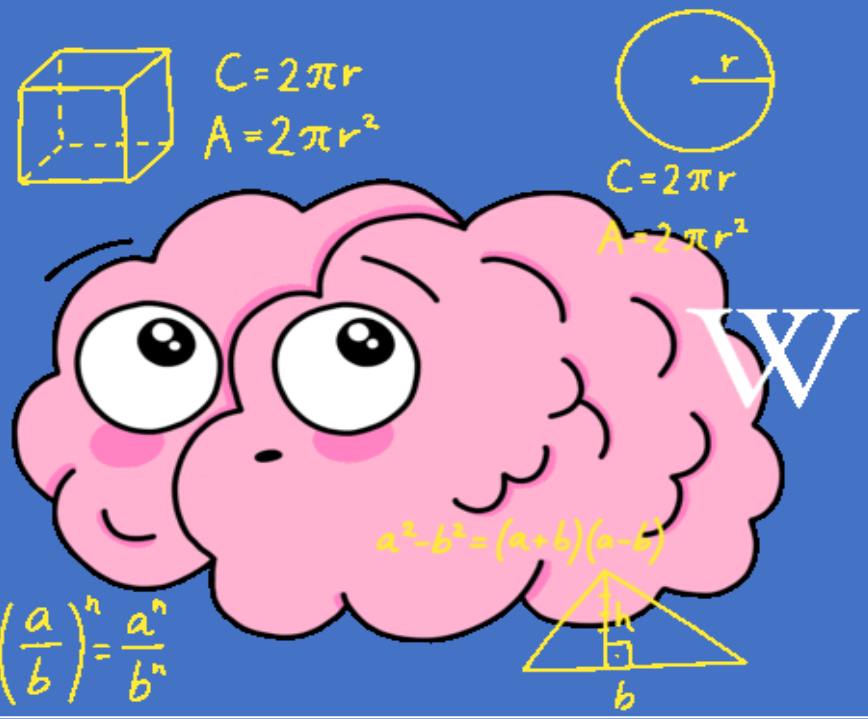
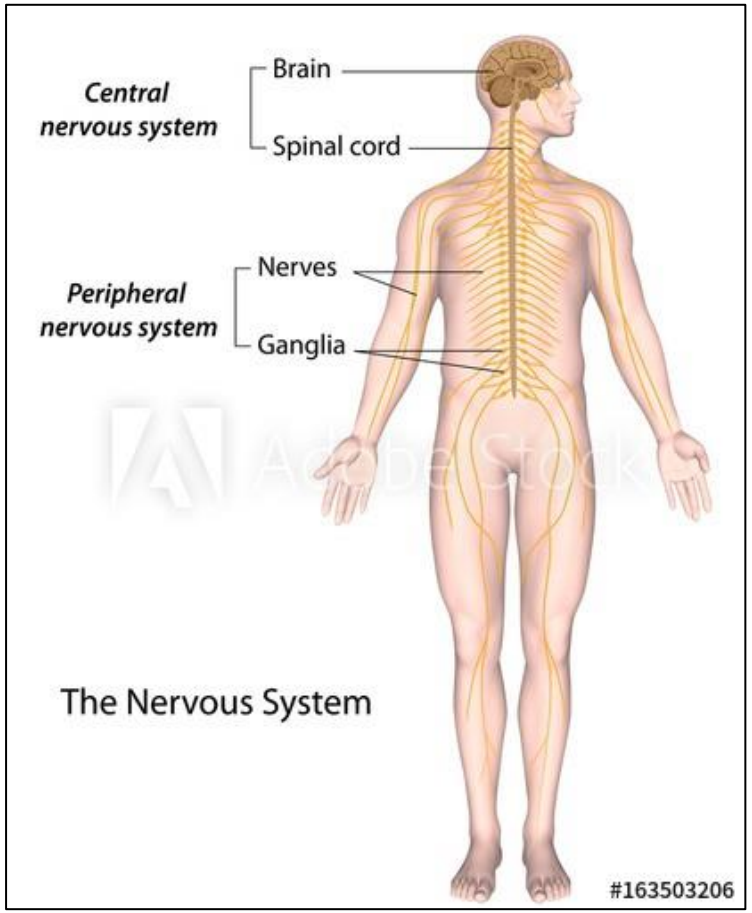


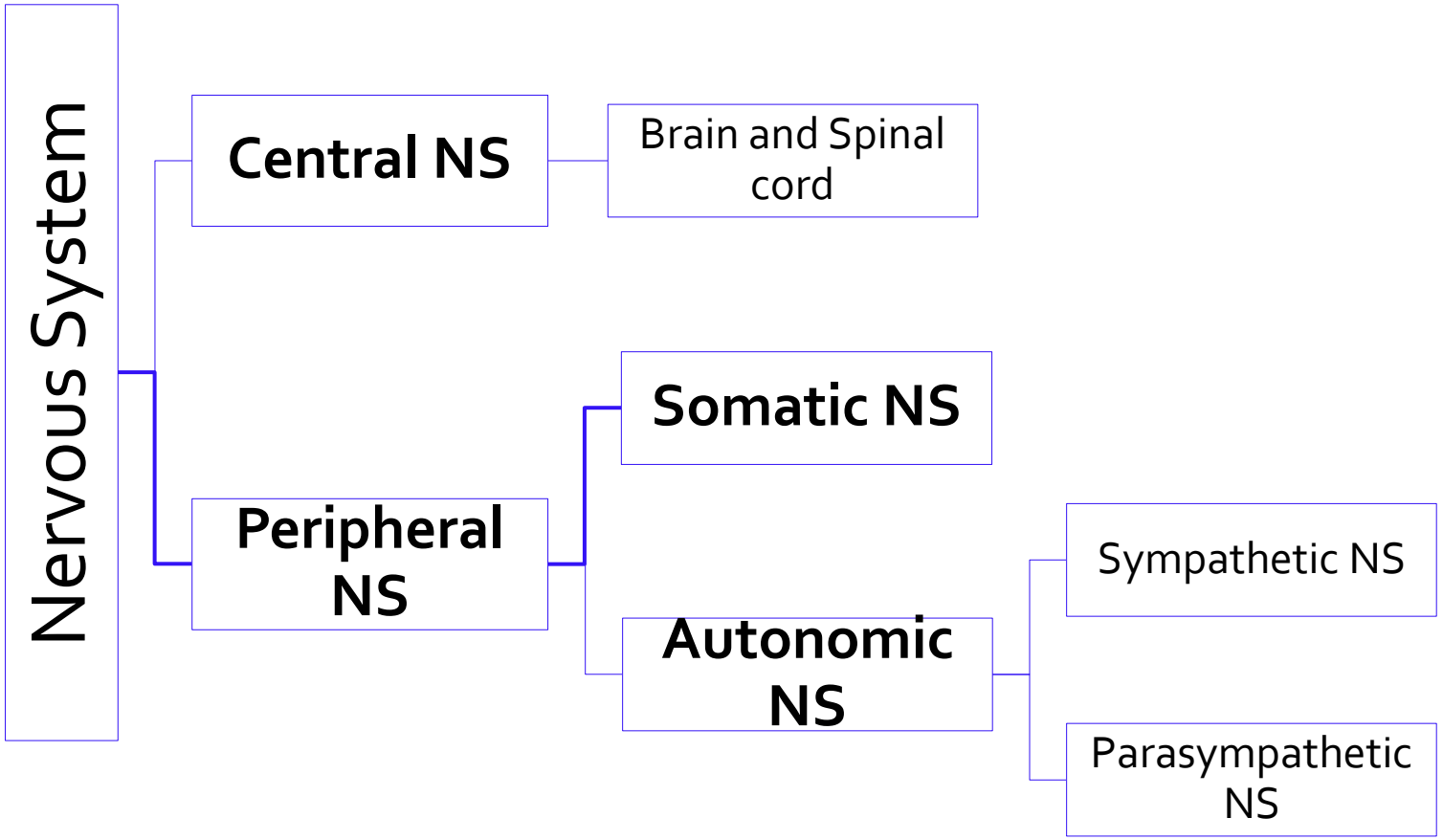
SYJC
CH. 9
CONTROL AND CO-ORDINATION

Unit 9.6 – Human Nervous System

By Firdous Ansari

UNIT 9.6 Human nervous system:





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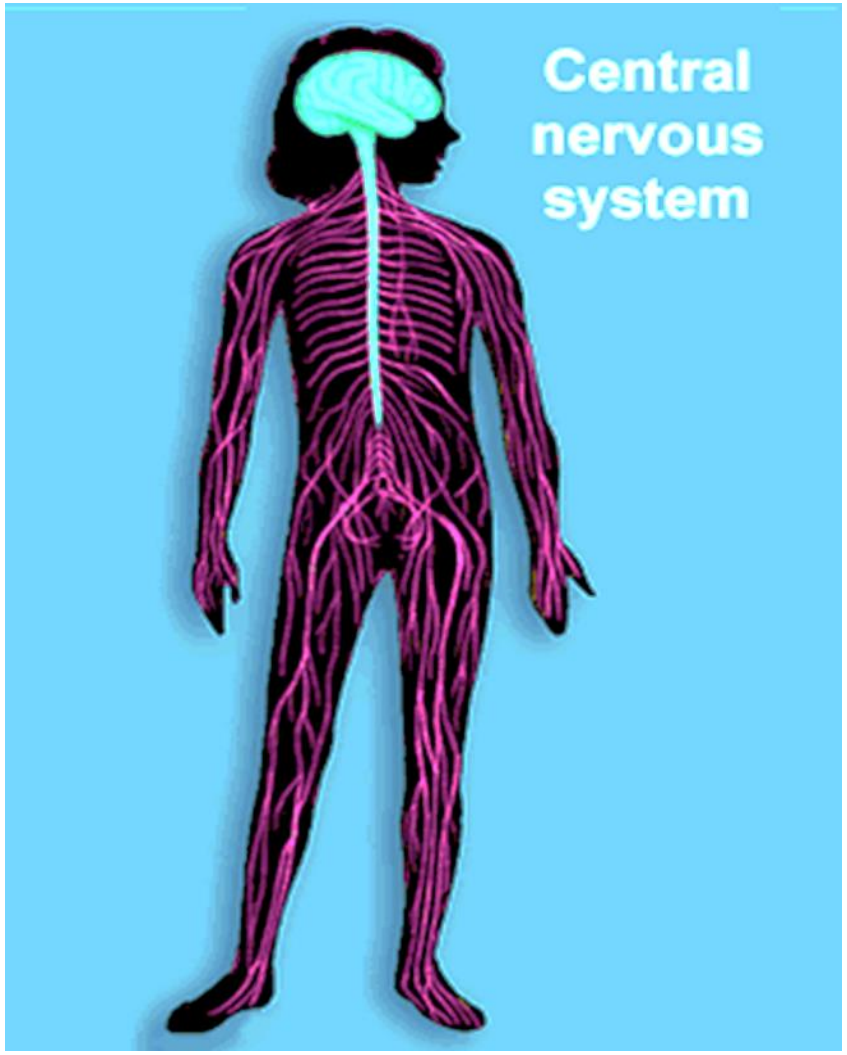
1) CENTRAL NERVOUS SYSTEM (CNS):

Consists of:

- **Meninges** (protective membranes)
- **Brain**
- **Spinal Cord**



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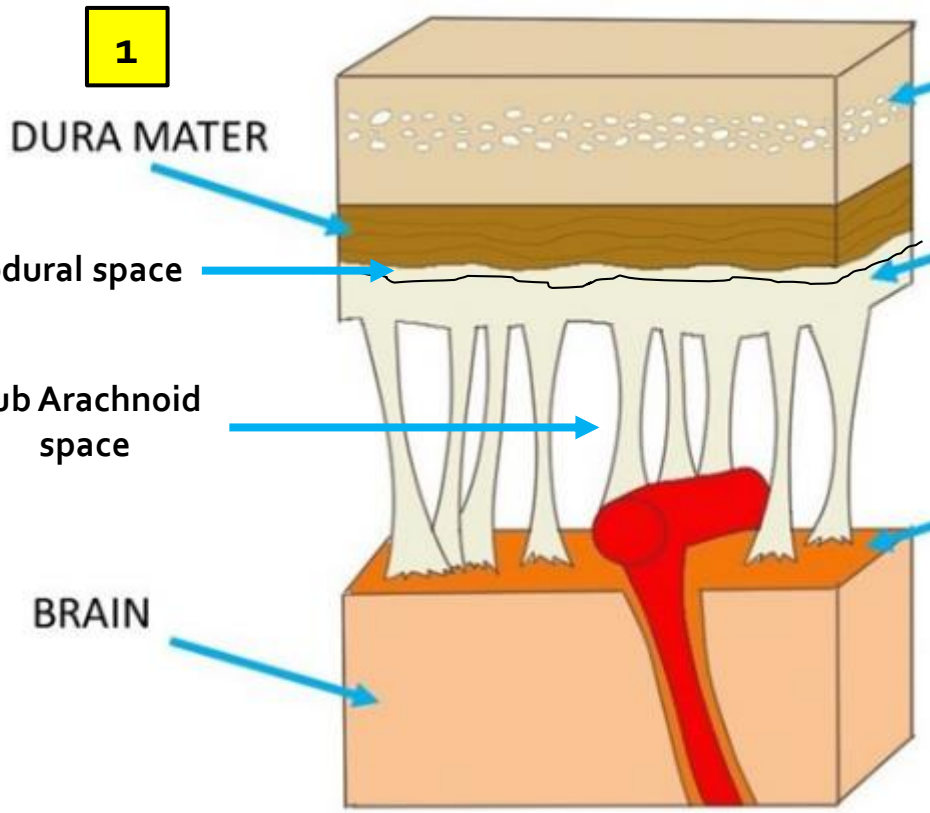
Meninges:

Outermost, tough, thick, Nonvascular

Serous fluid

C.S.F



Middle, nonvascular, Web like

Innermost, highly vascular

Meninges: Brain

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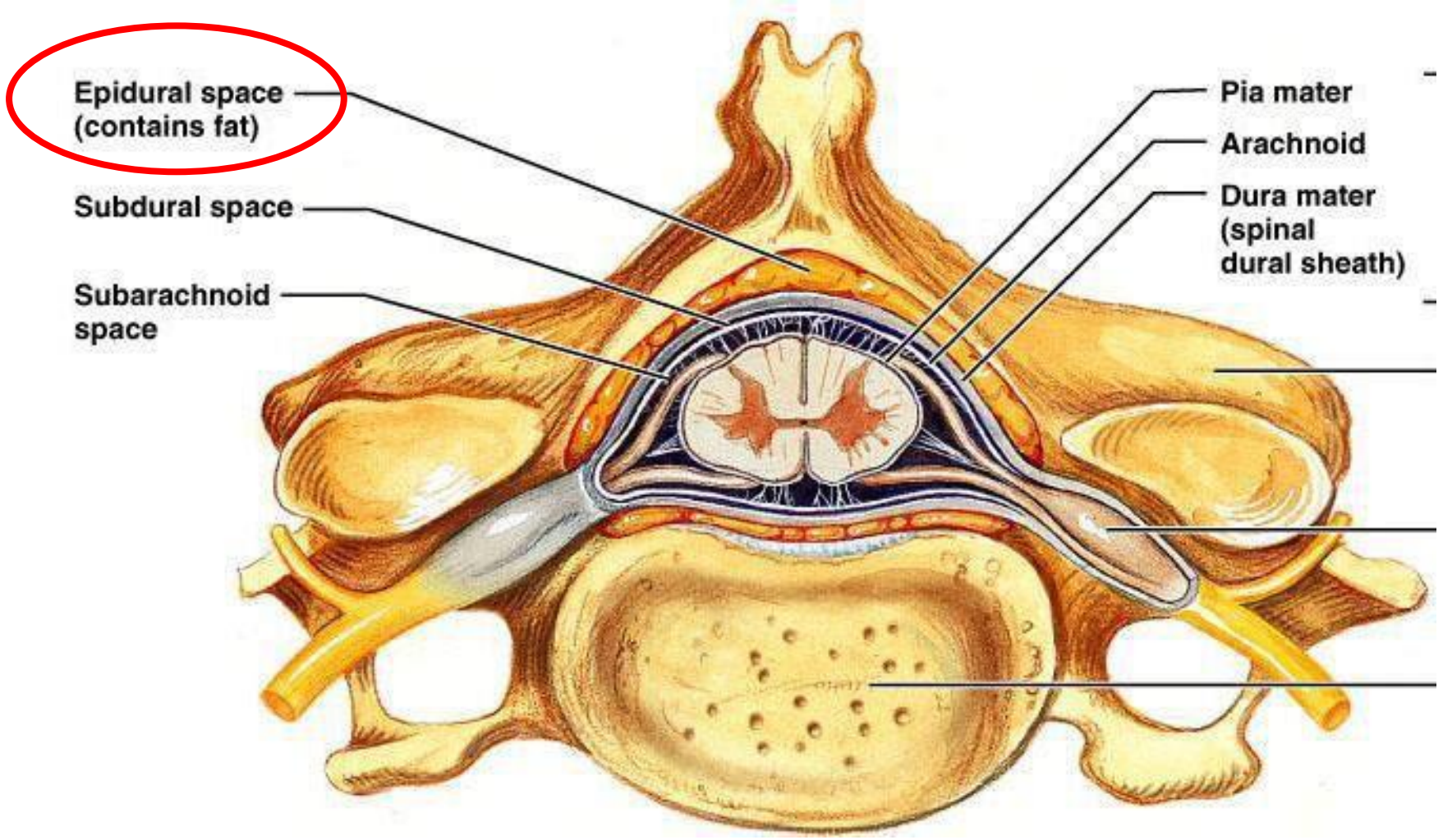
Additional space between Bone and Dura mater Contains Fat



Meninges : Spinal Cord

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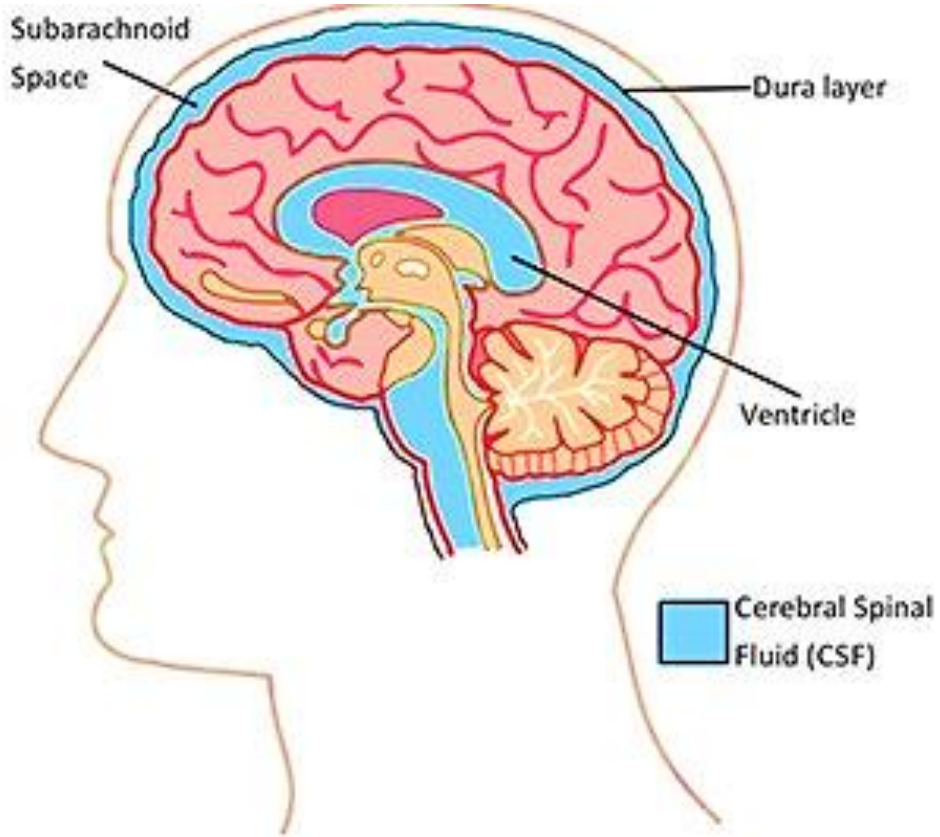
CSF (Cerebrospinal fluid):

Lymph like
Extra cellular fluid

Continuously secreted by –

- Pia mater
- Choroid plexus ependymal cells in ventricles of brain
- Central canal in spinal cord



Slightly alkaline
Specific gravity - 1.005
Volume - 100-200cc

Drained out of brain into Blood stream :
Foramen of Lushka
(a pair)
Foramen of Magendie
(median)
(In Medulla Oblongata)

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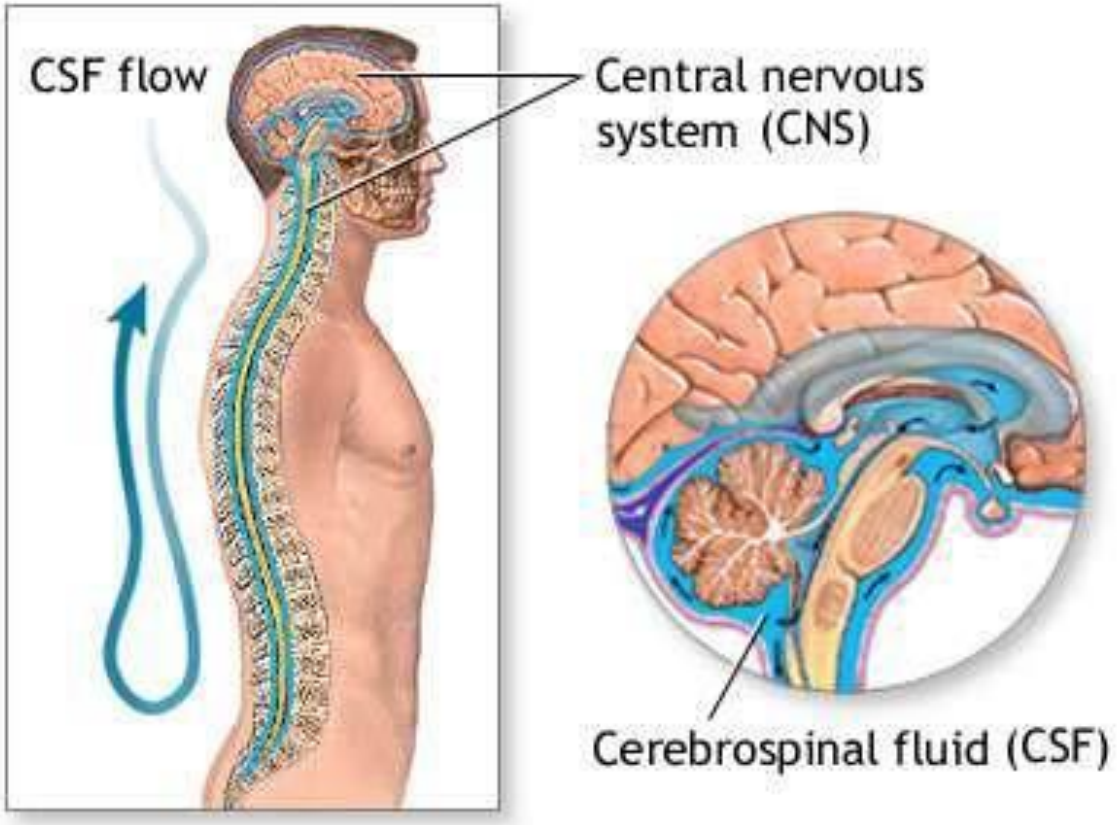
Function of CSF:

- Shock absorber
- Protection- mechanical injuries
- Maintains constant pressure inside cranium
- Exchange of materials
- Supplies oxygen to brain
- Prevents dessication of brain



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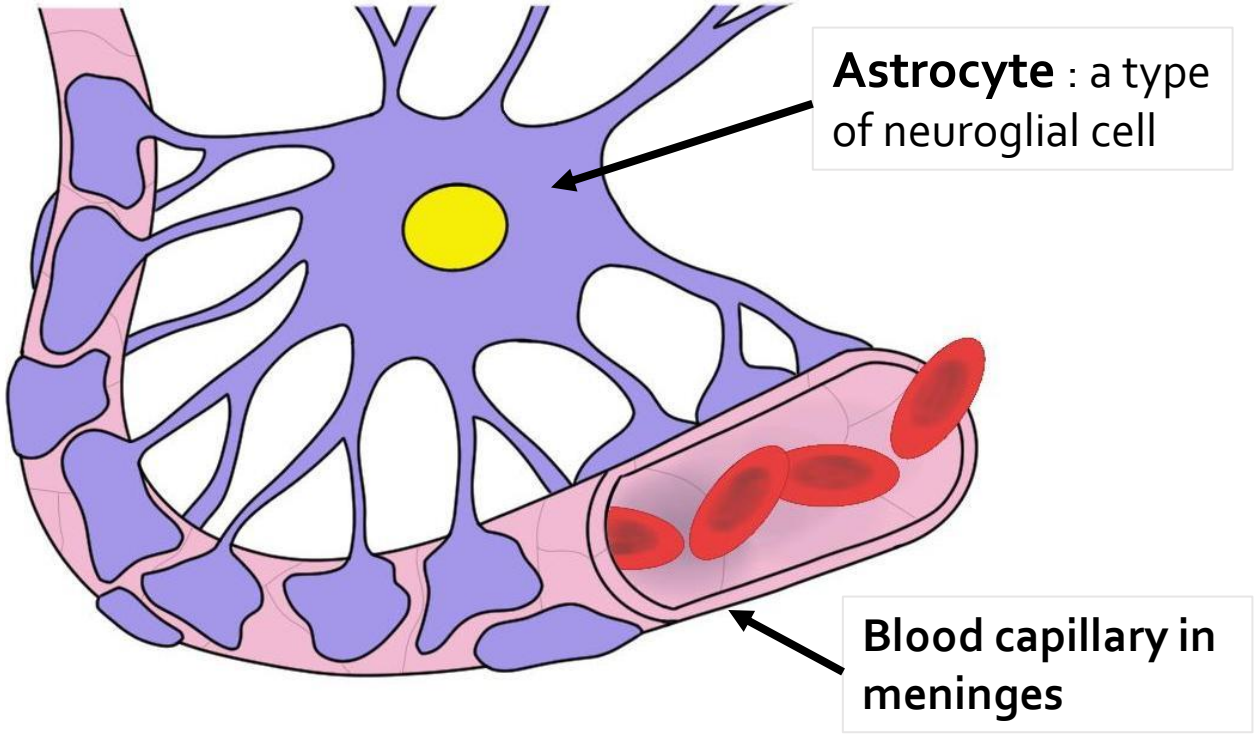
Blood Brain Barrier



Astrocytes and Endothelium keeps a check on :

- Ions and Large molecules entering brain tissue.
- Prevents toxins and pathogens entering brain tissue.

