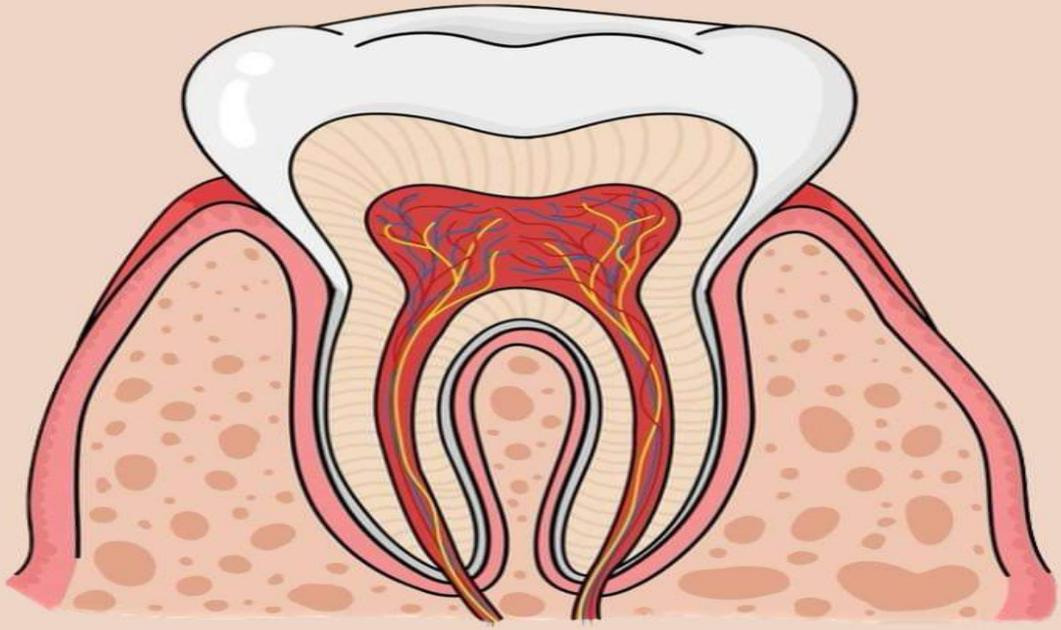
# ANATOMY



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DONE BY : Nour Al-amoush.

وَقُل رَّبِّ زِدْنِي عِلْمًا

# The Nervous System

الجهاز العصبي

The body consists of (Body Organisation)

cells → Tissues → organs → system ( has a function )

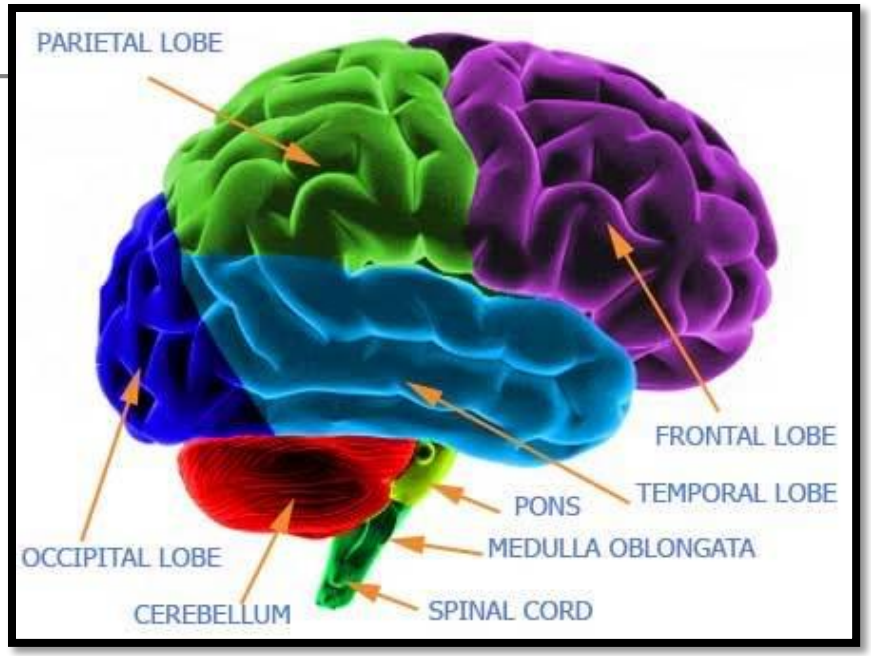
- كل system إله وظيفة معينة، و يتكامل مع باقي systems في الجسم

