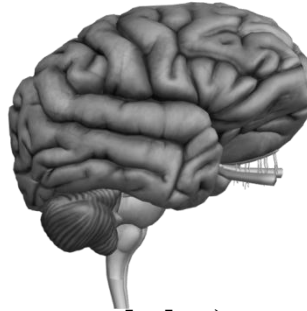


Central Nervous System

Human Brain



Fore Brain:- Forebrain (prosencephalon)

The forebrain consists of

Cerebrum

Diencephalon- epithalamus, thalamus, hypothalamus

Olfactory lobe

Cerebrum

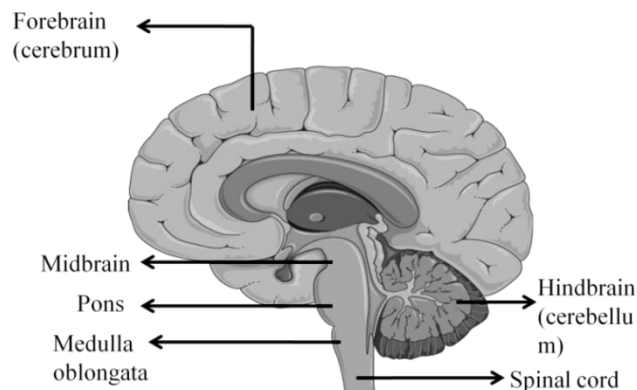
It is first & most developed part of brain.

– It makes 2/3 part of total brain.

– Cerebrum consist of two cerebral hemispheres, on the dorsal surface. A longitudinal groove is present between two cerebral hemispheres called as median fissure. Both the cerebral hemispheres partially connected with each other by curved thick nerve fibres called corpus callosum.

– Each cerebral hemisphere is divided into 4 lobes – Anterior, middle, posterior and lateral. Anterior lobe is also called frontal lobe (largest lobe). Middle lobe is also called parietal lobe. Central sulcus separates frontal lobe from parietal lobe. Lateral lobe or temporal lobe is separated from frontal lobe & parietal lobe by incomplete sulcus called lateral sulcus. Posterior lobe is also called occipital lobe, it is separated from parietal lobe by a sulcus called parieto occipital sulcus.

In right handed person, left hemisphere is dominant while in left handed person right hemisphere is dominant. Many ridges & grooves are found on dorsal surface of cerebral hemisphere. Ridges are known as gyri while grooves are called $\sigma\upsilon\lambda\chi\iota$. These cover the 2/3 part of cerebrum.



NEURAL CONTROL AND CORRDIATION

Olfactory lobes

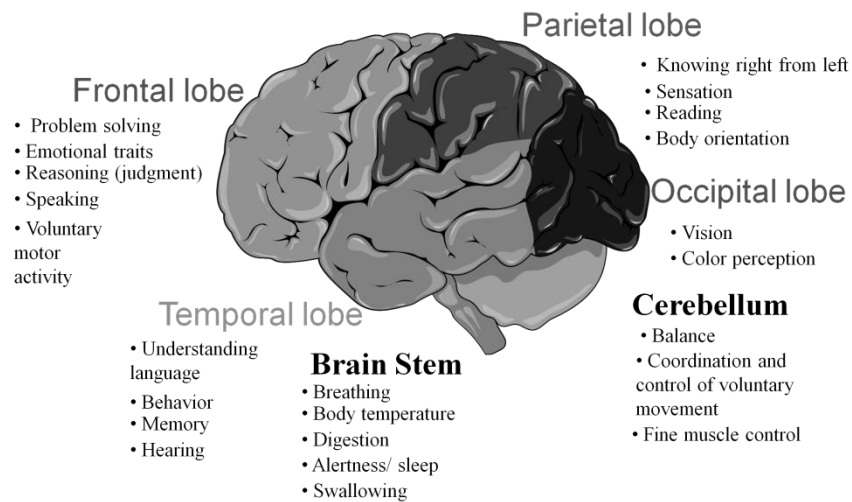
One pair of broad bean size organ called olfactory lobe/bulb are found an ventral surface of frontal lobe of cerebral hemisphere.

It is a small spherical & solid structure in human brain.

It is connected to olfactory centre (temporal lobe) through olfactory tract and are extentions of the brain's limbic system.