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A) The human brain (Encephalon)

- **Encephalology – Study of brain**
- **Three** main parts:
  a) **Forebrain** (Prosencephalon)
  b) **Midbrain** (Mesencephalon)
  c) **Hindbrain** (Rhombencephalon)

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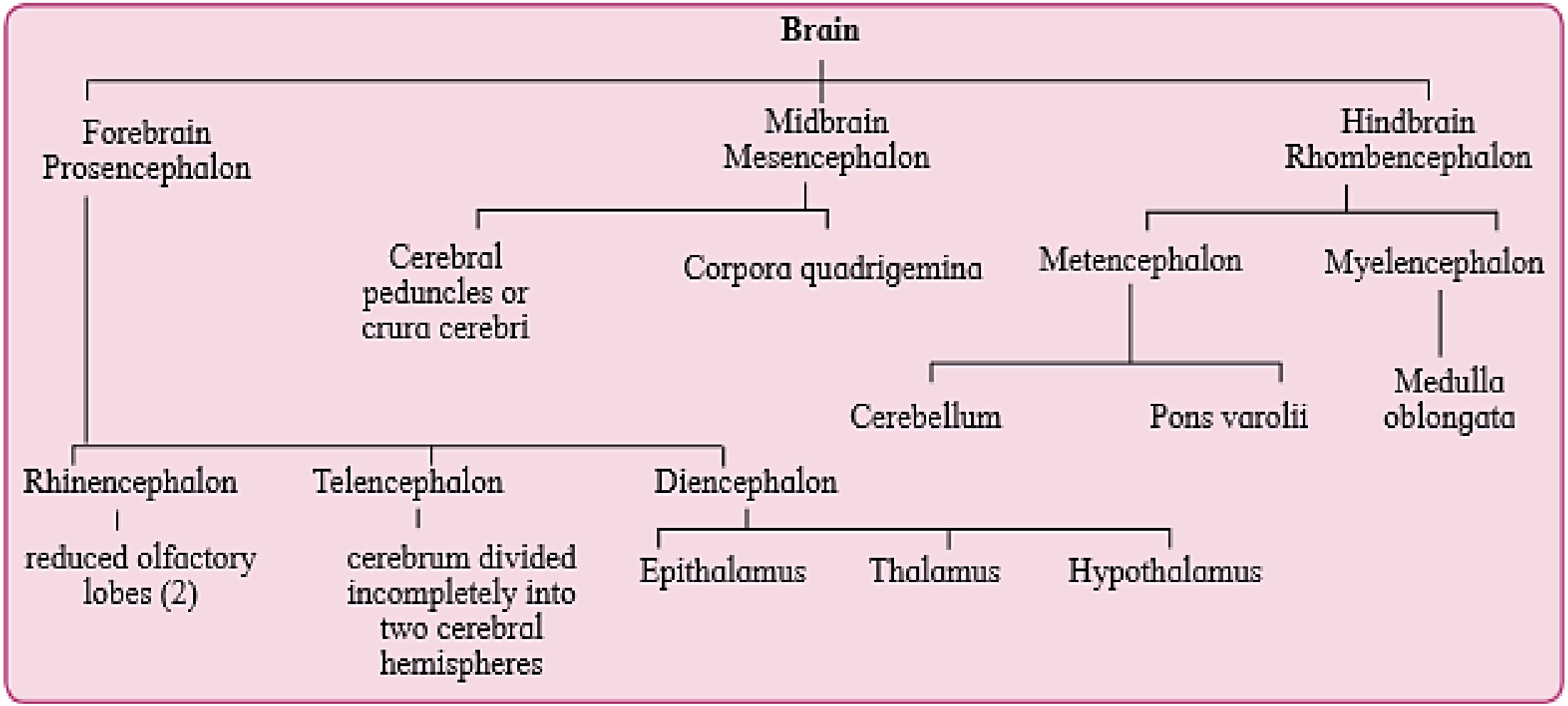
A) The human brain:



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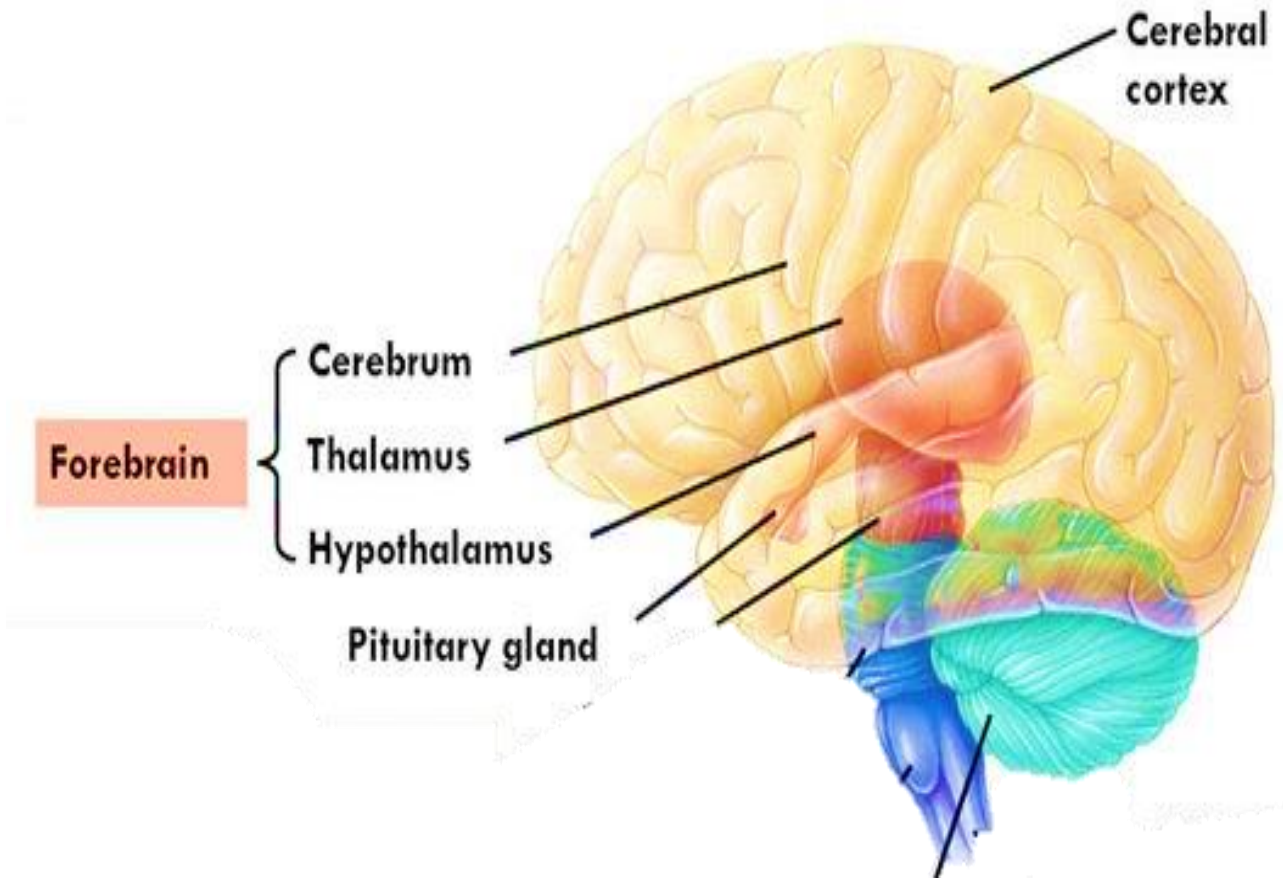
a) Forebrain:

Consists of:

i) Olfactory lobes

ii) Cerebrum

iii) Diencephalon



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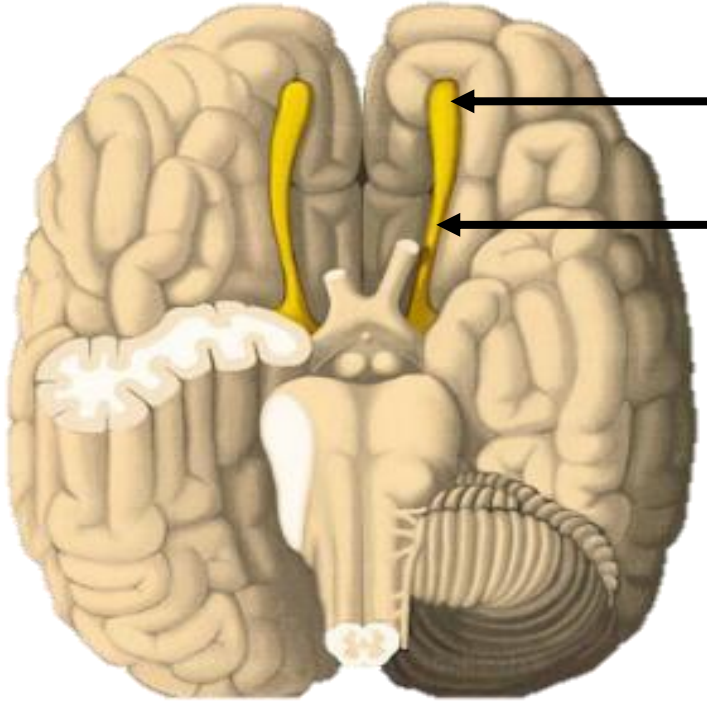
i) Olfactory lobes:

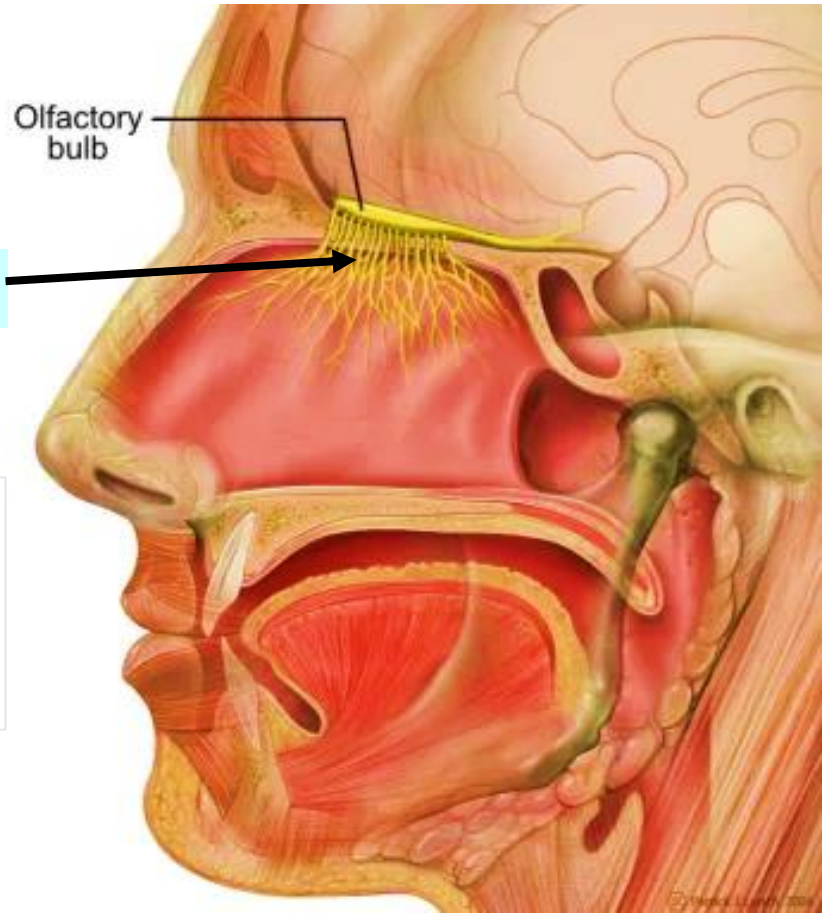


Olfactory bulb

Olfactory peduncle

- A pair
- Highly reduced
- Visible on ventral side

Olfactory nerve



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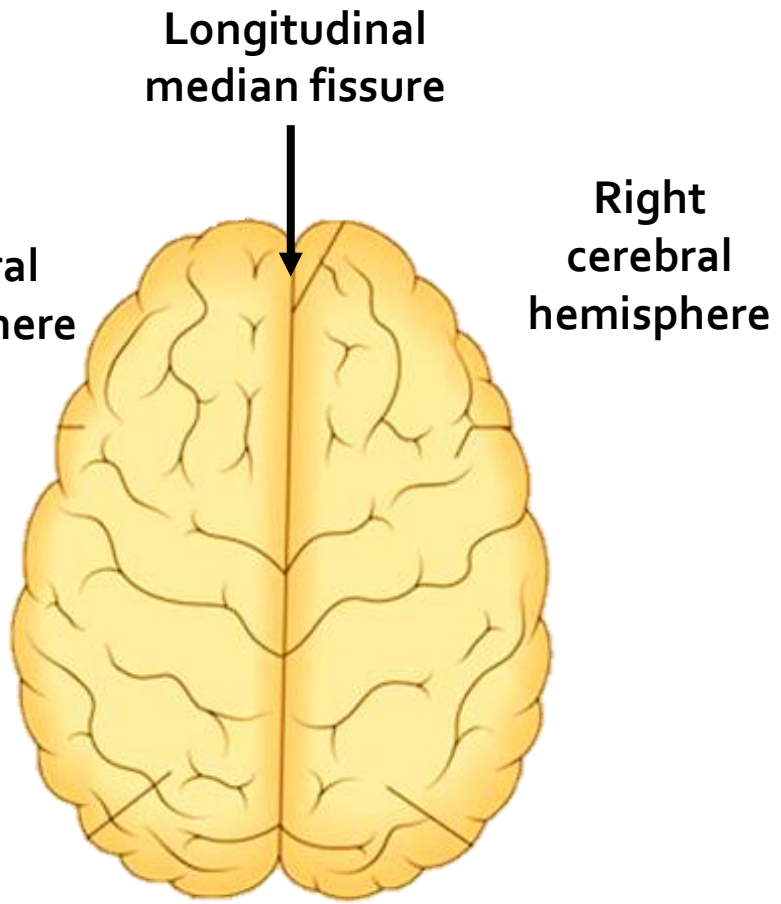
ii) Cerebrum: Largest part of brain (85%)

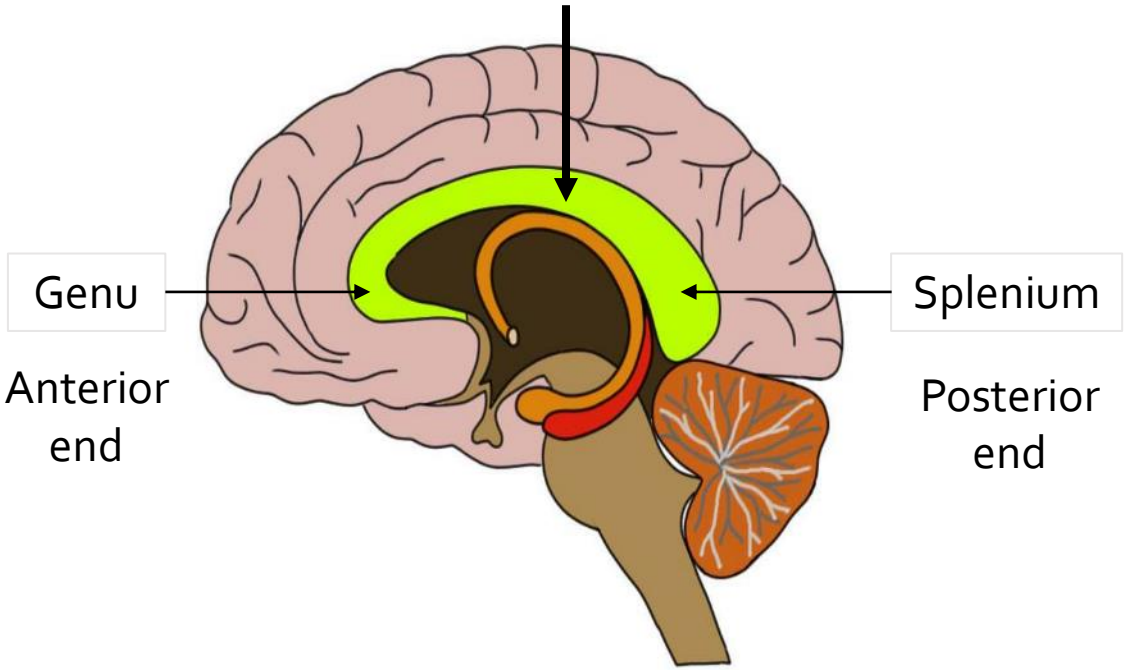


Dorsal view

Corpus callosum

Band of nerve fibres

Connects both the hemispheres



Saggittal view

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Cerebrum

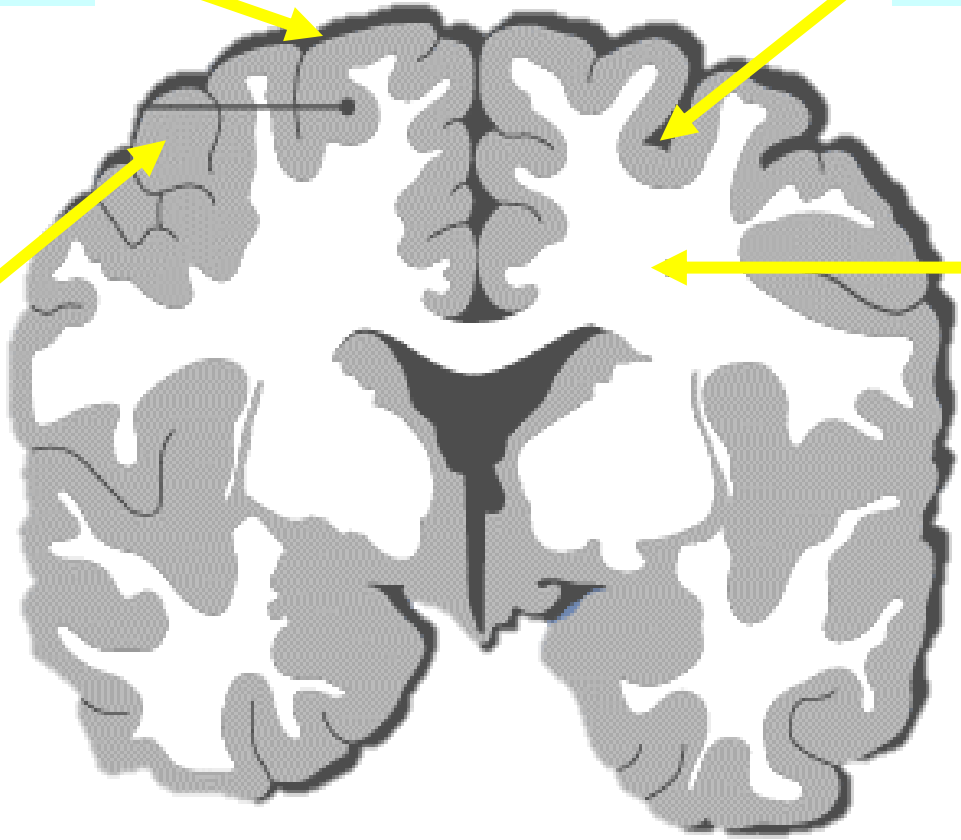
Gyrus /Gyri – Convulations

Sulcus/Sulci – grooves

1

Cortex

Outer part
Gray mater
Contains Cytons
Highly folded



Medulla

2

Inner part
White mater
Contains axons

Coronal section view

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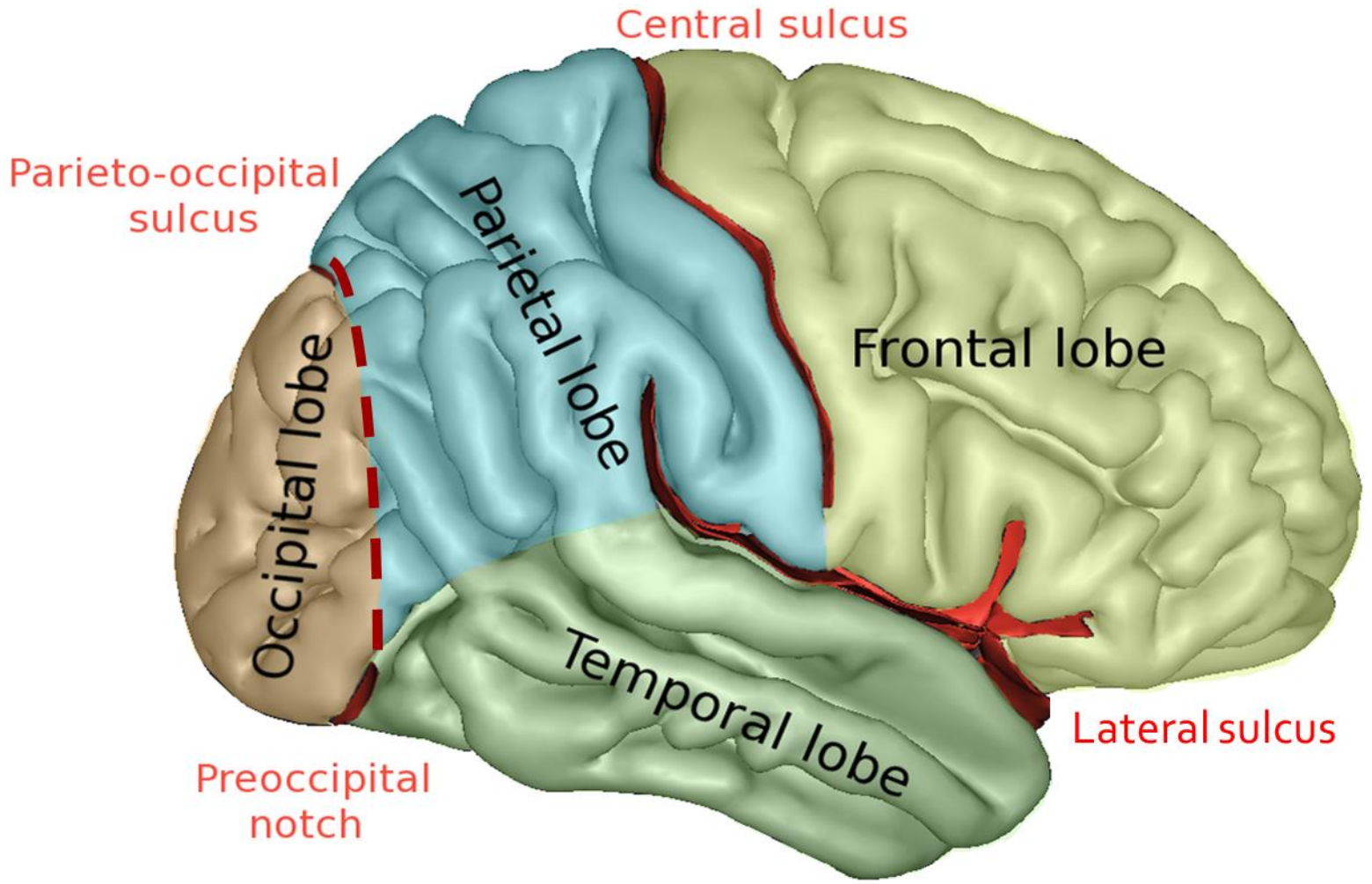
Cerebral hemisphere:

- Each hemisphere:
- Divided into - **Four lobes**
  - Frontal Lobe
  - Parietal Lobe
  - Occipital Lobe
  - Occipital Lobe
- by **three sulci**
  - Central Sulcus
  - Lateral/ Sylvian Sulcus
  - Parieto – Occiptal Sulcus



Lateral view

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Functional areas of cerebrum:

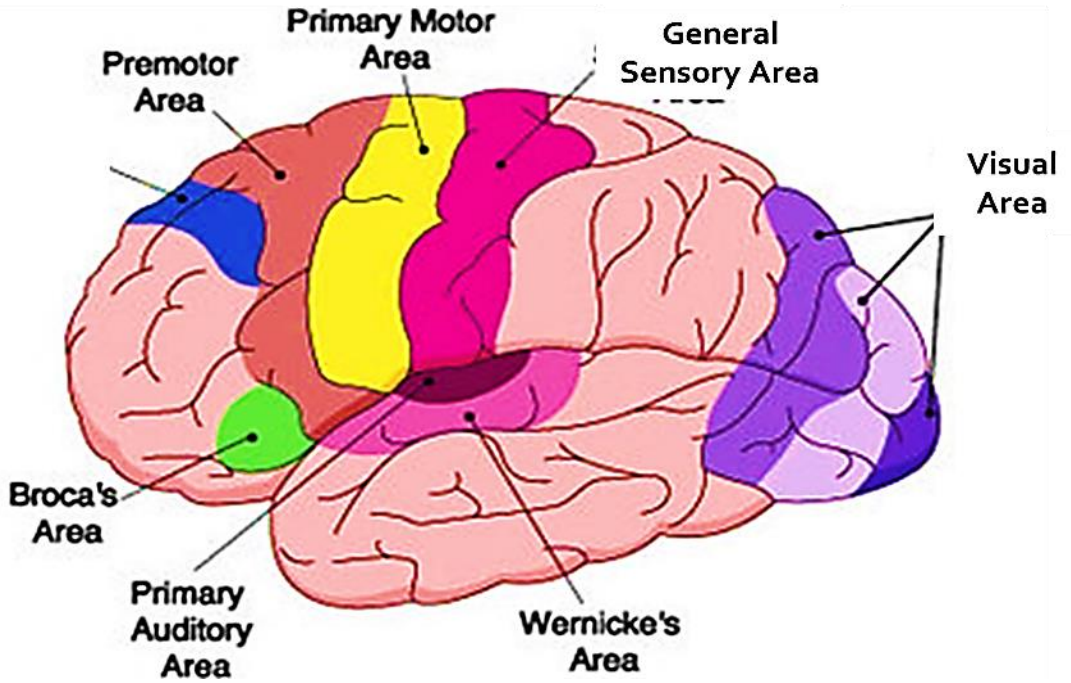
Parietal lobe:

General sensory area – Somaesthetic sensation

Gustatoreceptor – taste

Frontal Lobe:

- Cognitive areas
- **Motor Area** – voluntary motor activities
- **Premotor area** – involuntary movements, ANS
- **Association area** – Co ordination and movements
- **Broca's area** – Motor speech area, translates thoughts into speech.



