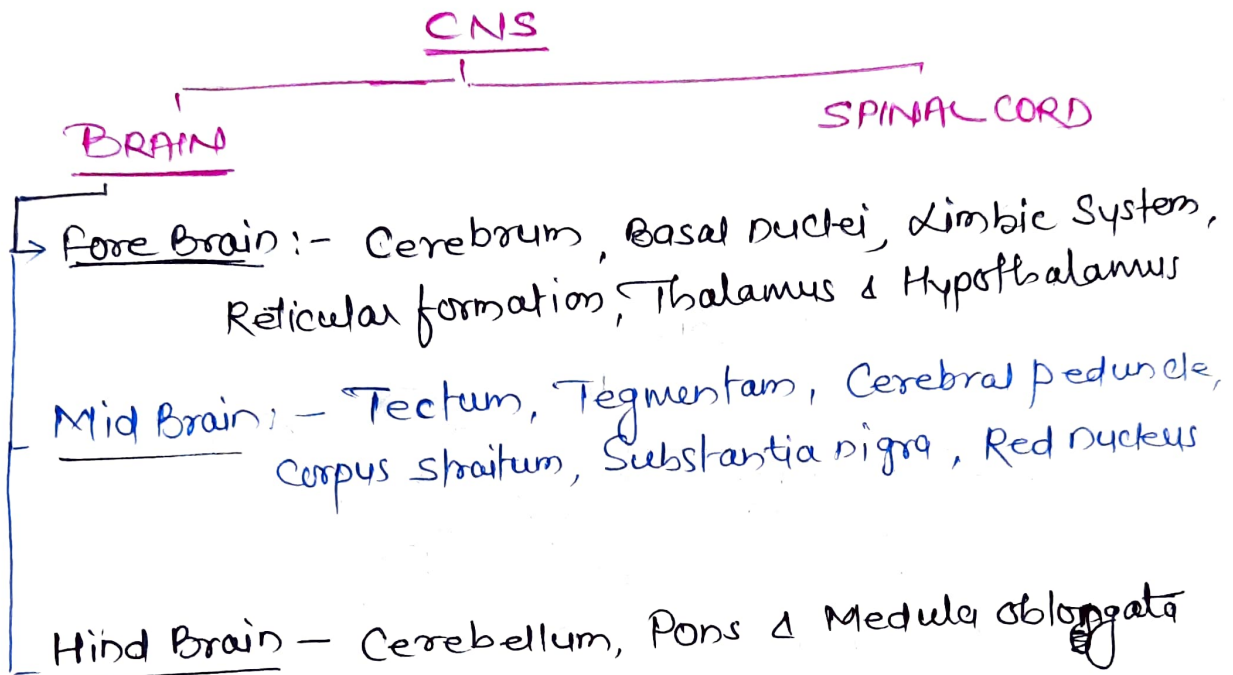


CENTRAL NERVOUS SYSTEM

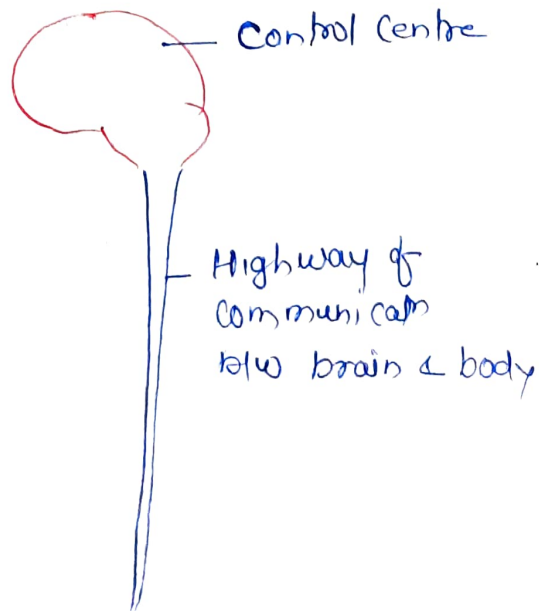
CPU of the human body, which controls most of the body functions & mind.

