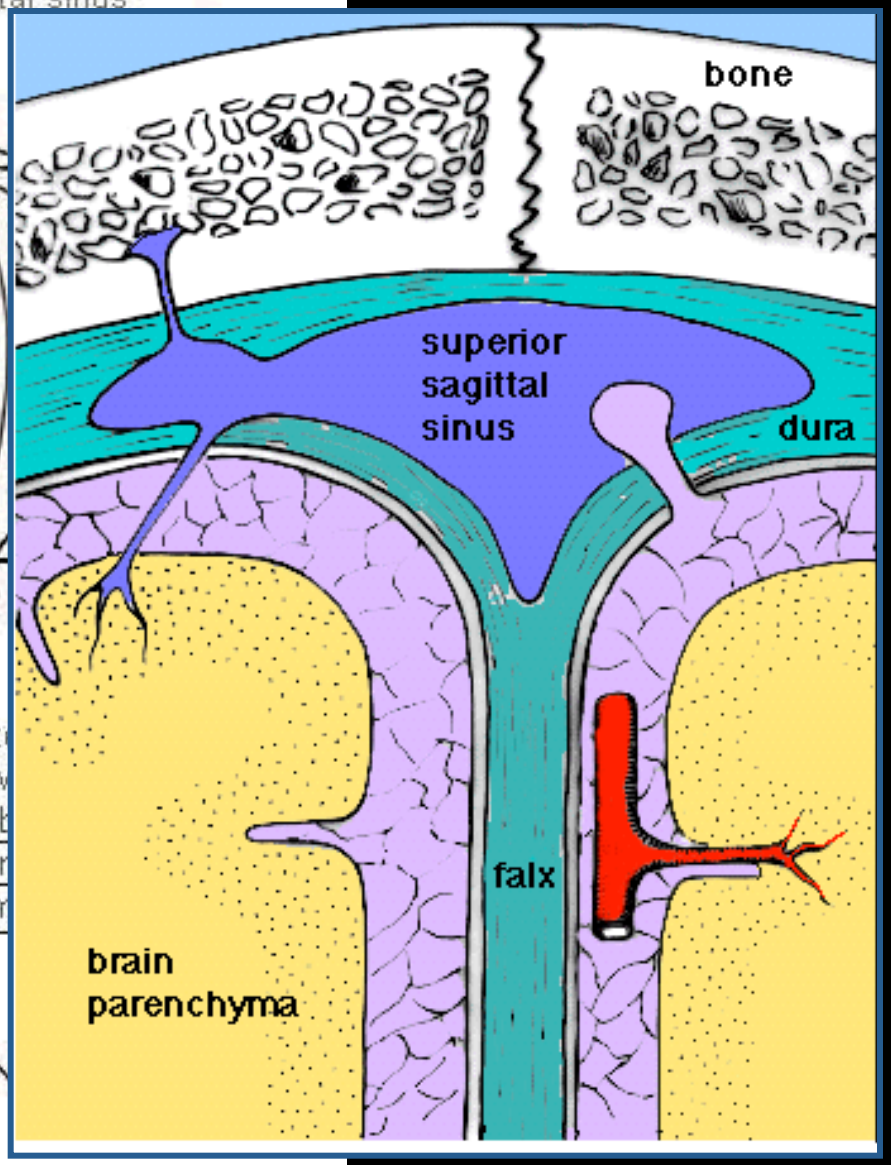


Leptomeninges =

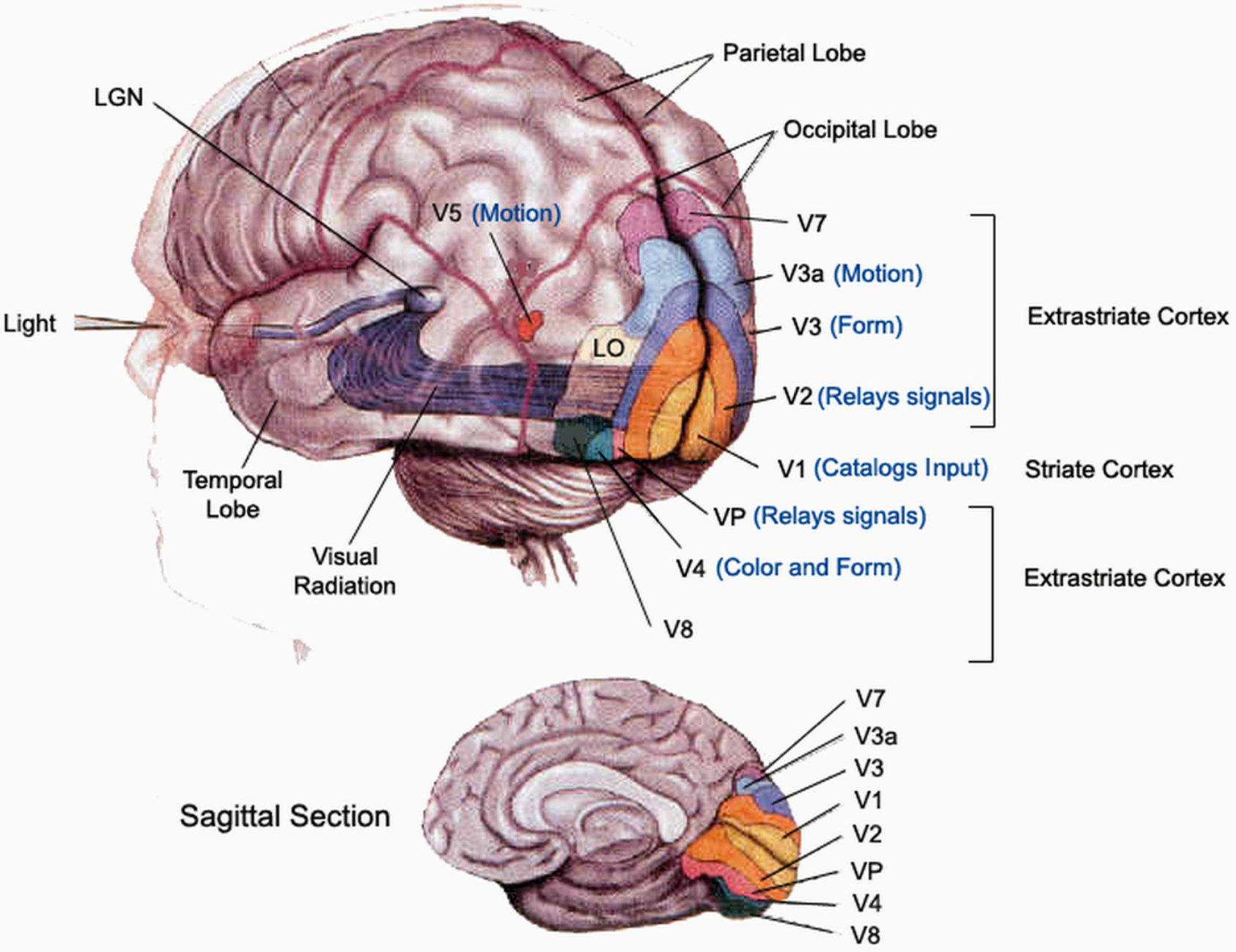
Arachnoid + pia mater

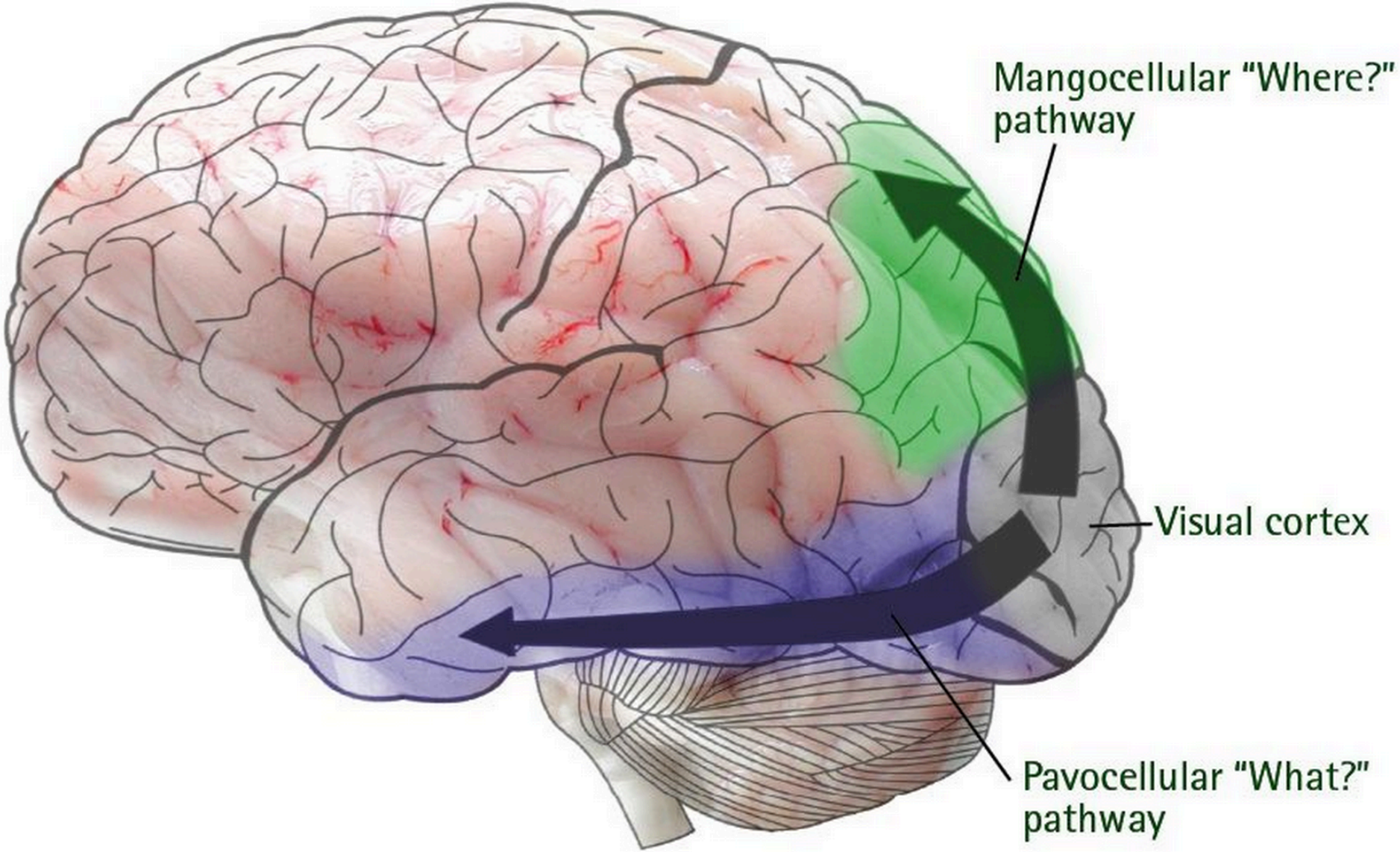
Flow of CSF


Lateral Ventricle
Choroid plexus
Subarachnoid space
Arachnoid villi
Saggital sinus
Third ventricle
Aqueduct of Sylvius
Fourth ventricle
Spinal nerves