Occipital lobe :

Visual area – vision

Wernicke's area (Intelligence centre) – Understanding of spoken and written words

Temporal Lobe:

Olfactory area – Smell

Auditory area – Hearing Speech and Emotions

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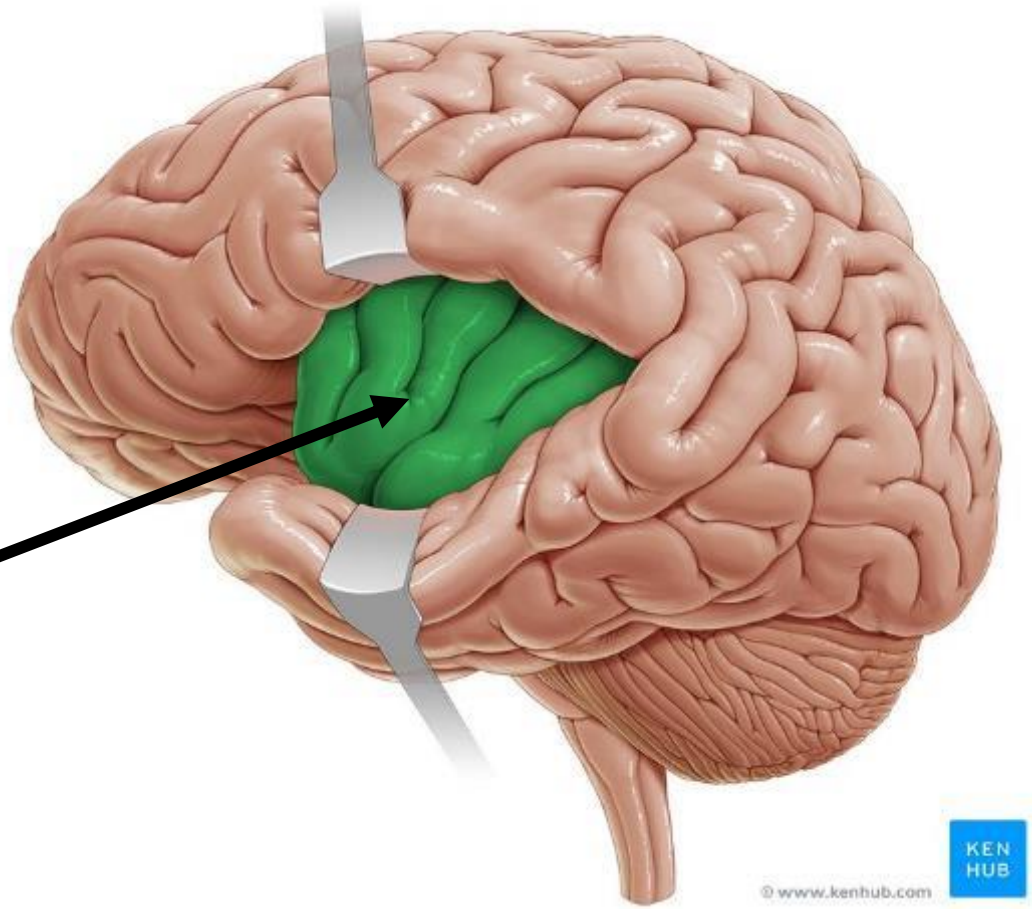
Cerebrum

The fifth lobe

Insula / Insular cortex

Folded deep within lateral sulcus.



Function :

processing of bodily sensations so they may be used to influence decision making

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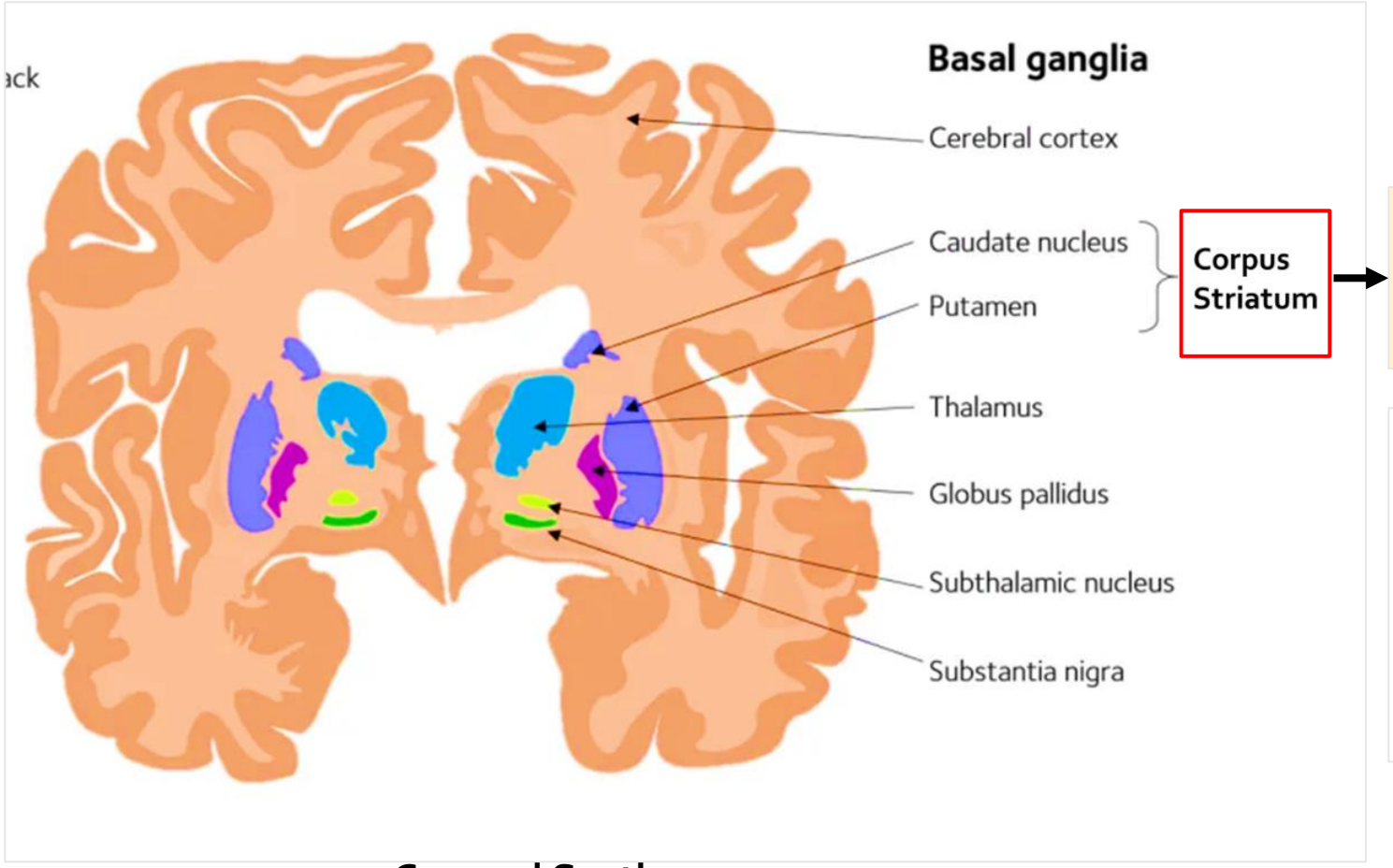
Cerebrum

Basal nuclei/ Basal ganglia: Grey matter mass within white matter



Coronal Section

- Largest basal nuclei
- At floor of Cerebrum laterally to Thalamus

Function:

- Receive neurotransmitters
- Execution of activities at subconscious level

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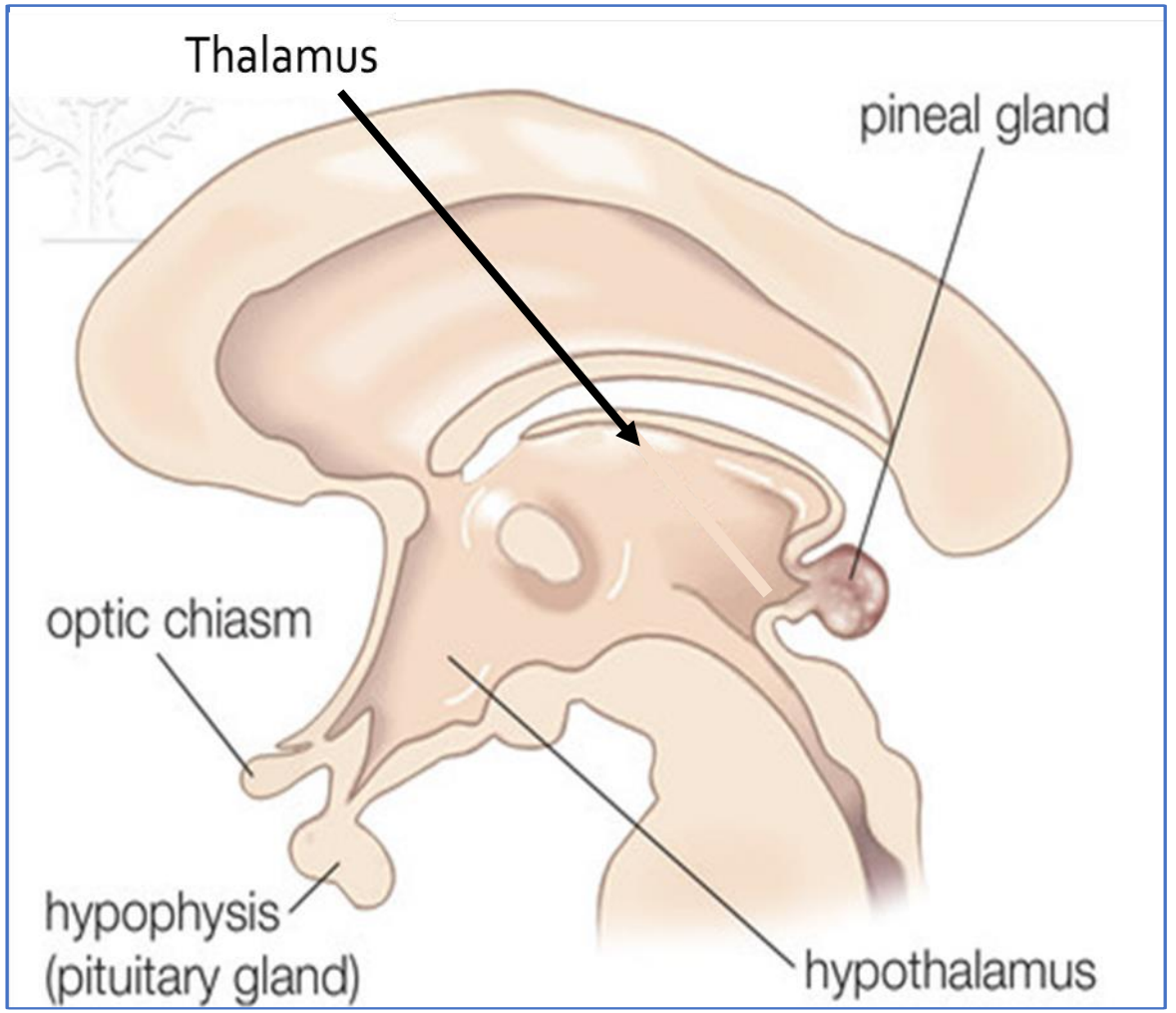
iii) Diencephalon:

- Location : in between Corpus callosum and Midbrain
- Divided into:
  1. Epithalamus
  2. Thalamus
  3. Hypothalamus



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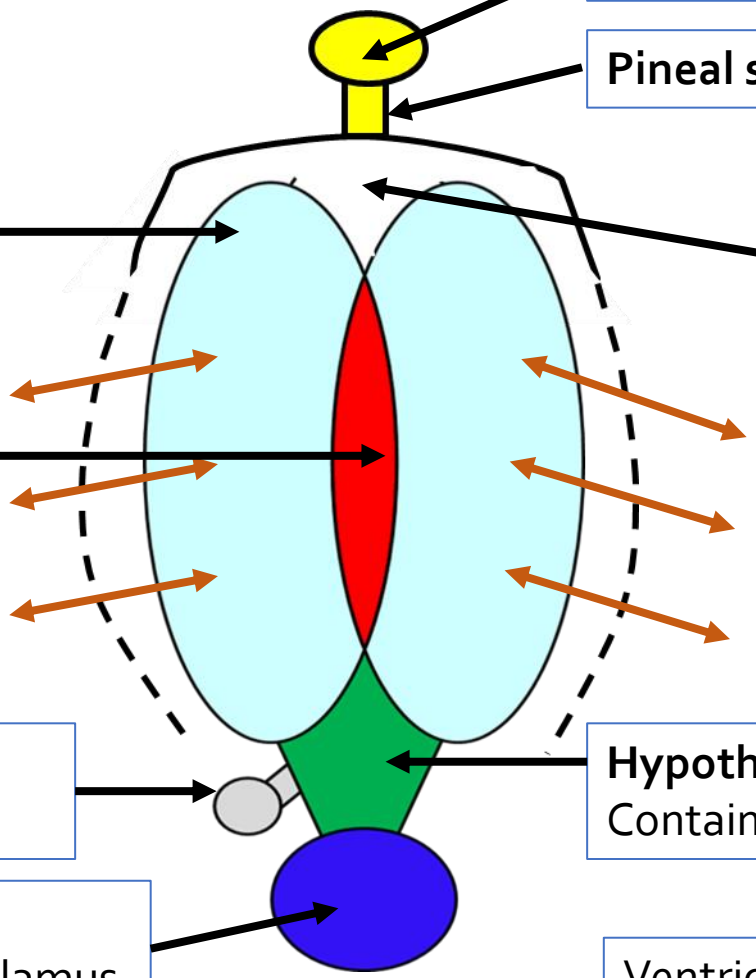
iii) Diencephalon: Structure



Pineal Body/Gland : Projection of Epithalamus

Pineal stalk

Thalami/Thalamus:
2 Lateral Thick walls
Contain Gray matter

Epithalamus : Roof
Thin non nervous

Habencular Commissure :
Fissure between 2 Thalami

RAS (Reticular Activating System):
Branches from Thalami.

Optic Chiasma :
In inferior Hypothalamus

Hypothalamus : Floor
Contains Hypothalamic nuclei in white matter

Pituitary Gland:
Projection of Hypothalamus

Ventricles – Diocoel

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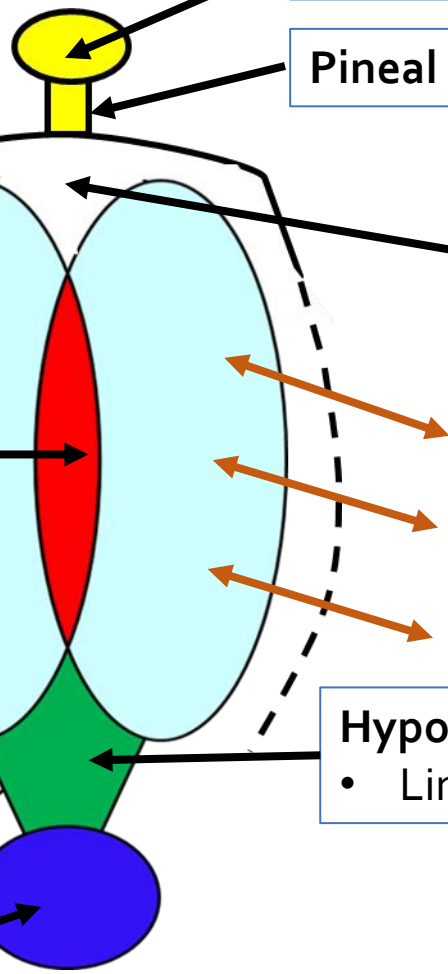
iii) Diencephalon: Function



Pineal Body/Gland : acts as endocrine gland

Pineal stalk : connects epithalamus to pineal gland

Thalami/Thalamus:
Gives out RAS

Epithalamus : Fuses with Pia mater to form Anterior Choroid Plexus

Habencular Commissure :
connects 2 Thalami

RAS (Reticular Activating System):
Connects various parts of brain

Optic Chiasma :
Crossing of 2 optic nerves in inferior Hypothalamus

Hypothalamus :

- Link Between Nervous & Endocrine system

Pituitary Gland:
Acts as endocrine gland

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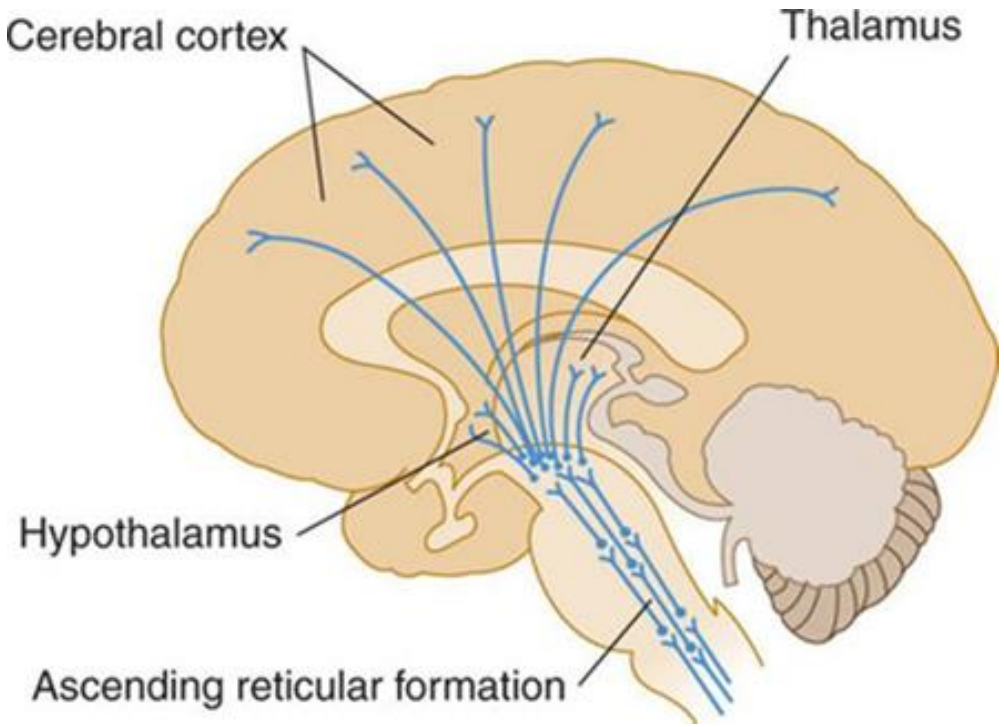
iii) Diencephalon: Function



RAS
(Reticular Activating System):

- Connects various parts of brain
- Acts as relay centre

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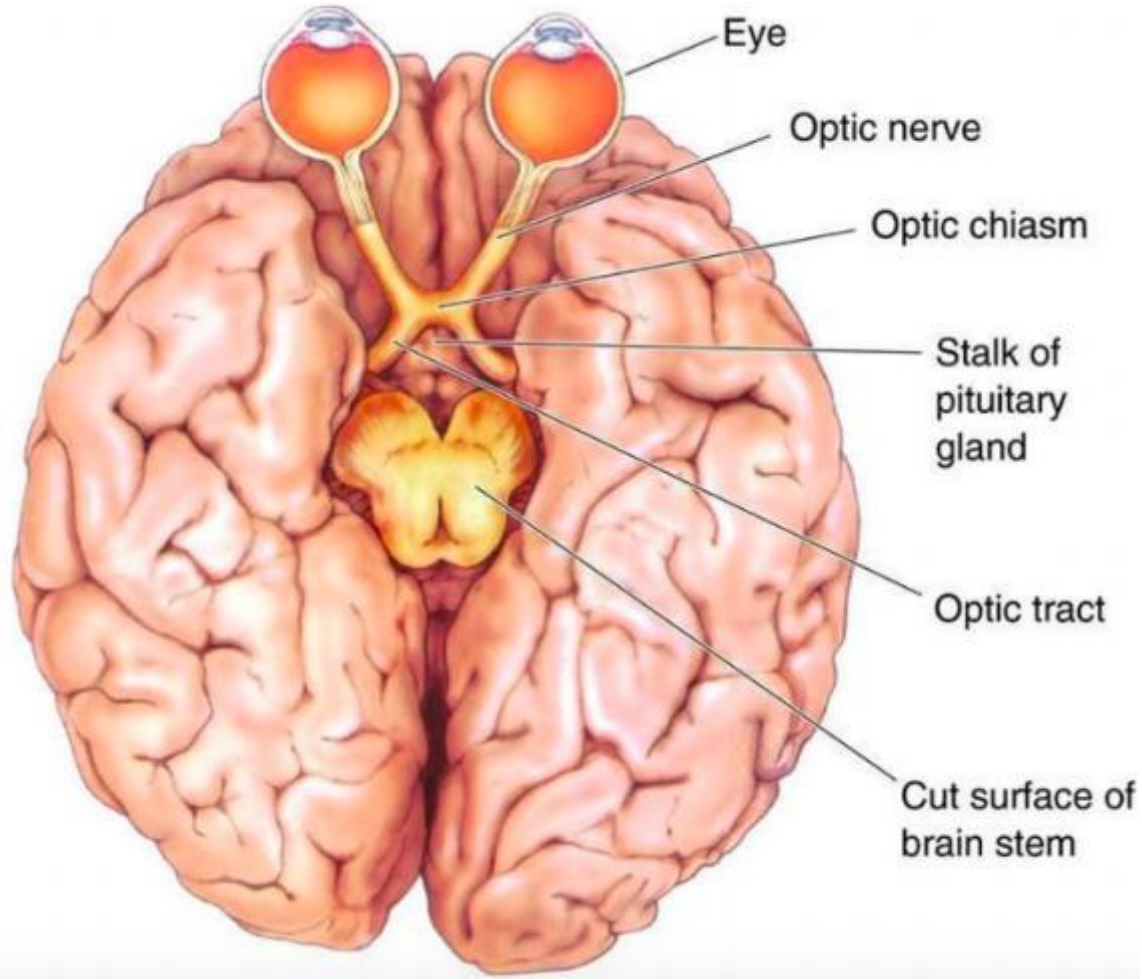

Optic Chiasma :
Crossing of 2 optic nerves in inferior Hypothalamus

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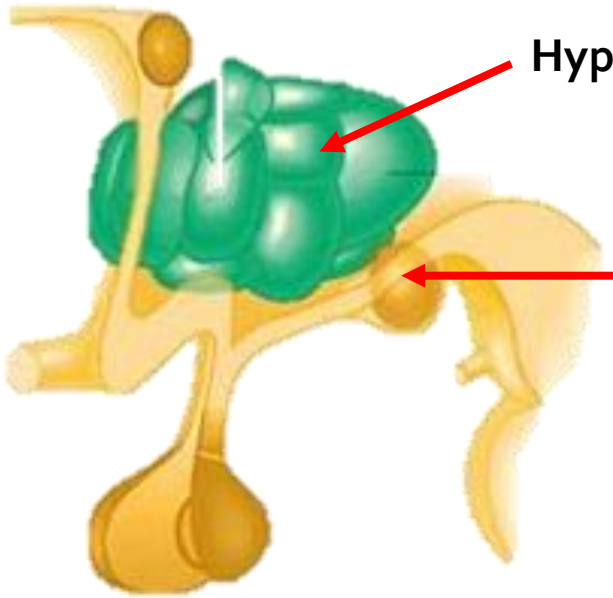
Hypothalamus: Function

- Link Between Nervous & Endocrine system
- Centers for : hunger, thirst, sleep, fatigue, satiety center, secretion of intestine and stomach glands
- Maintains Homeostasis
- Acts as Endocrine Gland (secretes neurohormones)
- Part of **Limbic system**.



