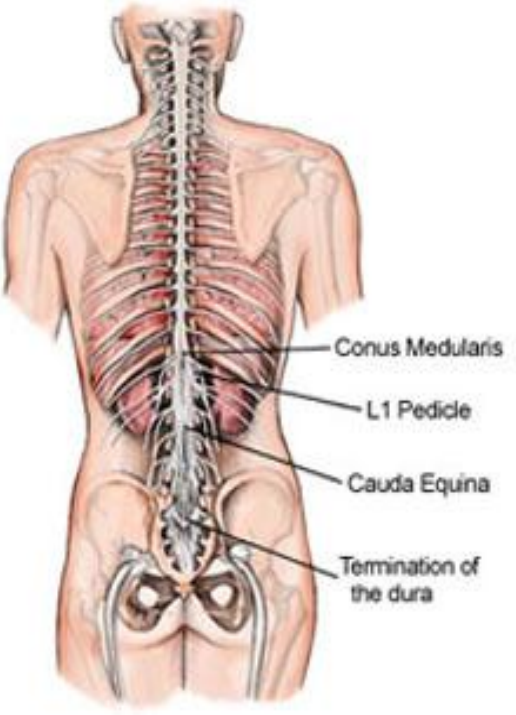
Unit N Notes #1 – The Central Nervous System

- The Central Nervous System (CNS) consists of both the brain and spinal cord.

Nervous System

Central Nervous System — **Brain** | **Spinal Cord**

Peripheral Nervous System — **Somatic** | **Autonomic** — Parasympathetic | Sympathetic



- The brain and spine are well protected. Bones including the skull and vertebrae primarily protect the CNS from trauma. The brain and spine are also wrapped in three layers of protective membranes, which form the Meninges, in between these layers cerebro-spinal fluid is present to further cushion the CNS.

A) Spinal Cord:

i) Function-

1. To relay reflex actions.

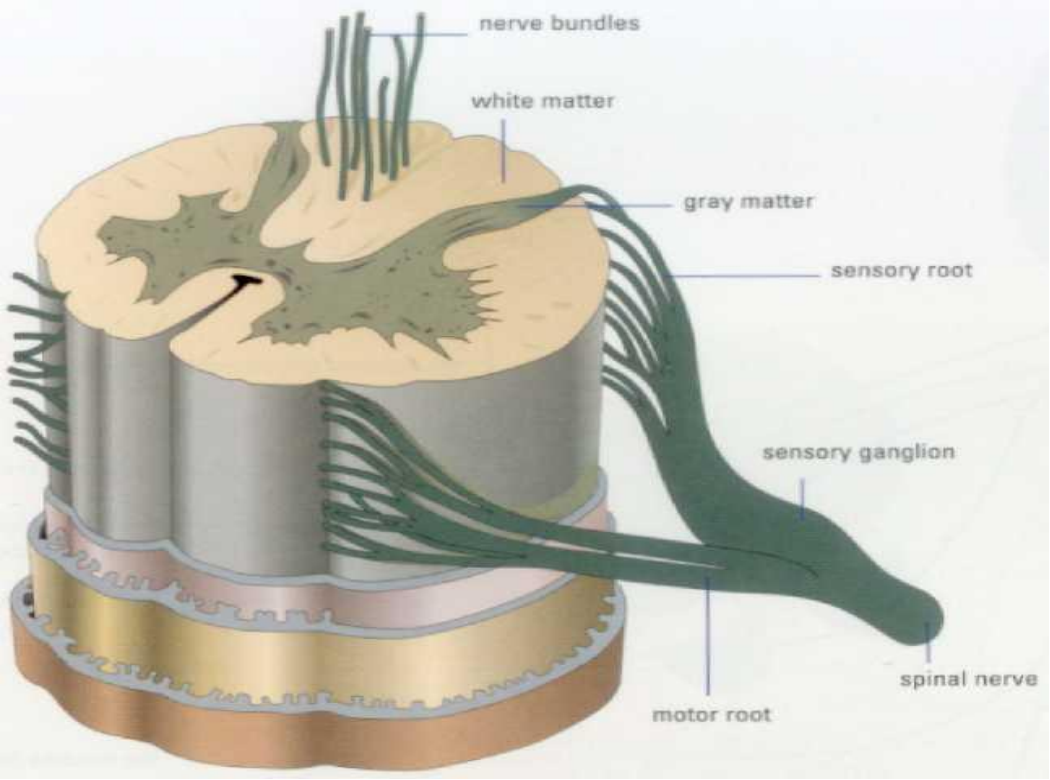
2. To allow for communication between the brain and the spinal nerves leaving the spine going out to the peripheral nervous system.

ii) Structure-

1. Central canal is filled with cerebrospinal fluid.

2. Gray matter is made up of unmyelinated cell bodies.

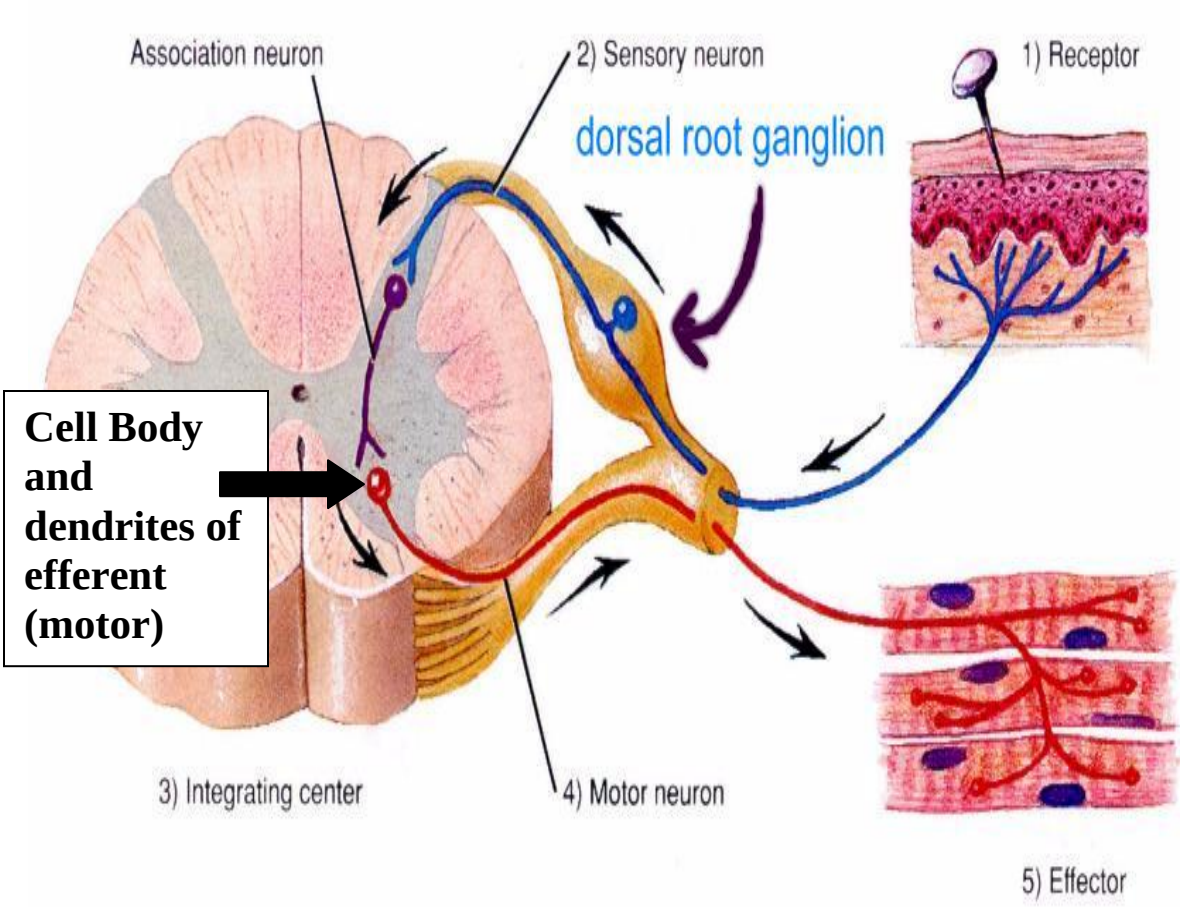
3. White matter consists of myelinated long fibers of interneurons. These interneuron bundles connect the spinal cord to the brain.