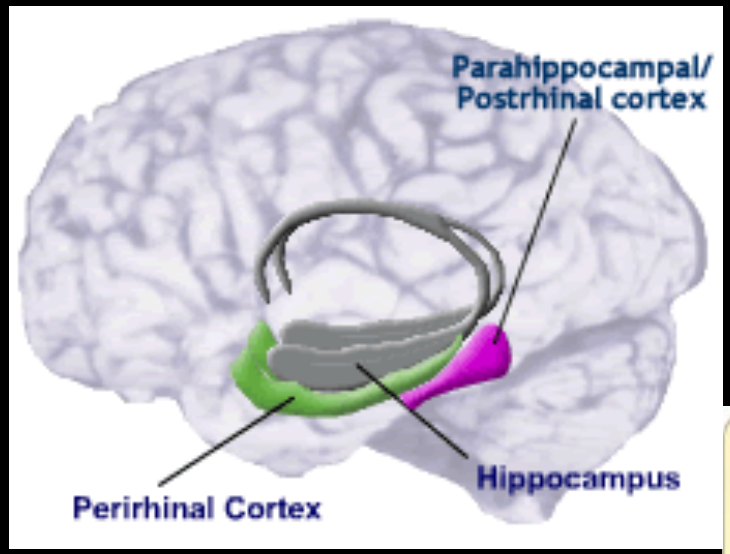

bone
superior sagittal sinus
dura
falx
brain parenchyma

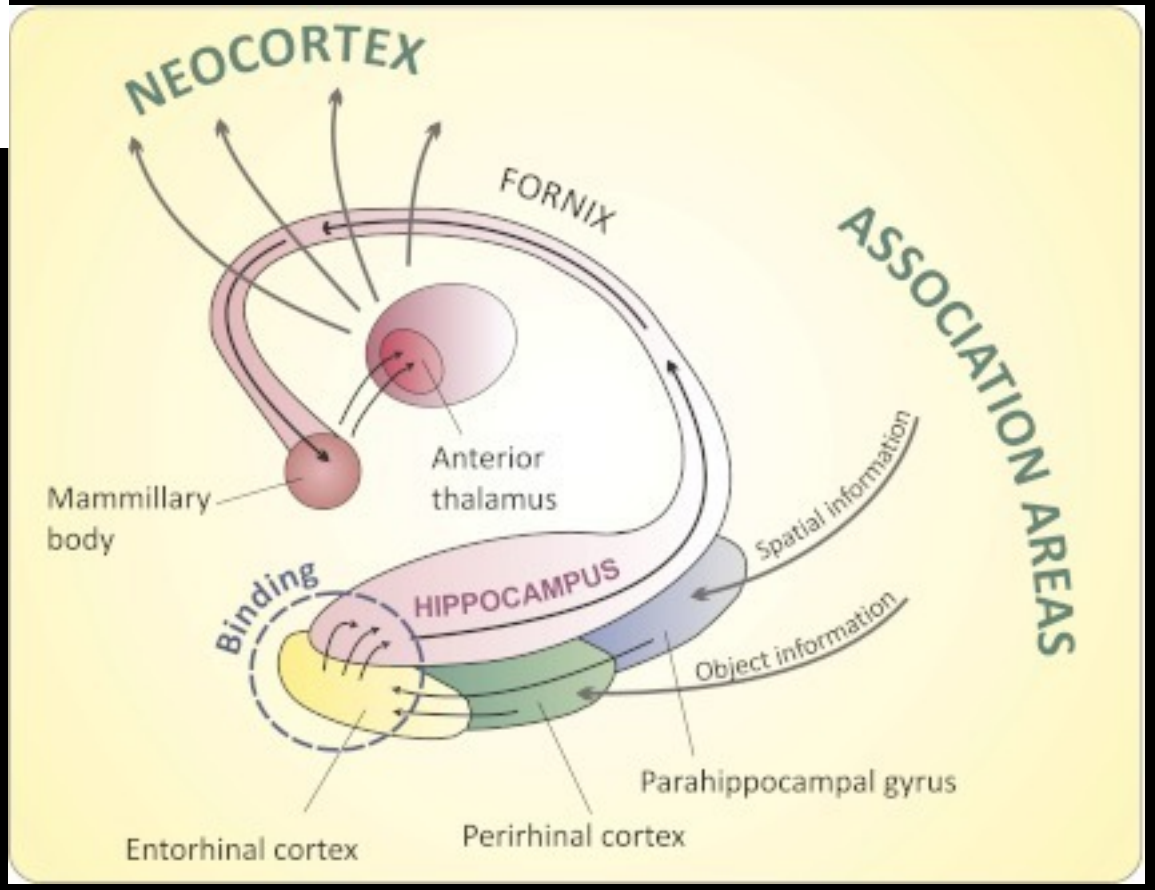
Visual Cortices



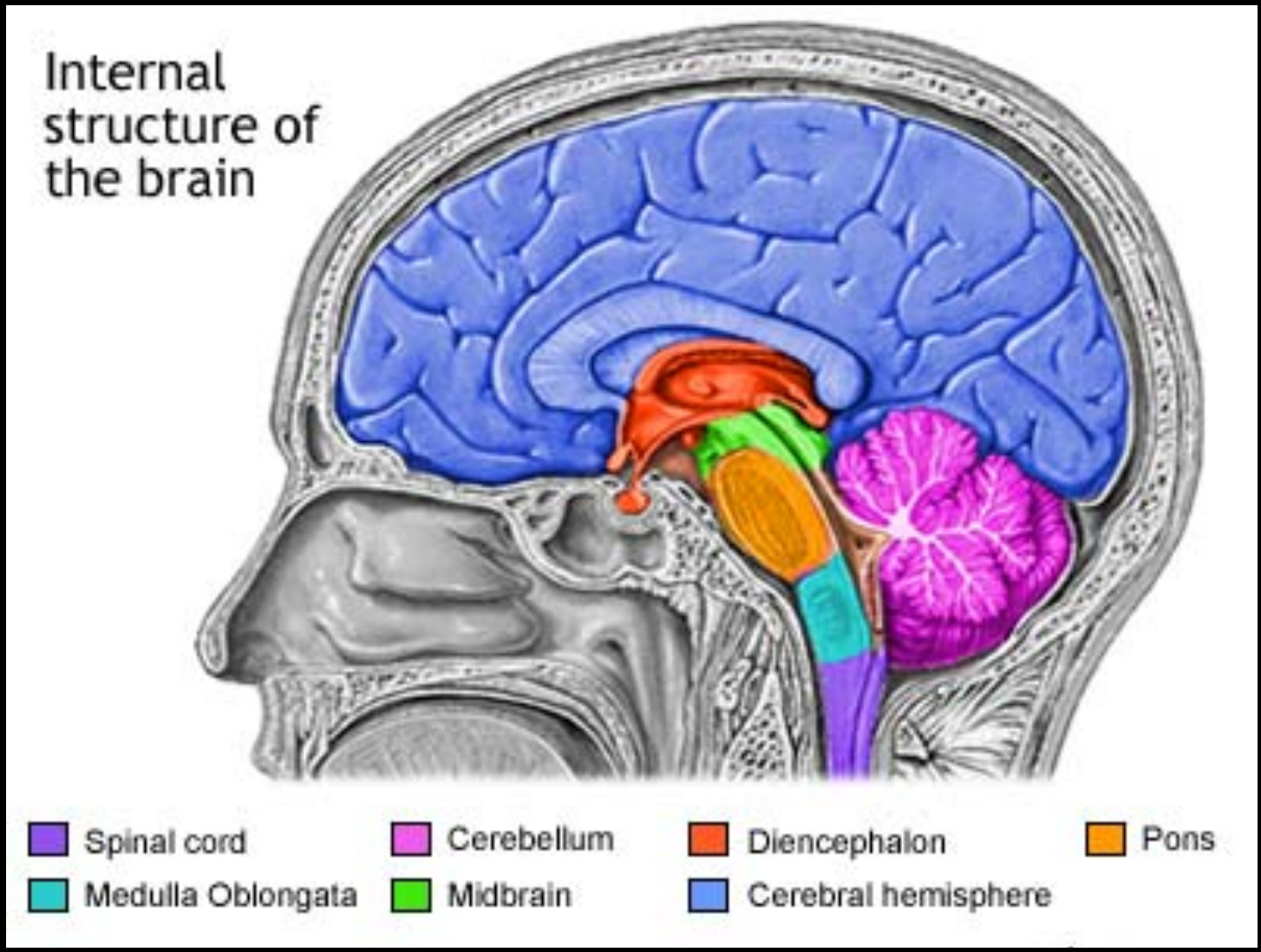

Mangocellular "Where?" pathway
Visual cortex
Pavocellular "What?" pathway

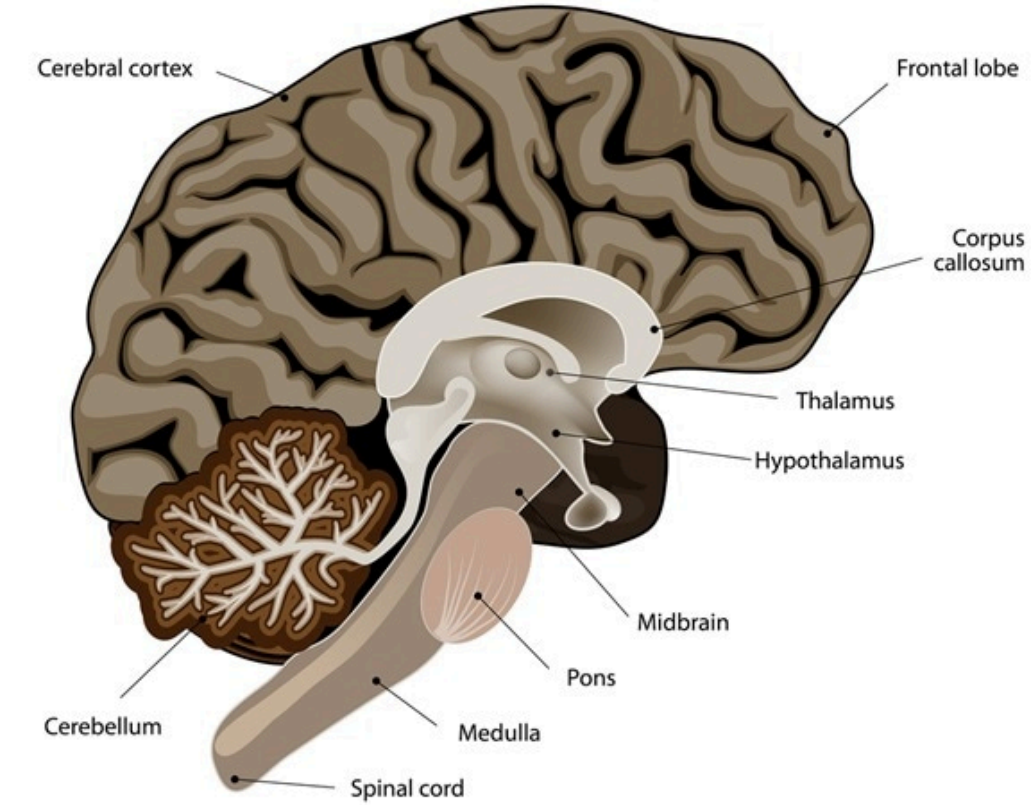