Type/Division -



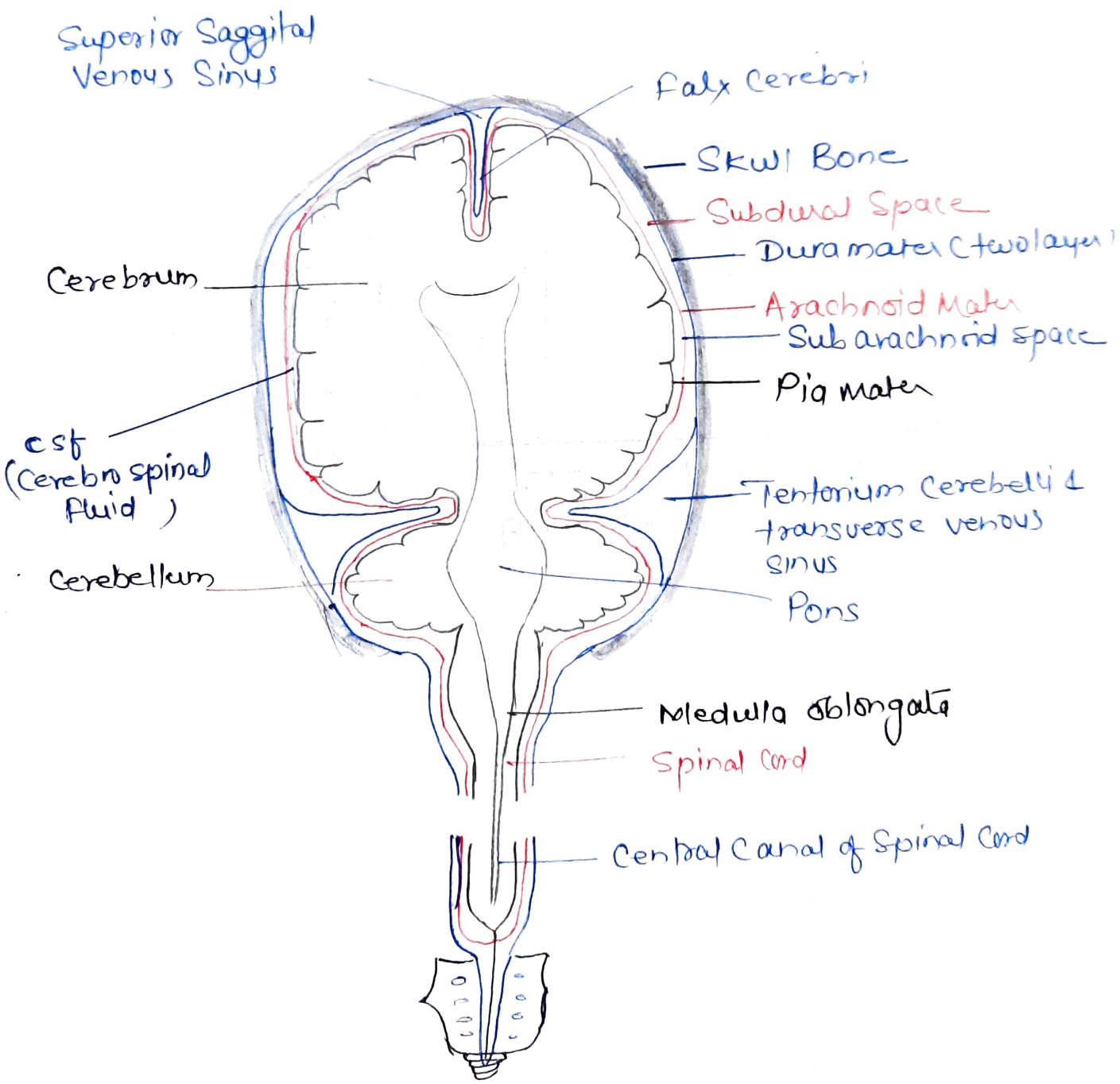
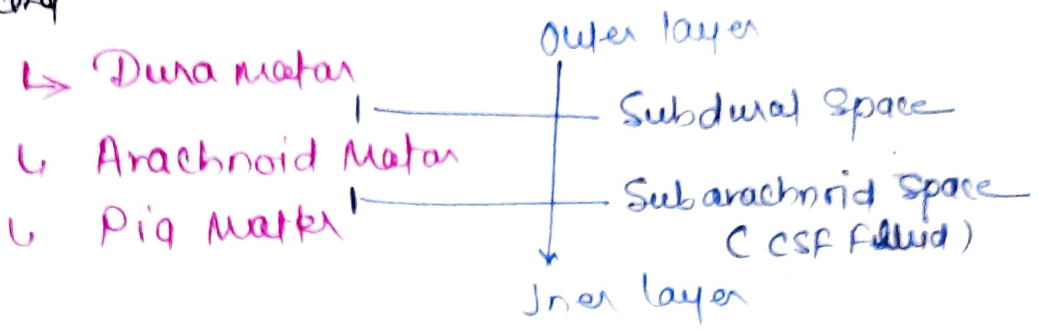
Major function -

- ① Detection & Processing of information
- ② Orientation & Movement
- ③ Reflex Reflex-Action



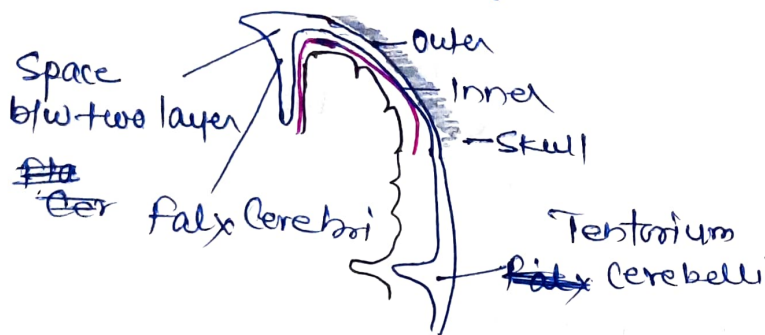
MENINGES

Layers of the Brain & Spinal Cord, called meninges, lying between skull & brain, & between vertebral foramina and spinal cord



1. DURA MATER

- # Consists of two layers of dense fibrous tissues
- # The outer layer takes place of the periosteum on the inner surface of the skull bones & inner layer provides a protective covering for the brain



- # Venous blood from the brain drains into venous sinuses b/w the layers of dura mater.
- # Spinal dura mater forms a loose sheath round the spinal cord, extending from the foramen magnum to the second Sacral vertebra
- # Nerve entering & leaving the spinal cord pass through the epidural space
- # Dyes, used for diagnostic purposes, and local anesthetic analgesic to relieve pain, may be injected into the epidural space.

2. Arachnoid Mater

- # Layer of fibrous tissue that lies between the dura mater and pia mater
- # Separated from duramater by Subdural space and from the pia mater by subarachnoid space, containing cerebrospinal fluid.
- # lies upto 2nd Sacral vertebra

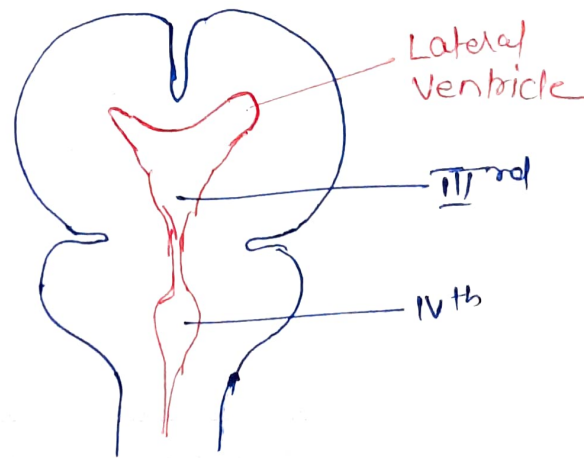
3. Pia Mater

- # Delicate layer of connective tissue containing many minute blood vessels
- # It adheres to the brain, completely covering the convolution & dipping into each fissure.
- # Continues upto "filum terminale"