output + input لازم يكون عنا ، Nervous system ؟ ومين يلي بتحكم

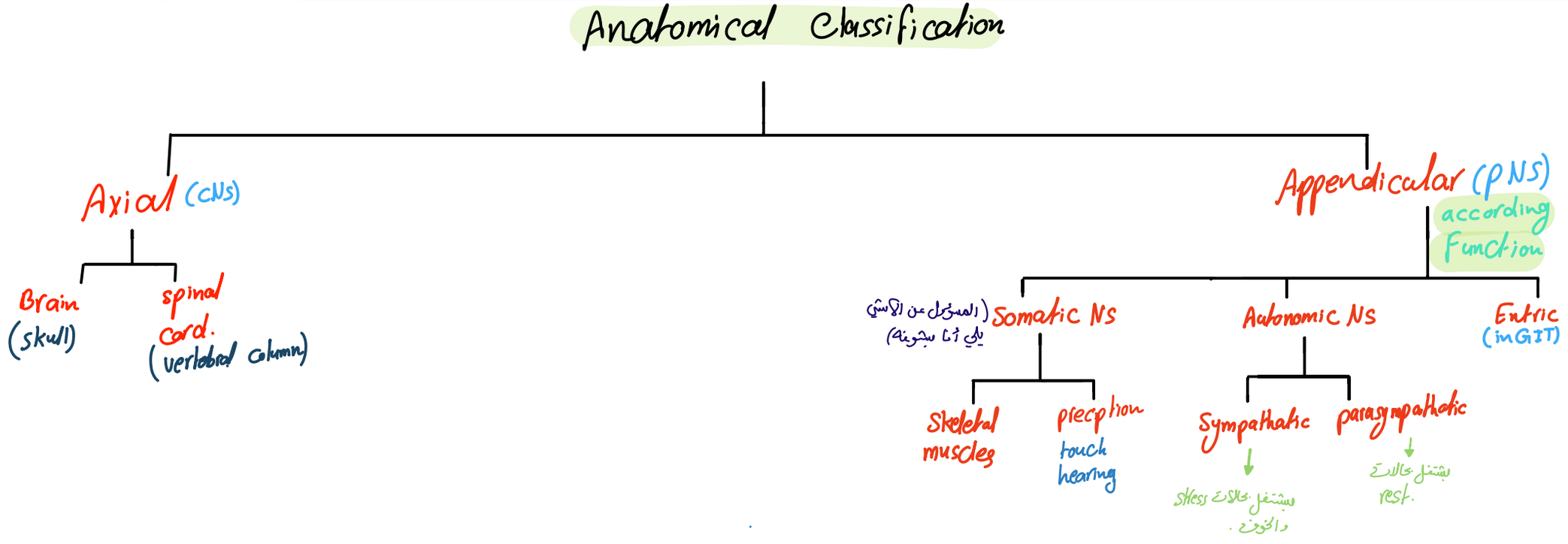
وبينظم بحر معالجة المعلومات في central nervous system .

في عنا system آخر برضو بيشتغل نفس المبدأ وهو endocrine system

وكمان هو بيشتغل بـ chemical substances زي الهرمونات



* قبل لا نبدأ بالشرح ، خلينا نشوف هذا المخطط عشان يساعدنا بتجميع الأفكار :