Perirhinal Cortex

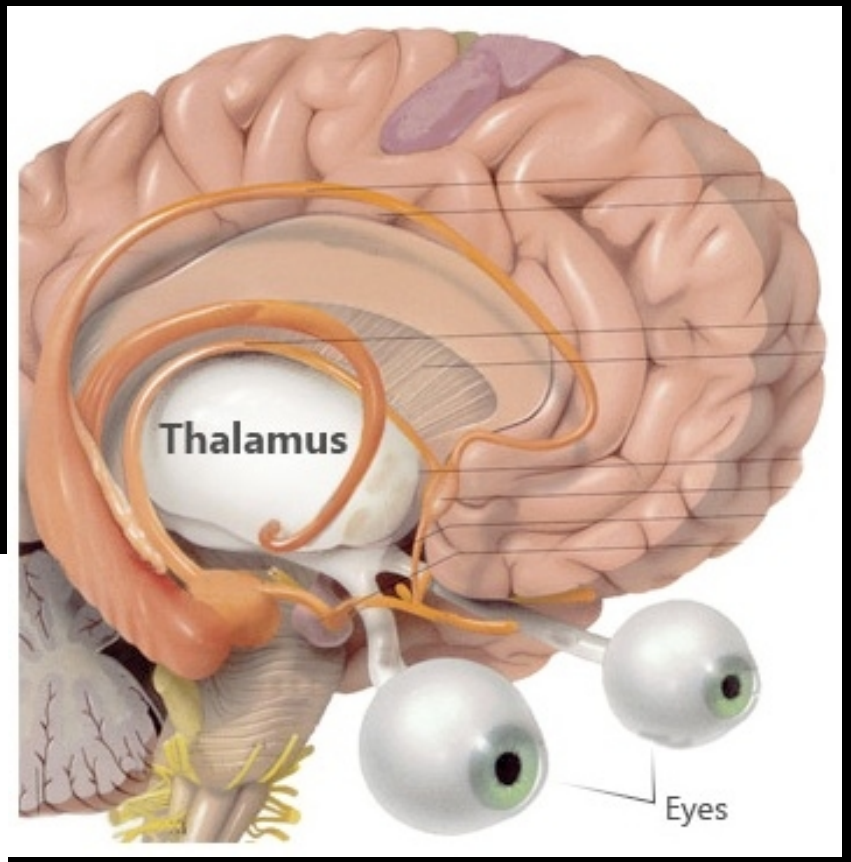


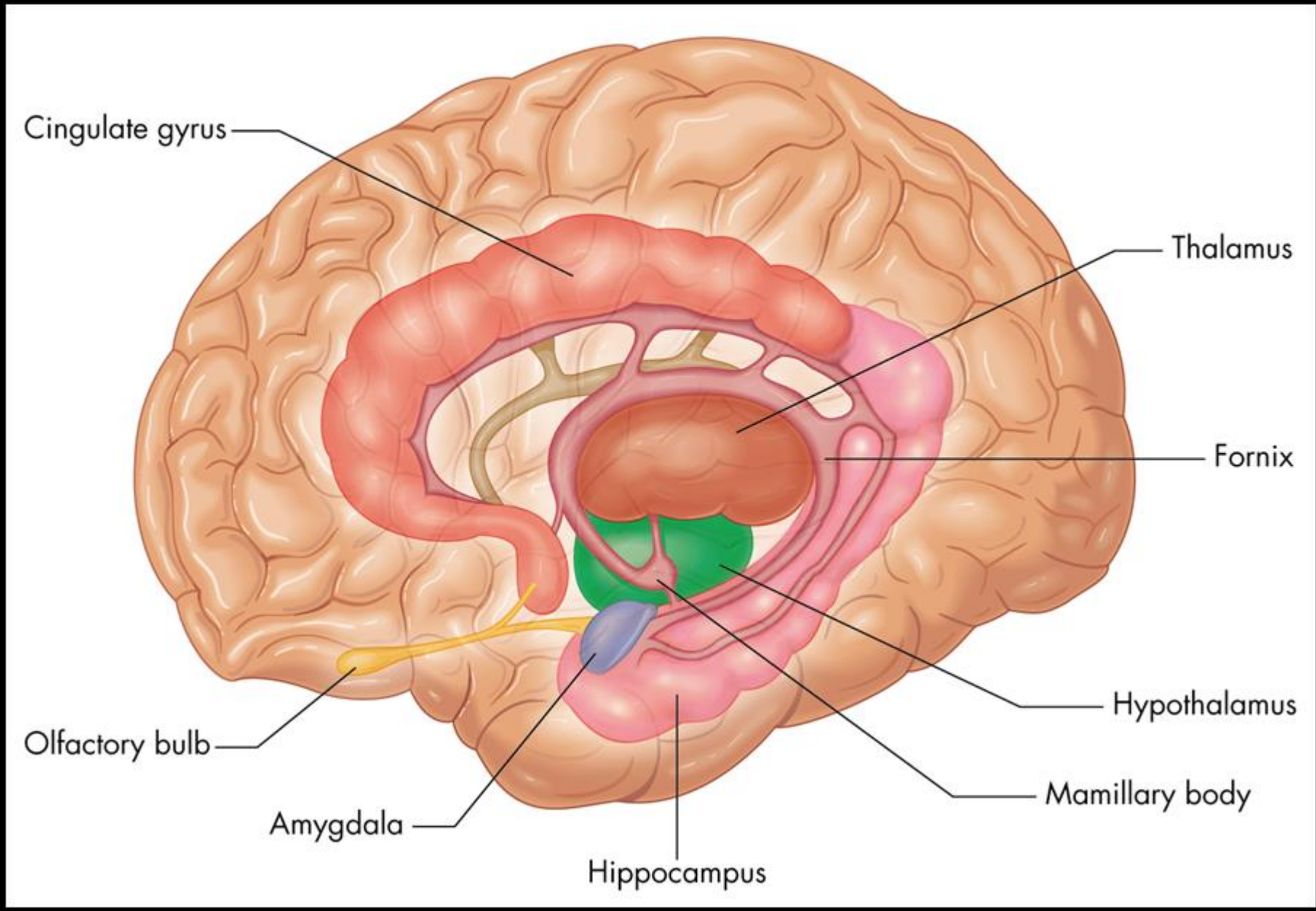


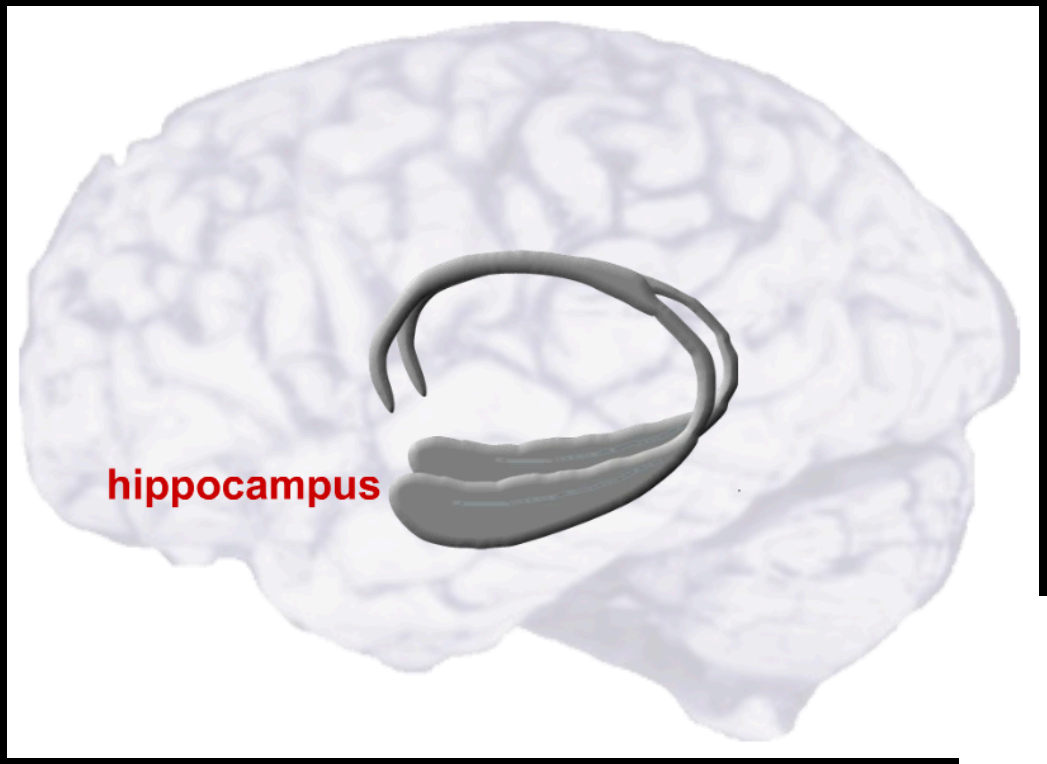
Pons

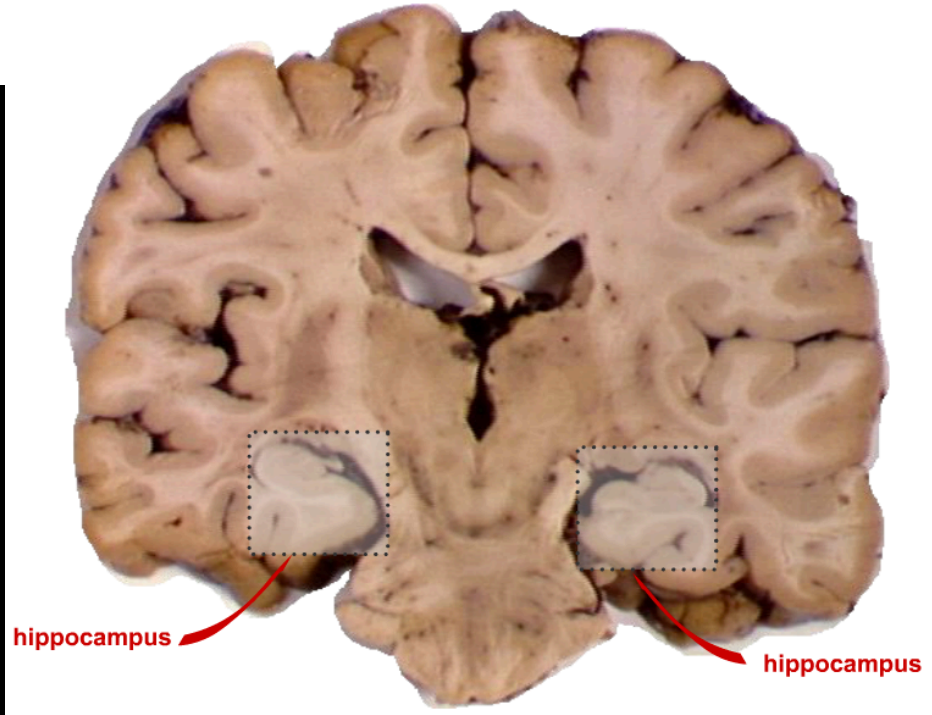

Internal structure of the brain
Spinal cord
Medulla Oblongata
Cerebellum
Midbrain
Diencephalon
Cerebral hemisphere