VENTRICLES

- # Cavities within the brain called Ventricles, containing CSF
- # There are 4 irregular-shaped cavities -

- ① Right & left Ventricles
- ② Third Ventricle
- ③ Fourth Ventricle

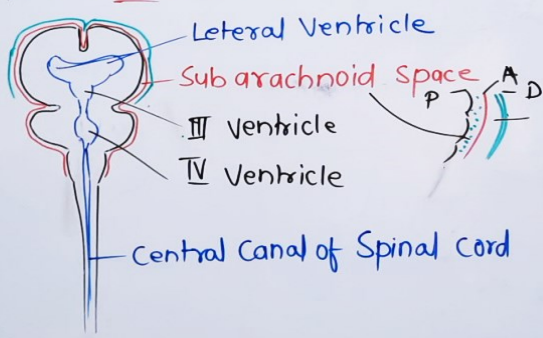


- # Lateral Ventricle :- RLV & LRV
 - # present in the **Cerebrum**
 - # It is like a Transverse - C-shaped & connected to III ventricle by Interventricle Foramen.
- # III ventricle :-
 - # present ~~is~~ between two halves of **Thalamus**.
 - # It is connected to the IVth ventricle by Cerebral aqueduct.
- # IV Ventricle :- lies in the front of **Cerebellum** & behind the **medulla oblongata** & pons.
 - # The IV ventricle is in continuity with **central canal** which extend throughout the **Spinal cord**.

CENTRAL NERVOUS SYSTEM:

CEREBRO SPINAL FLUID (CSF)

- # It is a modified tissue fluid present in Sub-arachnoid space, Cerebral-ventricles & Central canal of Spinal Cord
- # In Adult = 150 ml
- # It is a clear, colourless, watery fluid formed by the blood vessels of choroid plexuses



Rate of production:- 0.5 ml/min

Composition

- Proteins - 15-45 mg/dL
- Glucose → 50-80 mg/dL
- Lymphocyte → 0-5 / cu mm
- Electrolyte (meq/L)
 - ✓ Na^+ - 150
 - ✓ K^+ - 3
 - ✓ Ca^{2+} - 2.3
 - ✓ Mg^{2+} - 2.3
 - ✓ HCO_3^- - 21
 - ✓ Cl^- - 130

Pressure - ✓ Lumber - 70-180 mmHg
✓ Ventricle - 70-190 mmHg

- Functions -
- 1) Bathing of Brain & Spinal cord
 - 2) Act as a shock absorber (Protection)
 - 3) Act as a buffer
 - 4) Supply nutrients & take away of waste
 - 5) protect brain & spinal cord from infection

CENTRAL NERVOUS SYSTEM

- # Control Centre (CPU)
- # Regulates variety of Body function

DIVISION

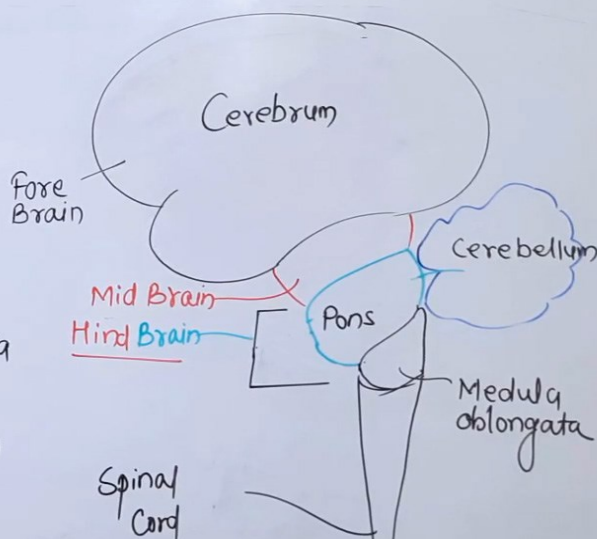
1. Brain

- A. Fore Brain :- Cerebrum, Basal Nuclei, limbic System, Reticular formation, Thalamus, Hypothalamus
- B. Mid Brain :- Tectum, Tegmentum, Cerebral Peduncle, Corpus striatum, Substantia nigra, Red nucleus
- C. Hind Brain - Cerebellum, Pons, Medulla oblongata