- The gray matter has the appearance of a "H" with two extensions "horns" pointing to the back or dorsal (back) side of the body → "Dorsal Horns", while the other two horns point toward the ventral (belly) surface of the body → "Ventral Horns".

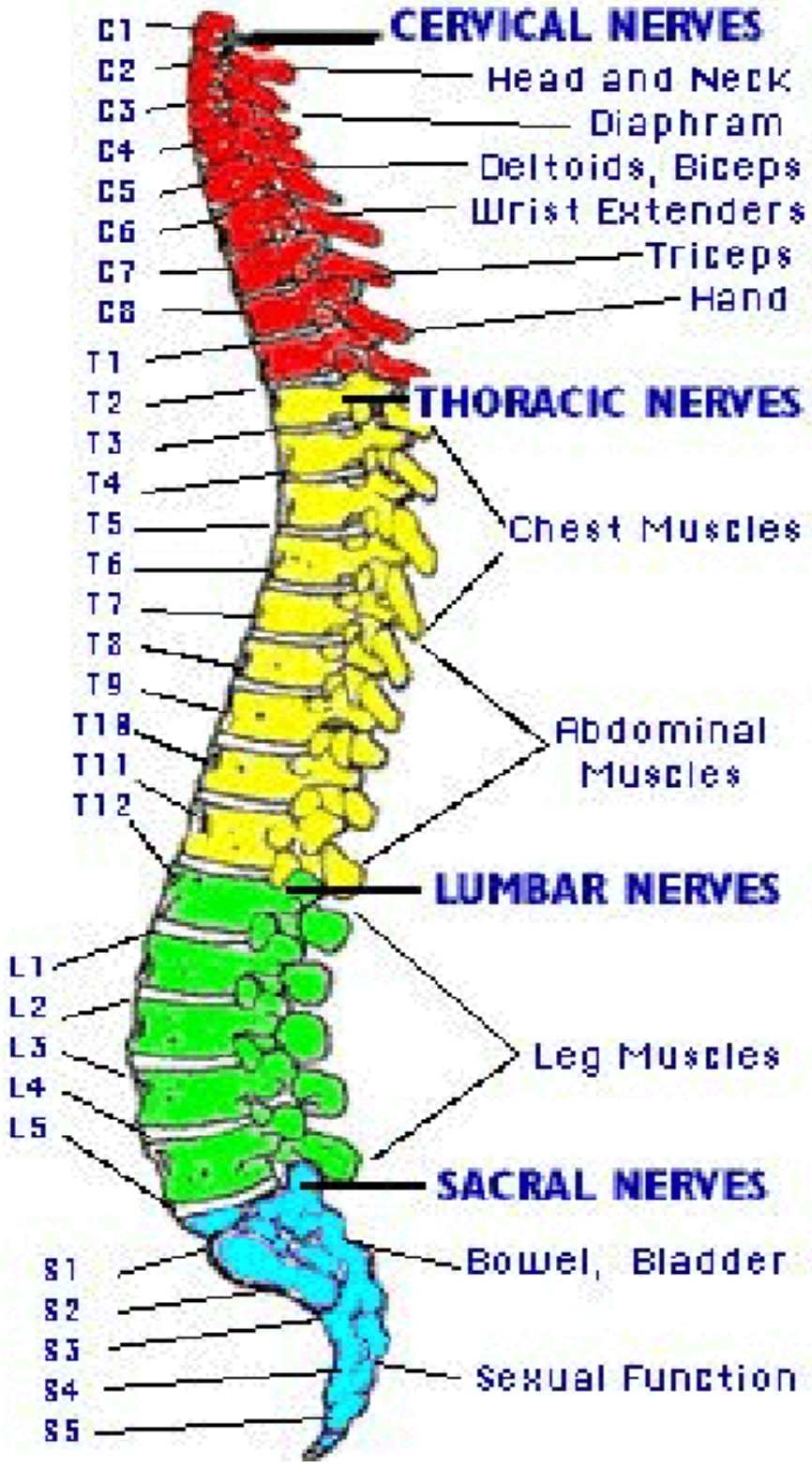
- The axons of sensory (afferent) neurons run into the dorsal horns of the gray matter. Therefore the dorsal (back) part of the cord is specialized for carrying sensory information up to the brain.

- The dendrites and cell bodies of motor (efferent) neurons are located in the ventral horns of the gray matter. Therefore the ventral (front) part of the cord sends messages from the brain to the effectors of the body.



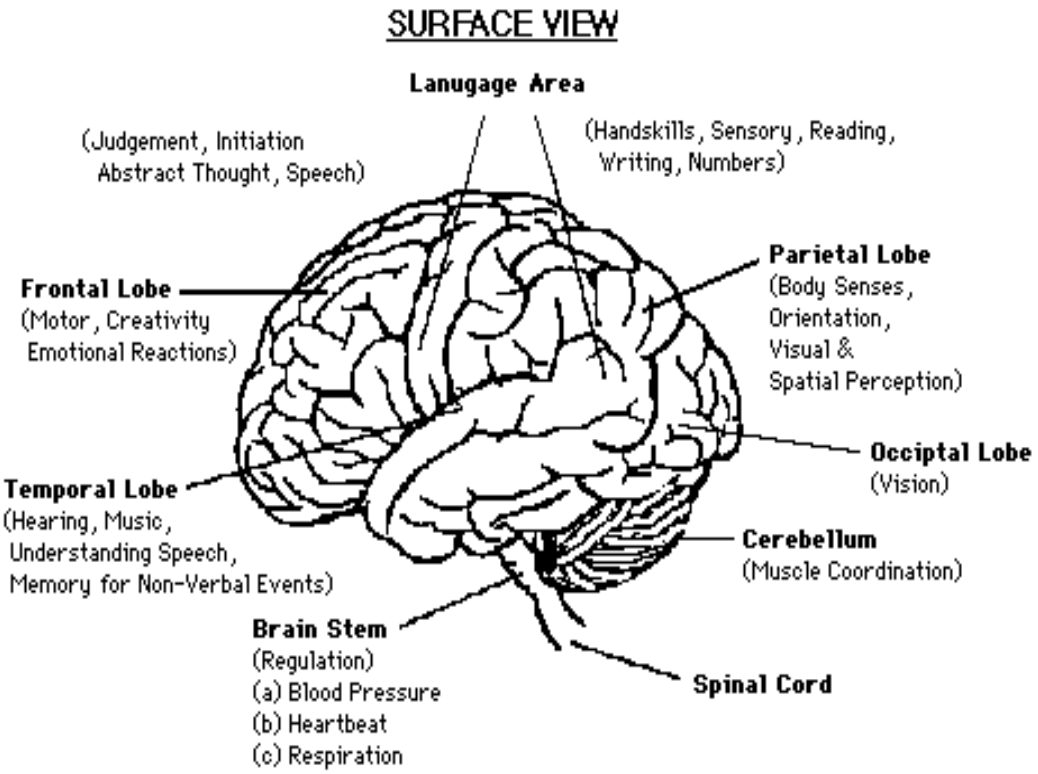
- Interneuron fibers run together in parallel bundles called tracts. Left and right tracts crossover each other prior to entering the brain. Therefore, left side of the brain controls right side of the body and vice versa.