Pons


Cerebral cortex
Frontal lobe
Corpus callosum
Thalamus
Hypothalamus
Midbrain
Pons
Cerebellum
Medulla
Spinal cord

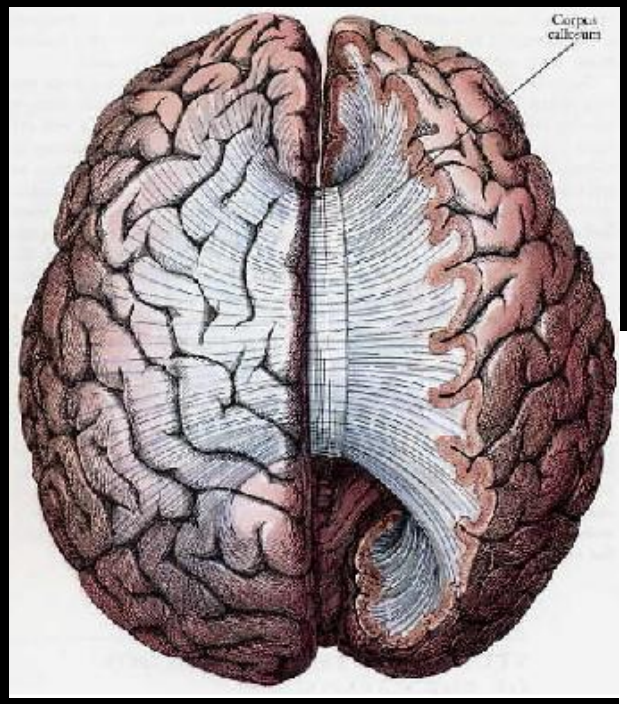

Thalamus
Eyes

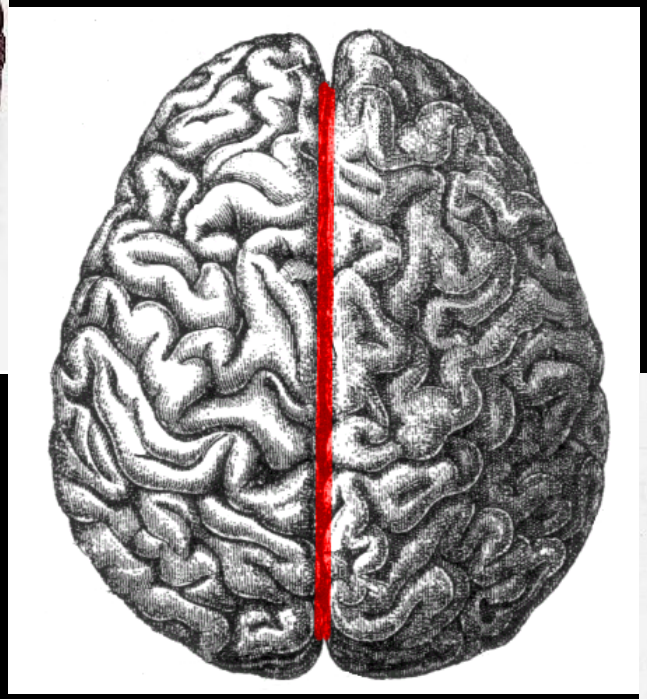

Cingulate gyrus
Thalamus
Fornix
Hypothalamus
Mamillary body
Olfactory bulb
Amygdala
Hippocampus