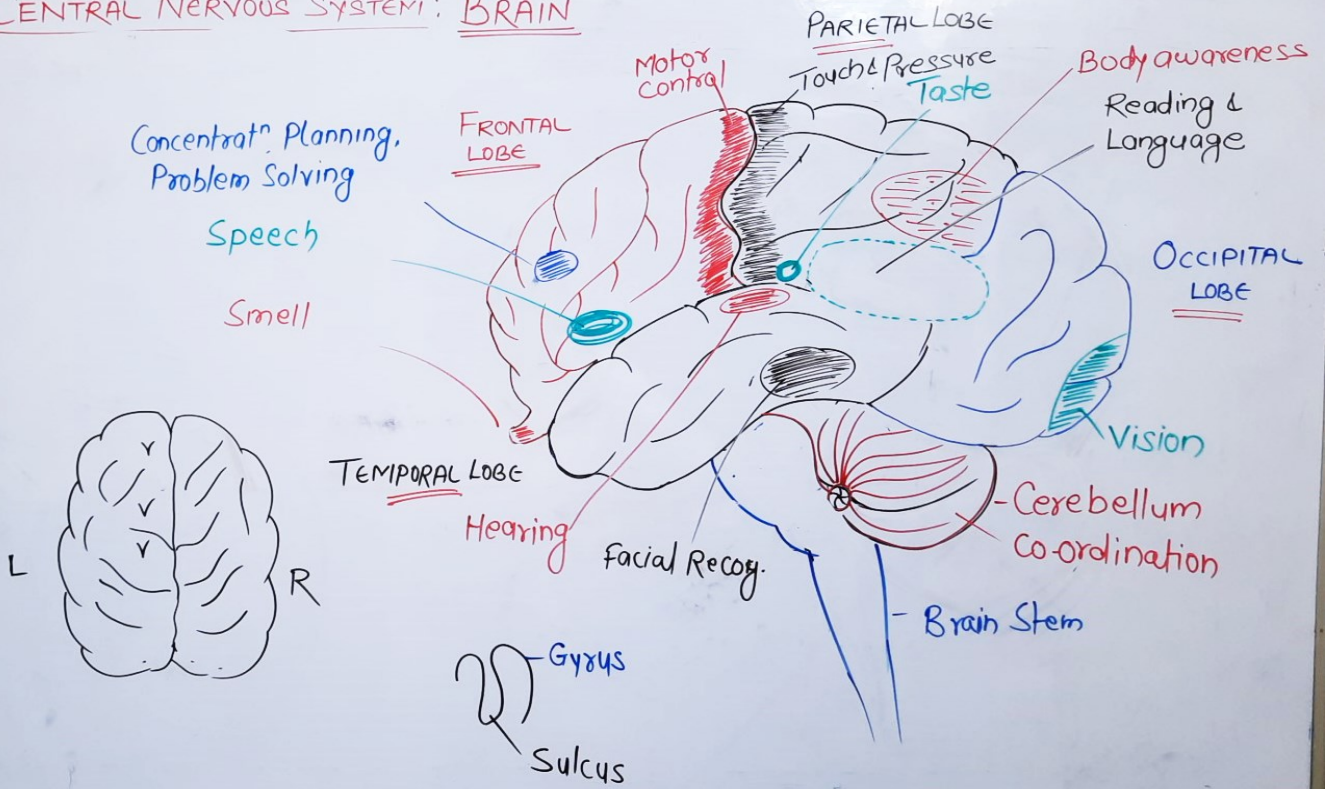
2. Spinal Cord

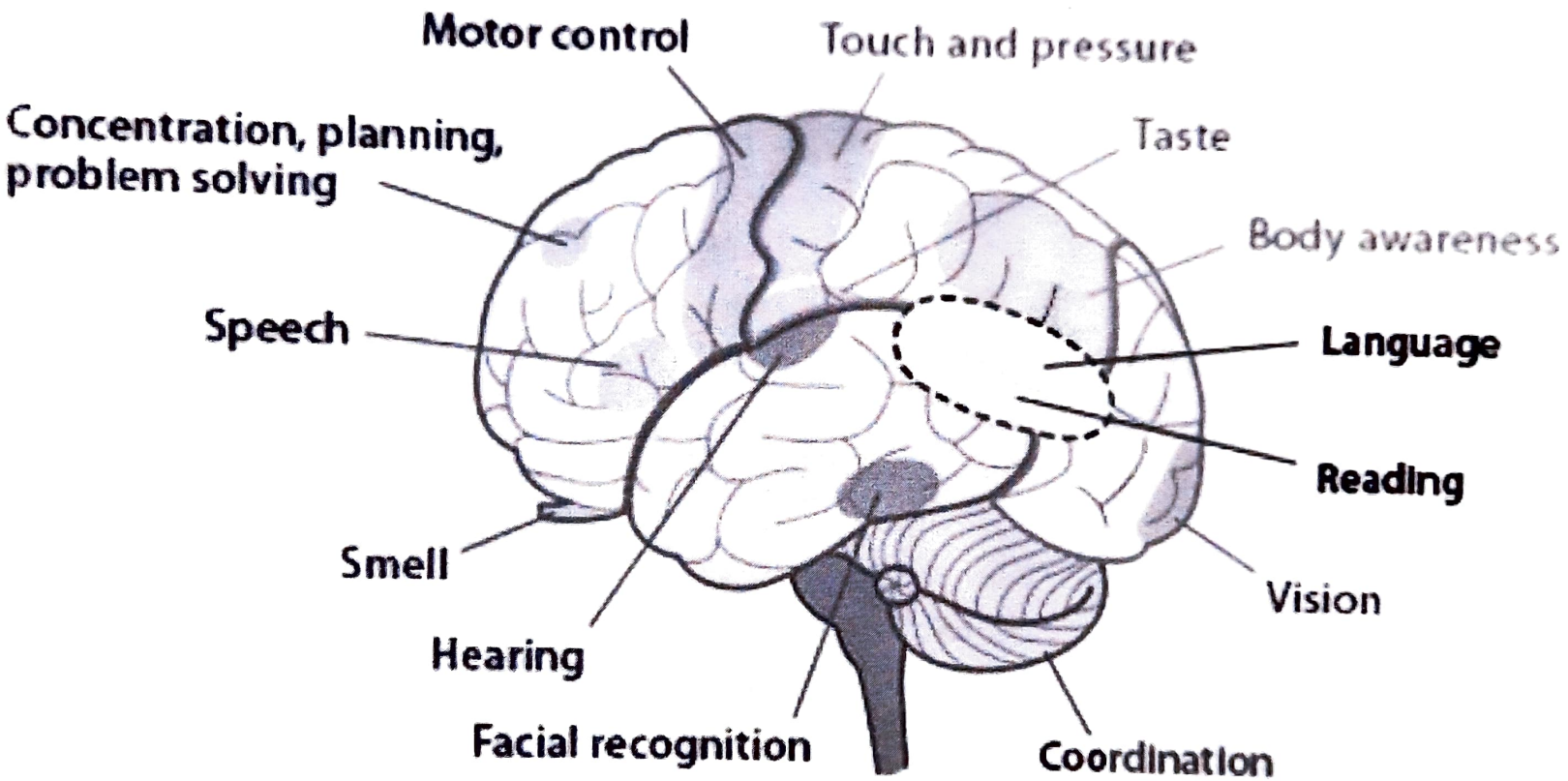
Major function -

- ① Detection & Processing of Information
- ② Movement & Body orientation
- ③ Reflex activity



CENTRAL NERVOUS SYSTEM: BRAIN





nuclei - junctions betⁿ two neuron.

Frontal Lobe

- Problem solving
- Emotional traits
- Reasoning (judgment)
- Speaking
- Voluntary motor activity

Parietal Lobe

- Knowing right from left
- Sensation
- Reading
- Body orientation

Q.2
K.S.R.B.