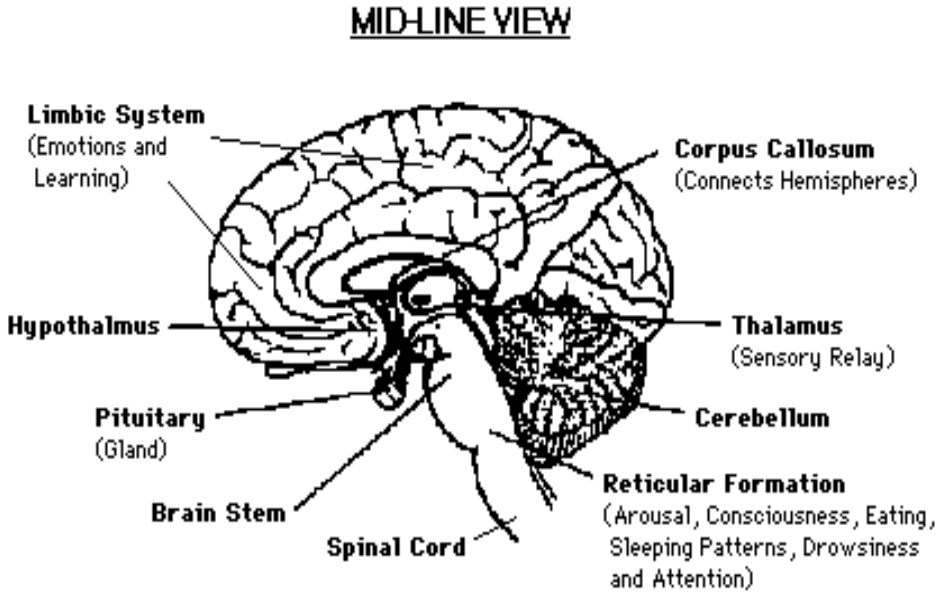
SPINAL NERVES and their Function
(*Not Part Of Learning Outcomes*)



Segmental spinal Cord level and Function	
Level	Function
Cl-C6	Neck flexors
Cl-T1	Neck extensors
C3, C4, C5	Supply diaphragm
C5, C6	Shoulder movement, raise arm (deltoid); flexion of elbow (biceps); C6
	externally rotates the arm (supinates)
C6, C7, C8	Extends elbow and wrist (triceps and wrist extensors); pronates wrist
C7, C8, Tl	Flexes wrist
C8, Tl	Supply small muscles of the hand
Tl -T6	Intercostals and trunk above the waist
T7-Ll	Abdominal muscles
Ll, L2, L3, L4	Thigh flexion
L2, L3, L4	Thigh adduction
L4, L5, S1	Thigh abduction
L5, S1 S2	Extension of leg at the hip (gluteus maximus)
L2, L3, L4	Extension of leg at the knee (quadriceps femoris)
L4, L5, S1, S2	Flexion of leg at the knee (hamstrings)
L4, L5, S1	Dorsiflexion of foot (tibialis anterior)
L4, L5, S1	Extension of toes
L5, S1, S2	Plantar flexion of foot
L5, S1, S2	Nexion of toes

B) The Brain:


SURFACE VIEW
Lanugage Area
(Judgement, Initiation
Abstract Thought, Speech)
(Handskills, Sensory, Reading,
Writing, Numbers)
Frontal Lobe
(Motor, Creativity
Emotional Reactions)
Parietal Lobe
(Body Senses,
Orientation,
Visual &
Spatial Perception)
Occiptal Lobe
(Vision)
Temporal Lobe
(Hearing, Music,
Understanding Speech,
Memory for Non-Verbal Events)
Cerebellum
(Muscle Coordination)
Brain Stem
(Regulation)
(a) Blood Pressure
(b) Heartbeat
(c) Respiration
Spinal Cord


MID-LINE VIEW
Limbic System
(Emotions and
Learning)
Corpus Callosum
(Connects Hemispheres)
Hypothalmus
Thalamus
(Sensory Relay)
Pituitary
(Gland)
Cerebellum
Reticular Formation
(Arousal, Consciousness, Eating,
Sleeping Patterns, Drowsiness
and Attention)
Brain Stem
Spinal Cord