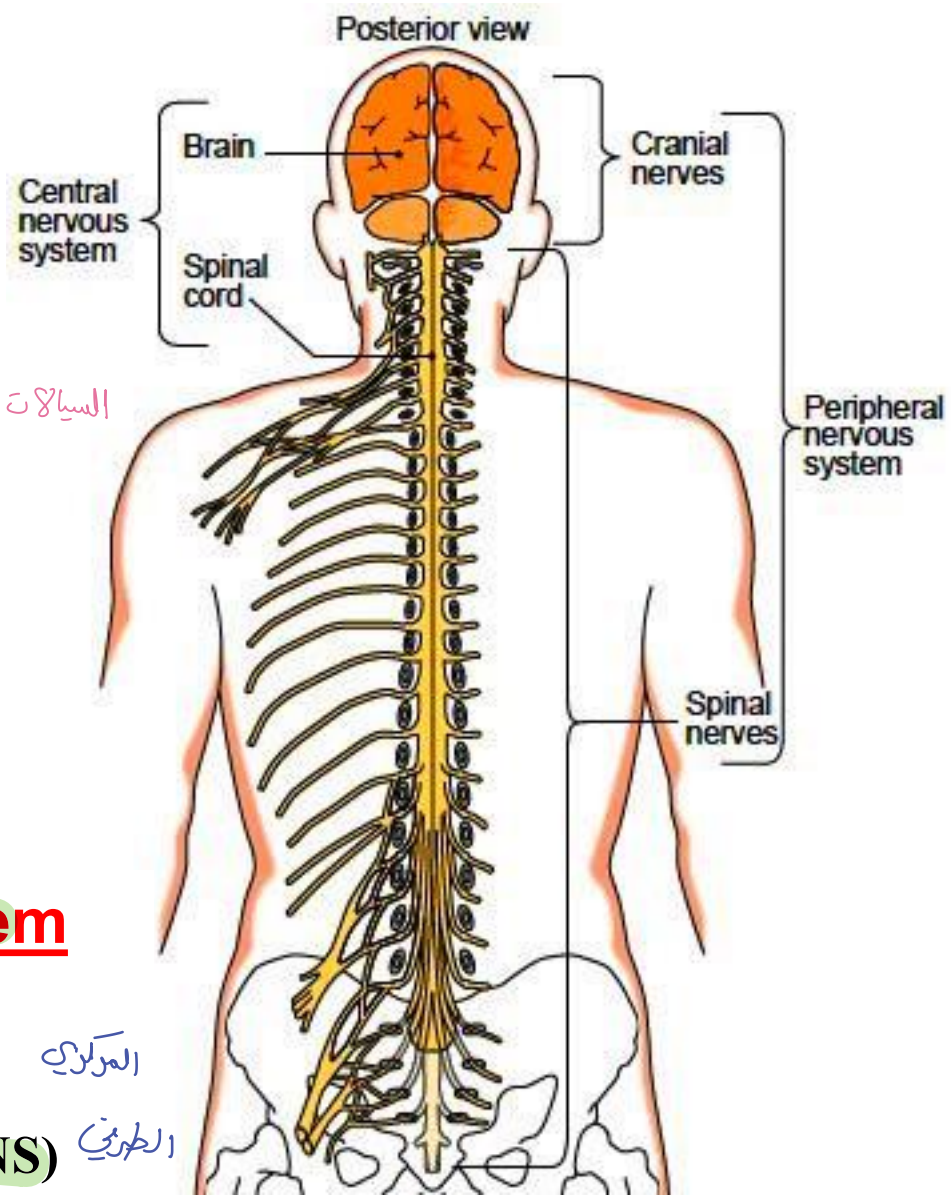

#Always remember that sympathatic is oppoist to parasympathatic

- sympathatic ↓
  - contraction of Blood vessels
  - Relaxation of stomach wall
- parasympathatic ↓
  - Relaxation of Blood vessels
  - contraction of its wall

في عنا تقسيمة حسب embryology بس الدكتور أجّل شرحه لحتى نفهمه بشكل أوضح .

# Overview

- The nervous system is the system that **controls** the various functions of the body by the means of **electrical impulses (action potential)** السيالات العصبية
- In comparison مقارنة بينهم, the endocrine system controls various functions of the body by means of **chemical substances (hormones)**