Occipital Lobe

- Vision
- Color perception

Temporal Lobe

- Understanding language
- Behavior
- Memory
- Hearing

Cerebellum

- Balance
- Coordination and control of voluntary movement
- Fine muscle control

G.
3CF

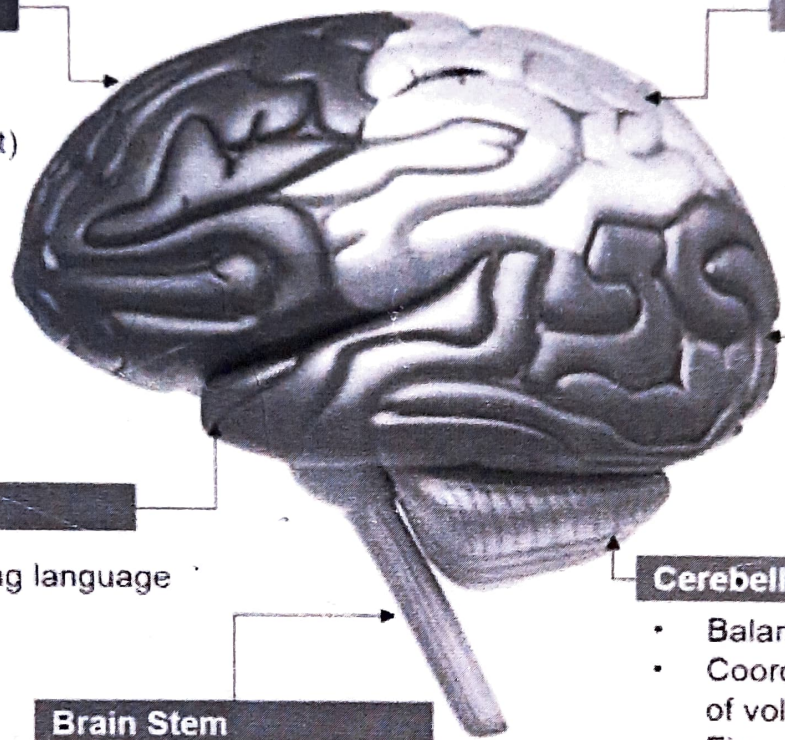
Brain Stem

- Breathing
- Body temperature
- Digestion
- Alertness/sleep
- Swallowing

M.O.
vomiting centre
suckling
swallowing

pons
respiration centre

cranial nerves
& → cranial nerves
re. obl.



Brain

Parts:-

- ① Fore Brain:- Cerebrum, Basal ganglia, Limbic System, Reticular formatⁿ, Thalamus, & Hypothalamus
- ② Mid Brain:- Tectum, Tegmentum, Cerebral peduncle, corpus striatum, Substantia nigra, Red nucleus
- ③ Hind Brain:- Cerebellum, Pons and medulla oblongata

* Cerebrum (Cerebral Hemispheres)

It consists two symmetrical hemisphere which are separated by "~~the~~" Falx Cerebri" & joined by a pulley-like band known as "corpus callosum"

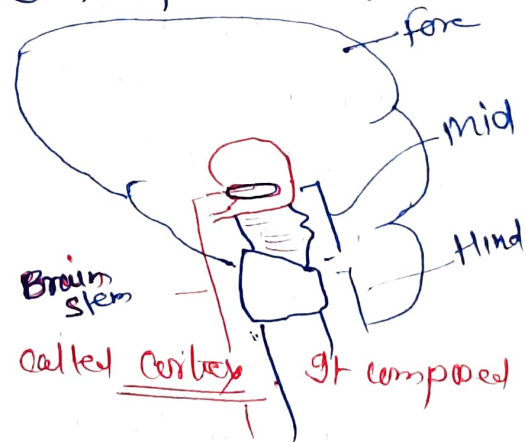
* Right side of the body is represented on the left hemisphere and vice-versa.

⇒ Each hemisphere has five main lobes so divided by four main fissures

Lobes ⇒ ① Frontal lobe, ② Parietal lobe, ③ Temporal lobe, ④ Occipital lobe, ⑤ Limbic area

Fissures:- ① Central ~~sulcus~~ Sulcus

- ② Parieto-occipital Sulcus
- ③ Callosomarginal Fissure
- ④ Sylvian fissure



* Gray matter form the covering surface layer called Cortex. It composed of nerve with related fibre.

* White matter suited underneath the gray matter.

* nuclei are not in gray matter

Function of Cerebral Cortex:-

- ① Motor function:-
 - (a) General motor functⁿ - Volitional - Voluntary
 - (b) Special functⁿ - Regulation of muscle tone, equilibrium and control of posture through ANS
 - (c) Control the centres for speech, smell, & eye movements

② Sensory Function: - Analyse the ~~special~~ sense of touch, pain, pressure, temp, vibration, tactile, discriminative and also govern special senses like ~~touch~~, taste, smell, vision, & hearing.

③ Conditional Reflexes

④ Control of Intelligence - memory, planning, judgement, learning

Frontal Lobe: - motor & sensory strips

↳ Speech Centre - thoughts are formulated into words

Left Side - motor cortex - control right side of body - Hands

Right Side - less dominant

↳ Problem Solving

↳ Speech

↳ Emotional

↳ Voluntary motor activity

↳ Reasoning, judgement

Temporal Lobe 2 Contains Auditory Cortex

↳ Hearing impulse received ~~by~~ from both ear

↳ Largely associated with sensory cortex - seen, heard, felt

↳ Damaged caused complex visual and Auditory Hallucination

↳ Understanding language

↳ memory

↳ Behavior,

↳ Hearing

Parietal Lobe 1 - Parietal Cortex

↳ Ability to assess the the weight, texture, identity of object that is the stereognostic sensation