i) Medulla Oblongata- Part of Brain Stem

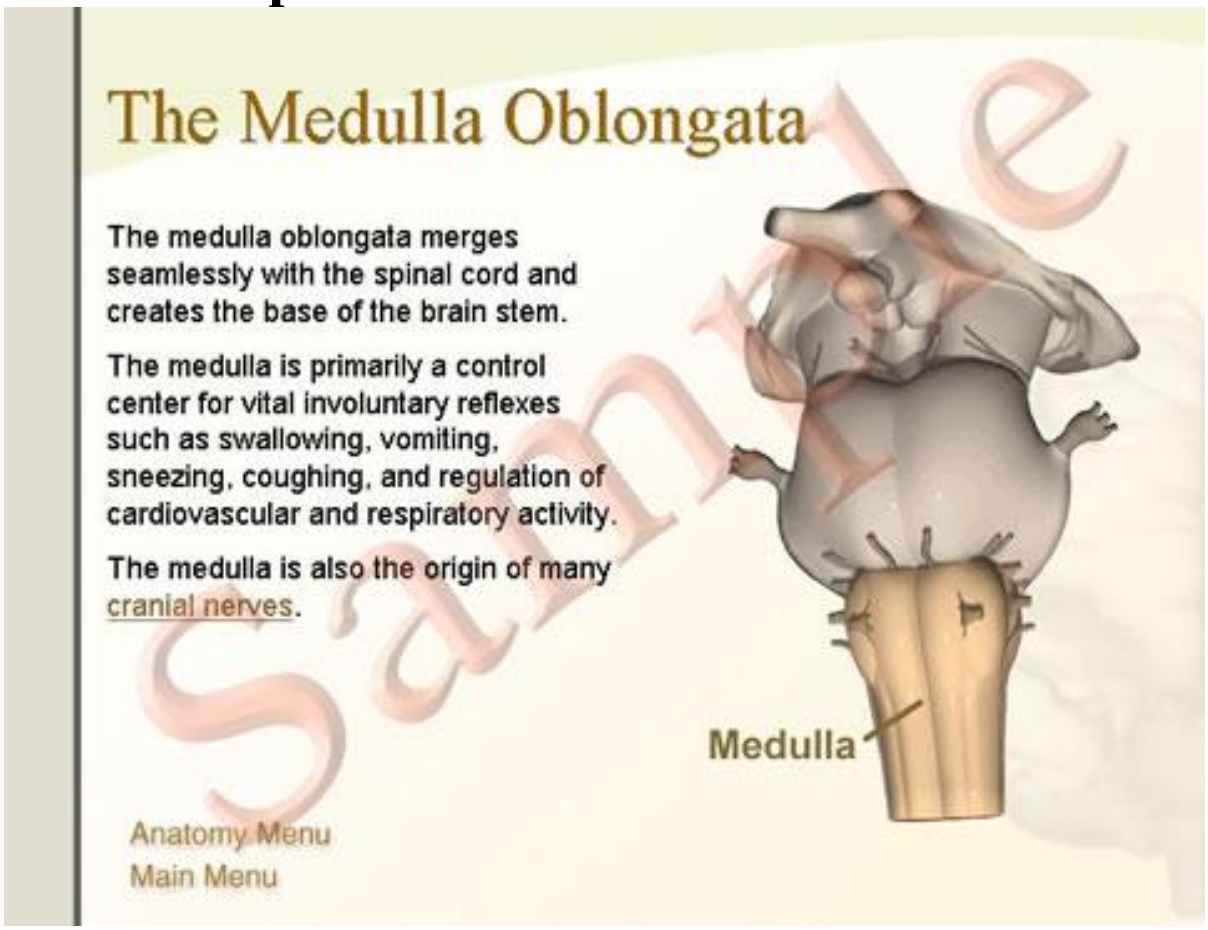
- Part of the "Subconscious Brain"

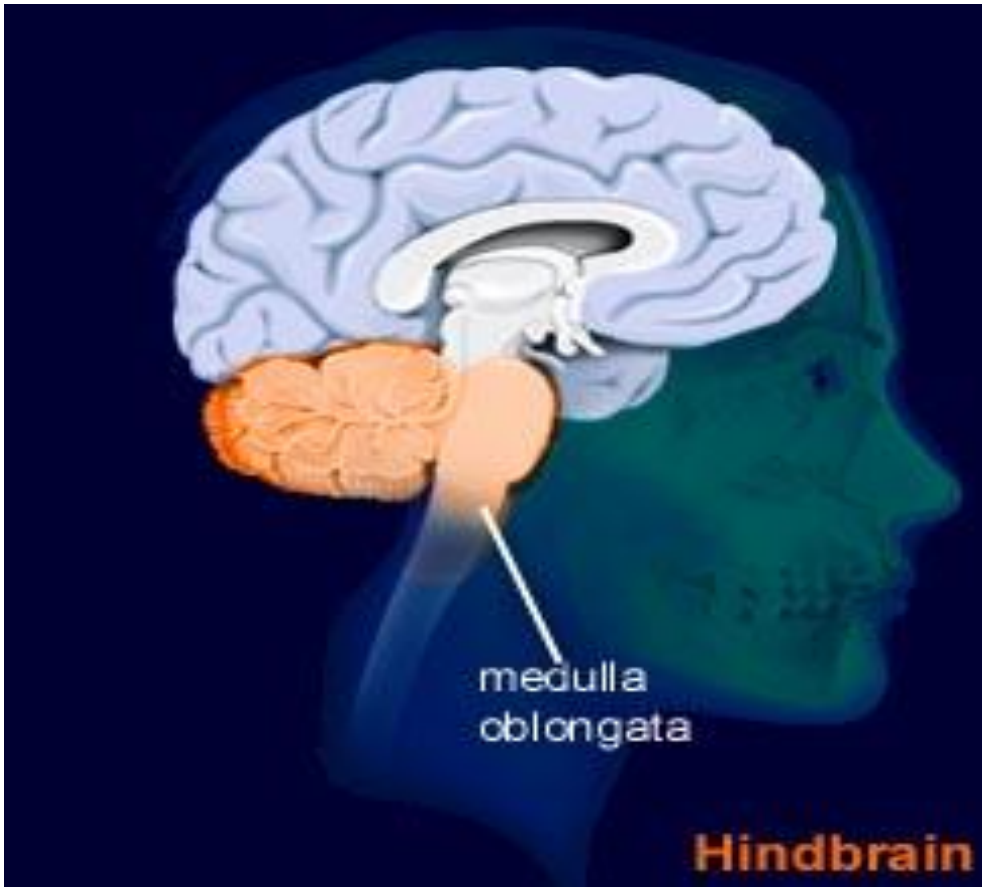
-Found at the bottom of the brain.

-Pathway between higher brain and spinal cord.

-<u>Contains Reflex Centers</u> for: Vomiting, coughing, sneezing, hiccupping, and swallowing.

-<u>Regulates -Vitals</u>: Heartbeat rate, breathing, and blood pressure.





***ii) Hypothalamus* → For Homeostasis**

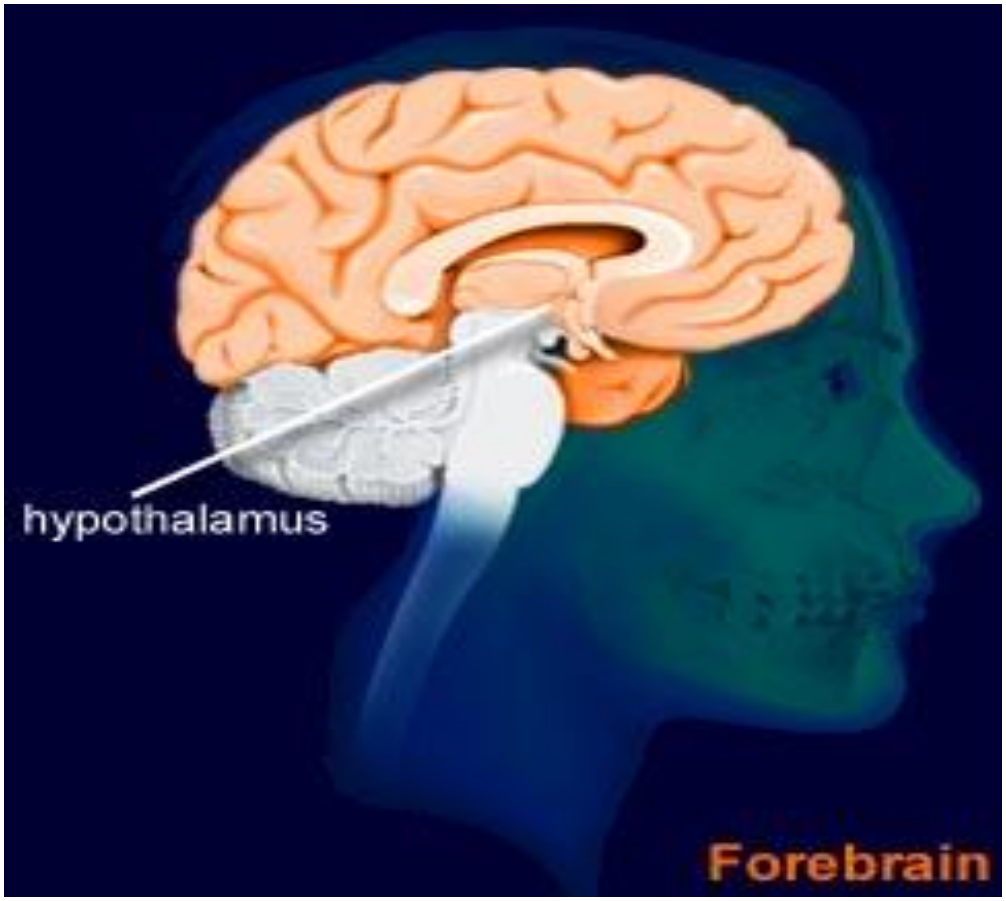
-Located just superior and dorsal to the pituitary gland, forms floor of third ventricle of brain.