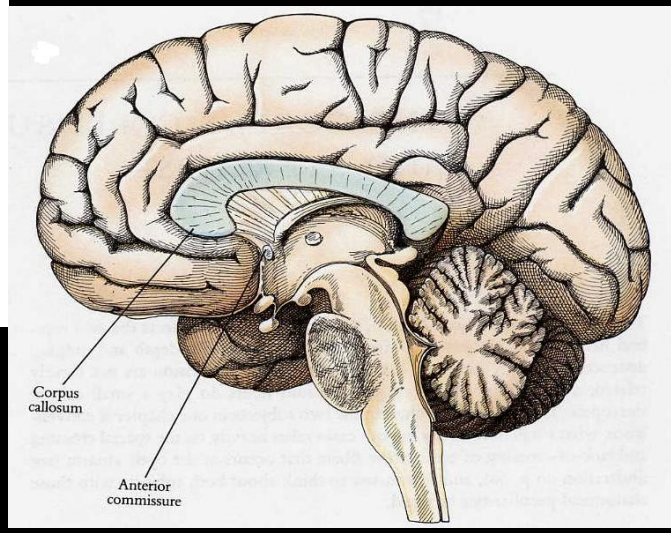

hippocampus

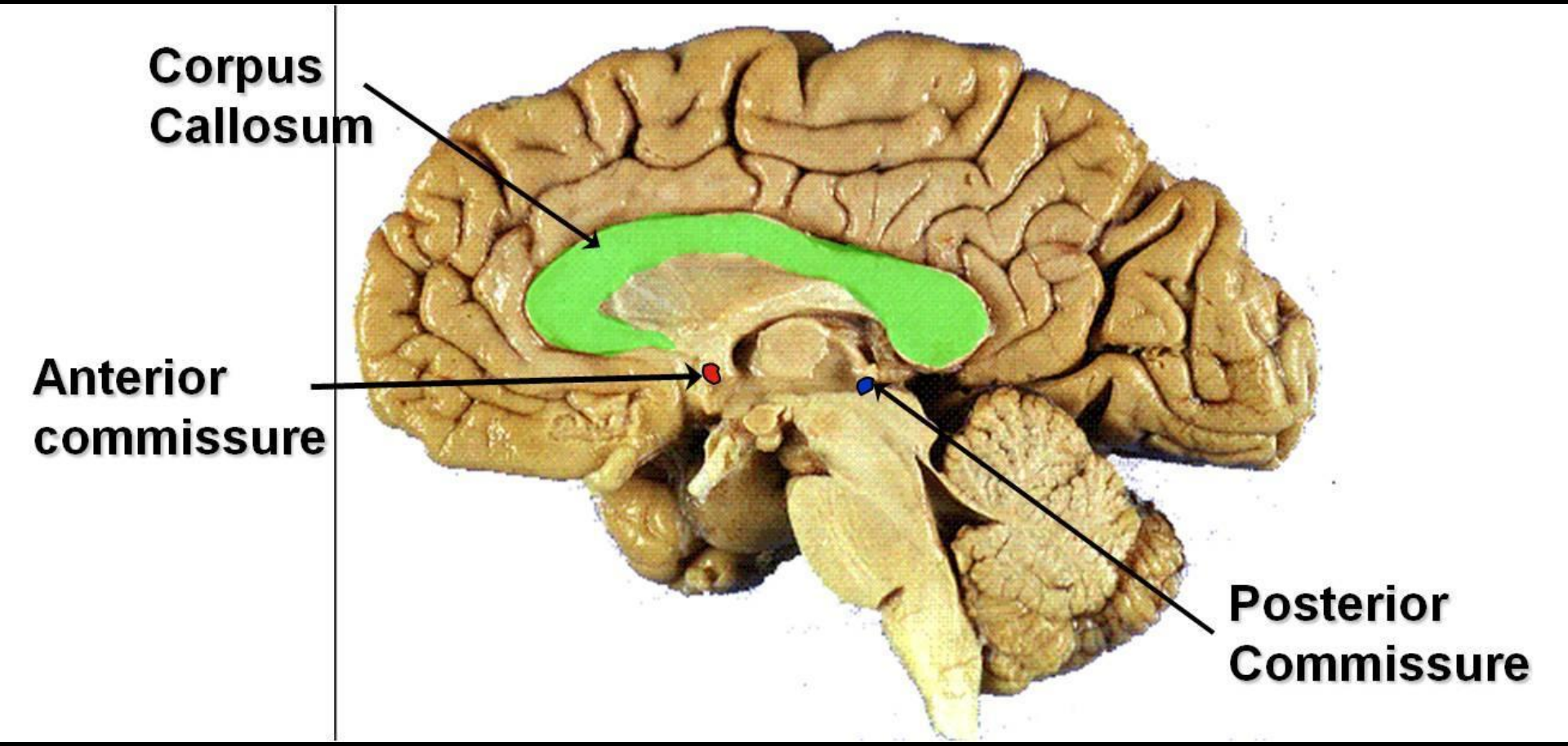

hippocampus
hippocampus

Corpus callosum

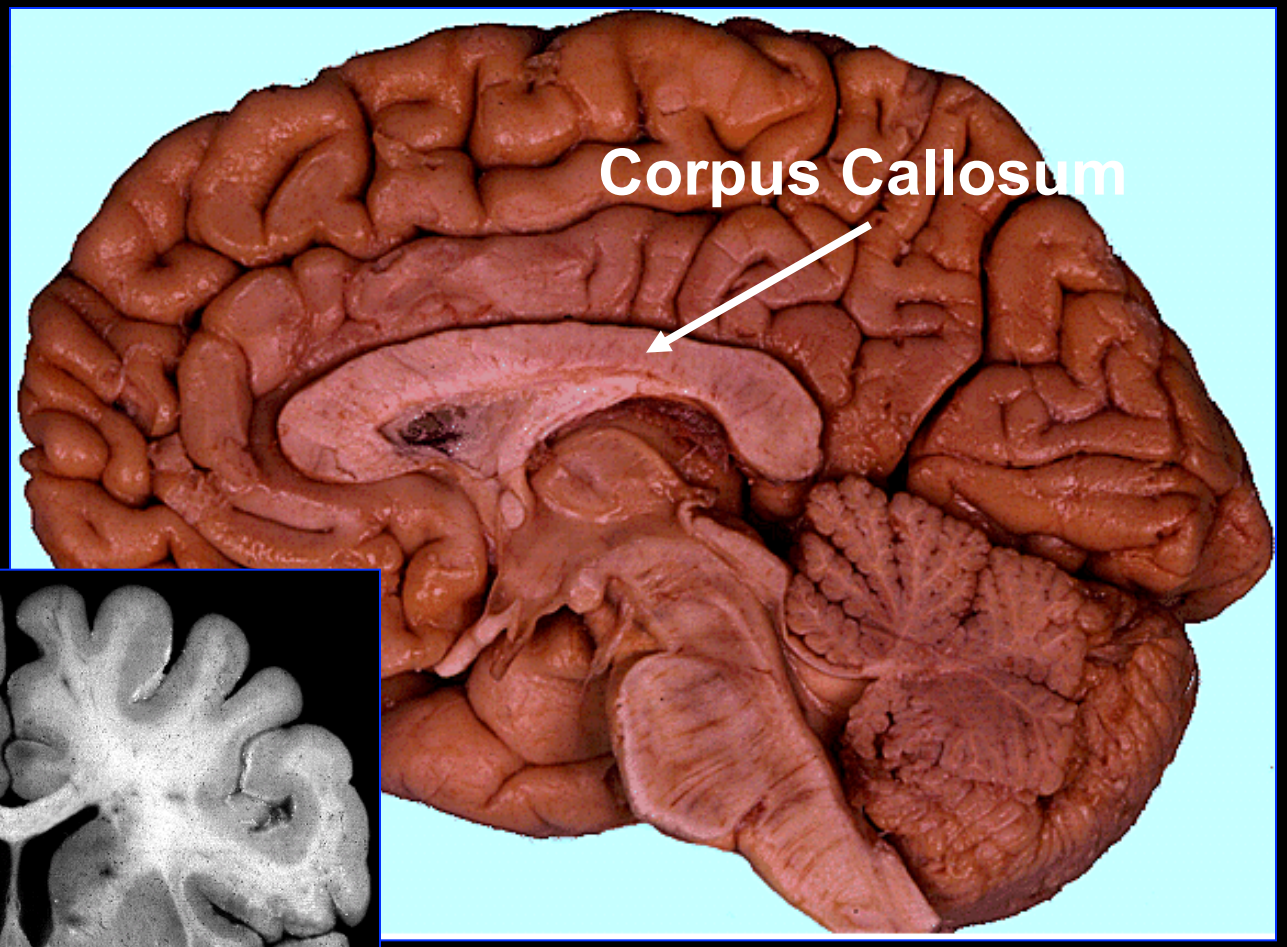


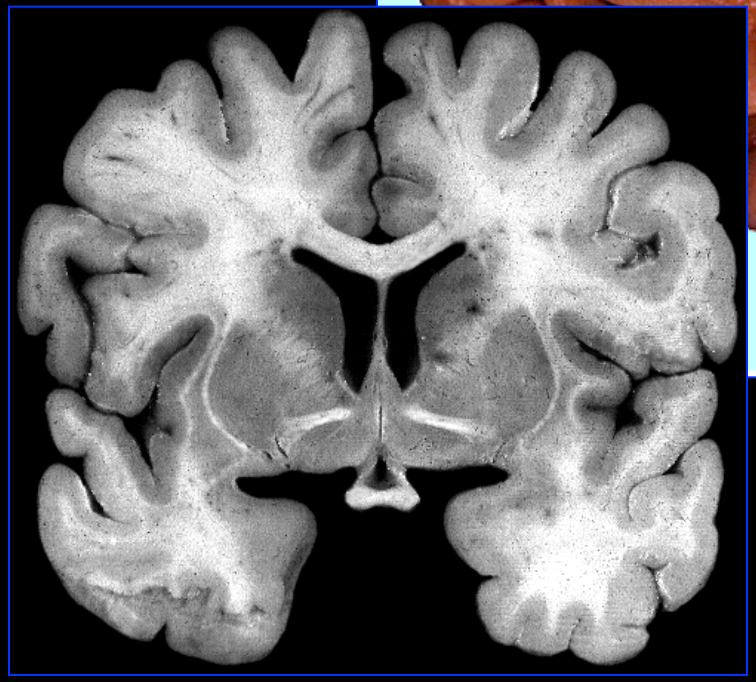




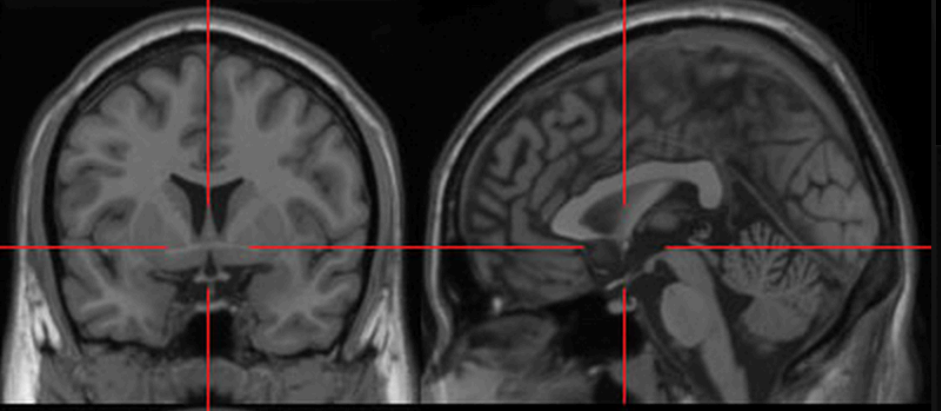

Corpus
Callosum
Anterior
commissure
Posterior
Commissure

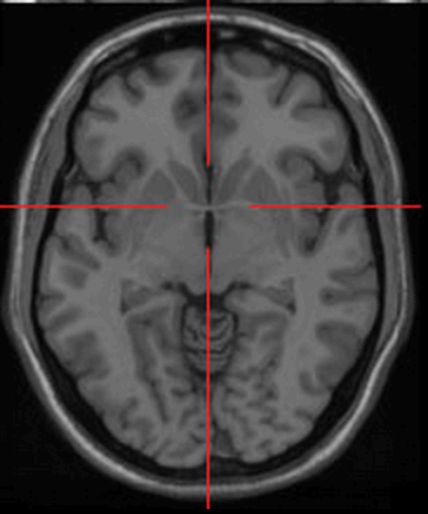
Callosum (L): hard, tough

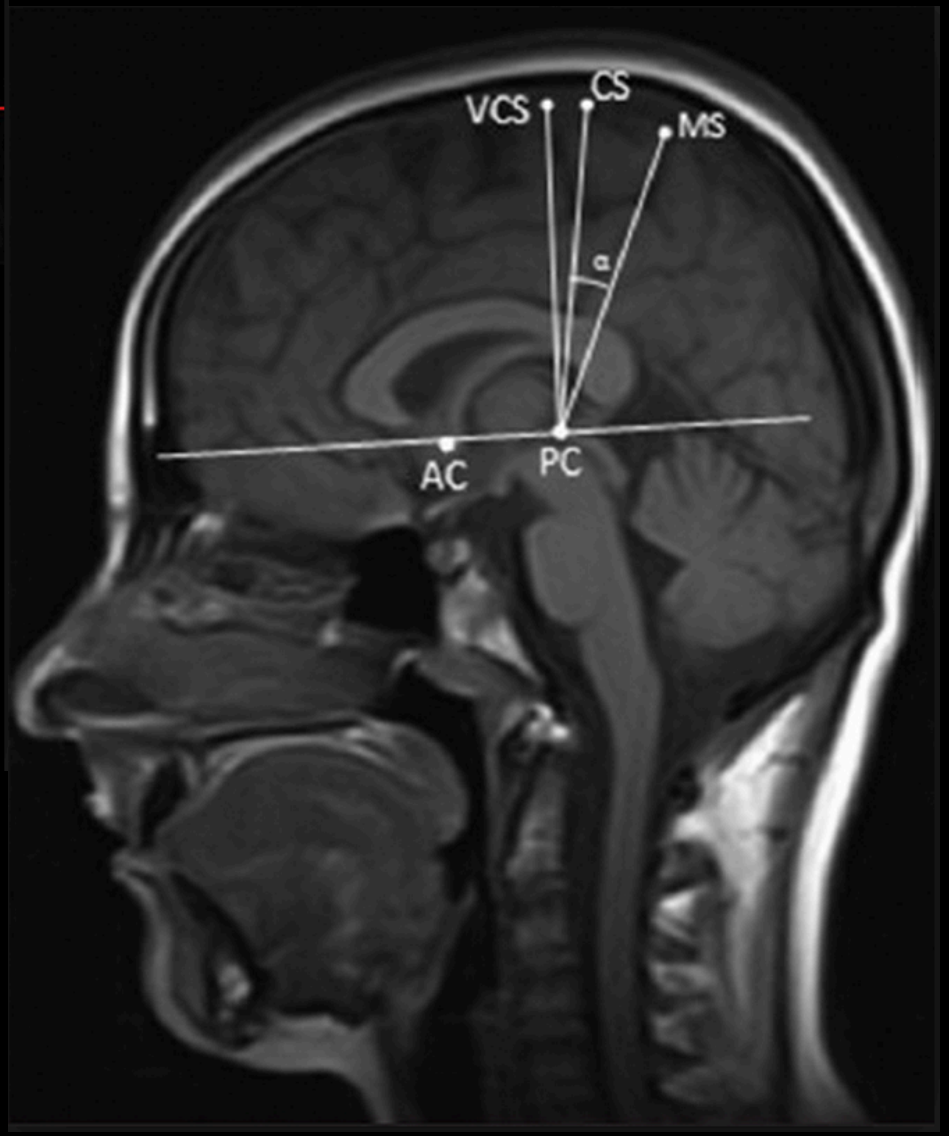


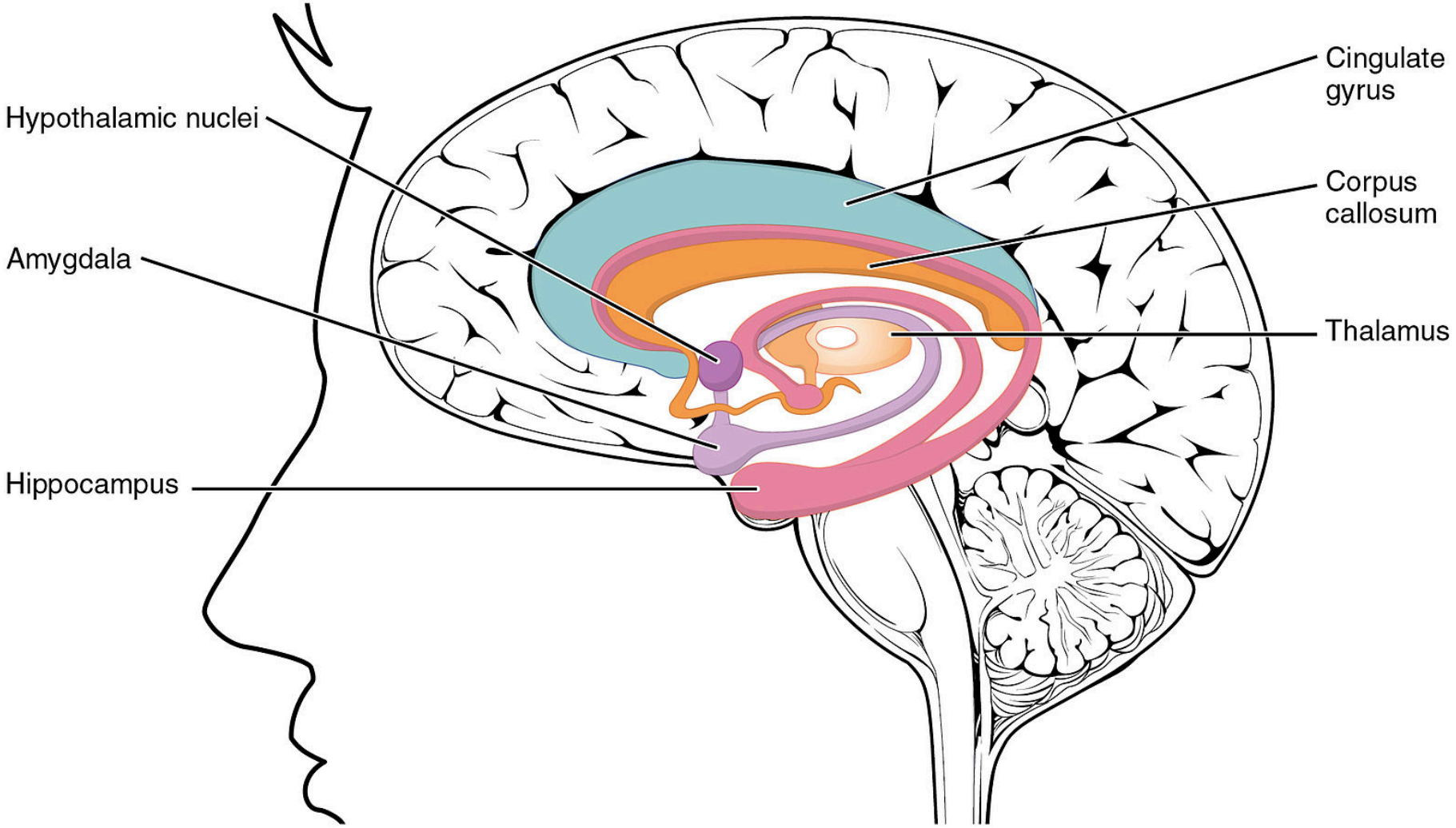


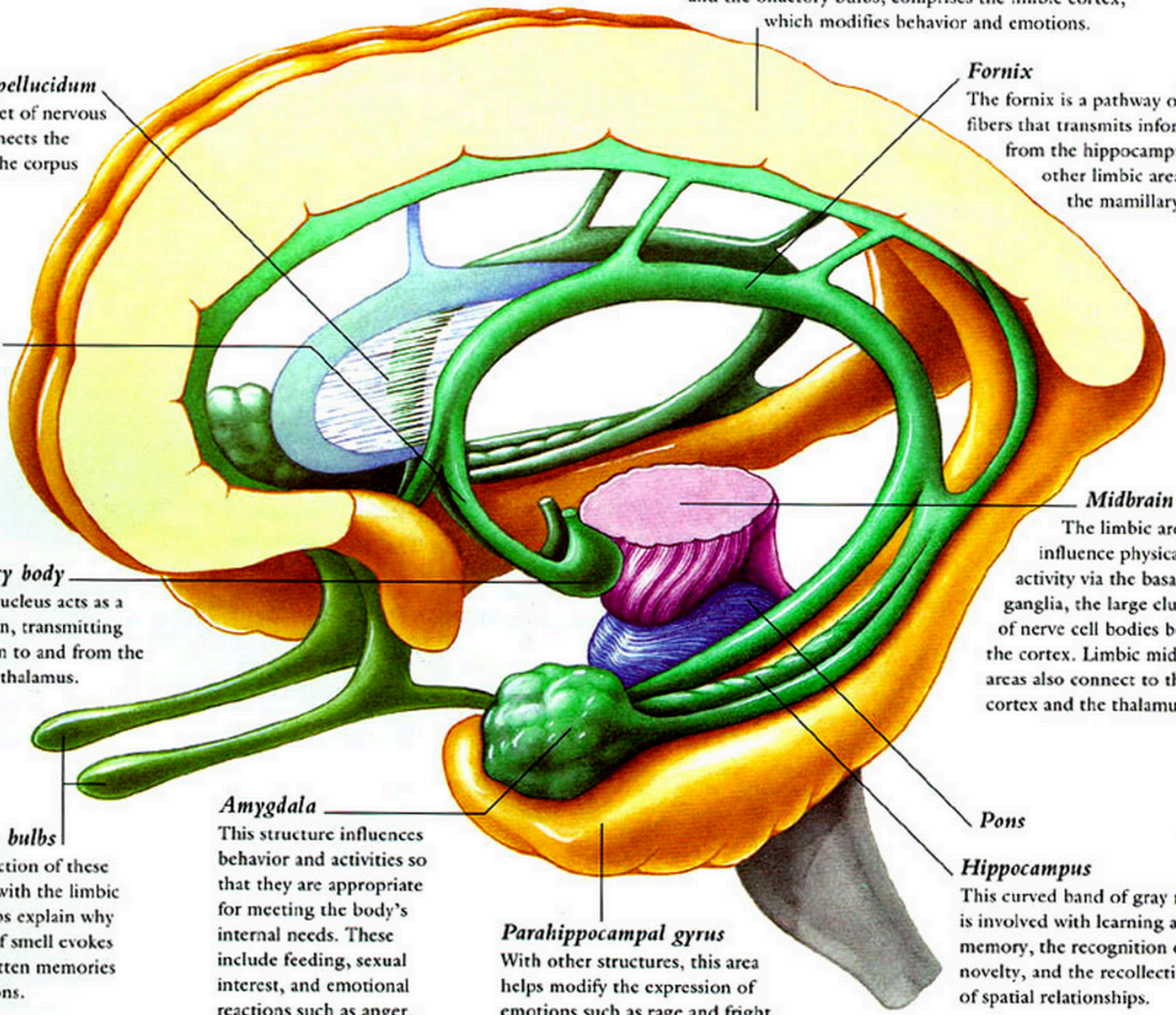
Commissure vs decussation






VCS
CS
MS
α
AC
PC


Hypothalamic nuclei
Amygdala
Hippocampus
Cingulate gyrus
Corpus callosum
Thalamus



Cingulate gyrus
This area, together with the parahippocampal gyrus and the olfactory bulbs, comprises the limbic cortex, which modifies behavior and emotions.

Septum pellucidum
A thin sheet of nervous tissue connects the fornix to the corpus callosum.

Fornix
The fornix is a pathway of nerve fibers that transmits information from the hippocampus and other limbic areas to the mamillary body.

Column of fornix

Midbrain
The limbic areas influence physical activity via the basal ganglia, the large clusters of nerve cell bodies below the cortex. Limbic midbrain areas also connect to the cortex and the thalamus.

Mamillary body
This tiny nucleus acts as a relay station, transmitting information to and from the fornix and thalamus.