↳ Sensation

↳ Body orientation

↳ Reading

Occipital Lobe - Visual Cortex - light visual impulse

↳ Vision

↳ Colour perception

→ Hypothalamus :-

- part of fore brain, situated below the thalamus
- ⇒ It is the most imp co-ordinating centre for motor control for of visceral activity.
- It is connected with mid brain and receive fibres from thalamus, basal nuclei, olfactory & other regions of cerebral cortex

Functions :-

- ① Highest control for ANS
- ② It is one of the reflex centre for the control of emotional changes
- ③ Sleep centre
- ④ Regulator of Body temp through Autonomic ~~reflex~~ effects involving Respiration & Circulation
- ⑤ Control of hunger, feeding, obesity, & thirst
- ⑥ Control of GI acid Secretion
- ⑦ Control of Sexual behaviour
- ⑧ Sec of posterior pituitary hormones
- ⑨ Sec of Anterior pituitary hormones by regulatory Releasing factors

Thalamus = Large oval mass of Grey-matter situated on either side of III Ventricle & extended some distance behind it

Function - It is an imp sensory relay station for the impulse from cerebellum, Reticular formation, basal ganglia, impulse of pain, temp, touch, etc before reaching to cerebral cortex

- ✦ imp reflex centre for emotional reaction such as rage and Anger
- ✦ Ventral part of thalamus is mainly concerned with "Arousal and Alert React"

Basal nuclei → Corpus striatum
→ claustrum
→ Amygdaloid body

Function :- Motor cortex for voluntary muscle activity

Limbic System

It is an integrated network concerned with emotions & include thalamus, hypothalamus, hippocampus, amygdala, Reticular formation in the brain stem.

⇒ The emotional changes such as love, hate, envy, revenge, selfishness, etc controlled by this system.

Cerebellum

It is a biggest part of the hind brain and is situated behind the pons and medulla oblongata. It is separated from pons and medulla oblongata by the IV ventricle. The weight is about 150g in adult.

It has two hemispheres joined by narrow median strip the vermis.

Functionally divided into two parts

- ① Floccular-nodular lobe - Regulation of posture & equilibrium
- ② Corpus Cerebelli - receives tactile, proprioceptive, auditory, and visual impulses through the spinal cord & cerebrum.

- ✦ Balance
- ✦ ~~co-ordinate~~ Co-ordination & control of voluntary muscles
- ✦ Fine muscle control.

Brain Stem

It is a posterior part of brain, continuous with spinal cord

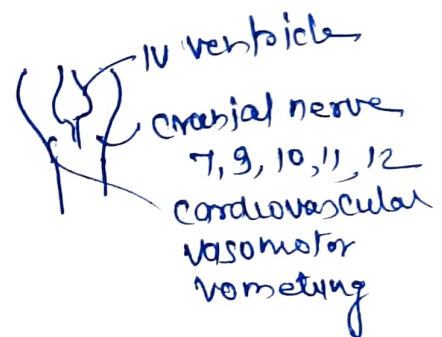
In human Brain stem includes the Midbrain, pons & medulla oblongata of hind brain

→ It is though, a crucial part of brain providing the main motor and sensory nerve supply to the face, neck via the cranial nerves.

- The main functions are - Regulation of

- ① Breathing (Respiration)
- ② Body temp
- ③ Digestion
- ④ Alertness / sleep
- ⑤ Swallowing

Medulla Oblongata :-



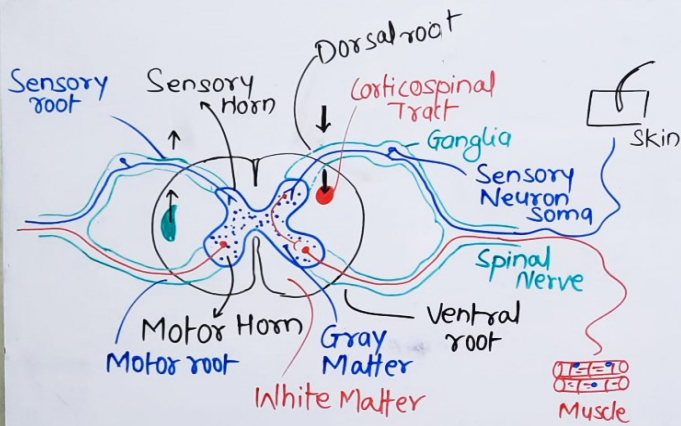
Function ① Control of CVS through pressor & depressor centre

- ② Control of Respiration through inspiratory & expiratory centre
- ③ Integrated reflexes such as coughing, sneezing, Swallowing, Salivary, Sucking, Vomiting

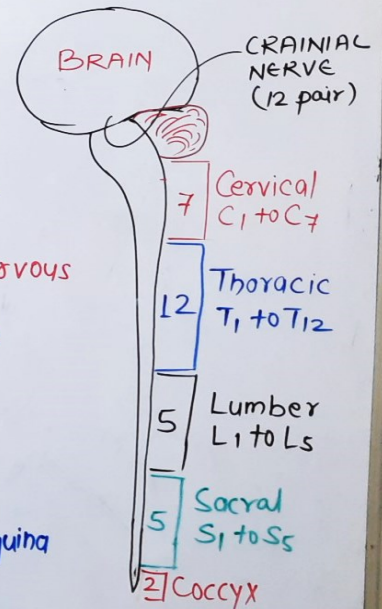
Pons :- Situated b/w midbrain & medulla oblongata, on the anterior part at the base V, VI, VII, & VIII cranial nerves come out & posterior part of pons covered by the cerebellum.

major function :- maintenance of normal ~~of~~ rhythm of Respiration through pneumotaxic and apneustic centre

SPINAL CORD



- ↳ Extension of Brain
- ↳ Long tubular structure
- ↳ 46 cm long
- ↳ Made up by Nervous tissue
- ↳ 31 pair nerve