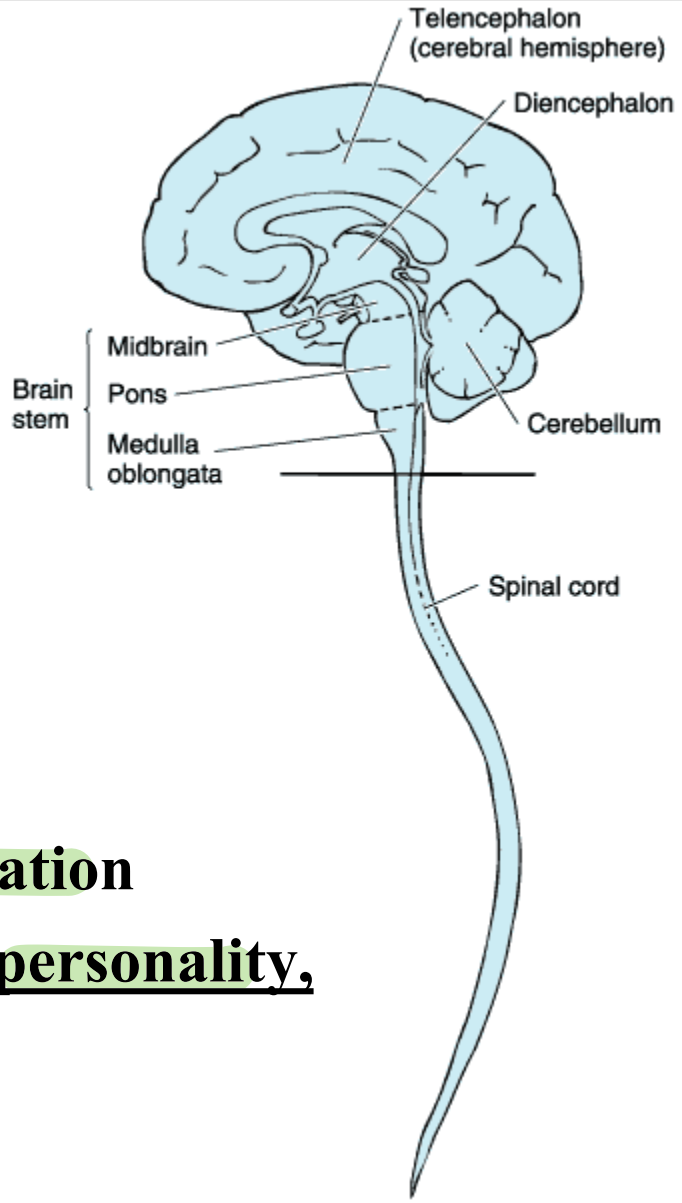



## Divisions of the nervous system

1. **Central Nervous System (CNS)** المركزي
2. **Peripheral Nervous System (PNS)** الطرفي

# 1- The Central Nervous System (CNS)

- Formed of the brain and spinal cord
- Formed of millions of nerve cells (**neurons**) and supporting cells (**glia** cells or **neuroglia** cells)
- Well protected within the skull (Brain) and vertebral column (spinal cord)




- **Functions:**

1. **Initiates motor commands**
2. **Receives and perceives sensory information**
3. **Responsible for our emotions, personality, behavior, memory and others**

# 2- The Peripheral Nervous System (PNS)

**Components of the PNS include all nervous tissue outside the CNS:**

A. **Nerves** (cranial **12** and spinal **31**): a bundle of hundreds to thousands of axons of **sensory** and/or **motor neurons**