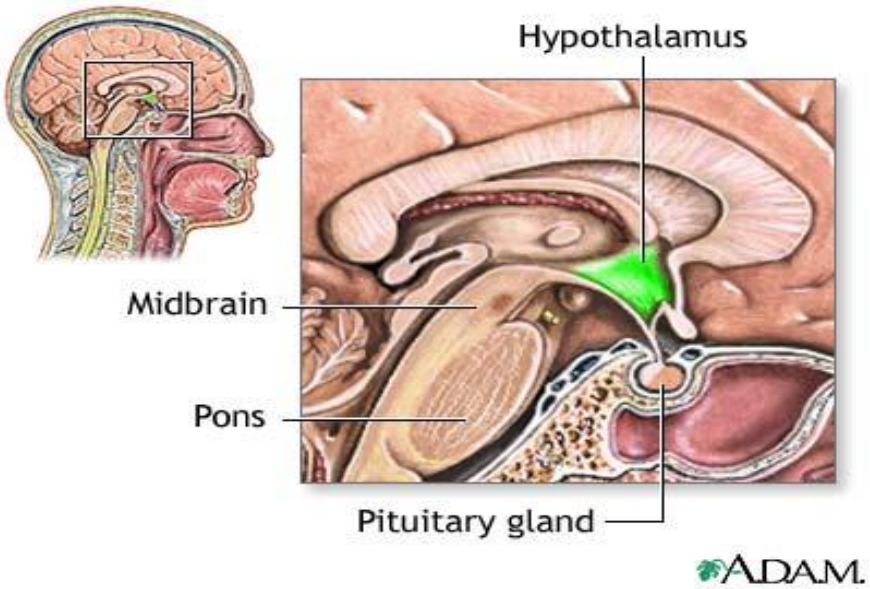
- Also part of the subconscious brain.

-Controls: The pituitary gland. → Hunger, thirst, sleep, body temp, water balance, and BP.

- Pituitary (Master Gland); release hormones: ADH, Oxytocin, TSH, Growth Hormone, and more.

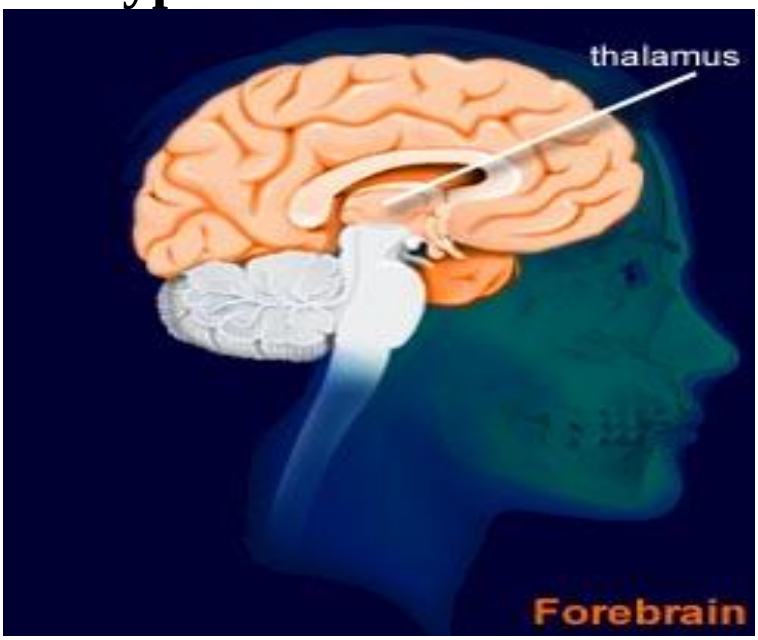
- <u>Maintains homeostasis</u> by controlling endocrine, Hypothalamus acts as a direct link between Nervous System and the Endocrine (hormonal) system.





iii) Thalamus- The "Gatekeeper/Operator"

-Above the hypothalamus



- <u>Channels</u> and <u>prioritizes</u> in-coming sensory info (visual, auditory, somatosensory) to the appropriate places of cerebrum, and prevents sensory overload.

iv) Cerebellum

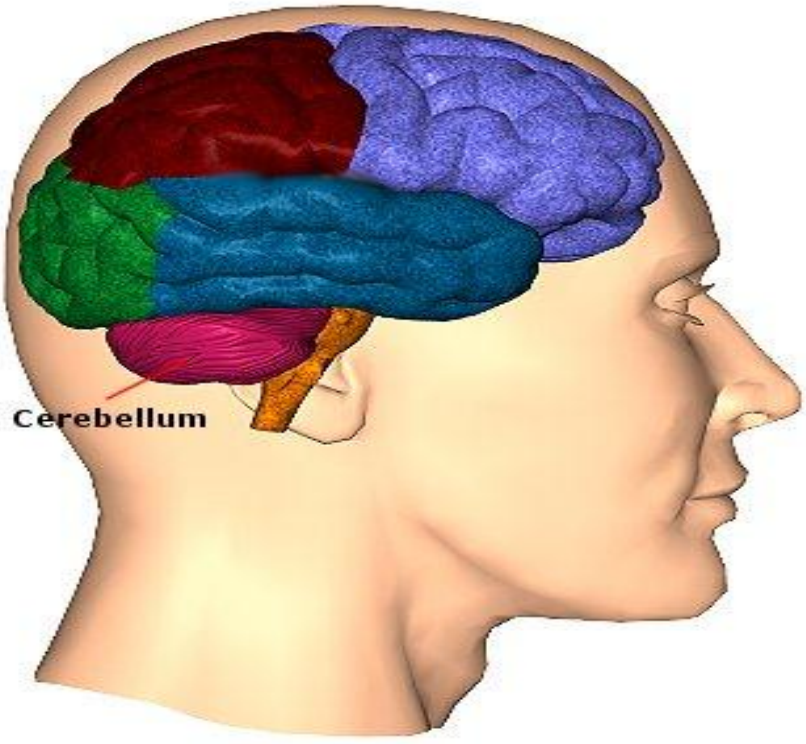
-Butterfly shaped structure.