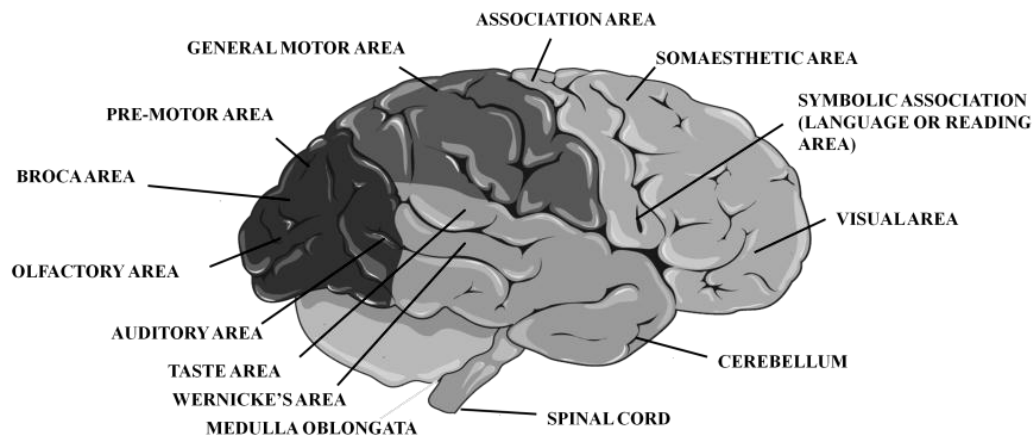
Functions: It is supposed to be centre of smelling power.

Some animal like sharks and dogs have well developed olfactory lobes.

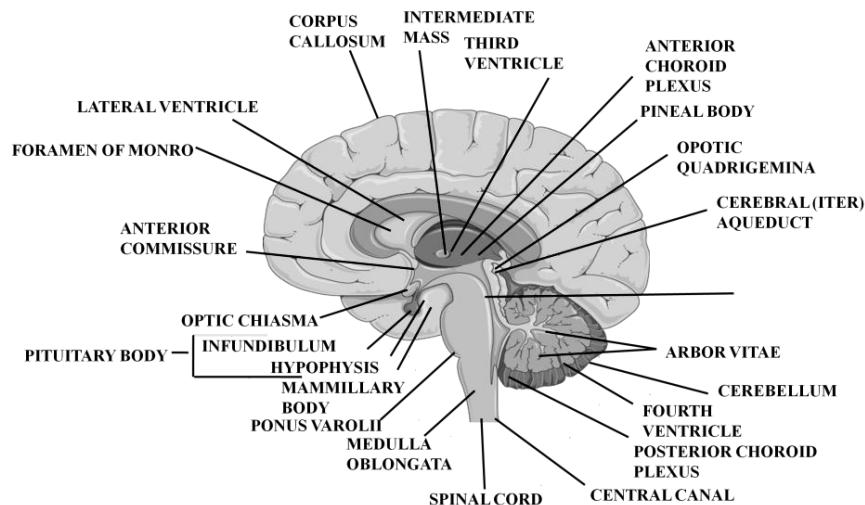


Cerebrum fissures,

It divide each cerebral hemisphere into four lobes interconnected by thick band of transverse nerve fibres called corpus callosum. Formed of grey matter and is called cerebral cortex, while deeper part is formed of white matter and is called cerebral medulla. Cerebral cortex is with a number of sensory areas.



NEURAL CONTROL AND CORRDIATION



- (i) Motor area lies in frontal lobe and controls the voluntary moments;
- (ii) Premotor area lies in frontal lobe and controls involuntary moments;
- (iii) Association area lies in frontal lobe and controls association between various sensations and movements and is also the seat of learning, memory and communication;
- (iv) Somaesthetic area lies in parietal lobe and controls general sensation like pain, touch and temperature;
- (v) Visual area lies in occipital lobe and controls visual sensation;
- (vi) Auditory area lies in temporal lobe and controls hearing;
- (vii) Olfactory area lies in the temporal lobe and controls the smell
- (viii) Taste area lies in the parietal lobe and controls gestation.