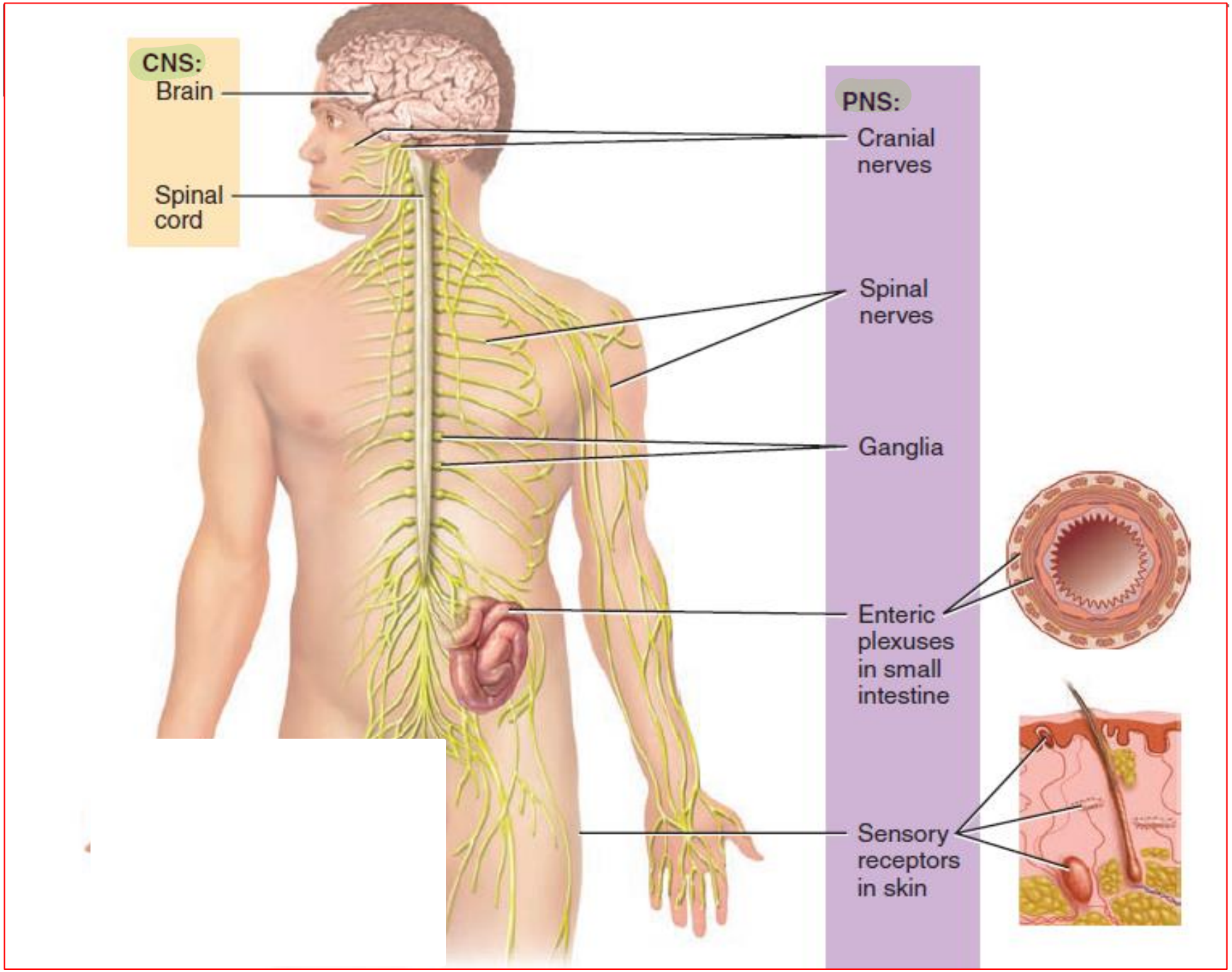
B. **Ganglia** are collection of neurons outside the central nervous system (**neuron cell bodies**)

C. **Sensory receptors** are parts of neurons or specialized structures that can detect changes in the internal or external environment

- **Skin:** pain, touch and heat receptors
- **Eye**: Photoreceptors
- **Nose:** Olfactory receptors
- **Muscle**: Golgi tendon organ

D. **Enteric plexuses** (**GIT**)

It consists of extensive networks of neurons located in the walls of organs of the gastrointestinal tract.


CNS:
Brain
Spinal cord
PNS:
Cranial nerves
Spinal nerves
Ganglia
Enteric plexuses in small intestine
Sensory receptors in skin