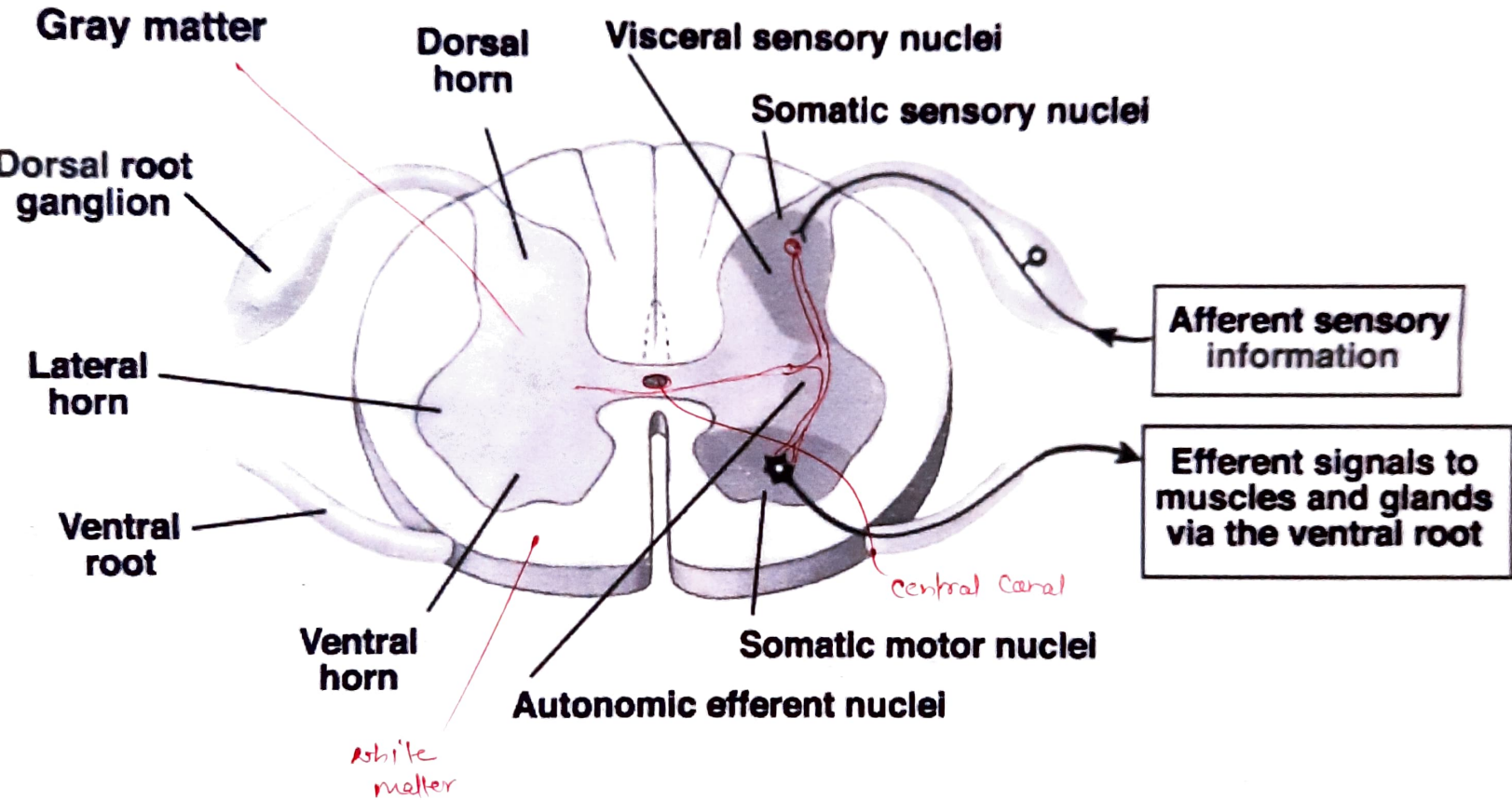


Function:- 1) Establishes link b/w Brain & other parts of body

- 2) Reflex action
- 3) Interconnected with PNS
- 4) Regulate visceral functions of body

Cauda Equina

Filum terminal
(Thin & long)



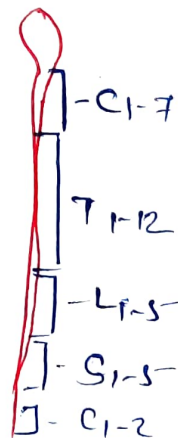
Spinal Cord

It is a long, thin, tubular structure made up of nervous tissue, which extend from the medulla oblongata in the brain ~~stem~~ stem to the lumbar region of the vertebral column.

- It enclosed the central canal of the spinal cord, which contains CSF.
- It is 46 cm long and is thicker in cervical and lumbar region where the nerve supplying in the extremities arise. The lower end of spinal cord consists of bunch (end area) of nerves giving the appearance of horse's tail & hence called "cauda equina". The terminal nerves is thin and long & hence called filum terminale.

There are 31 pairs (62) of nerves on either side that arise from the spinal cord:-

- ① Cervical = 7
- ② Thoracic = 12
- ③ Lumbar = 5
- ④ Sacral = 5
- ⑤ Coccygeal = 2



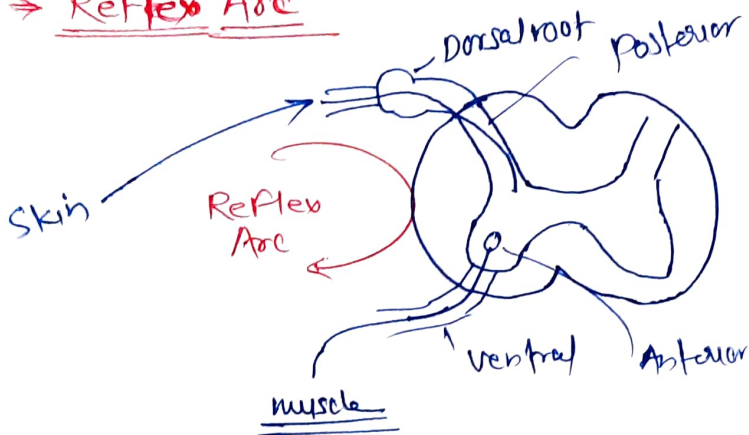
major function :- ① It establishes the link b/w the brain & other parts of body - Brain - Spinal Cord - PNS
through the sensory and motor tract & the peripheral nerves

- ② It is the seat of reflex action
- ③ It is interconnected with ANS
- ④ There are small inter spinal tract in spinal cord

Reflex Action

- ⇒ It is a rapid, speed & involuntary movement in response to a stimulus. It is made possible by neural pathway called reflex arcs, which can act on an impulse before that impulse reach to brain.
- ⇒ It is part of defense mechanism of the body and its action is more rapid than the voluntary action.
- ex - Against temp & pin, (withdrawal of hand)
- closing of eyes against foreign body
- ⇒ Reflex action arises out of the nerve impulses passing through a reflex arc with its centre in the spinal cord.