Functions:-

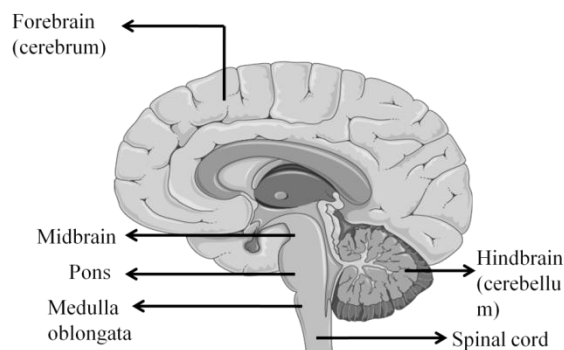
- Cerebral hemisphere controls all the voluntary activities of body.
- It is concerned with perception of a number of sensory stimuli.
- It is seat of memory, will, intelligency, reasoning and learning.
- Thalami one pair of masses of neurons present in cerebral medulla below thalami. Controls the involuntary functions like hunger, thirst, sweating, sleep, fatigue, sexual desire, water balance, blood pressure, anger fear, temperature regulation etc. secretes neurohormones also gives a nervous process called infundibulum (forms pars nervosa) which meets a pharyngeal outgrowth called hypophysis. Both collectively form master gland called pituitary body. In front of hypothalamus, there is cross of two optic nerves called optic chiasma. Behind the hypothalamus, there is one pair of small, rounded, nipple-like bodies called mammillary bodies or corpora mammillares.
- **Limbic system** (also called emotional brain) is a wish-bone or fork-like nucleus present close to hypothalamus. It has important role in controlling the behavior patterns like feeding habits, sexual behavior and emotional behaviour.

Other important nuclei are:

NEURAL CONTROL AND CORRINATION

Amygdala (It is almond-shaped area between two forks of limbic system and controls emotional behavior like aggression and fear) and hippocampal area (It is 'sea-horse' shaped and makes swollen lower tip of limbic fork. It controls learning, memory, etc.) Thalami and hypothalamus collectively form diencephalon. Inside diencephalon, there is a narrow cavity called third ventricle or diacoel which is connected anteriorly with lateral ventricle (also called paracoels) of cerebral hemispheres by a common aperture called foramen of Monro, while it is connected posteriorly with fourth ventricle of medulla oblongata through a narrow longitudinal canal called iter or Aqueduct. Roof of diencephalon is called epithalamus, whose anterior part forms a non-nervous anterior choroid plexus which secretes cerebrospinal fluid. Its posterior part forms pineal body at the tip of a pineal stalk

Mid-Brain:-



Mid-Brain:-

- **Optic lobes:** are one pair, large sized lobes present on dorsal side. Each is divided transversely into upper and larger superior colliculus and lower and smaller inferior colliculus. So there are four optic lobes, so called optic quadrigemina (only in mammals).
- **Functions:** These controls visual reflexes (superior coliculi); and auditory reflexes inferior coliculi).
- **Cerebral peduncles.** These are a pair of thick bands of longitudinal nerve fibres present on the floor of mid-brain.

Functions:

- Four optic lobes or colliculus present, superior optic lobes are the main centres of **pupillary light reflexes**. Inferior optic lobes are related **acoustic (sound) reflex action**.
- Crura cerebri controls the muscles of limbs.

Tier:

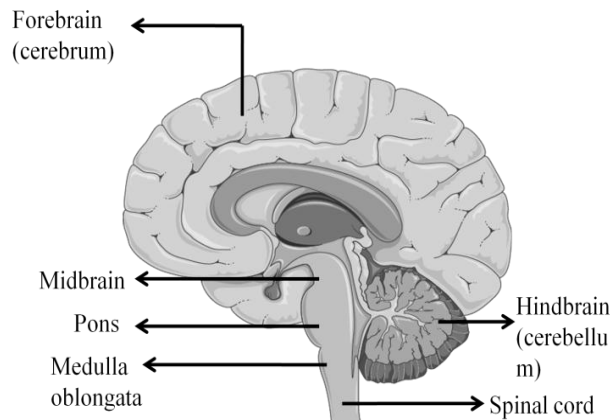
A tent shape space or cavity present between anterior pons, medulla & posterior cerebellum called IVth ventricle 3rd and 4th ventricle are connected with each other through a hollow tube known as Tier or Aqueduct of salvias.

Hind Brain:-

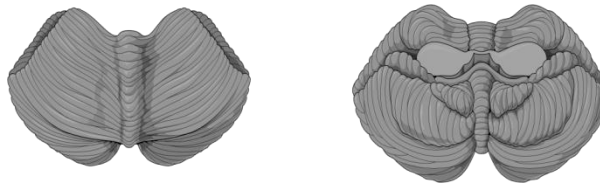
NEURAL CONTROL AND CORRDIATION

Hind Brain :

3 Parts – (1) Pons (2) Cerebellum (3) Medulla Oblongata (M.O.)



Cerebellum (Little brain)