# Functionally, PNS can be divided into:

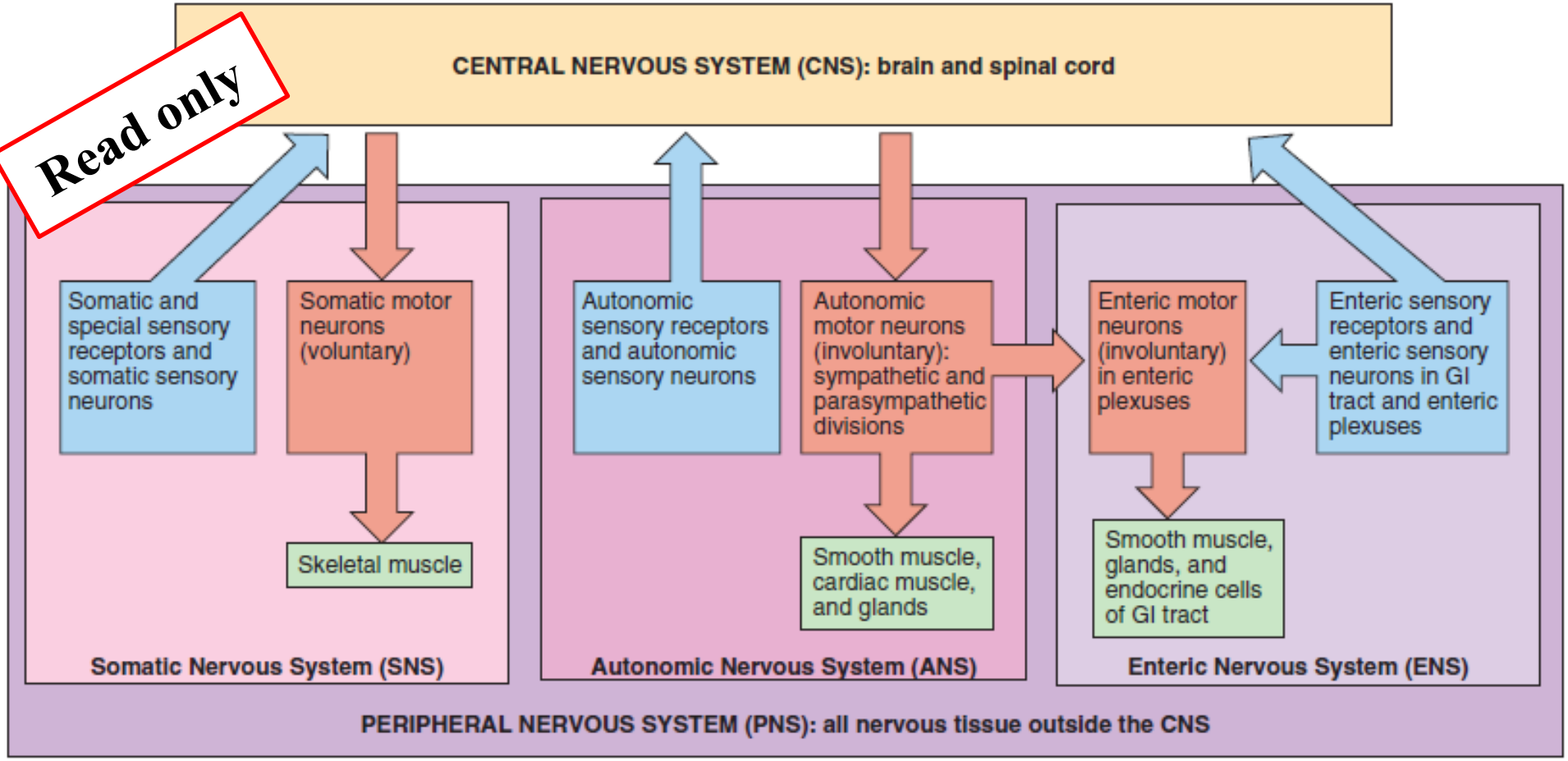
1. **Somatic Nervous system SNS:** connected to **skin, skeletal muscles, joints and the special senses (vision, hearing, taste, and smell).** We are fully conscious of this part. Our voluntary movements **(Skeletal muscles)** and our sensation of pain and touch are controlled by this part
2. **Autonomic Nervous System ANS:** we are not conscious of this part, because it controls all of our involuntary actions, like our heart rate, respiratory rate and blood pressure **(Visceral organs)**
   - Acts on **smooth muscles, cardiac muscles and glands**.

   **Divided (motor part) into:**

   A. **Sympathetic** helps support exercise of emergency actions, the "fight-or-flight" responses

   B. **Parasympathetic** takes care of "rest-and-digest" activities.
3. **Enteric part:** controls the secretions and movements of the various parts of the digestives tract unconsciously