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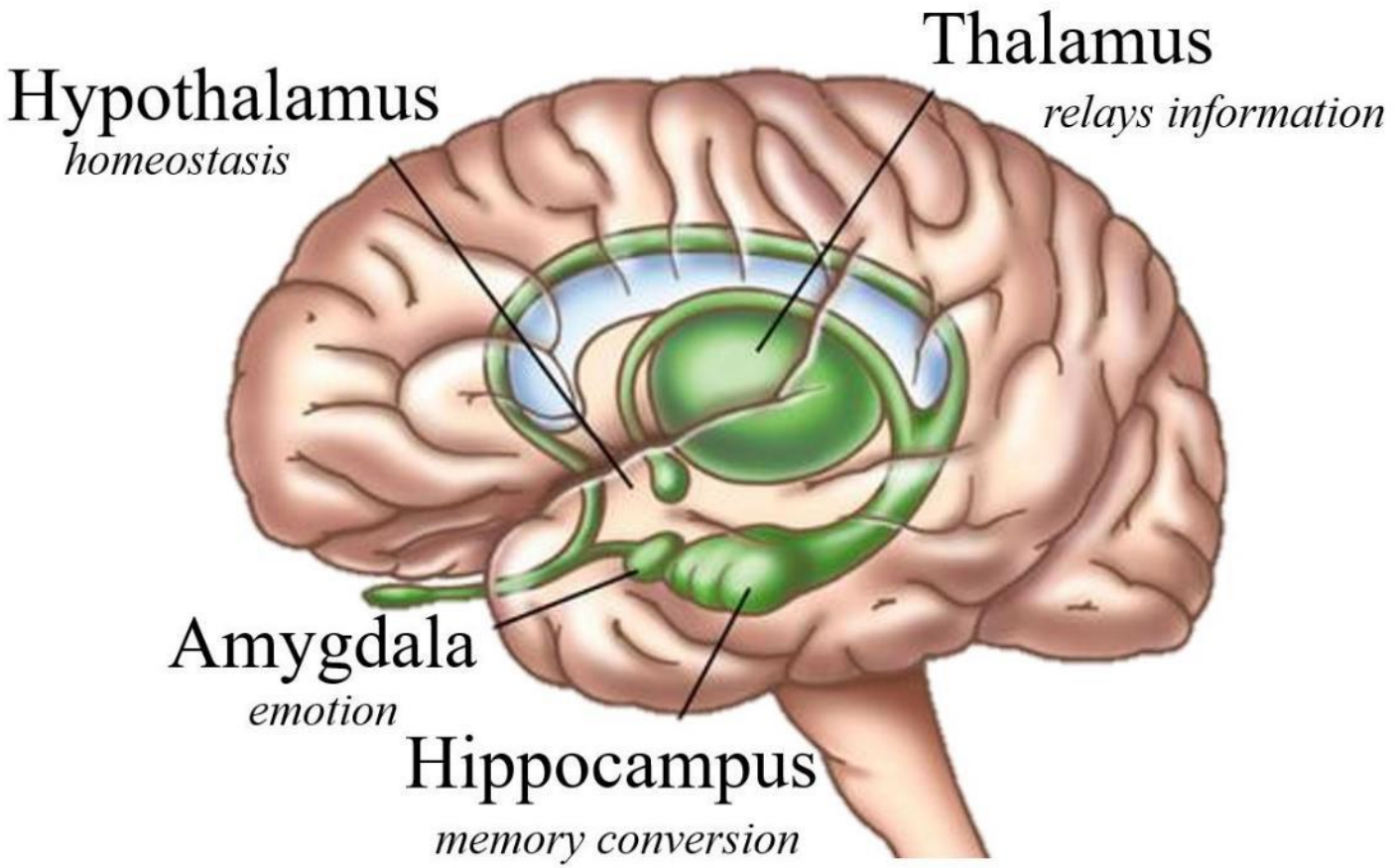
Limbic system:

- Complex neuronal circuit
- Formed by
  - Hypothalamus
  - Amygdala,
  - parts of Epithalamus,
  - Thalamus,
  - Hippocampus
- Function: Emotional reactions motivation drives , memory.



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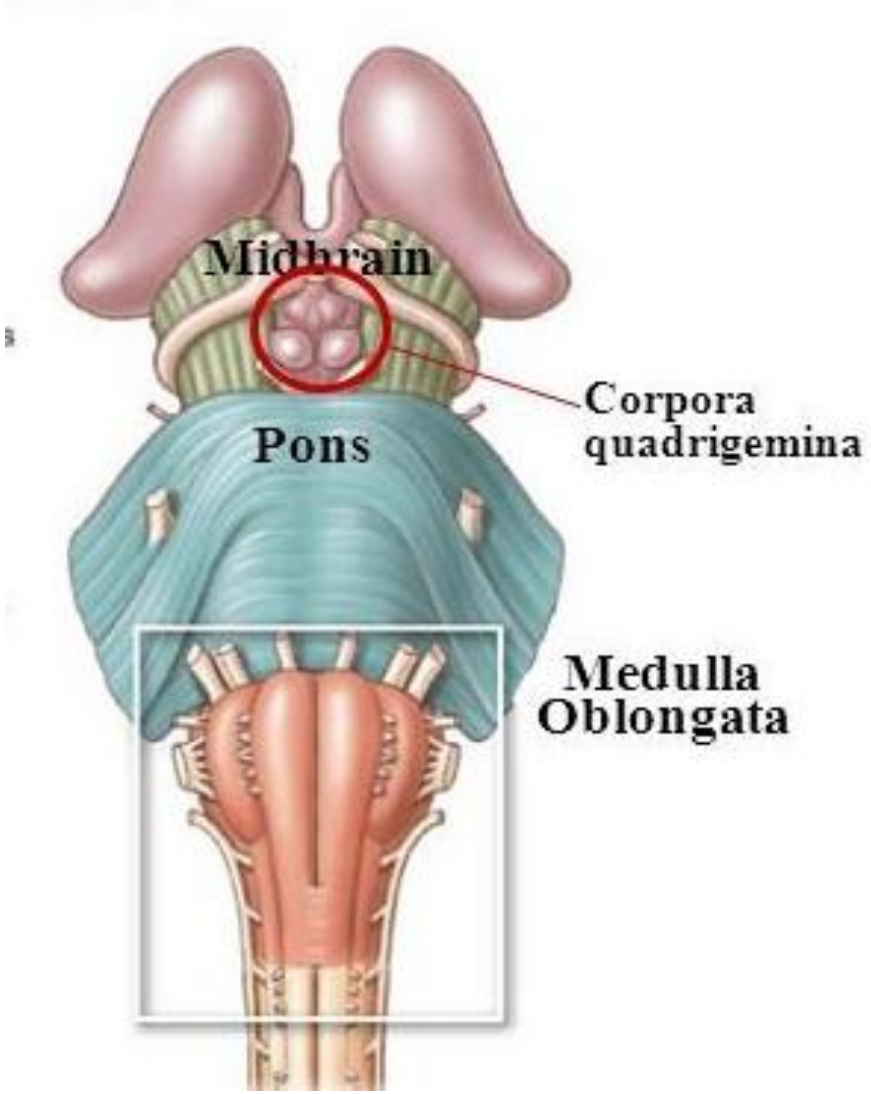
b)Mid brain:

Location : Between Diencephalon and Pons.

Parts:

1. **Corpora quadrigemina**
2. **Crura cerebri**

- **Red nucleus**
- **Cerebral Aqueduct**



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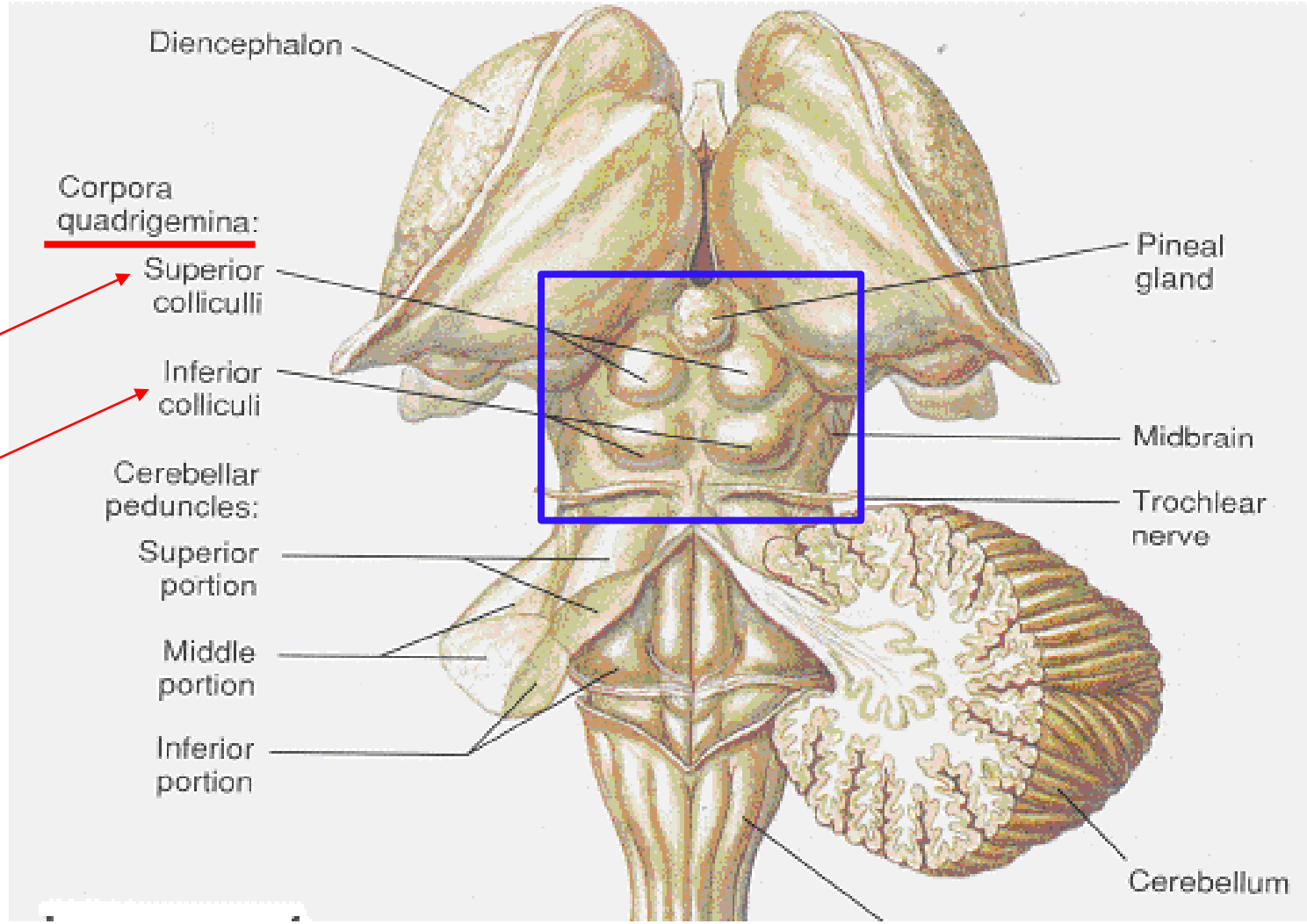
b)Mid brain:

i) Corpora quadrigemina

- Four rounded elevations
- Also called Optic Lobes

1. Two superior colliculi
(visual reflexes)

2. Two inferior colliculi
(auditory reflexes)



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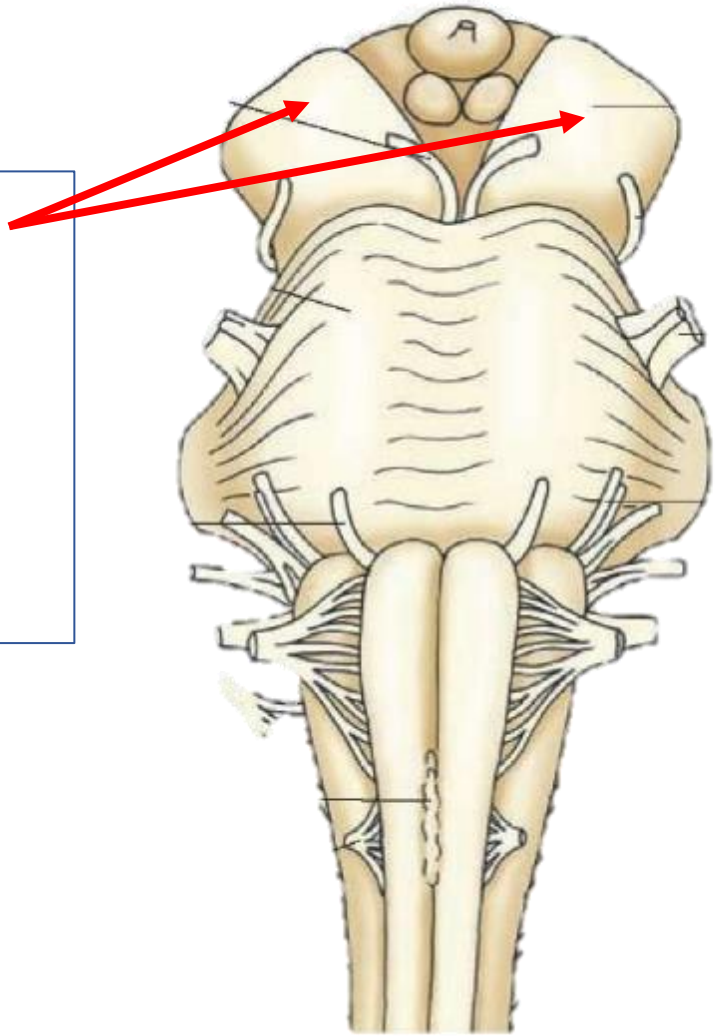
b)Mid brain:

ii) **Crura cerebri/ cerebral peduncles**

- Two thick fibrous tracts
- Ascending & Descending Tracts (RAS)
- Connect cerebrum to midbrain.



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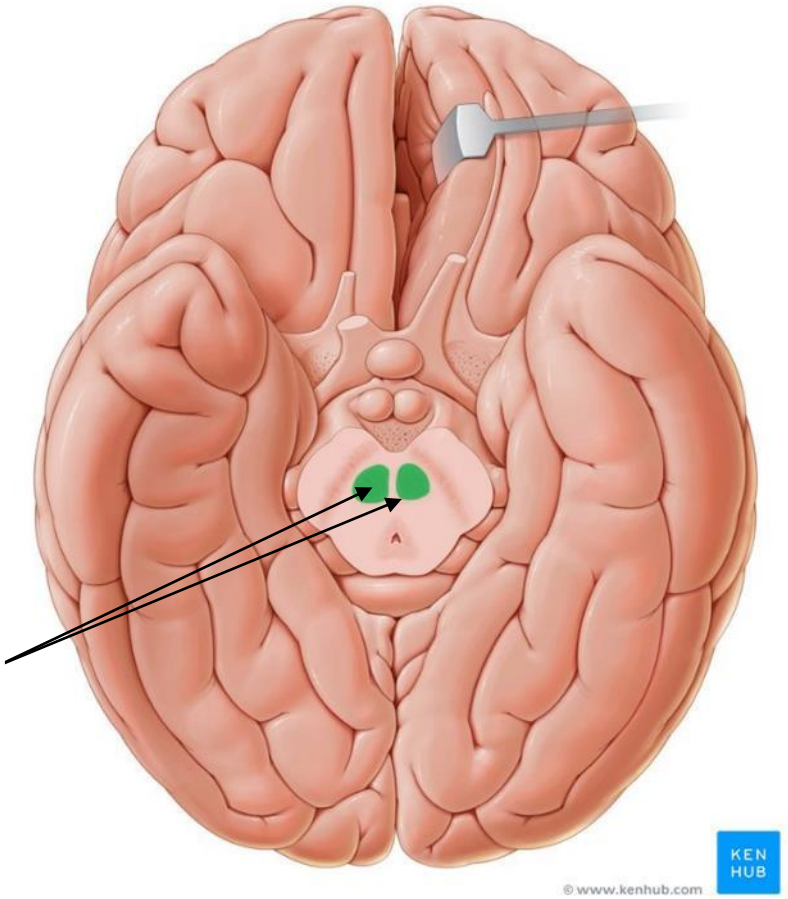
Red nucleus : Mass of grey matter within white matter

- Location : Centre of mid brain
- Function : Control posture, Muscle tone, Modify some motor activities.



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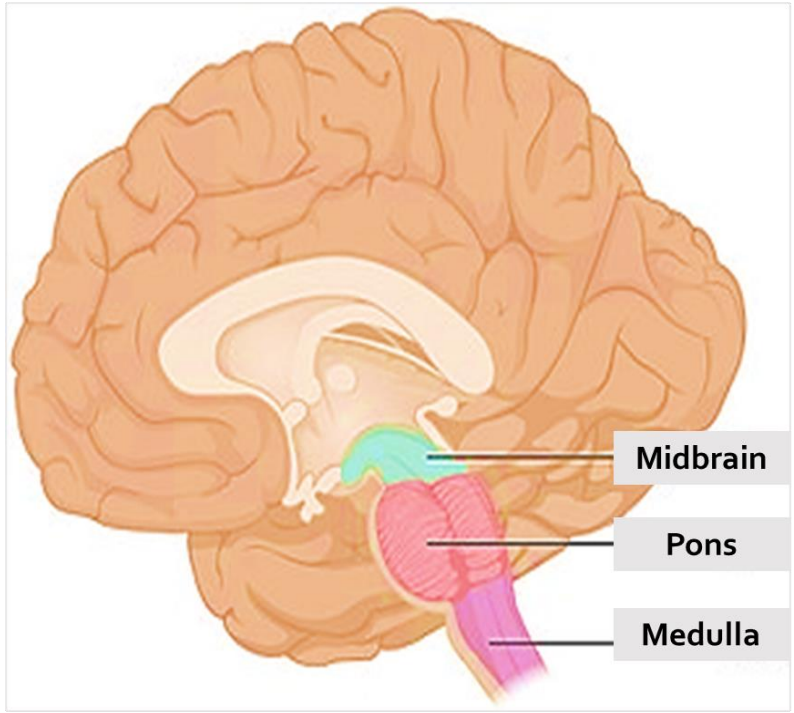
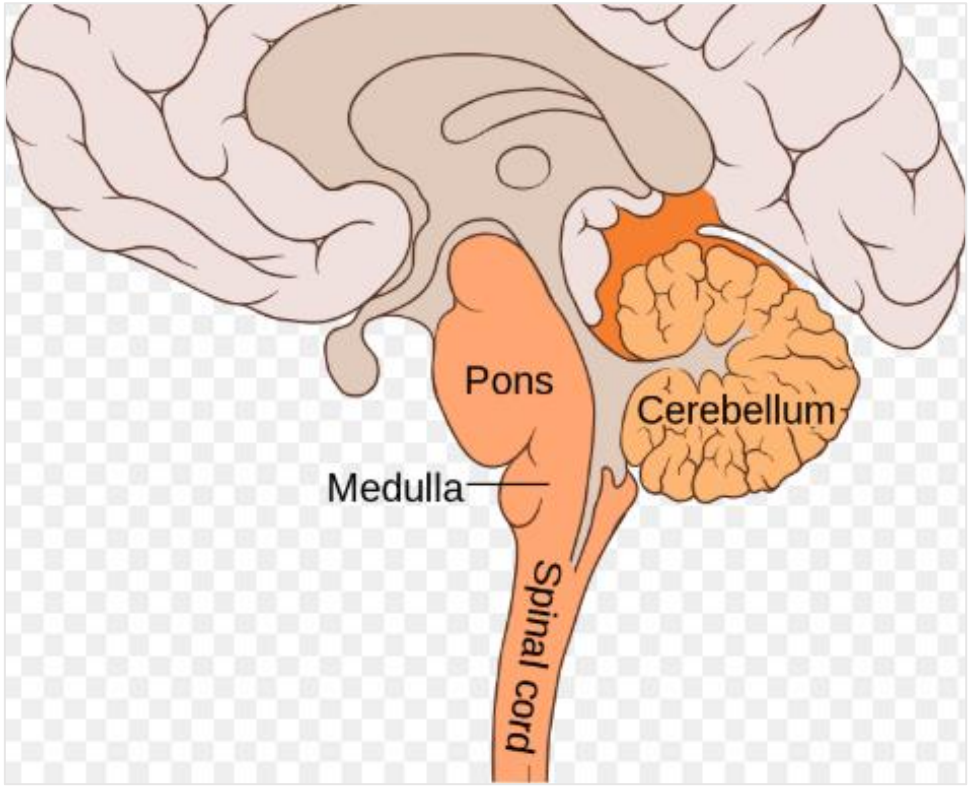
c) Hindbrain:



Midbrain, Pons & Medulla – Brain Stem

- Posterior region of brain
- Consists of:
  1. **Pons varolli**
  2. **Cerebellum**
  3. **Medulla oblongata**



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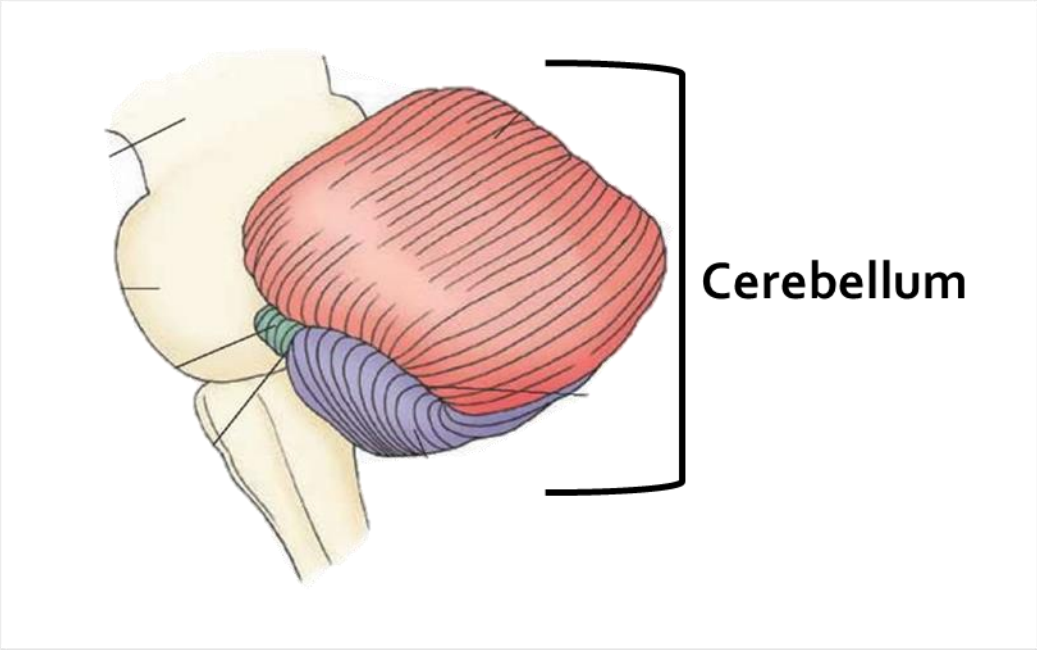
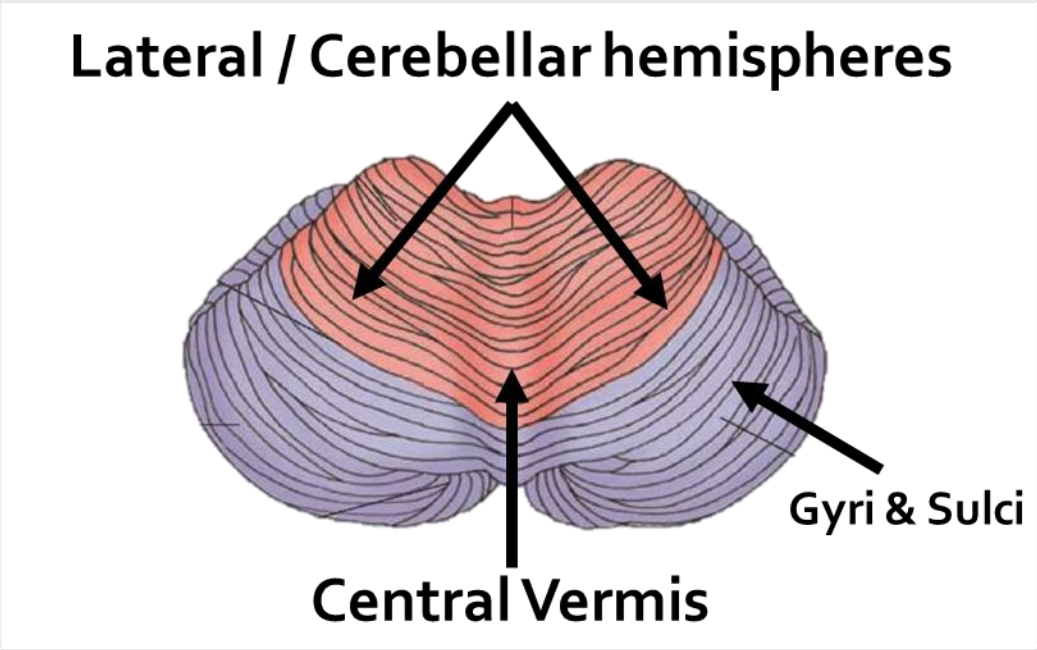
a) Cerebellum: Second largest part of brain