Cerebellum (Little brain):-

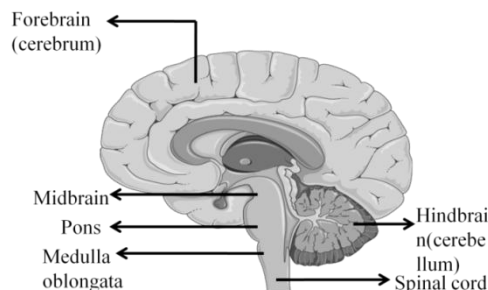
It is the second largest part present below the occipital part of cerebral hemisphere. It is formed of three lobes: Two large-sized cerebellar hemispheres and a small-sized median vermis is connected with other parts of brain by three pairs of cerebellar peduncles of bundles of medullated nerve fibres white matter forms a tree-like branching pattern called arbor vitae, so the cerebellum is solid.

Functions:

- (I) coordinates the voluntary movements.
- (ii) It controls equilibrium and posture.
- (iii) Cerebellum controls rapid muscular activities such as running, typing, talking, etc

Medulla oblongata:-

It is posterior most part of brain. It is pyramid-shaped. It is with a cavity called fourth ventricle or myelocoel. Roof of medulla oblongata is thin, non-nervous and.

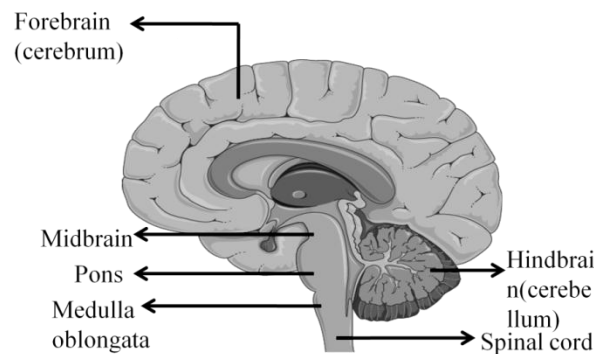


NEURAL CONTROL AND COORDINATION

- forms posterior choroid plexus controls involuntary functions of body through centres like cardiac centres (heart beat); respiratory centres (respiration); vasomotor centres (contraction of blood vessels); salivary centres (secretion of saliva) controls coughing, sneezing, vomiting, urinating defaecation, gut peristalsis, swallowing of food, etc.
- Midbrain, pons Varolii and medulla oblongata collectively form the brain stem. In medulla oblongata and pons Varolii, grey matter is internal and white matter is external.

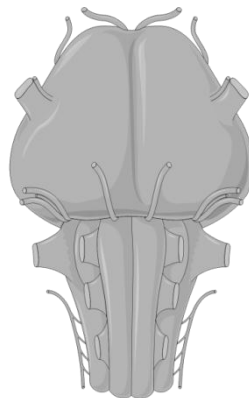
Pons Varolii.

It is a thick band of transverse nerve fibres present at floor of medulla oblongata. It coordinates two cerebellar hemispheres coordinates muscles of two sides of body. It also relays impulses between medulla oblongata and superior parts of brain like cerebellum and cerebrum through bands of myelinated nerve fibres called peduncles.



Brain stem

Mid brain, pons and medulla are situated in one axis and it is called as Brain stem.



Cerebrospinal fluid

This fluid is clear and alkaline in nature just like lymph. It has protein (Albumin, globulin), glucose, cholesterol, urea, bicarbonates, sulphates and chlorides of Na, K. Protein & cholesterol concentration is lesser than plasma & Cl^- conc. is higher than plasma.

– In a healthy man, in 24 hrs, 500 ml of C.S.F. is formed & absorbed by arachnoid villi. At a time total volume of C.S.F. is 150 ml.

NEURAL CONTROL AND CORRINATION

– CSF is present in ventricle of brain, subarachnoid space of brain & spinal cord. Formation : Mainly in choroid plexus of lateral ventricles, minor quantity is formed in IIIrd ventricle & IVth ventricle. Collection of CSF for any investigation is done by lumbar puncture (L.P.). It is done at L3–L4 region. Spinal anaesthesia is also given by L.P. Functions of C.S.F.:– Protection of Brain: It act as shock absorbing medium and work as cushion.

– It provides buoyancy to the brain, so net weight of the brain is reduced from about 1.4 kg to about 0.18 kg.

– Excretion of waste products.

Endocrine medium for the brain to transport hormones to different areas of the brain.

Circulation : From the ventricles CSF comes into subarachnoid space through foramen of Magendie & foramen of Luschka.