⇒ Reflex Arc



It incorporates the following

- ① Sensory organ which receive impulse from stimulus - Skin
- ② Sensory nerve fibre conducts impulses to the cell in the posterior root ganglion and then grey matter of the posterior horn of Spinal cord.
- ③ The grey matter of spinal cord through connector nerve pass on the impulses to Anterior horn of Spinal cord
- ④ motor nerve transmits the impulse to respective organ
- ⑤ Motor organ (muscle) stimulated by impulse coming from motor nerve.

Types of Reflex Arcs :-

- ① Monosynaptic :- involving only one synapse, e.g. - stretch reflex of muscle
- ② Disynaptic :- two synapse Afferent → o Intermediary → efferent
ex - Extension Reflex
- ③ Poly synaptic :- involving many intermediary neurons and effector. - withdrawal reflex

Types of Reflexes :-

- ① Unconditioned or Inborn Reflexes :- Inherent, & Not alter
 - Ⓐ Superficial - corneal reflex, abdominal reflex
 - Ⓑ Deep - Knee jerk, Ankle jerk
 - Ⓒ Visceral - digestive reflex - vomiting
- ② Conditional & Acquired

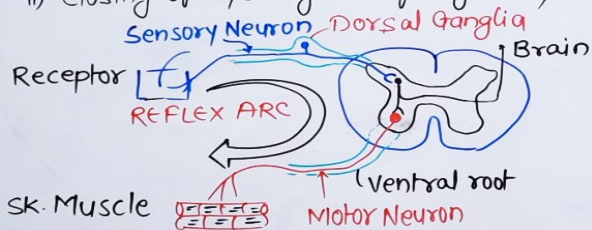
CRANIAL NERVE

= 12 pair

- ① I Olfactory - mucous mem. of nose - Smell
- ② II Optic - Retina & Vision & movement of eye ball
- ③ III Oculomotor - eye muscle - Accomodation of vision
- ④ IV Trochlear - Superior oblique - movement of eye mus. of eye ball
- ⑤ V Trigeminal - Face - Sensation from face & scalp
- ⑥ VI Abducens - Lateral Rectus - movement of eye ball
- ⑦ VII Facial - Skin, face, Salivary gland - taste, Salivary Sec.
- ⑧ VIII Auditory - ear, cochlea - Hearing & equilibrium
- ⑨ IX Glossopharyngeal - Pharynx, taste bud, Salivary gland - Taste, Swallowing movement
- ⑩ X Vagus - pharynx, larynx, abdominal organ - parasympathetic
- ⑪ XI Spinal Accessory - movement of head, rot shoulder, voice
- ⑫ XII Hypoglossal - muscle of tongue - Tongue movement

REFLEX ACTION

- ↳ It is a rapid & involuntary movement in response to a stimulus. It is a part of defense system of the body.
- ↳ It is made possible by neural pathway called reflex arcs, which can act on an impulse before that impulse reach to brain.
- ↳ Ex. → i) Withdrawal of hand against temp. & pin
ii) Closing of eyes against foreign body



INCORPORATED THINGS

1. Sensory Organ → Receive impulse from stimulus
2. Sensory Nerve → Conduct impulse from cell to spinal cord through posterior root
3. Gray Matter - connector b/w posterior to anterior
4. Motor Nerve → Conduct impulse to motor organ

5. Motor organ (muscle) - Stimulated by impulse

Types of Reflex Arcs -

1. Monosynaptic - Involving only one synaps. ex - Stretch reflex of muscle
2. Disynaptic - two synaps involved
Afferent - Interneuron - Efferent
ex - Extension Reflex
3. Polysynaptic - Involving many intermediate neuron & Effector
Ex - Withdrawal Reflex

Types of Reflexes -

1. Unconditioned or Inborn Reflexes → "Inherent"
 - a) Superficial → Corneal & abdominal reflexes
 - b) Deep → knee jerk, Ankle jerk
 - c) Visceral → Digestive reflexes - Vomiting
2. Conditioned or Aquired Reflexes
ex → Riding a Bike
Salivation
Repetitive Motor skill

CRANIAL NERVE

NERVE	PART	Types	DISTRIBUTION & FUNCTION
I. Olfactory	Fore Brain	Special Sensory	Olfactory mucosa of nose; Smell
II. Optic	Fore Brain	Sensory	Retina of Eyes; Vision
III. Oculomotor	Mid-Brain	Motor	Intraocular & four extra-ocular muscle of eyes Movement of the Eyes
IV. Trochlear	Mid Brain	Motor	one extra-ocular muscle, Move eye look at nose
V. Trigeminal	Pons	Mixed	Derivatives of frontonasal process & 1st pharyngeal arch, Face Sensation
VI. Abducent	Junction b/w Pons & Medulla	Motor	One extra-ocular muscle, Abduct the eyes
VII. Facial		Mixed	Derivatives of 2nd pharyngeal arch Facial Expression & Taste
VIII. Vestibulocochlear	Medulla	S. Sensory	- Internal Ear, Hearing & Balance
IX. Glossopharyngeal		Mixed	3rd pharyngeal arch, Taste & Gas Reflex
X. Vagus	Medulla	Mixed	Parasympathetic Innervation
XI. Spinal Accessory	Sup. Spinal Cord	Motor	superficial layer of neck, Shoulder shrug
XII. Hypoglossal	Medulla	Motor	Muscle of tongue, Swallowing & Speech