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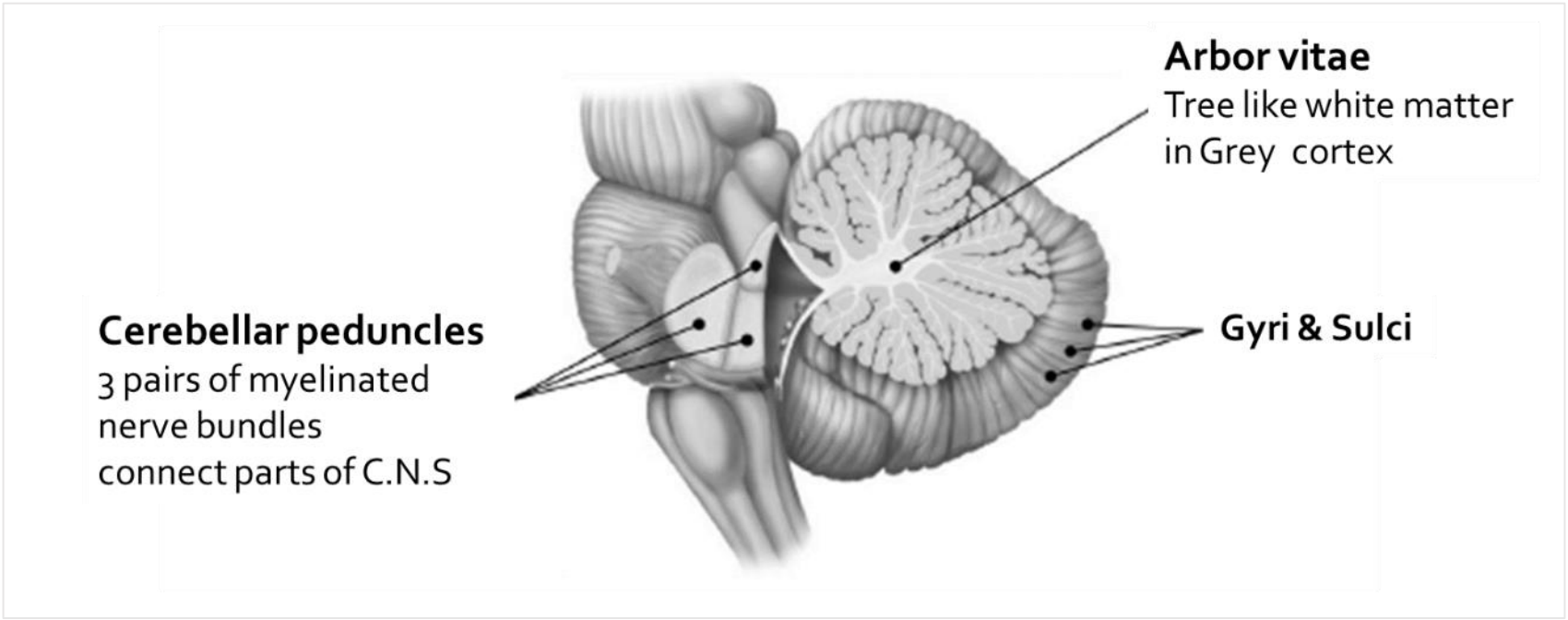
a) Cerebellum:



- **Cortex** – outer, thin Gray mater, has 30 million neurons
- **Medulla** – inner, tree like White mater

Function:

- Maintains equilibrium ,posture , balance, orientation
- Voluntary movements
- Neuromuscular activities e.g. walking, running, speaking
- Maintenance of muscle tone

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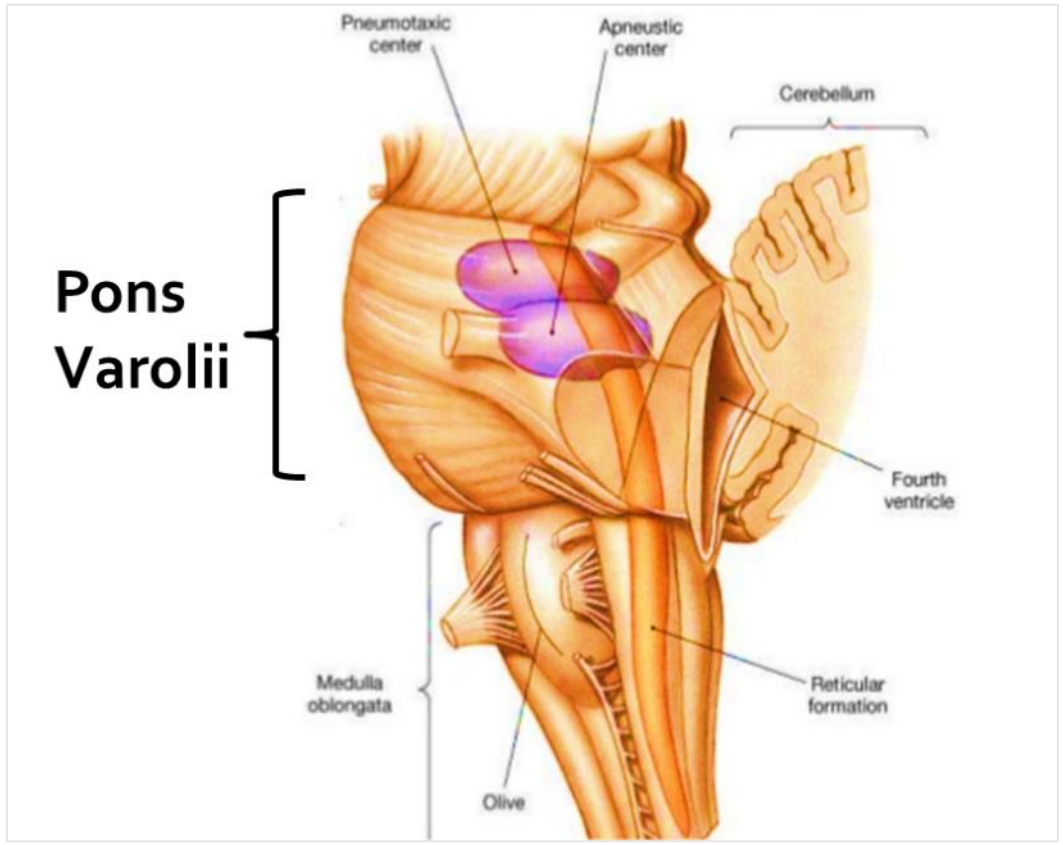
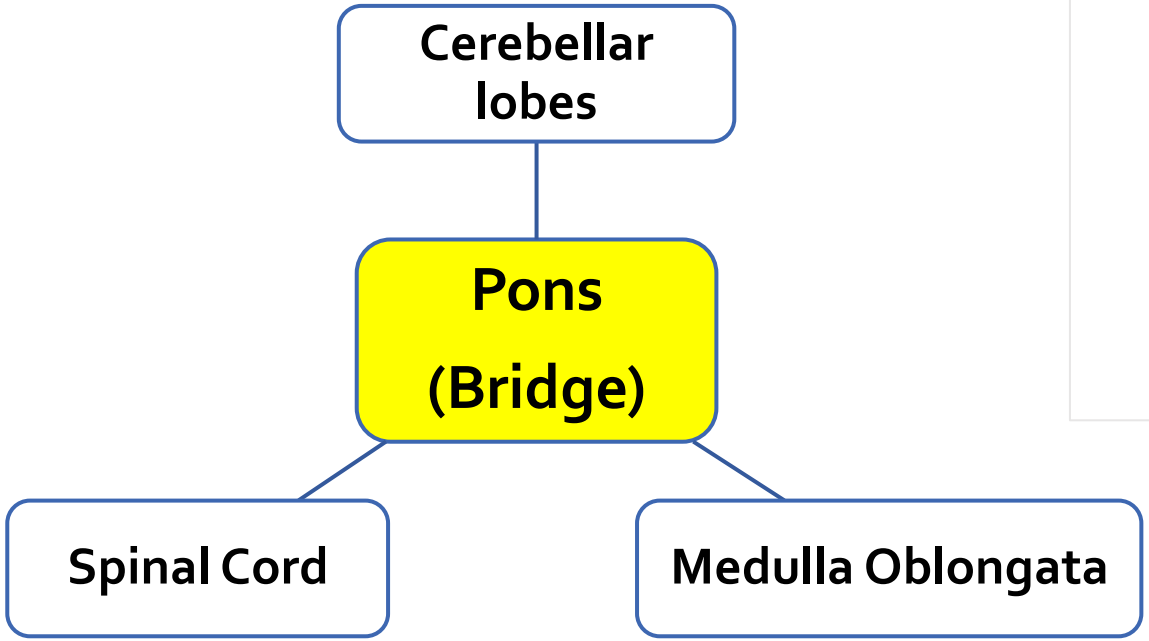
b) *Pons varolli*:

- Cross band of nerve fibres
- Outer- White mater, Inner – Gray mater
- Function : Connect cerebellar lobes, medulla oblongata , spinal cord.





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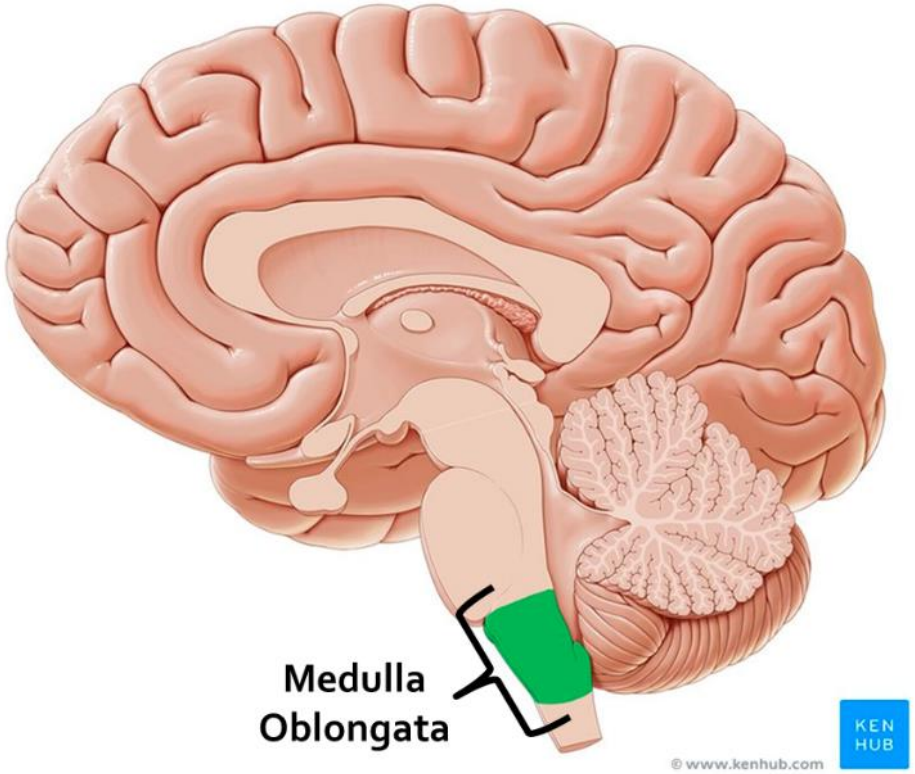
c) Medulla oblongata:

- Location: Posterior conical part
- Continues as spinal cord
- Inner – Gray mater , Outer – White mater
- Ventricle – Metacoel (IV)
- Roof of Metacoel – posterior choroid plexus, secretes CSF
- Choroid plexus- 3 openings

(a pair of lateral foramen of luschka and median foramen of Magendie)



Function:

- **Involuntary vital functions**
- **Non vital reflex**

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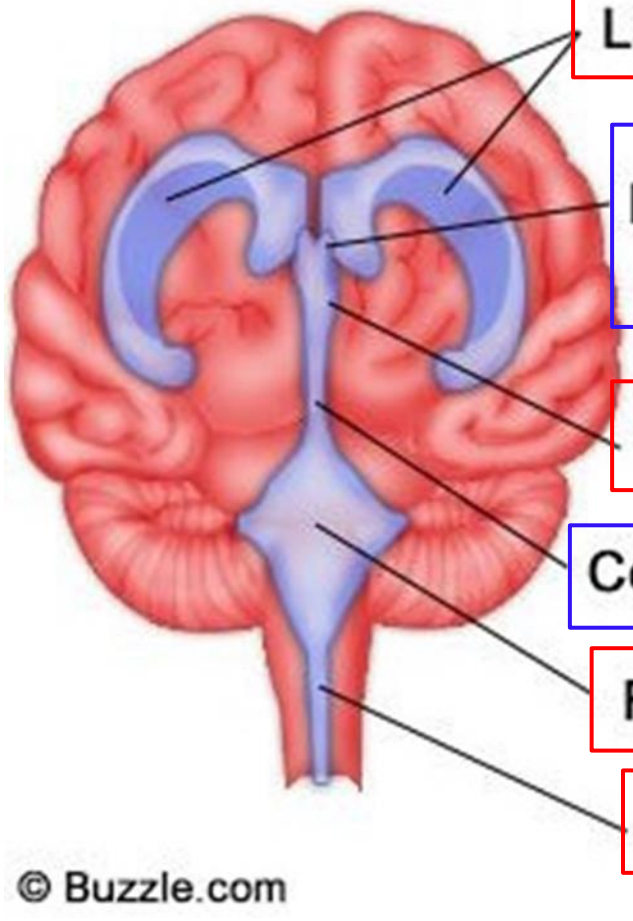
Ventricles of Brain



Lateral Ventricles	Paracoel - in Cerebrum – (I & II)
Interventricular foramen	Foramen of Monro – Between Paracoel and Dioceoel
Third Ventricle	Diocoel - in Diencephalon
Cerebral aqueduct	Duct of Sylvius / Iter – in midbrain, connects III & IV
Fourth Ventricle	Metacoel - In Medulla
Central canal	Continues in spinal Cord

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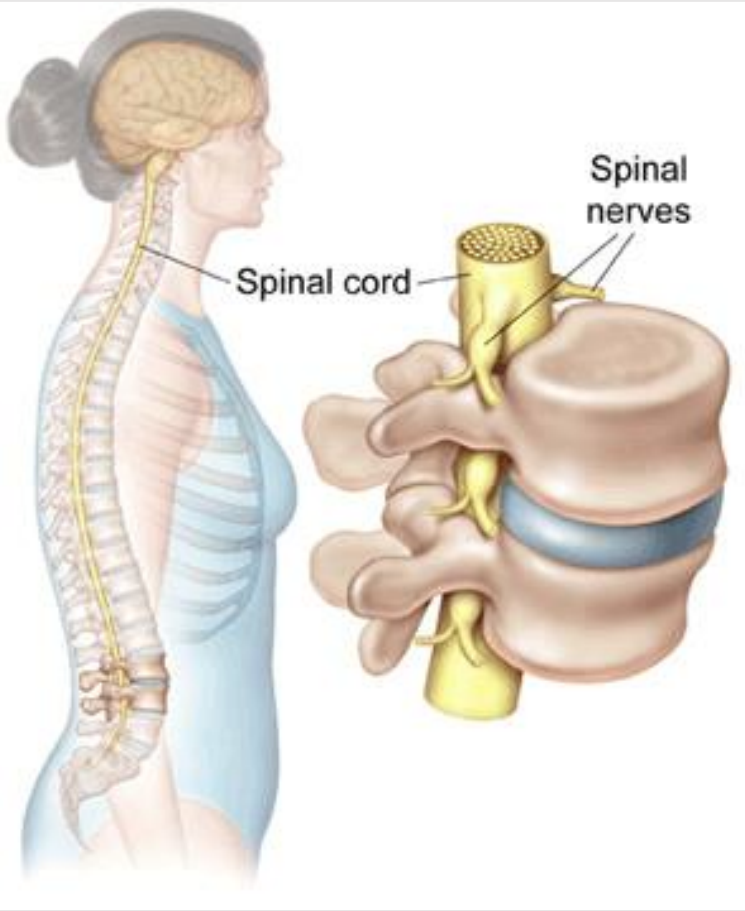
B) Spinal cord:



- Extension of Medulla
- Location: Neural canal of vertebral column
- Meninges (same as brain) – additional epidural space present
- CSF – Around and within spinal cord
- Gives rise to 31 pairs of Spinal nerves

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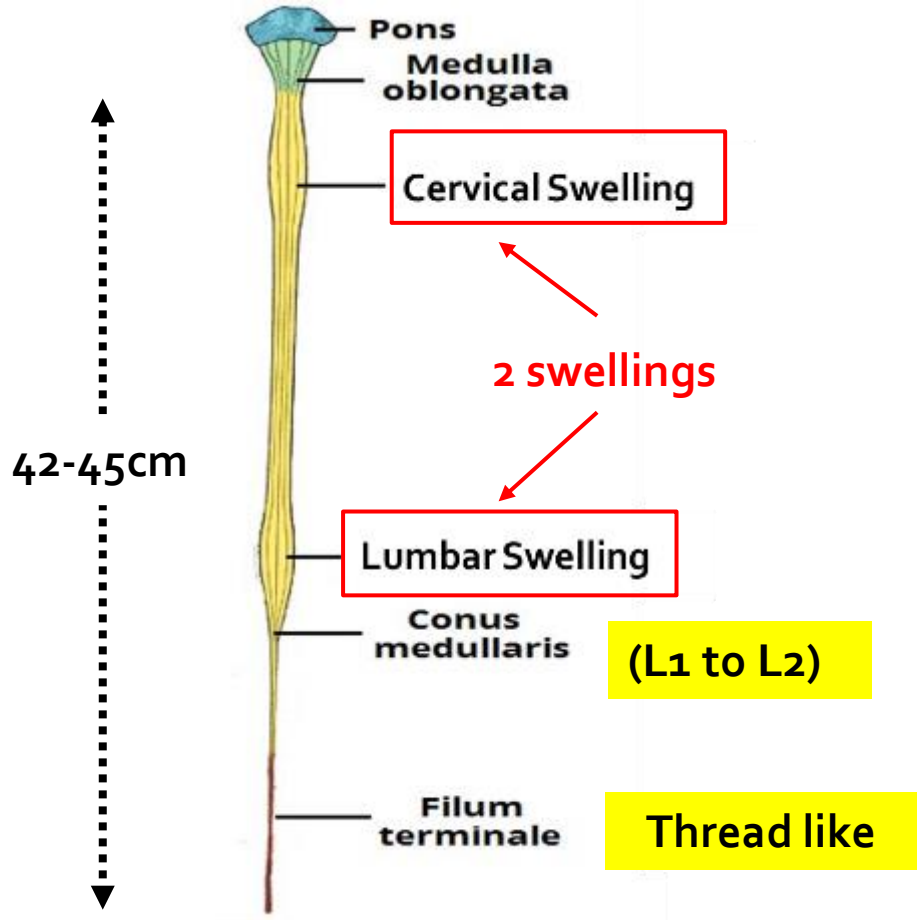
B) Spinal cord:

Anterior end –broad



Posterior end- tapering

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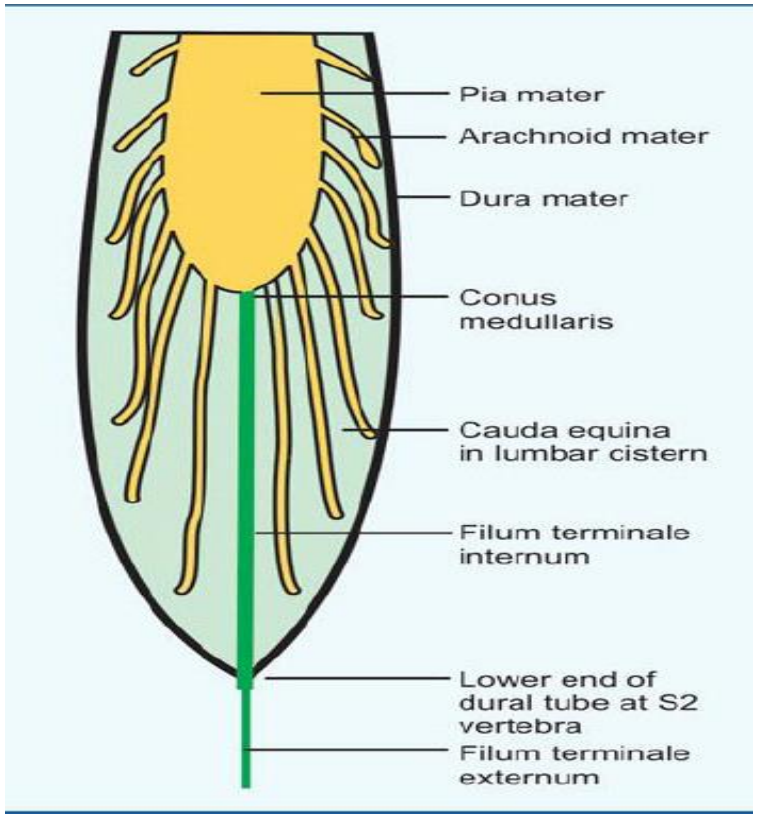
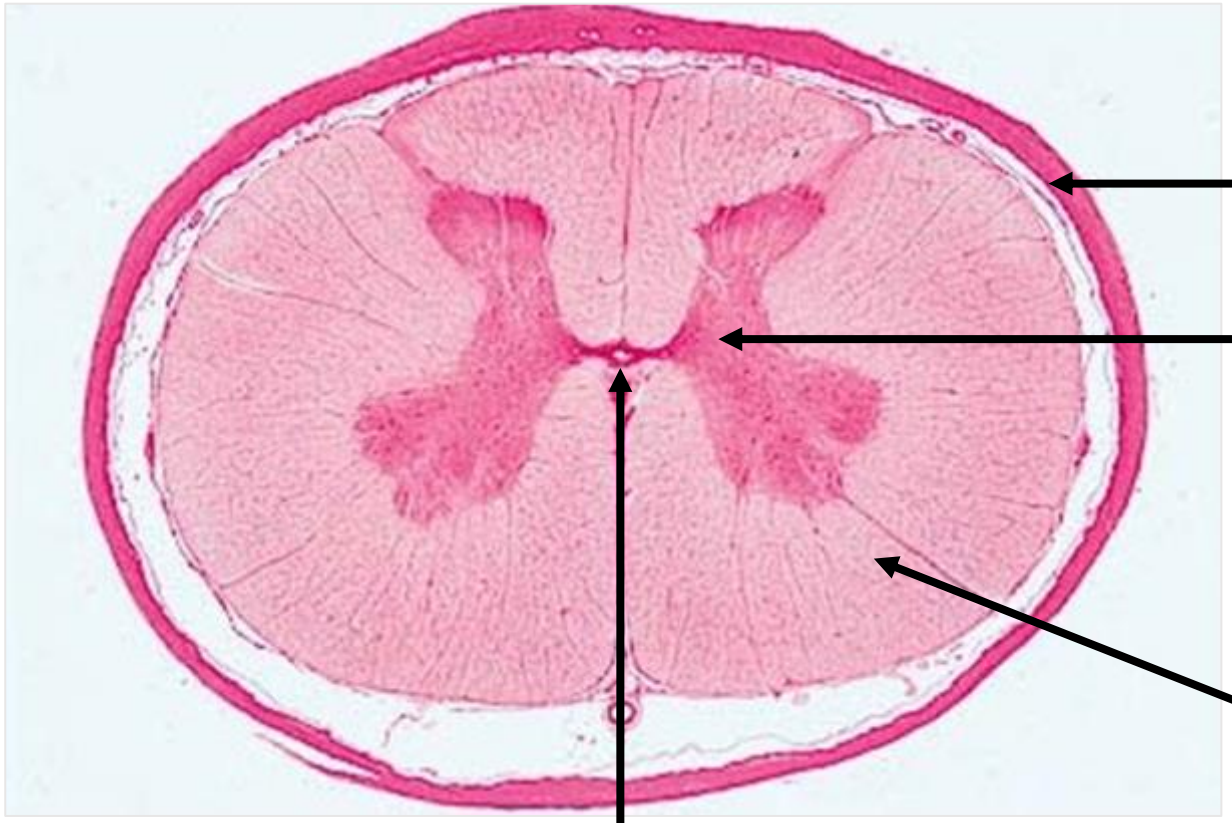