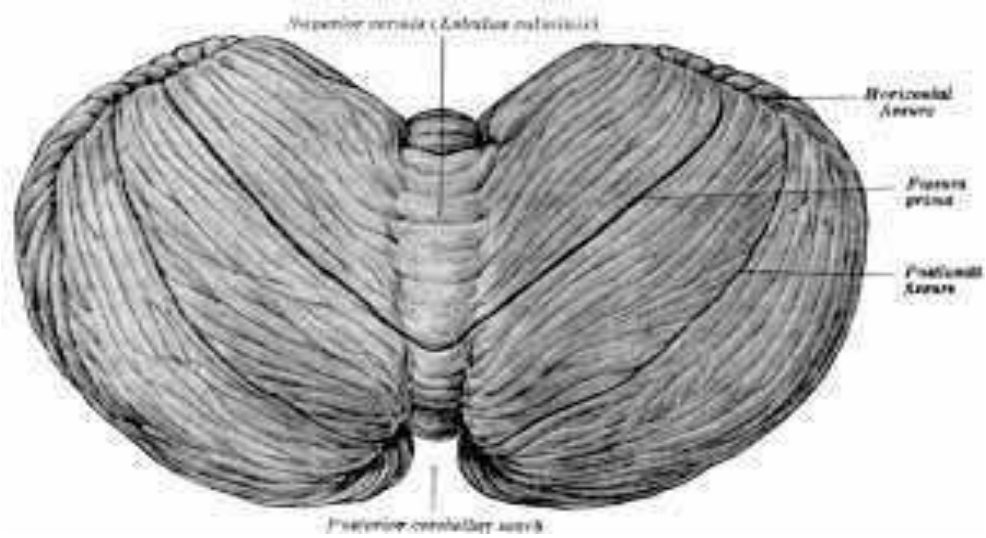
- Makes up the rear, lower portion of the brain; dorsal to the Pons and Medulla Oblongata of the Brain Stem.

- Second largest portion of the brain.

- Receives sensory info from sensory organs and muscles to help the brain interpret present body position

- Controls: Muscle co-ordination (smooth graceful motions) muscle tone, balance and posture.





Superior View of Cerebellum

v) Cerebrum – Conscious Brain

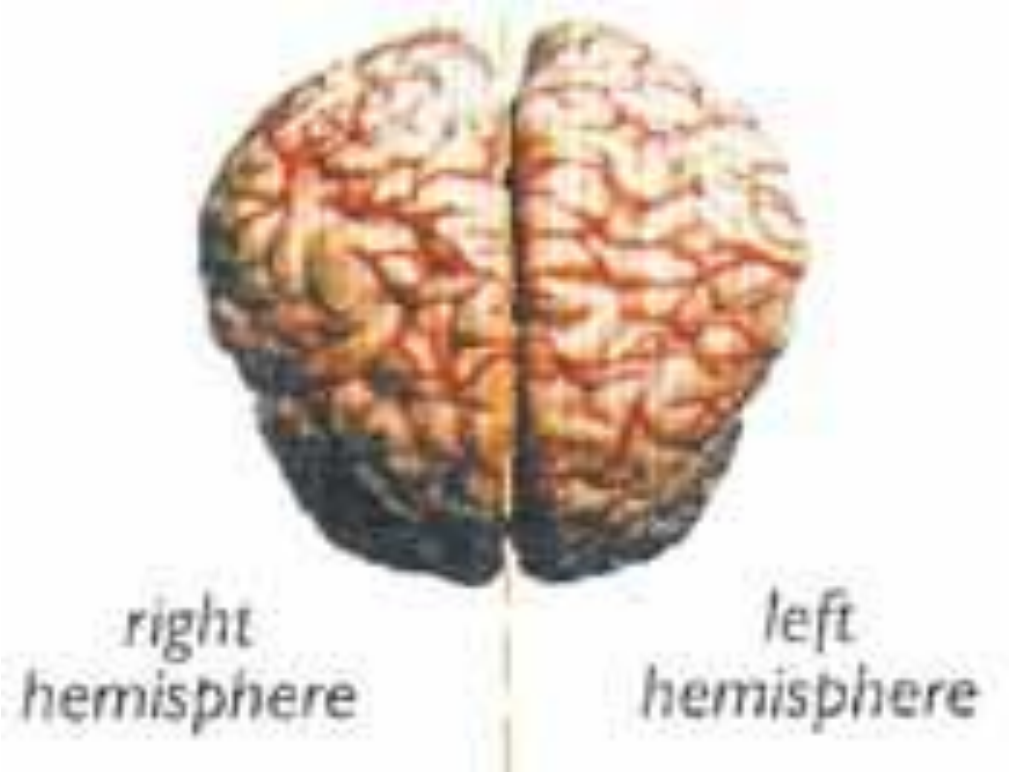
-Largest part of the brain

-Controls: Conscious thought.

- Perceives sensory information, and initiates movements, also holds memory.

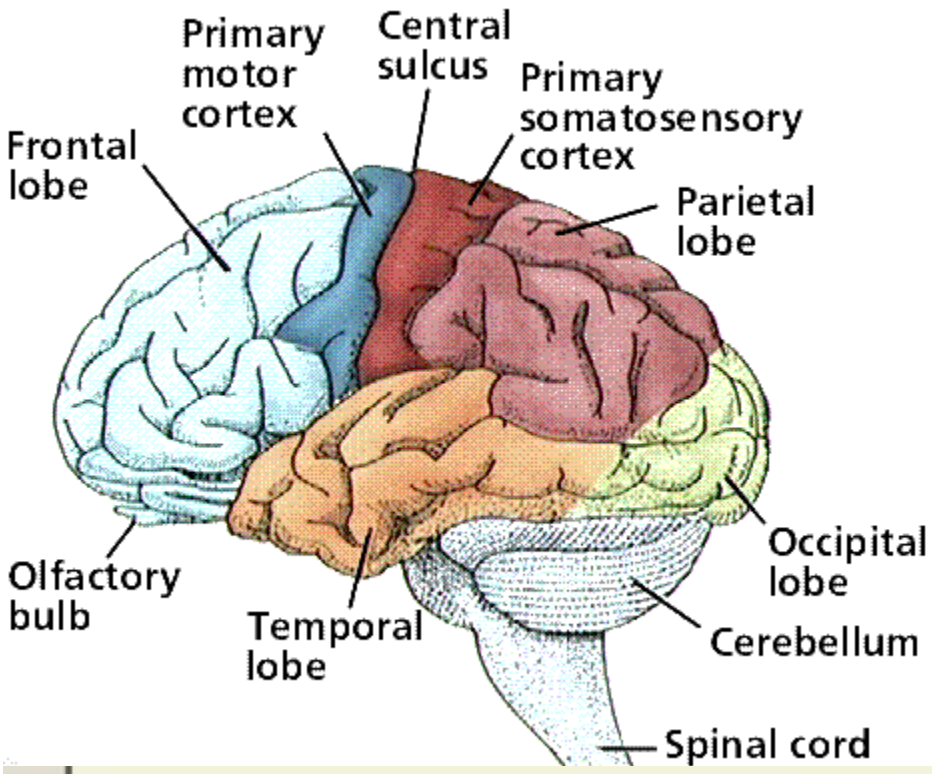
- Outer most layer is referred to as the cerebral cortex.