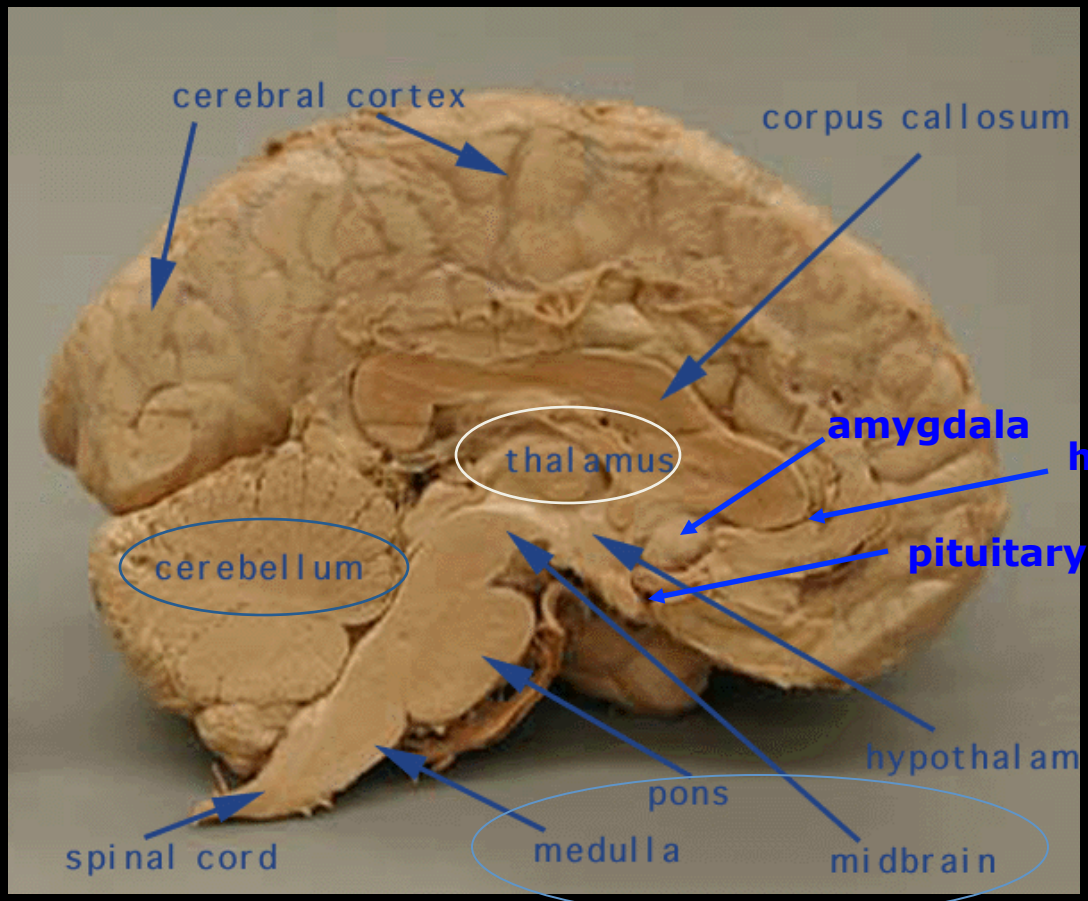
Amygdala
This structure influences behavior and activities so that they are appropriate for meeting the body's internal needs. These include feeding, sexual interest, and emotional reactions such as anger.

Pons

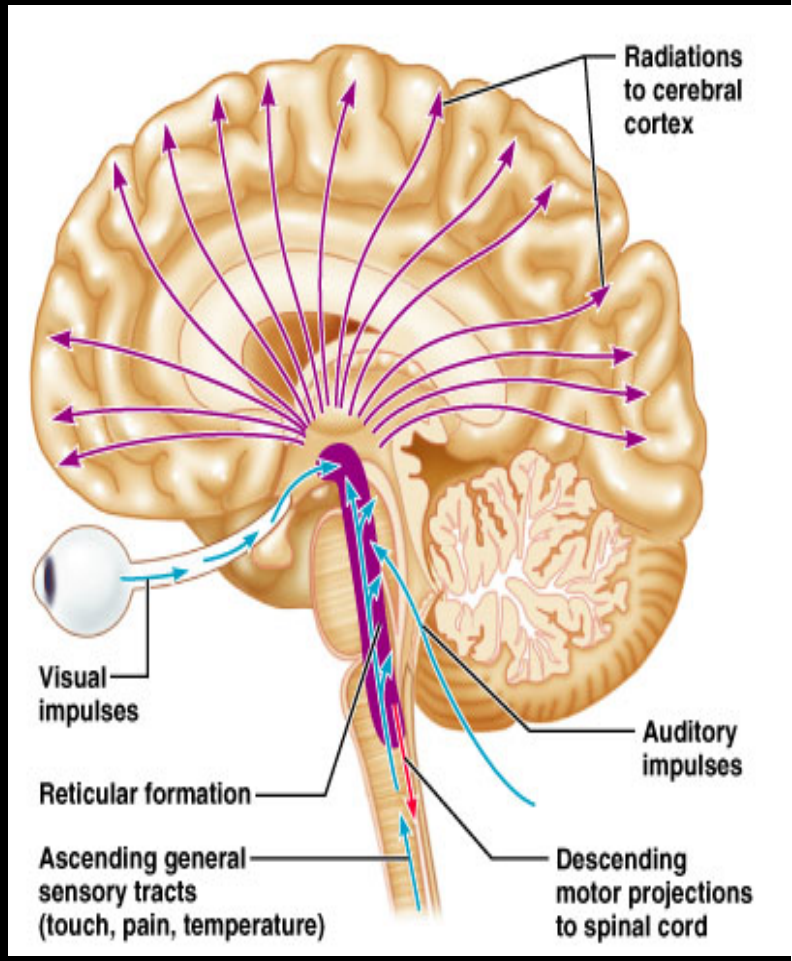
Hippocampus
This curved band of gray matter is involved with learning and memory, the recognition of novelty, and the recollection of spatial relationships.

Olfactory bulbs
The connection of these structures with the limbic system helps explain why the sense of smell evokes long-forgotten memories and emotions.

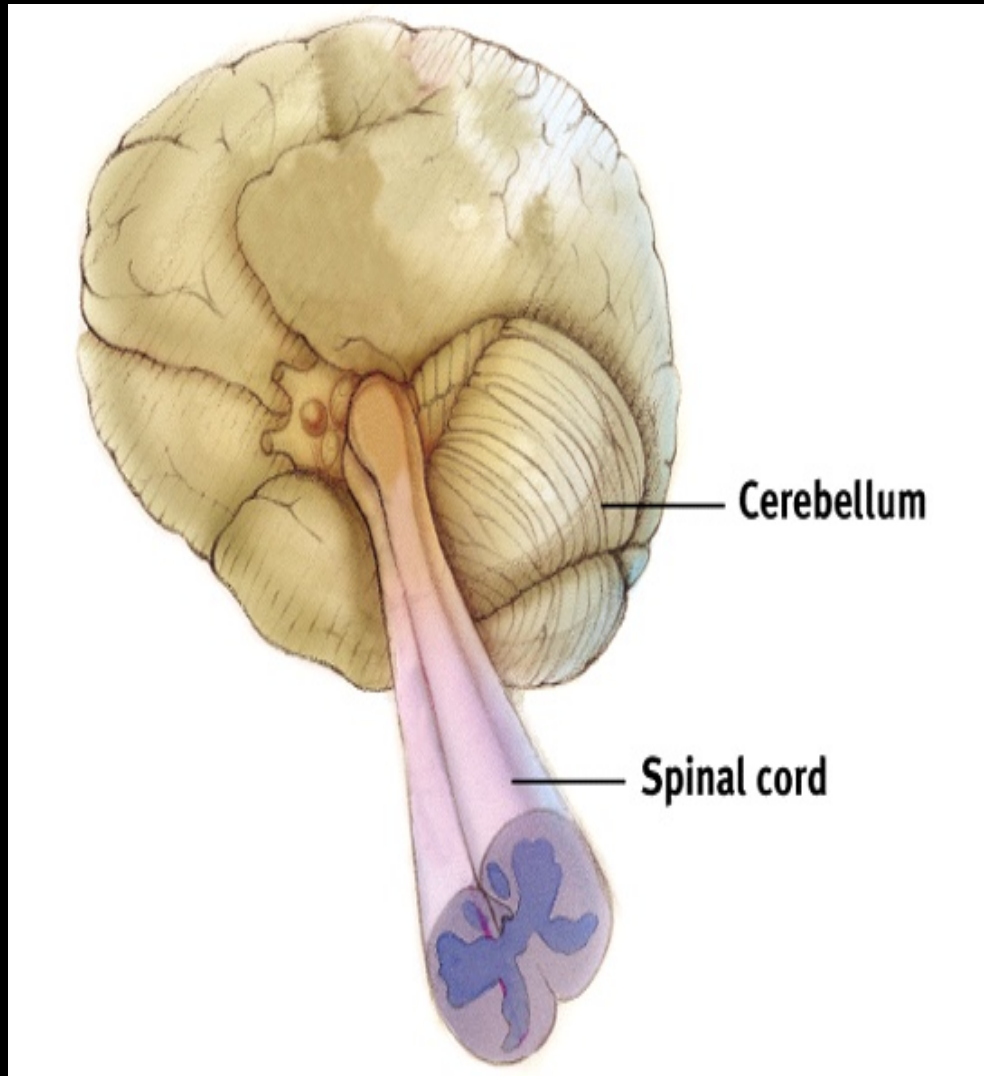
Parahippocampal gyrus
With other structures, this area helps modify the expression of emotions such as rage and fright.


cerebral cortex
corpus callosum
thalamus
amygdala
hippocampus
cerebellum
pituitary
hypothalam
pons
spinal cord
medulla
midbrain

- Widespread connections
  - Arousal of the brain as a whole
- Reticular activating system (RAS)
  - Maintains consciousness and alertness
  - Functions in sleep and arousal from sleep