Cauda Equina

- Nerves concentrated in swellings around conus medullaris.
- Nerves in hindpart + filum terminale
- appear like horse tail (**Cauda equina**)

T.S of spinal cord:



Meninges

Gray mater

Inner side, H shaped

Association/interneurons

White mater

Outer side

Ascending and Descending Tract

Central Canal

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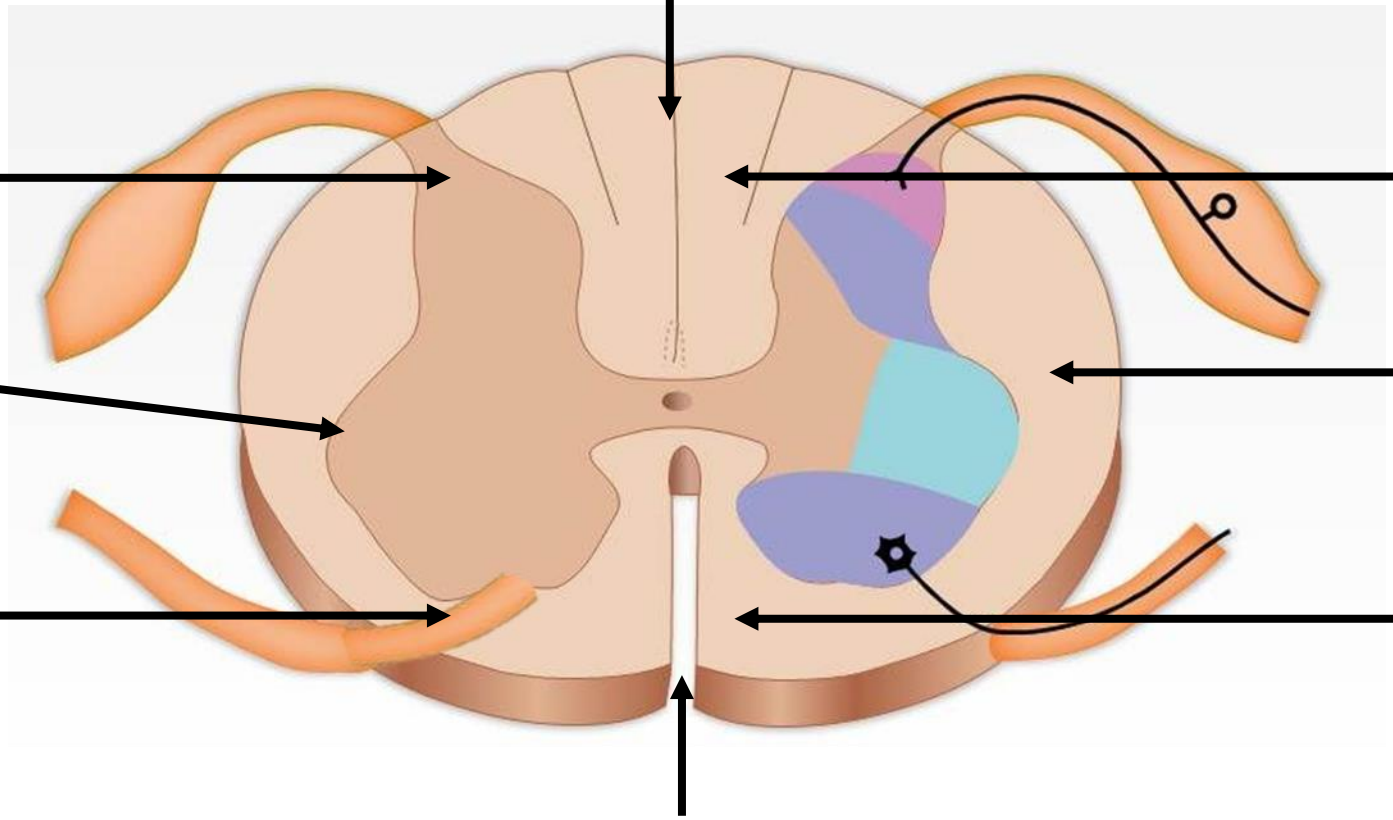
T.S of spinal cord:

Posterior Median Fissure

Gray mater is divided into:

White mater is divided into:



Dorsal Horn

Lateral Horn

neurons of ANS.

Ventral Horn

Motor neurons

Dorsal Funiculi

Lateral Funiculi

Ventral Funiculi

Anterior Median Fissure

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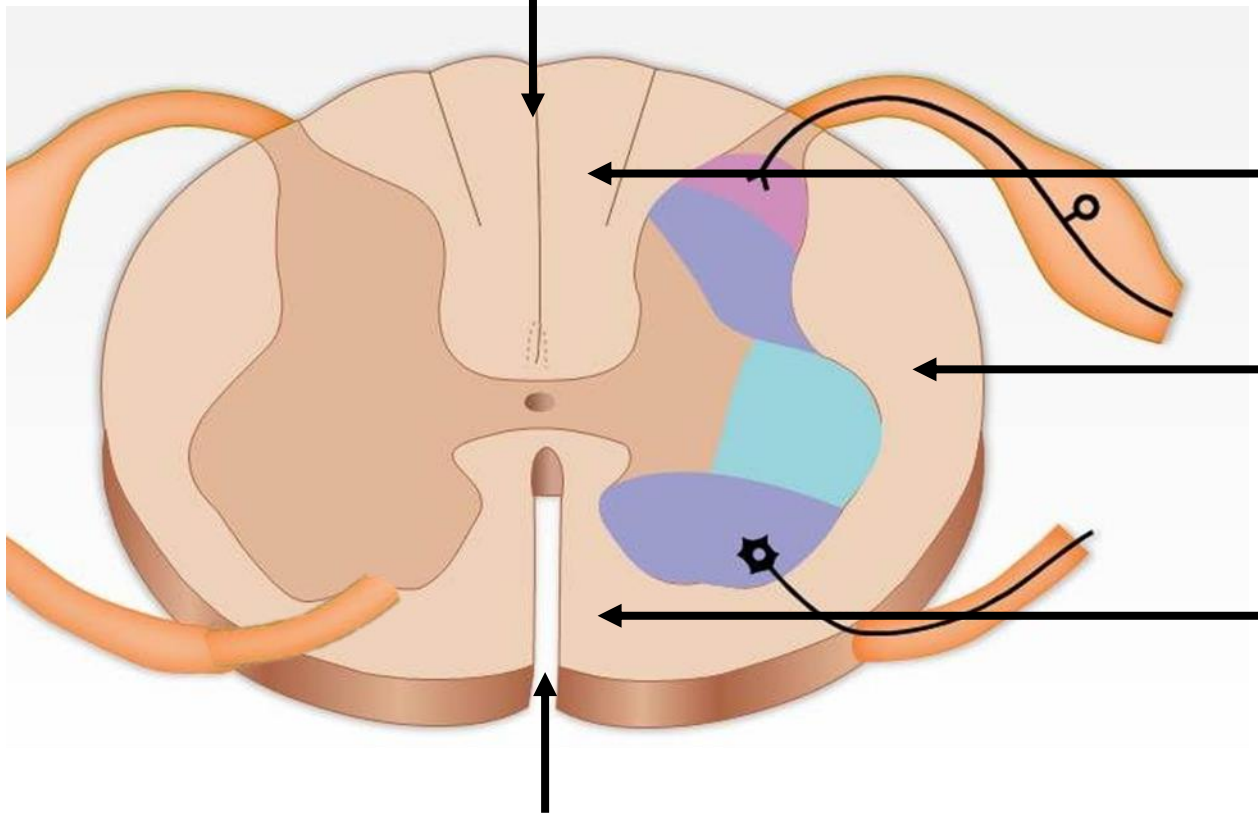
T.S of spinal cord:



White mater is divided into:

- Dorsal Funiculi → Ascending tracts (sensory impulses) Spinal cord → Brain
- Lateral Funiculi → Descending tracts (motor impulses) Brain → Spinal cord
- Ventral Funiculi → Descending tracts (motor impulses) Brain → Spinal cord

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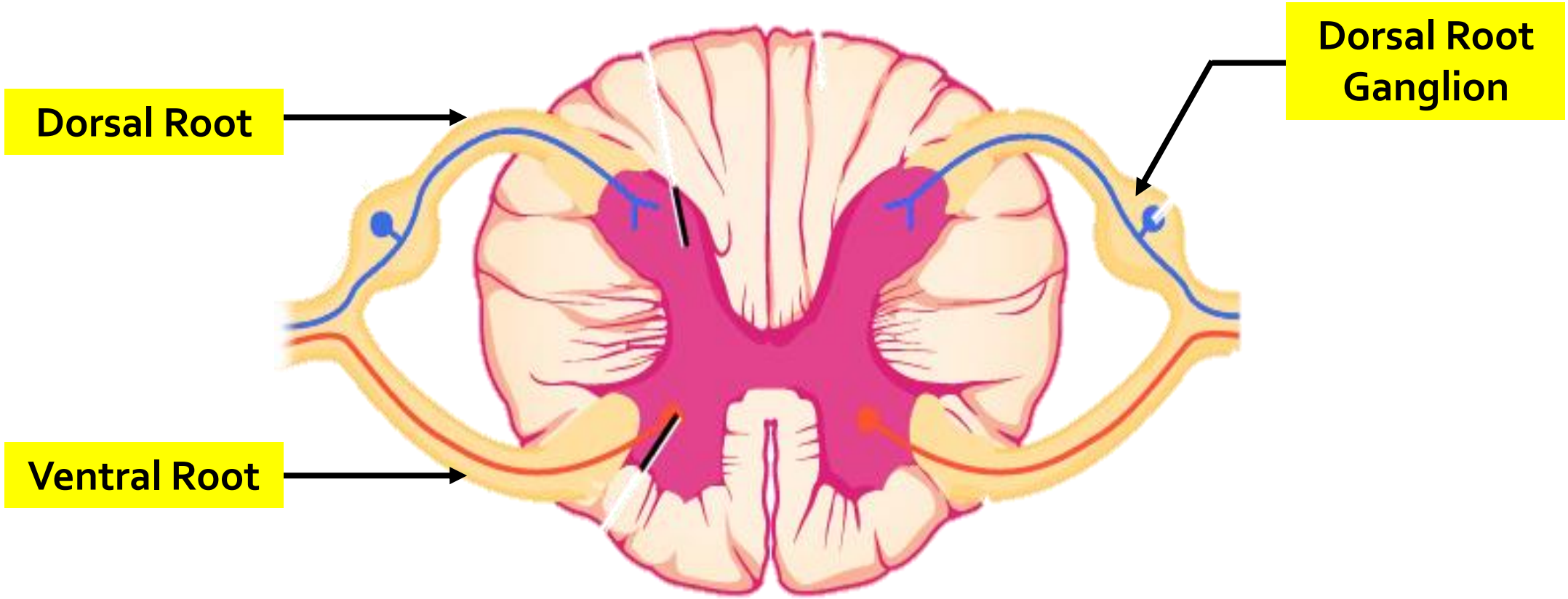
T.S of spinal cord:



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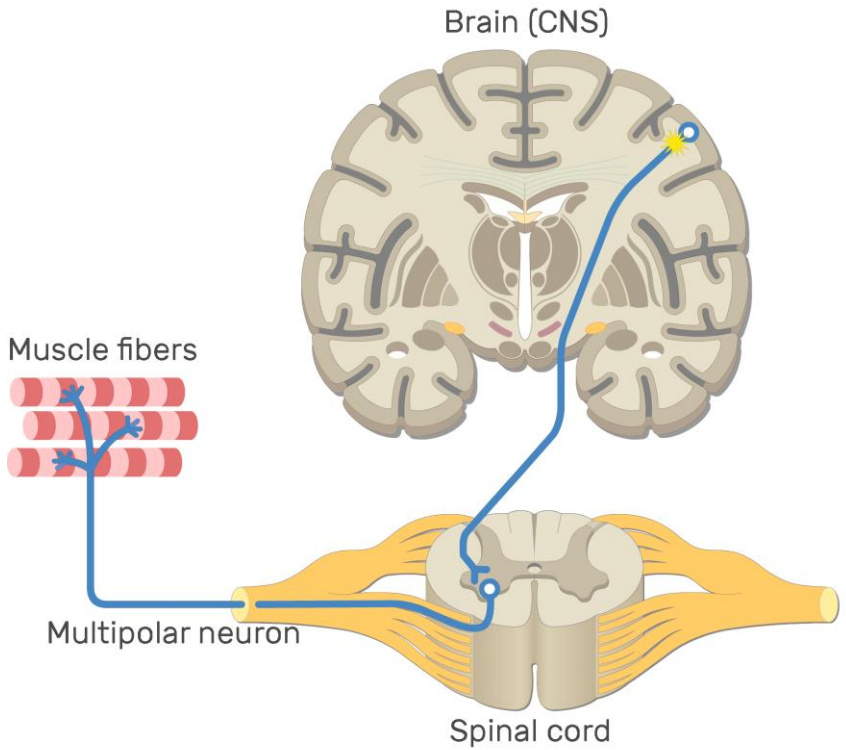
Functions of spinal cord:

- Main centre for – Reflex Action
- Pathway - impulse conduction
- Nervous connection – many parts of the body



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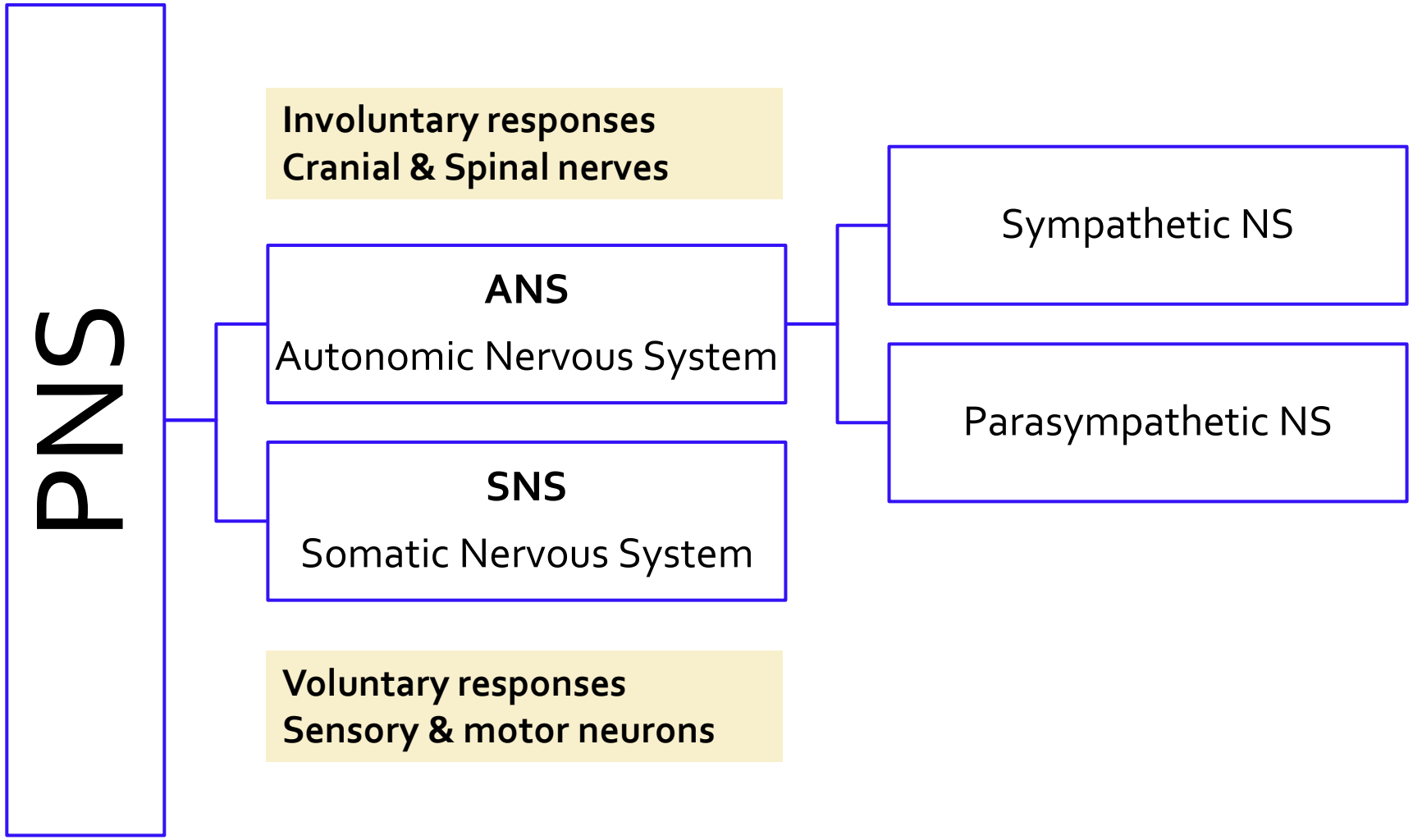
2. PNS –Types



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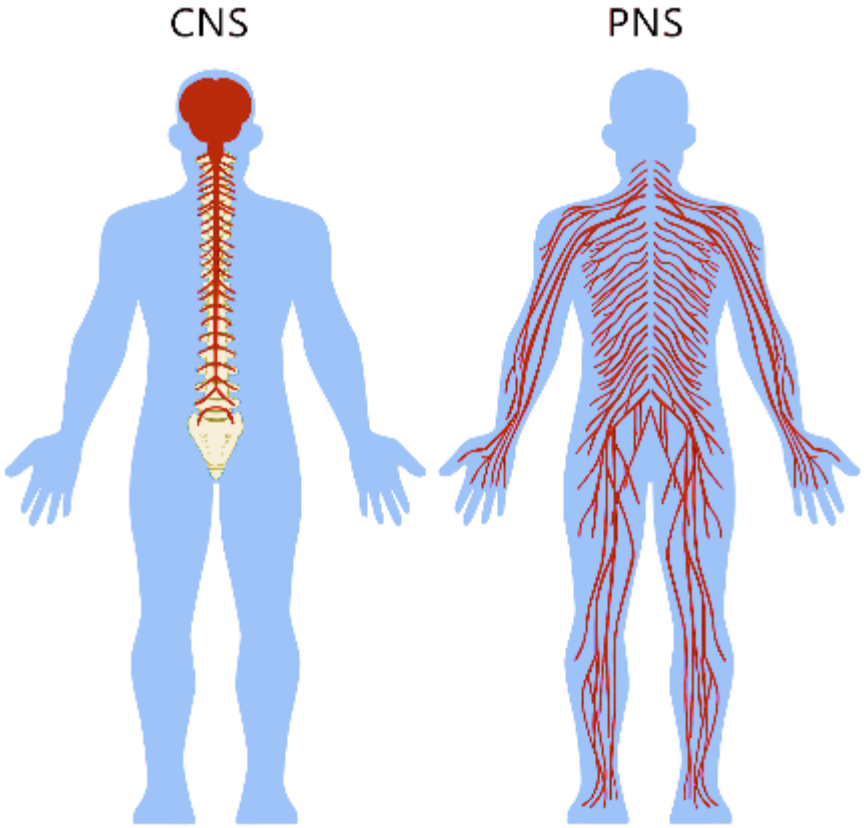
2) Peripheral nervous system (PNS):

- Connects CNS – Parts of body (receptors and effectors)



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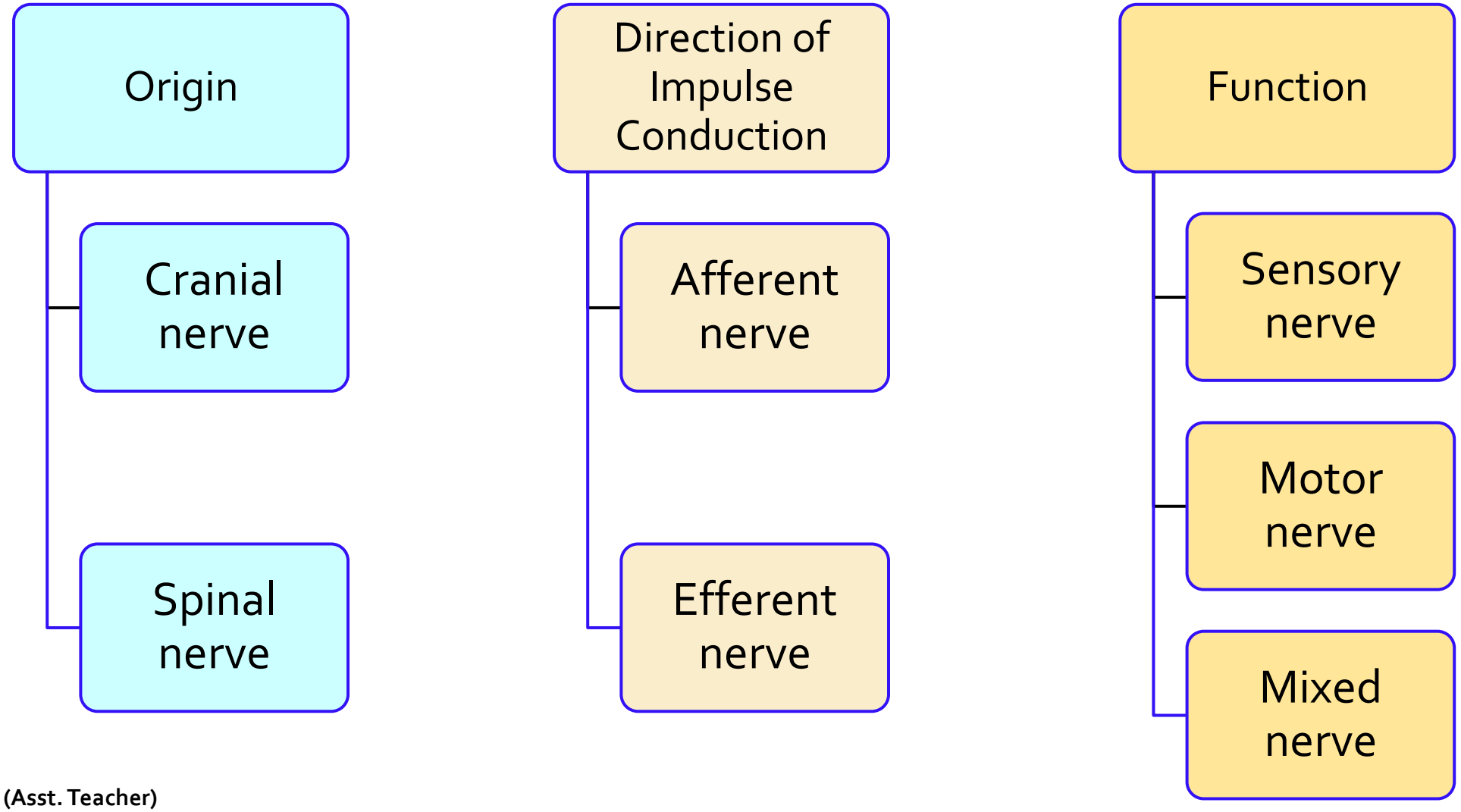
PNS -Types of Nerves



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i) Cranial nerves:

- Brain(all amniotes), originate or terminate
- 12 pairs
- Roman number I to XII
- According to function
    1. **Sensory (I, II, VIII)**
    2. **Motor (III, IV, VI, XI, XII)**
    3. **Mixed (V, VII, IX, X)**