In subarachnoid space, CSF is absorbed by arachnoid villi which pour it into cranial venous sinus. From venous sinus CSF enters in blood circulation.



Choroid plexus → Lateral ventricle → Foramen of Monro

↓
Diocoel

↓
Iter

↓
IVth ventricle

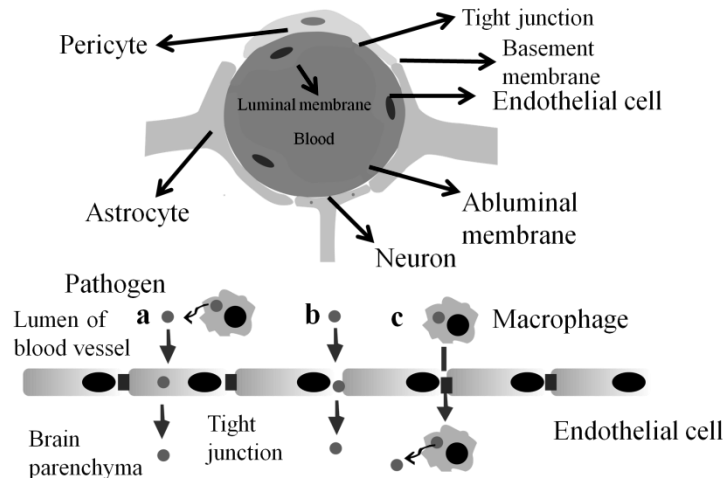
↓
Metacoel

C.S.F. Circulation

Blood ← Cranial ← Arachnoid ← Arachnoid ← Foramen of Magendie
 circulation venous villi space and Foramen of Luschka
 sinus

Blood-brain-barrier (BBB)

NEURAL CONTROL AND CORRDIATION



MENINGES:-

Brain is covered by three membranes of connective tissue termed as meninges or meninx.

Pia mater.

It is inner, thin and vascular. It is Innermost, thin and transparent membrane, made up of connective tissue.

Dense network of blood capillaries are found in it, so it is highly vascular. It is firmly adhere to the brain.

Piamater & arachnoid layer at some places fuse together to form leptomeninges. Piamater merges into sulci of brain & densely adhere to it.

At some places it directly merges in the brain and called telachoroidea. Telachoroidea form the choroid plexus in the ventricles of brain.

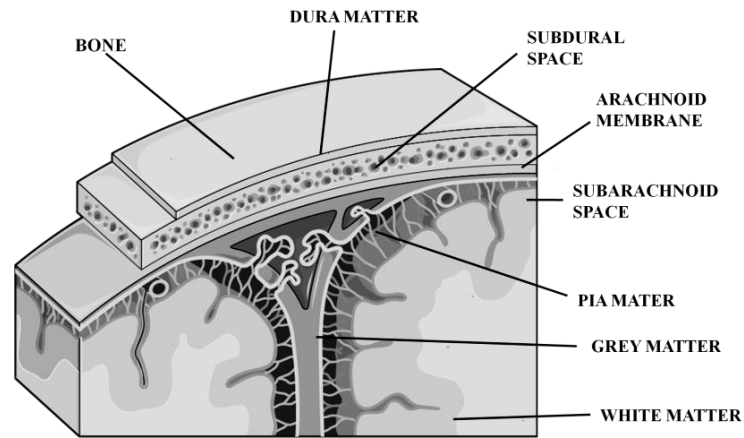
Arachnoid membrane spider webby structure formed of reticular connective tissue.

It is middle, thin and delicate membrane, made up of connective tissue. It is found only in mammals. It is non vascular layer. Infront of cranial venous sinus, it becomes folded, these folds called Arachnoid villi. These villi reabsorb the cerebrospinal fluid (CSF) from sub arachnoid space & pour it into cranial venous sinuses.

Dura mater it is outer, thicker and fibrous also carries oxygen and nutrients from blood to the neurons and neuroglia of CAS This is the first and the outermost membrane which is thick, very strong and non-elastic. It is made up of collagen fibres. This membrane is attached with the inner most surface of the cranium.

– It is double layer – outer Endosteal layer which is closely attached with inner most surface of cranium & no space is found between skull & Duramater (No Epidural space). Inner meningeal layer which is related with other meninges of brain. Both are vascular. Generally both layers are fused with each other, but at some places these are separated from one another & from a sinus called cranial venous sinus. These sinuses are filled with venous blood.

NEURAL CONTROL AND CORRINATION



Practice Question Online