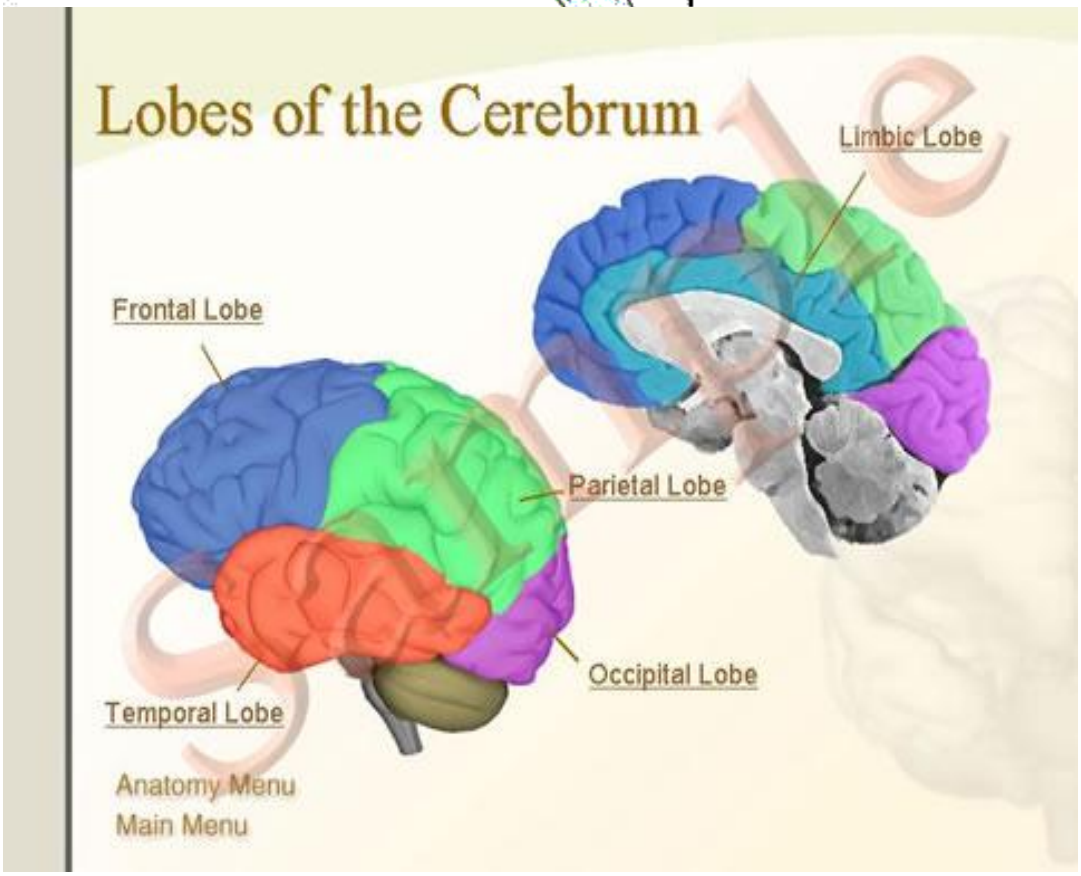
-Contains 2 hemispheres (Right and left).