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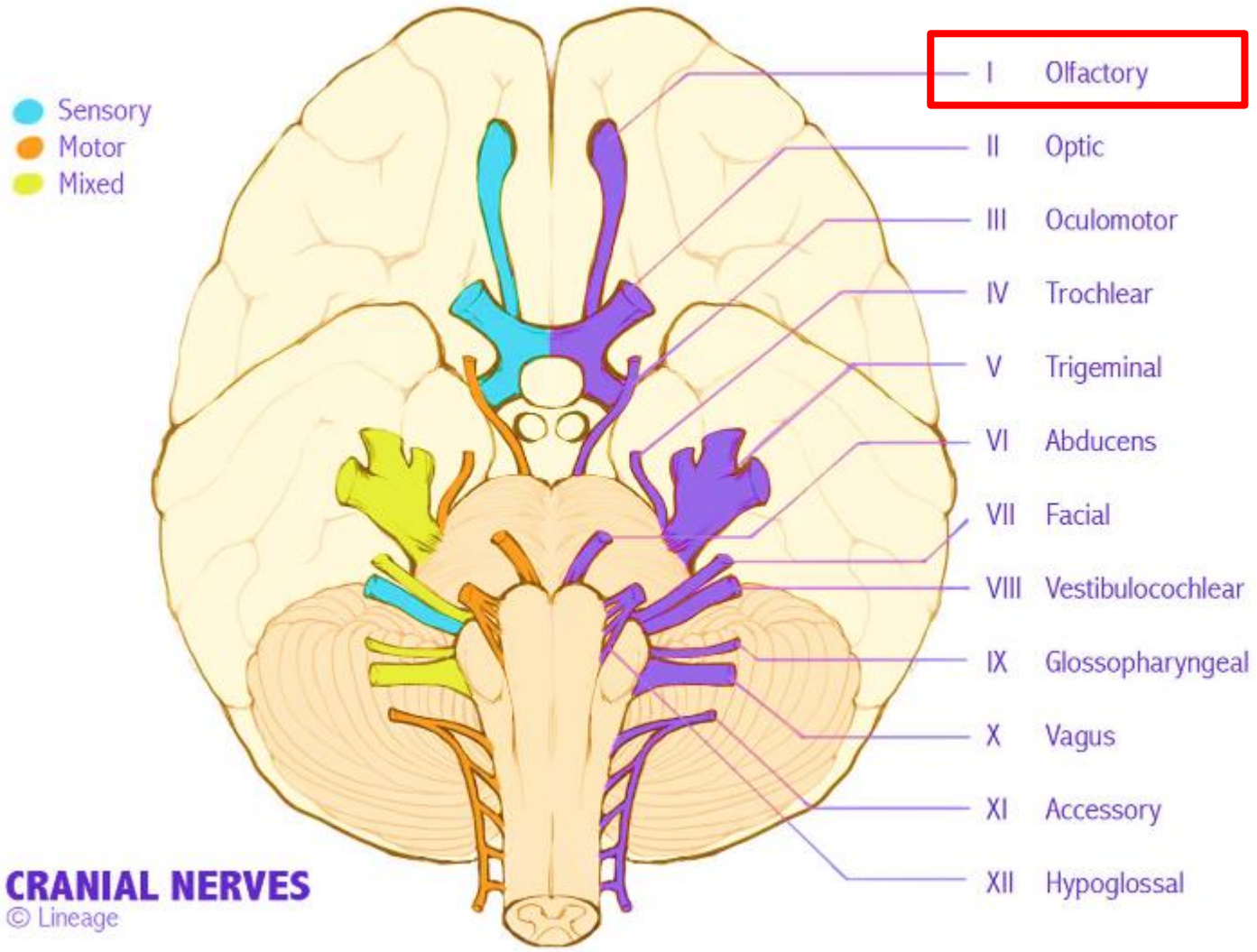
Olfactory lobe: Cranial Nerve



I – Olfactory nerve
Goes to – Epithelium of nose
Function – sensation of smell

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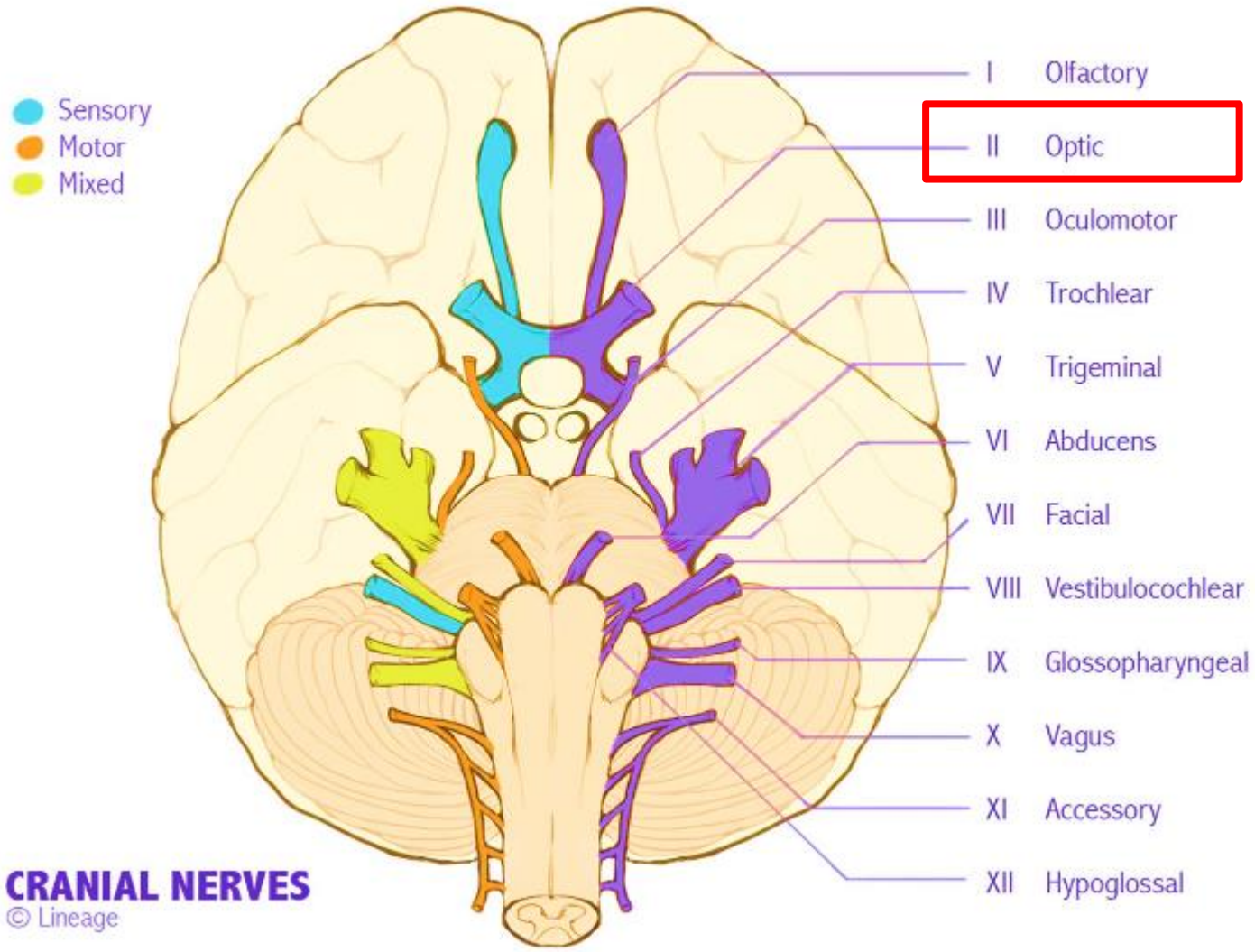
Diencephalon : Cranial Nerve



II – Optic nerve
Goes to : Retina of Eye
Function: carry Visual impulses

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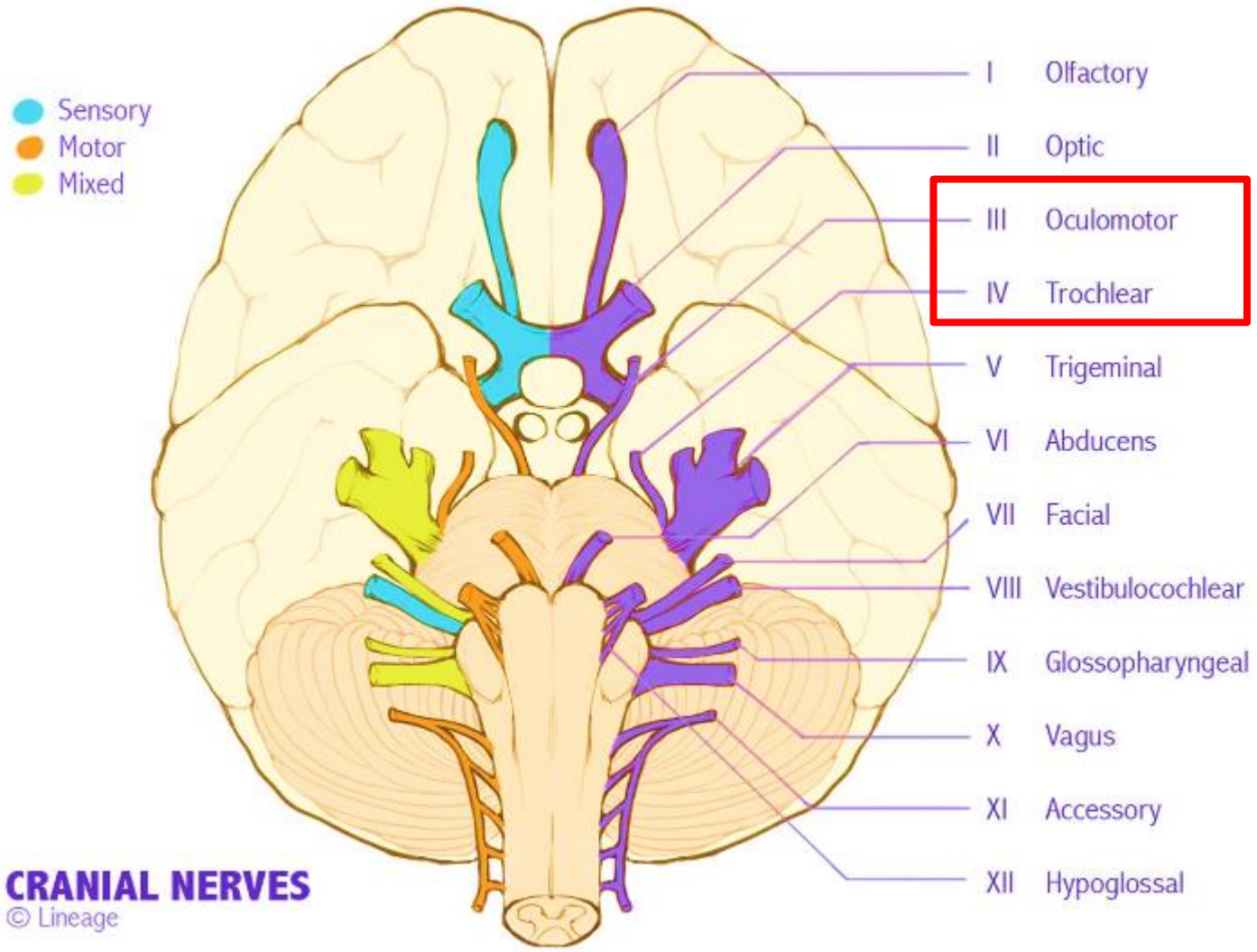
Midbrain: Cranial Nerve



III – Occulomotor
Goes to - Eye muscles
Function – Movement of eyeballs

IV – Pathetic
Goes to - Eye muscles
Function – Movement and rotation of eyeballs

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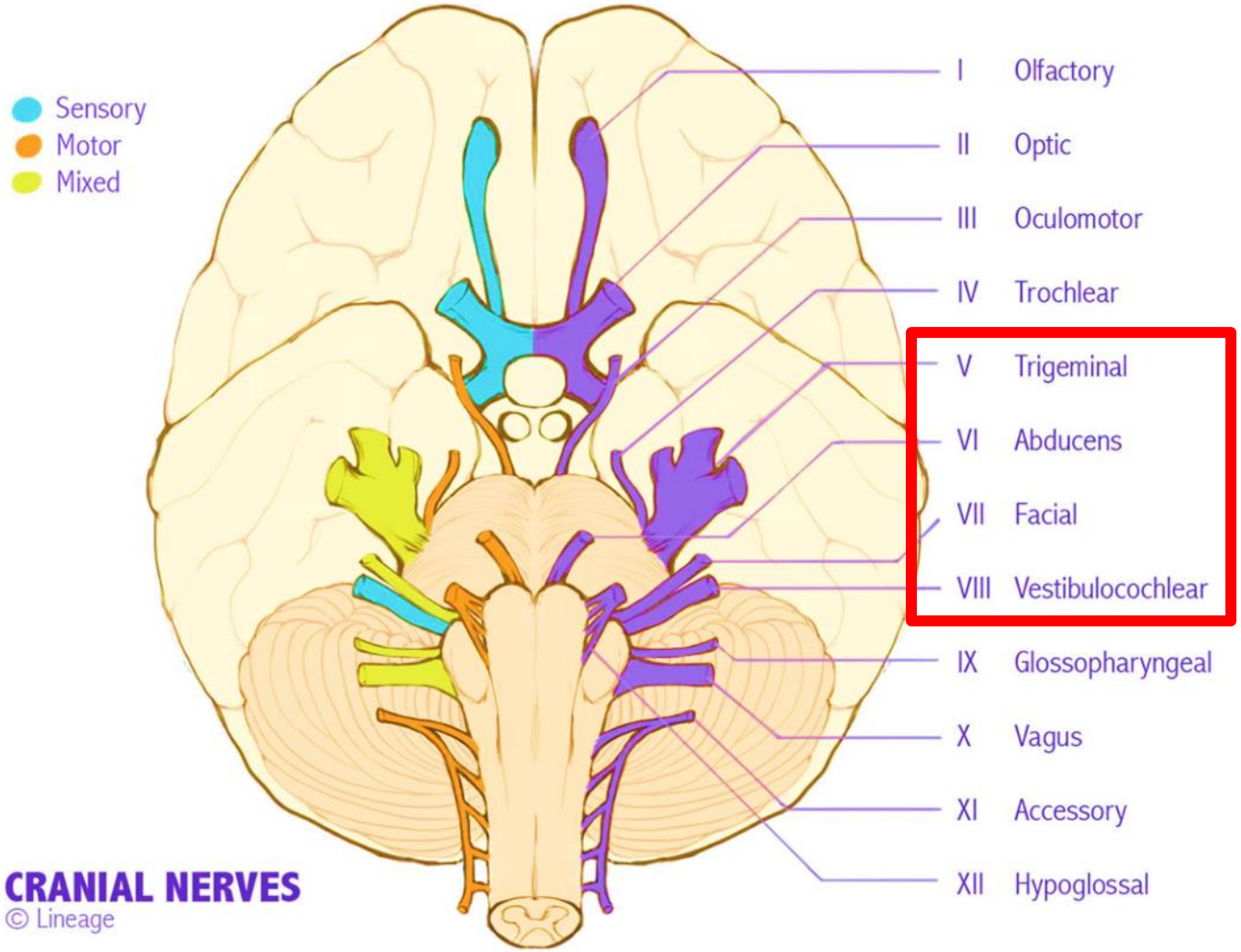
Pons – Cranial Nerve



V – Trigemial

Goes to : Various parts of head

Function – Sensation of skin touch, taste, jaw movements

Branches:

- Opthalmic
- Maxillary
- Mandibular

VI – Abducens

Goes to – Muscles of Eyeballs

Function – Movement of eye

VII – Facial

Goes to – Facial, Scalp and neck muscles; Various glands in head

Function – Facial expression, taste, saliva and tear section, movement of neck

VIII – Auditory

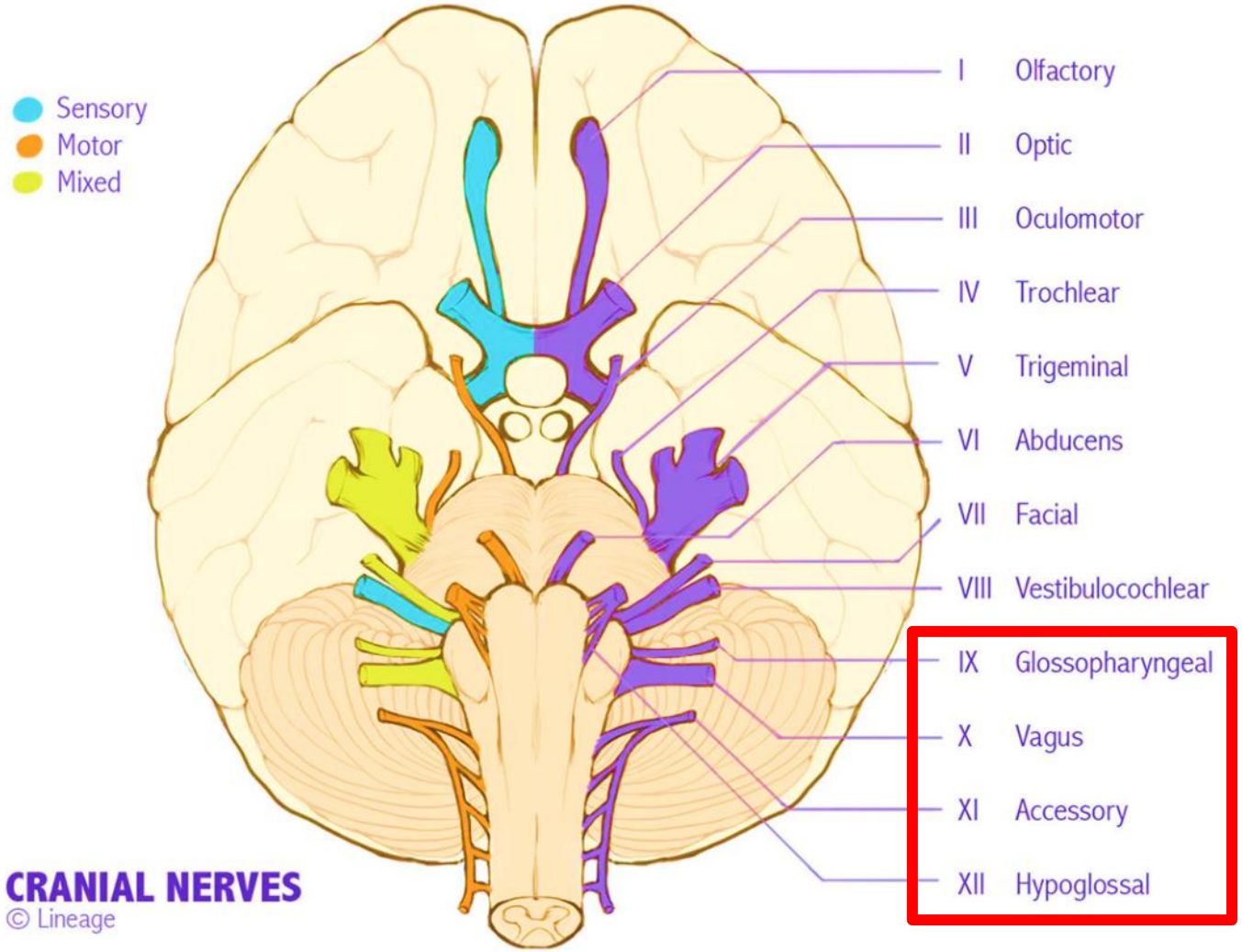
Goes to - Internal ear

Function – hearing & equilibrium

Branches –

- Vestibular
- Cochlear

Medulla– Cranial Nerve



IX – Glossopharyngeal
Goes to – Pharynx, tongue, salivary gland
Function – Taste, Salivation, Swallowing

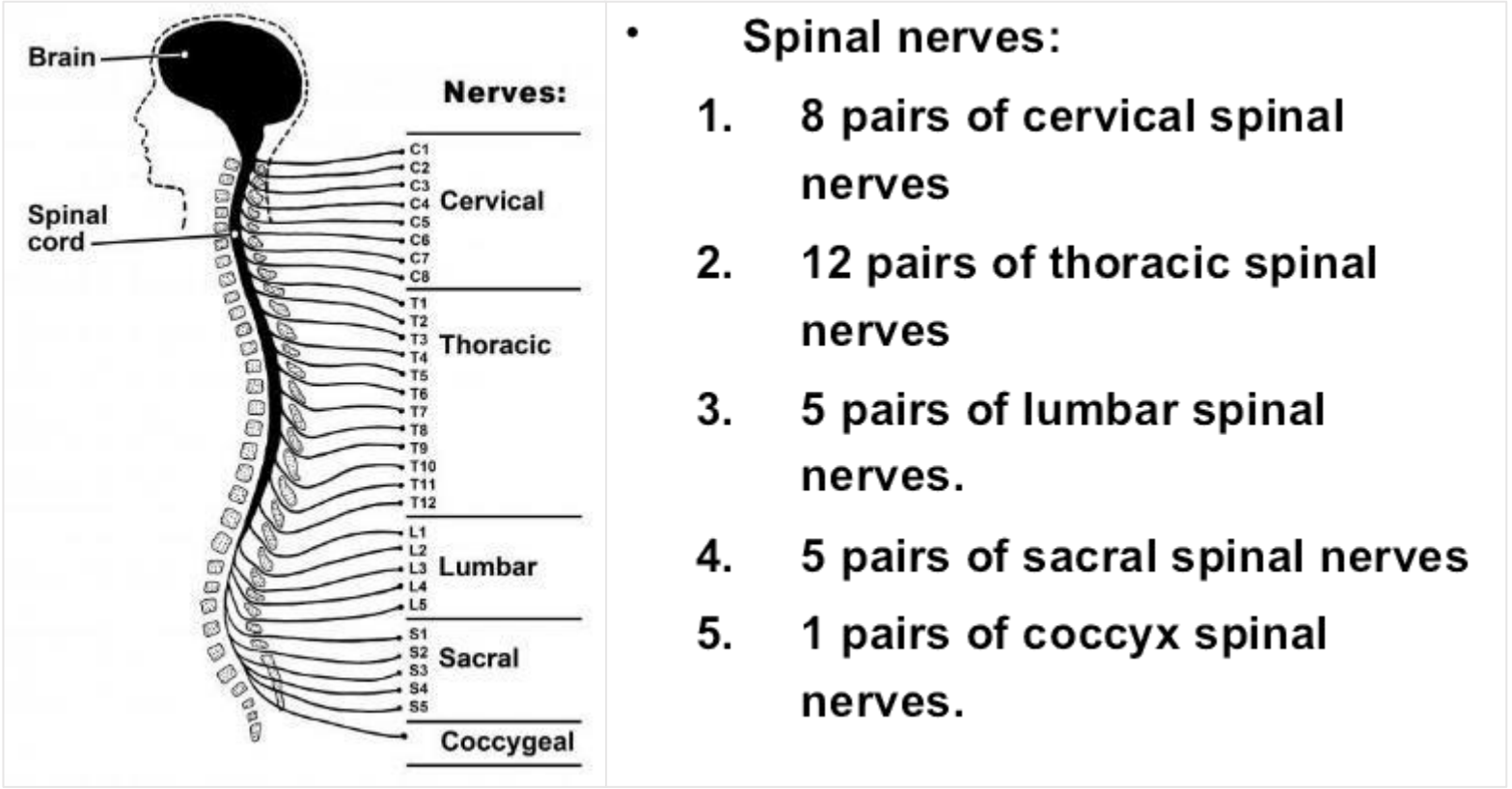
X – Vagus
Goes to – Various Vital organs
Functions – Various involuntary movement

XI – Spinal Accessory
Goes to - Neck and torso muscles
Function – Movements of larynx, Pharynx, shoulder and neck

XII – Hypoglossal
Goes to – tongue muscles
Function – Movement of tongue

ii) Spinal nerves:

- Originates from – spinal cord
- **31 pairs**
- **Mixed nerves**



- **Spinal nerves:**
  1. **8 pairs of cervical spinal nerves**
  2. **12 pairs of thoracic spinal nerves**
  3. **5 pairs of lumbar spinal nerves.**
  4. **5 pairs of sacral spinal nerves**
  5. **1 pairs of coccyx spinal nerves.**

Emerges out of intervertebral foramen

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Formation of a typical spinal nerve:

Both nerves together- mixed spinal nerve.