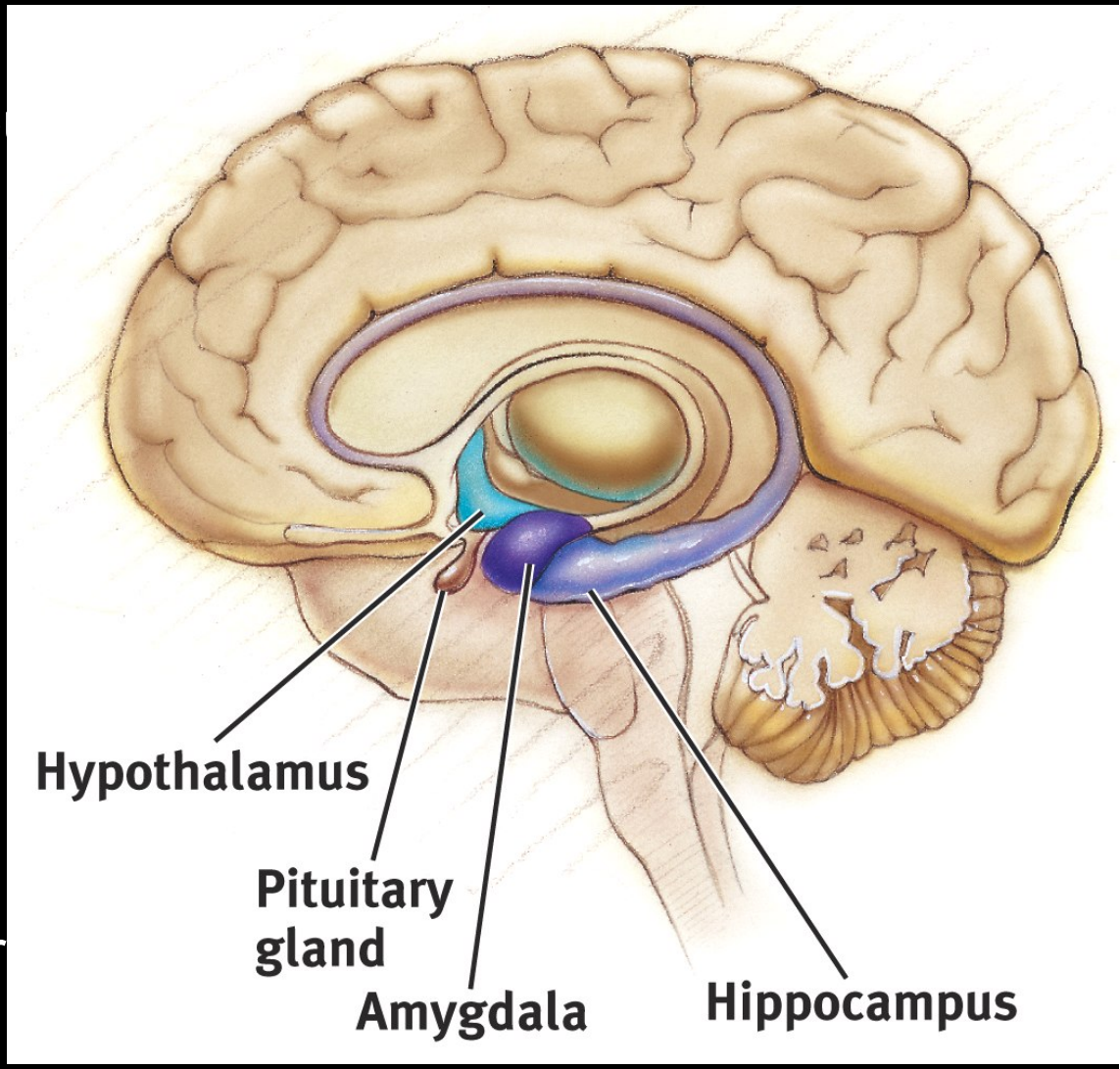


– helps coordinate voluntary movement and balance

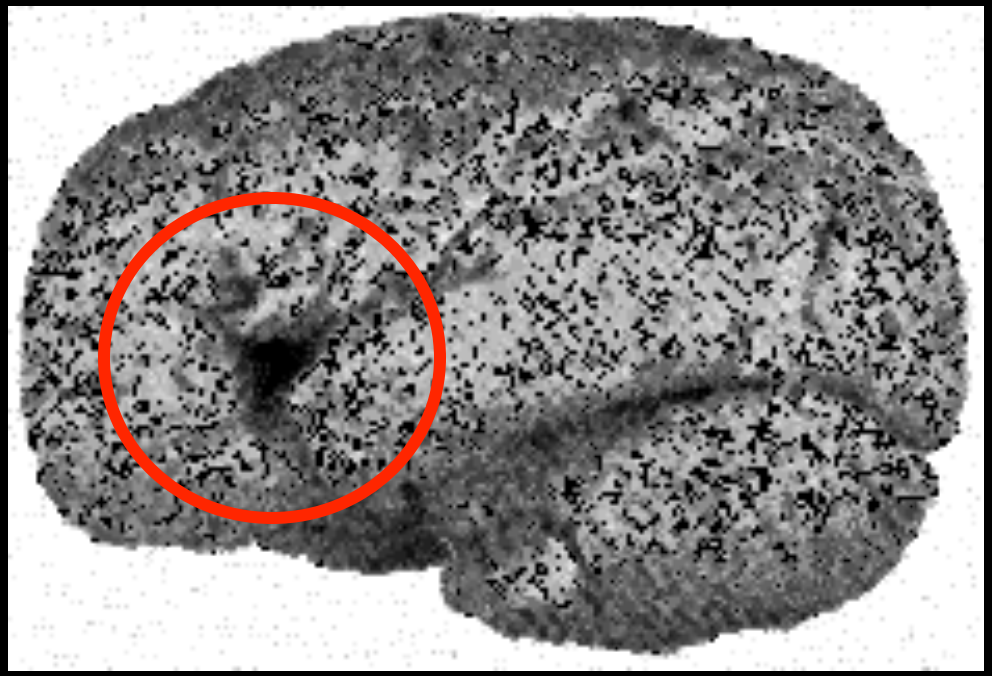


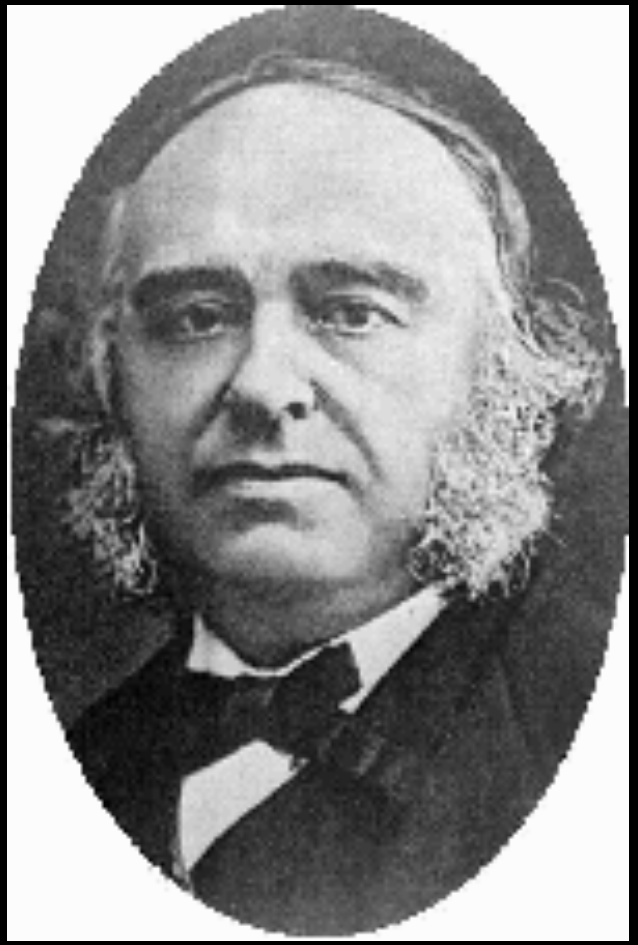
Limbic System

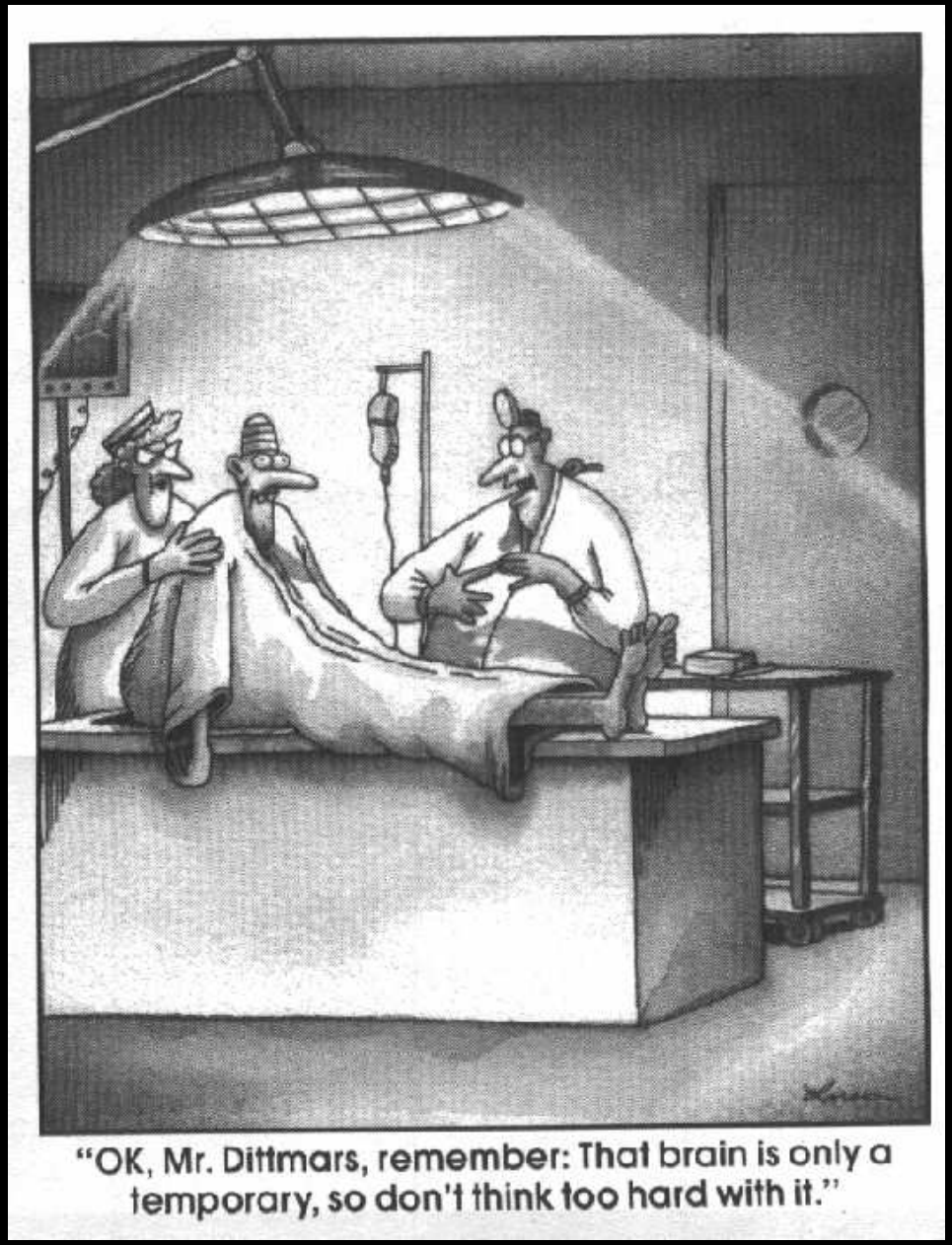
- Hypothalamus, pituitary, amygdala, and hippocamp all deal with basic drives, emotions, and memory
- Hippocampus → Memory processing
- Amygdala → Aggression (fight) and fear (flight)
- Hypothalamus → Hunger, thirst, body temperature, pleasure; regulates pituitar gland (hormones)




TIME
The Psychotic & Society
CHARLES WHITMAN







"OK, Mr. Dittmars, remember: That brain is only a temporary, so don't think too hard with it."