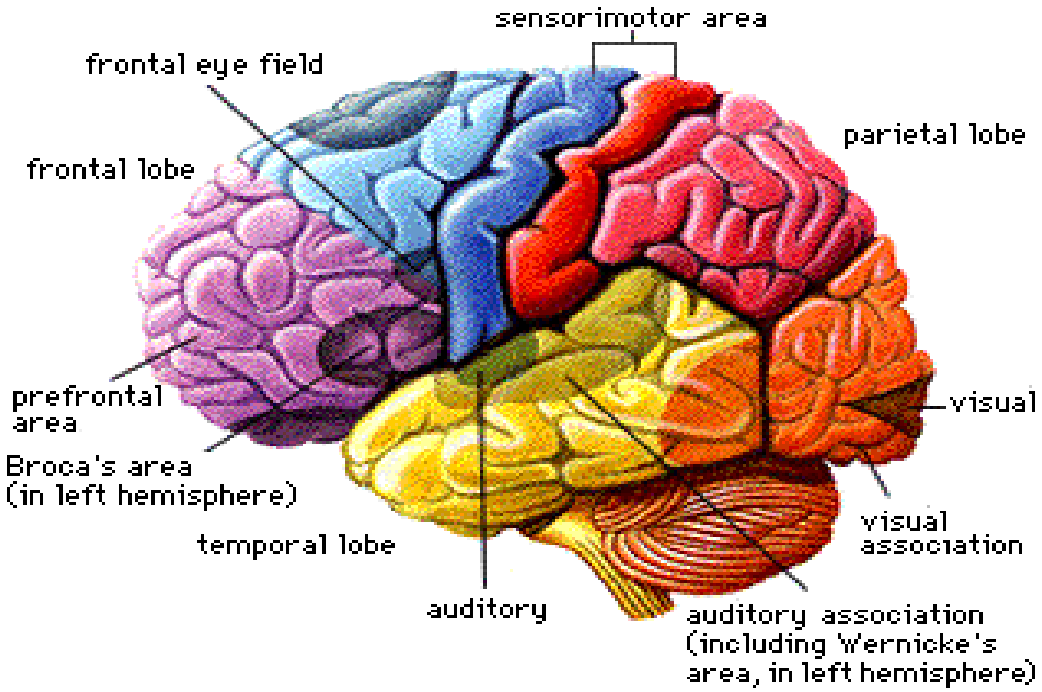


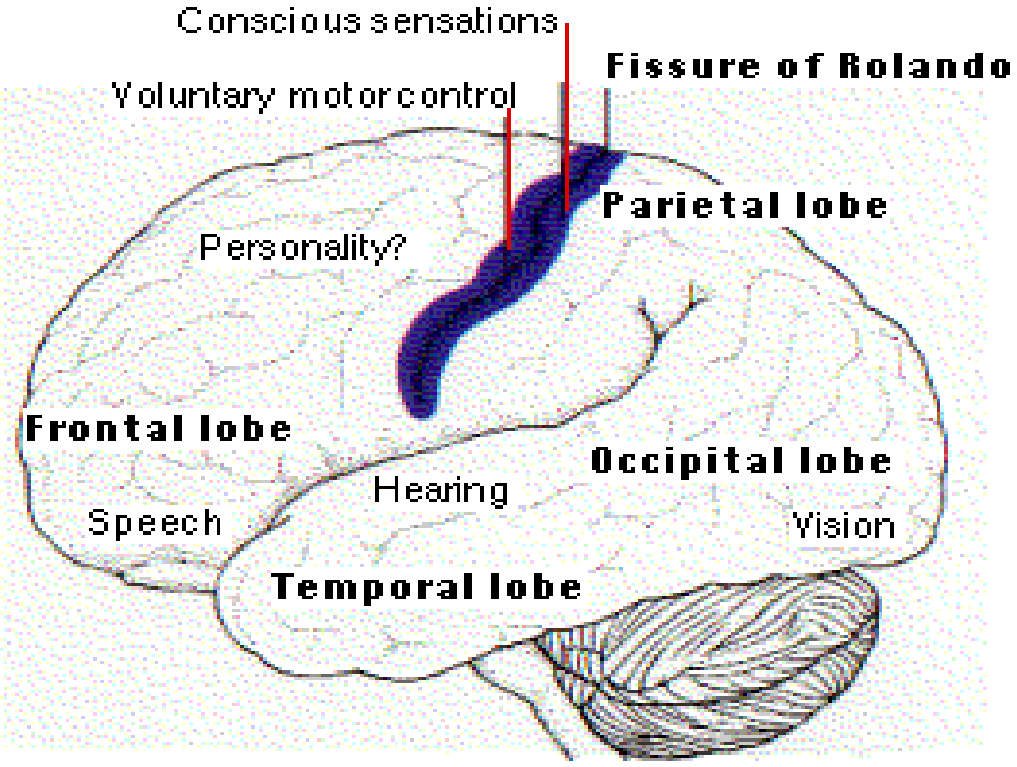
-Parts:

1. **Frontal Lobe - Conscious thought**
2. **Temporal Lobe – Hearing and smelling**
3. **Parietal Lobe – Temperature, Touch and Pain**
4. **Occipital Lobe – Vision**


Primary motor cortex
Central sulcus
Primary somatosensory cortex
Frontal lobe
Parietal lobe
Occipital lobe
Olfactory bulb
Temporal lobe
Cerebellum
Spinal cord


Lobes of the Cerebrum
Limbic Lobe
Frontal Lobe
Parietal Lobe
Occipital Lobe
Temporal Lobe
Anatomy Menu
Main Menu

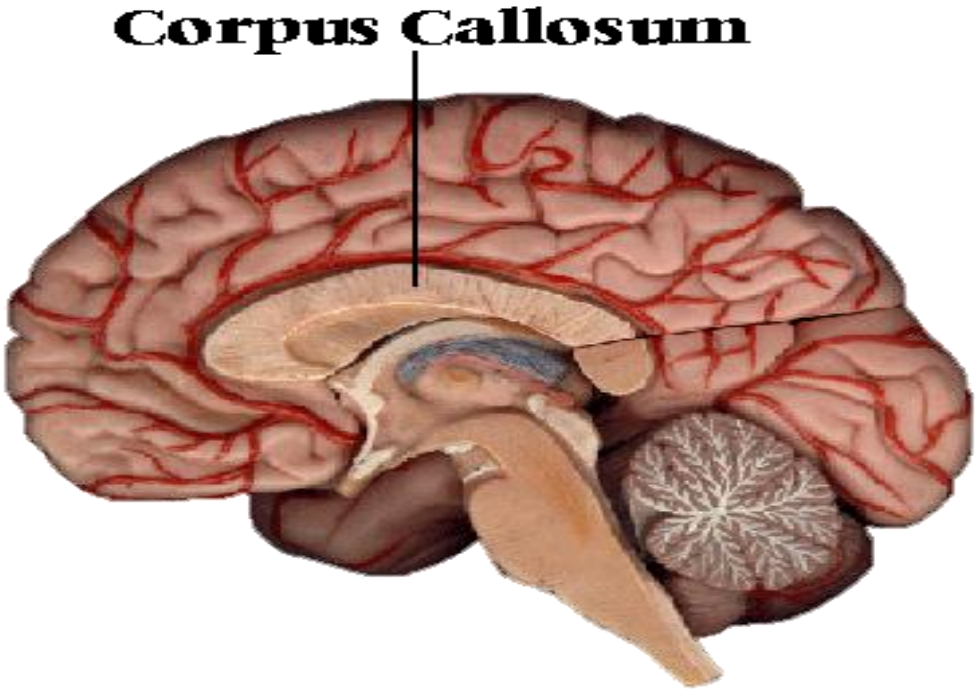

sensorimotor area
frontal eye field
parietal lobe
frontal lobe
prefrontal area
visual
Broca's area (in left hemisphere)
visual association
temporal lobe
auditory
auditory association (including Wernicke's area, in left hemisphere)


Conscious sensations
Fissure of Rolando
Voluntary motor control
Parietal lobe
Personality?
Frontal lobe
Occipital lobe
Hearing
Speech
Vision
Temporal lobe

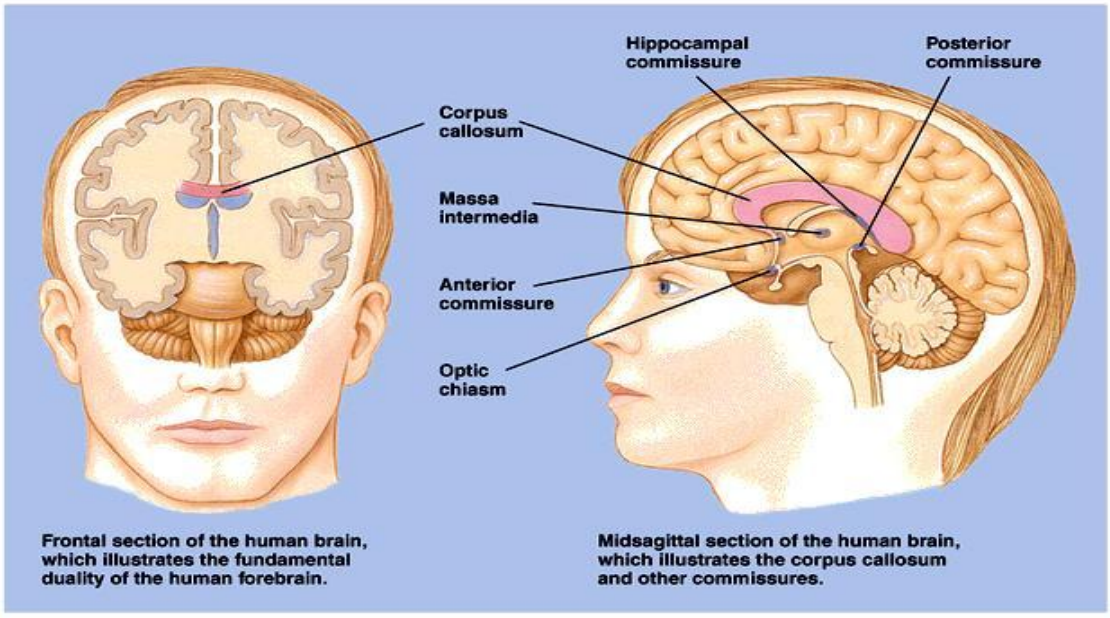
vi) Corpus Callosum

-Holds the hemispheres of the Cerebrum together

-Conducts impulses from one side of the brain to the other.



► Cerebral Hemispheres and Cerebral Commissures



Frontal section of the human brain, which illustrates the fundamental duality of the human forebrain.

Midsagittal section of the human brain, which illustrates the corpus callosum and other commissures.