To skin and muscles of dorsal side

Ramus Dorsalis

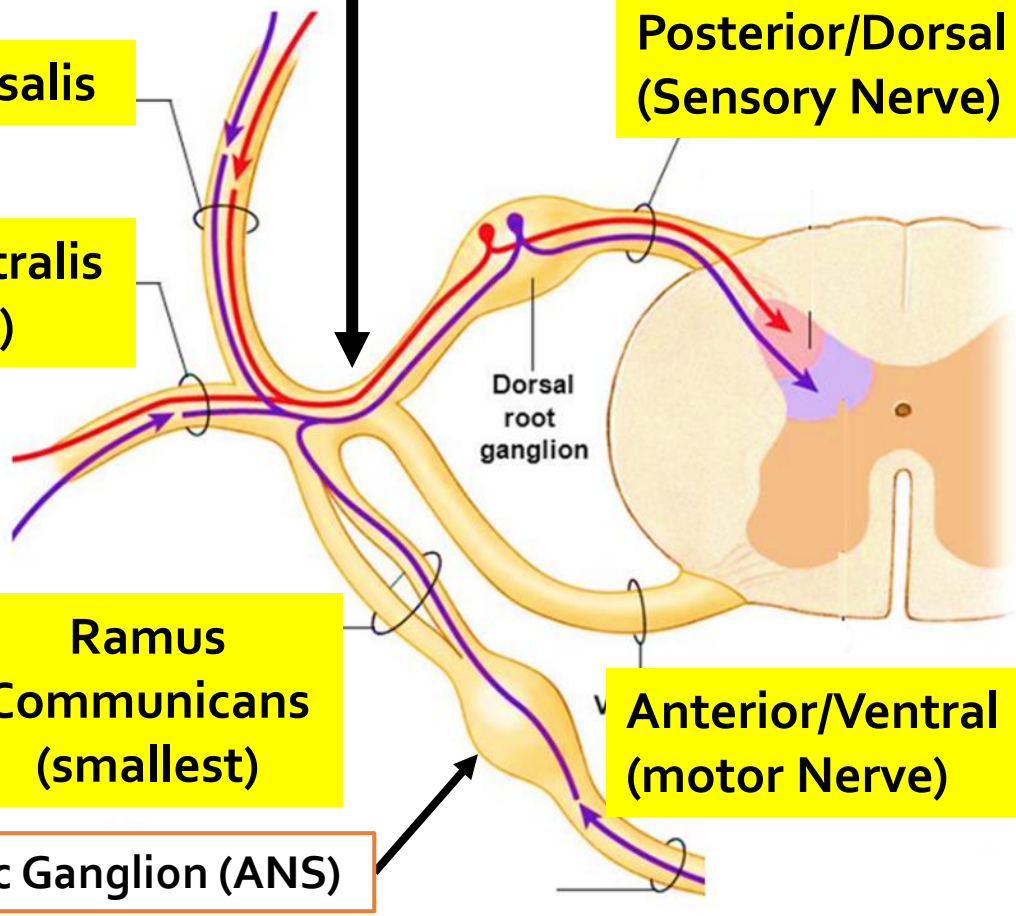
To organs & muscles of lateral and Anterior side

Ramus Ventralis (largest)

From T1 to L3 Spinal nerve

Ramus Communicans (smallest)

Sympathetic Ganglion (ANS)



Posterior/Dorsal Root (Sensory Nerve)

Receives Sensory neuron

Anterior/Ventral Root (motor Nerve)

Gives out Motor neuron

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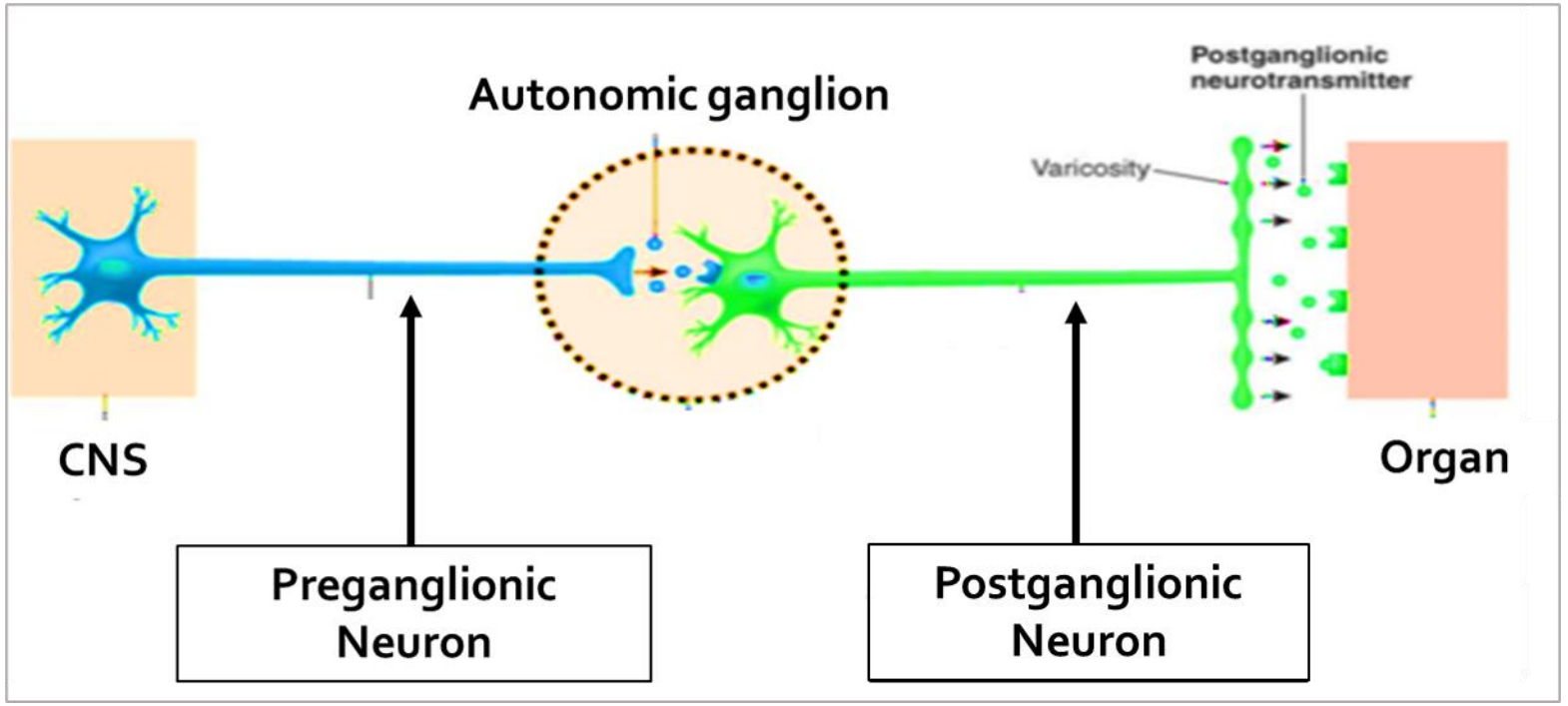
3. Autonomous nervous system:

- Transmits impulses from CNS to organs
- Communicates with organs and glands
- Involuntary responses
- Cranial & Spinal nerves



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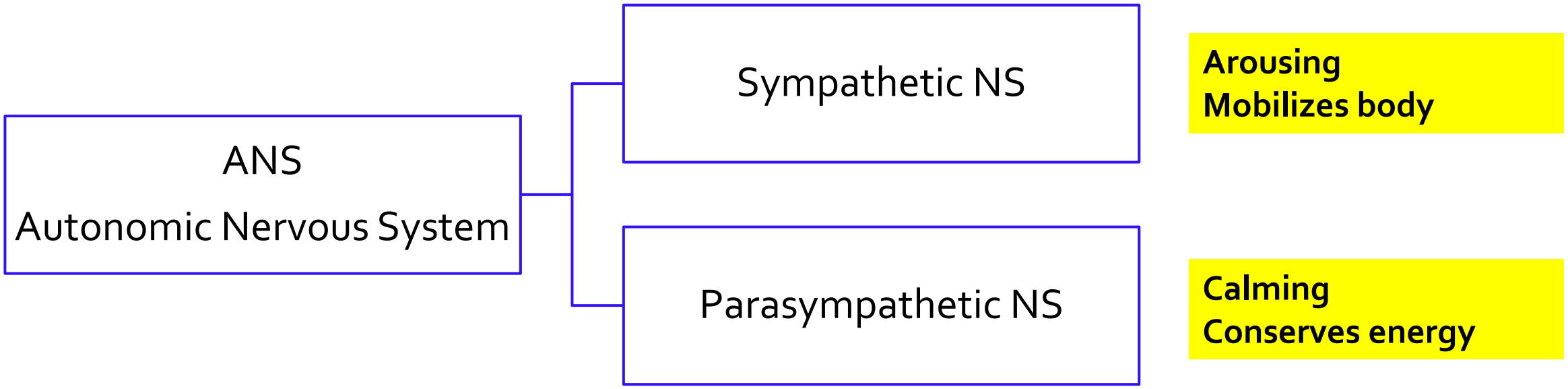
3. Autonomous nervous system:



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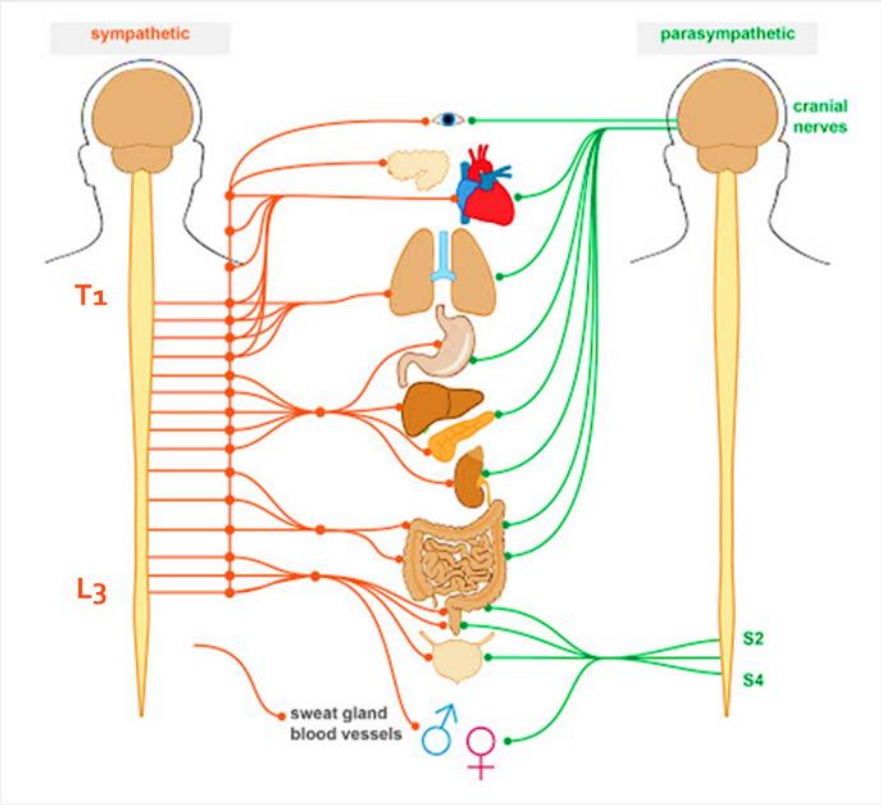
SYMPATHETIC NERVOUS SYSTEM	PARASYMPATHETIC NERVOUS SYSTEM
- Thoraco-lumbar outflow	- Cranio –sacral
- 22 pairs of sympathetic ganglia	-ganglia close or within wall of effector organ



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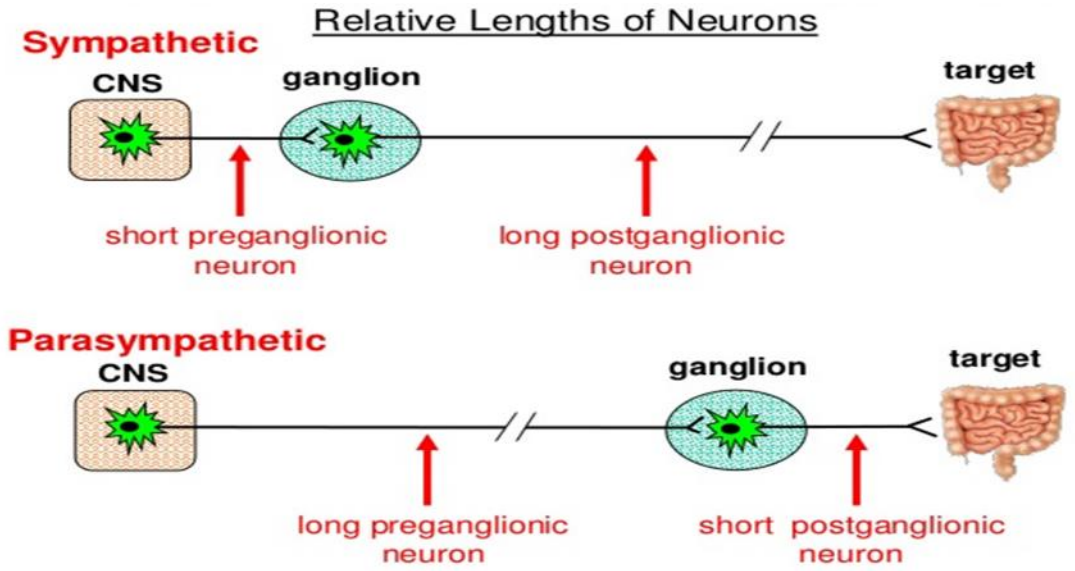
SYMPATHETIC NERVOUS SYSTEM	PARASYMPATHETIC NERVOUS SYSTEM
- Preganglionic nerve fibres short and post ganglionic nerve fibres long.	- Preganglionic nerve fibres long and post ganglionic nerve fibres short
-Post ganglionic nerve fibres secrete Adernaline and Noradrenaline	- Post ganglionic nerve fibres secrete acetylcholine
- Adrenergic fibres	- Cholinergic fibres



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SYMPATHETIC NERVOUS SYSTEM	PARASYMPATHETIC NERVOUS SYSTEM
- response- emergencies	- Housekeeping system - Antagonist to sympathetic , bring back to normal.
- Excitatory effect (except digestive and excretory organ)	- Digestive and excretory activities accelerated.

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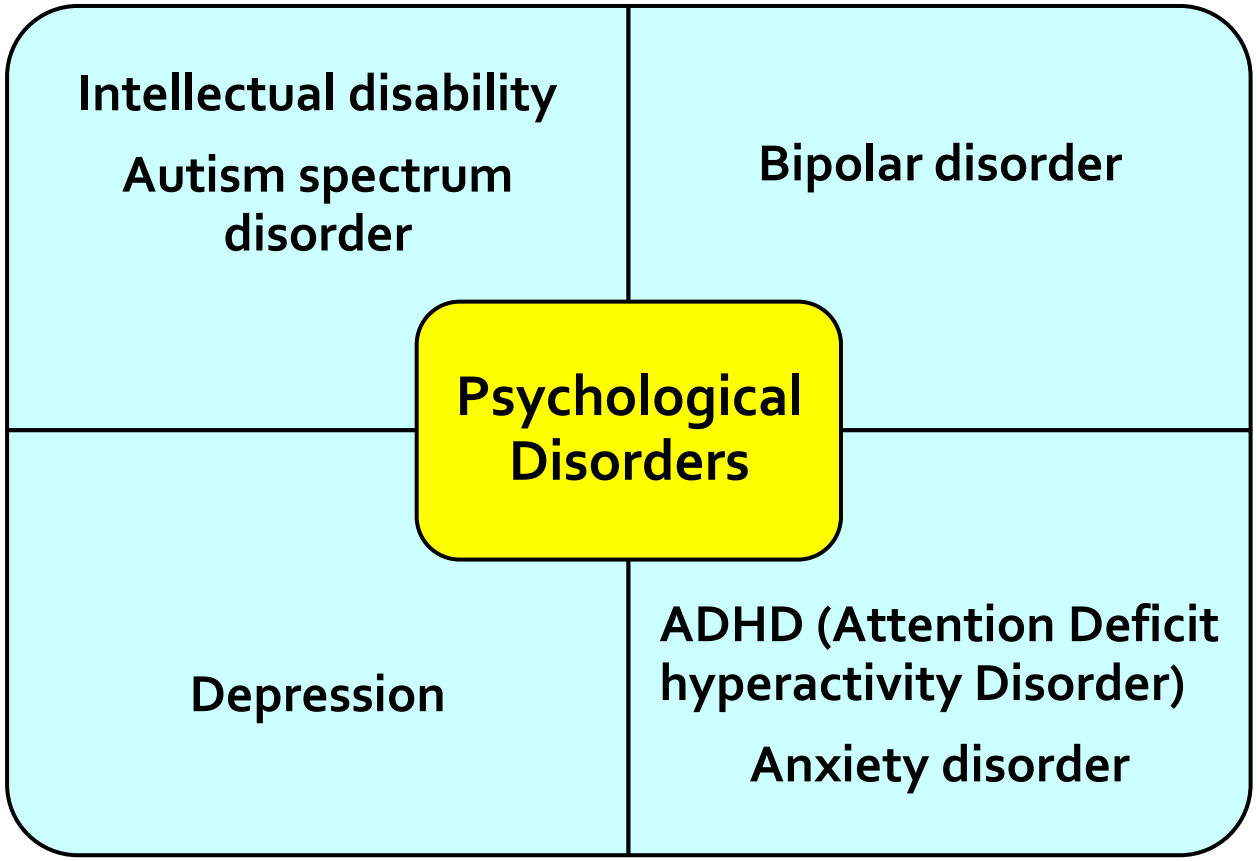
Unit 9.8: Disorders of nervous system

PSYCHOLOGICAL DISORDERS:

- Mental disorders
- Affect mood, thinking, behavior.
- Affect multiple aspects of life.

Major categories include:



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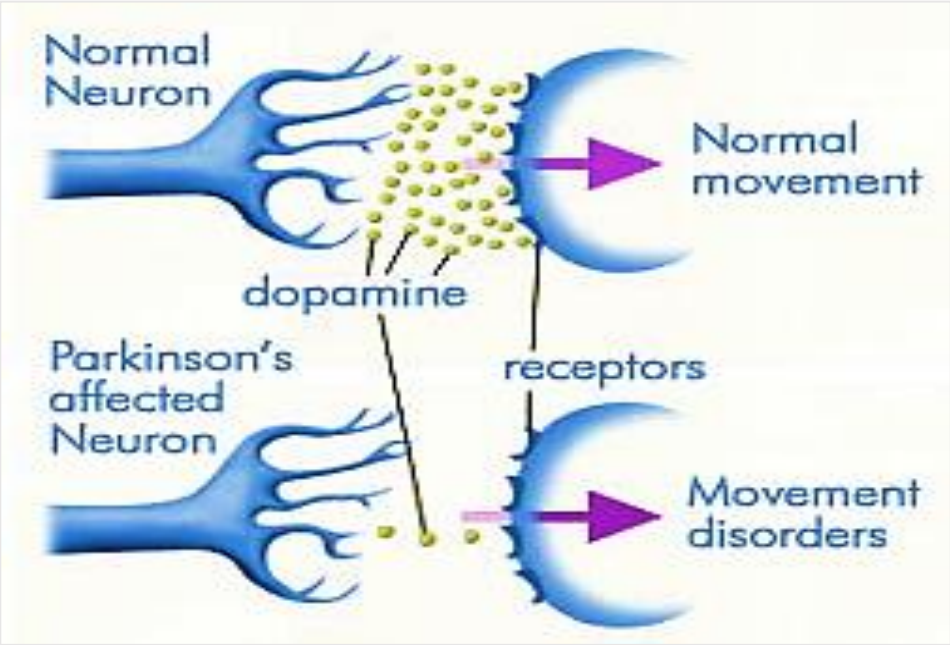
Disorders of nervous system - Parkinson's Disease

Cause : Degeneration of dopamine producing neuron



Effects:

- Tremors
- Stiffness
- Difficulty in walking, balance and co ordination

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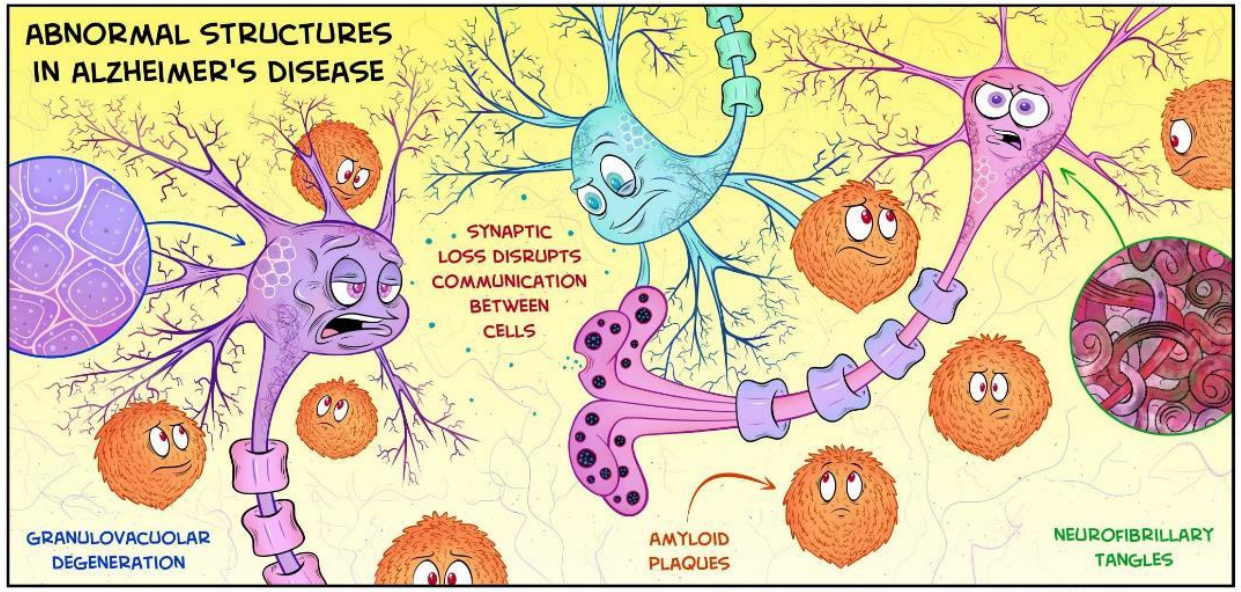
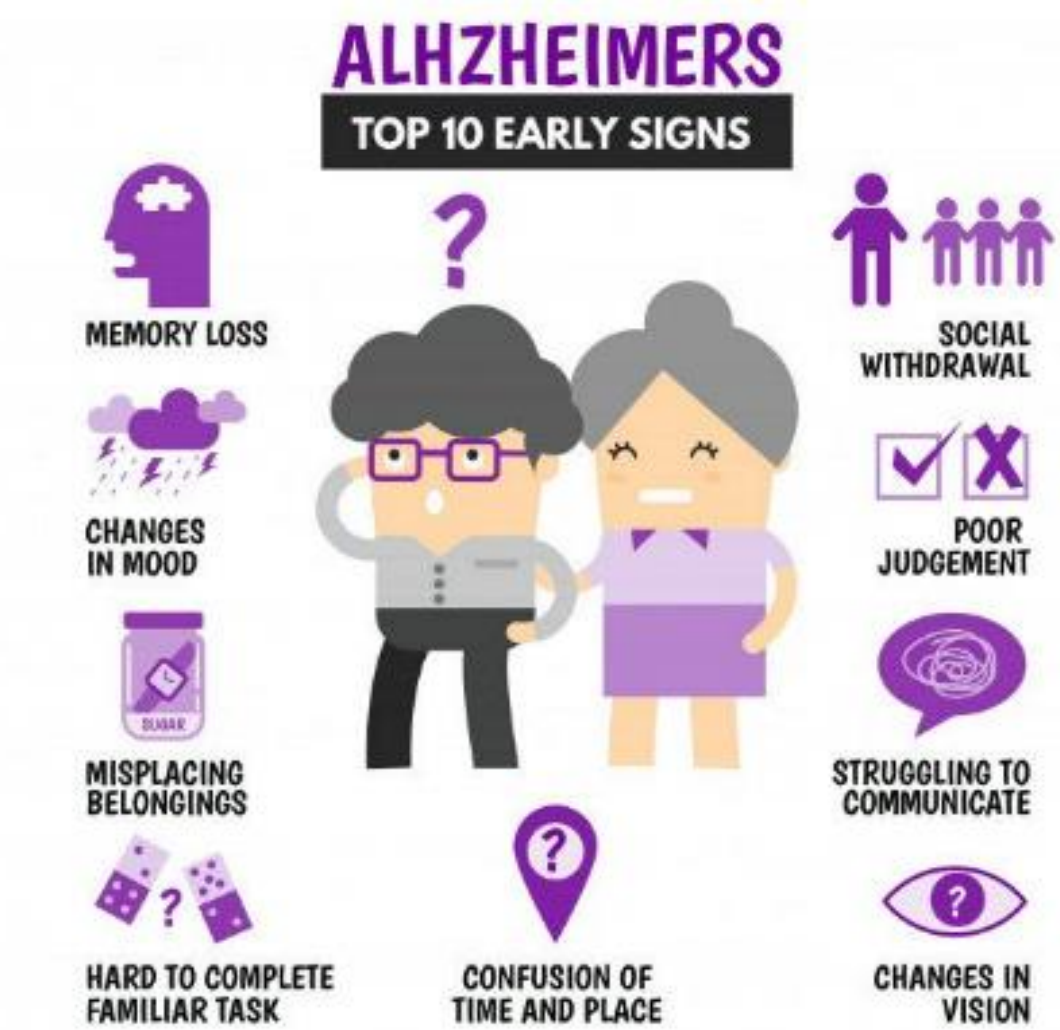
Disorders of nervous system - Alzheimer's Disease

- Most common form of dementia
- Increases with age





Cause : Occurs due to loss of cholinergic neurons, accumulation of amyloid proteins.

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