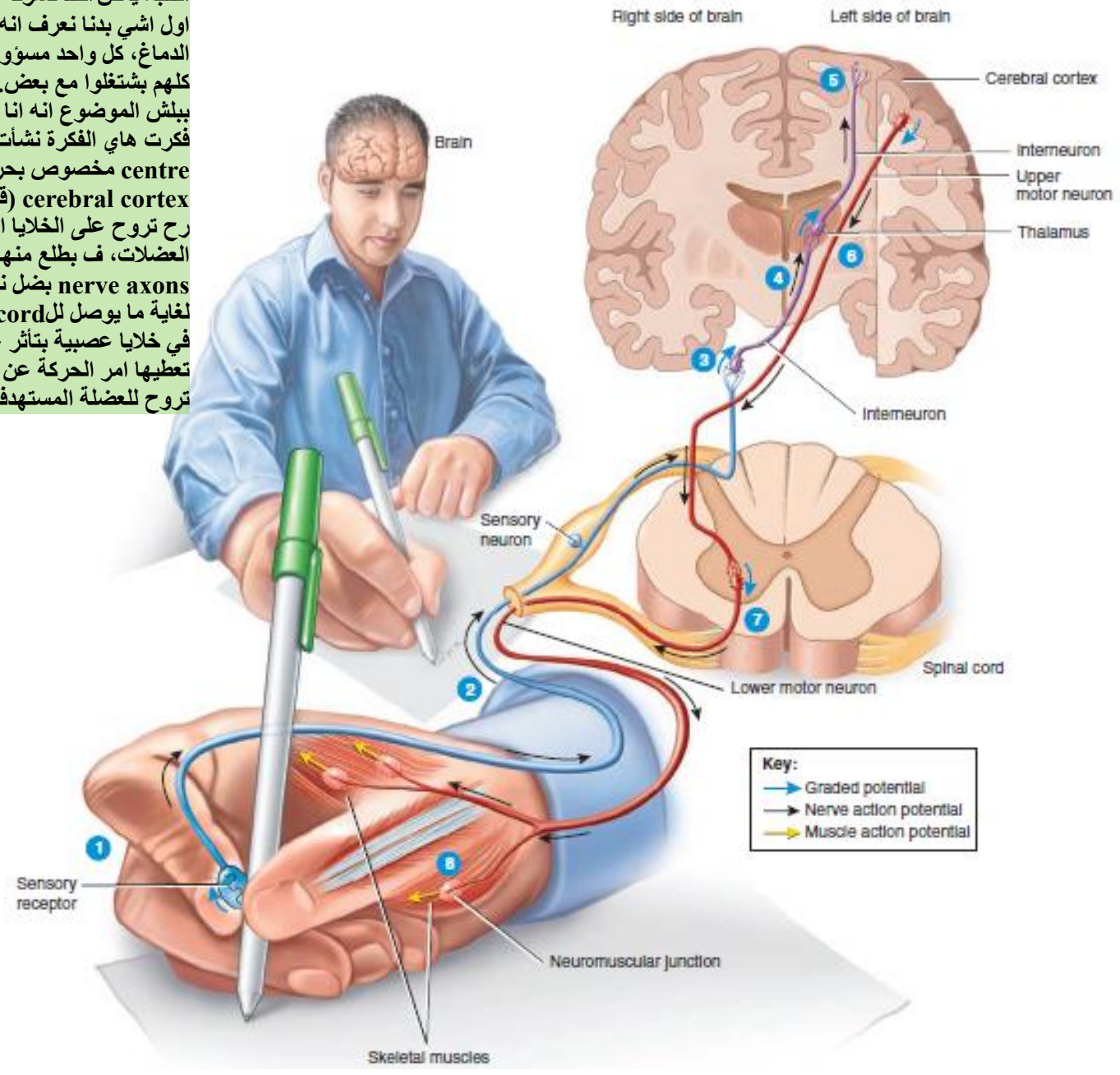
Read only




# Nervous system organizational chart

1. Blue boxes represent sensory components of the PNS
2. Red boxes represent motor components of the PNS
3. Green boxes represent effectors (muscles and glands).

هون هاي بتشرحلي كيف انا بقدر احرك ايدي و اكتب، يمكن احنا نشوفه بسيط لكن هو معقّد جدًا
اول اشي بدنا نعرف انه في كذا centre في الدماغ، كل واحد مسؤول عن شغلة معينة لكن كلهم بشتغلوا مع بعض.
ببلش الموضوع انه انا بدي اكتب اسمي، ف انا فكرت هاي الفكرة نشأت في الدماغ، بتروح على centre مخصوص بحركة العضلات في cerebral cortex (قشرة الدماغ) يعني الفكرة رح تروح على الخلايا العصبية يلي بتتحكم بحركة العضلات، ف بطلع منها اشي بشبه الاسلاك هي nerve axons بضل نازل في مسارات عصبية لغاية ما يوصل للspinal cord و هون برضو في خلايا عصبية بتأثر عليها الاشارة يلي اجت و تعطيها امر الحركة عن طريق axons in pns و تروح للعضلة المستهدفة عشان تتحرك و تنقبض



# Histology Of The Nervous System

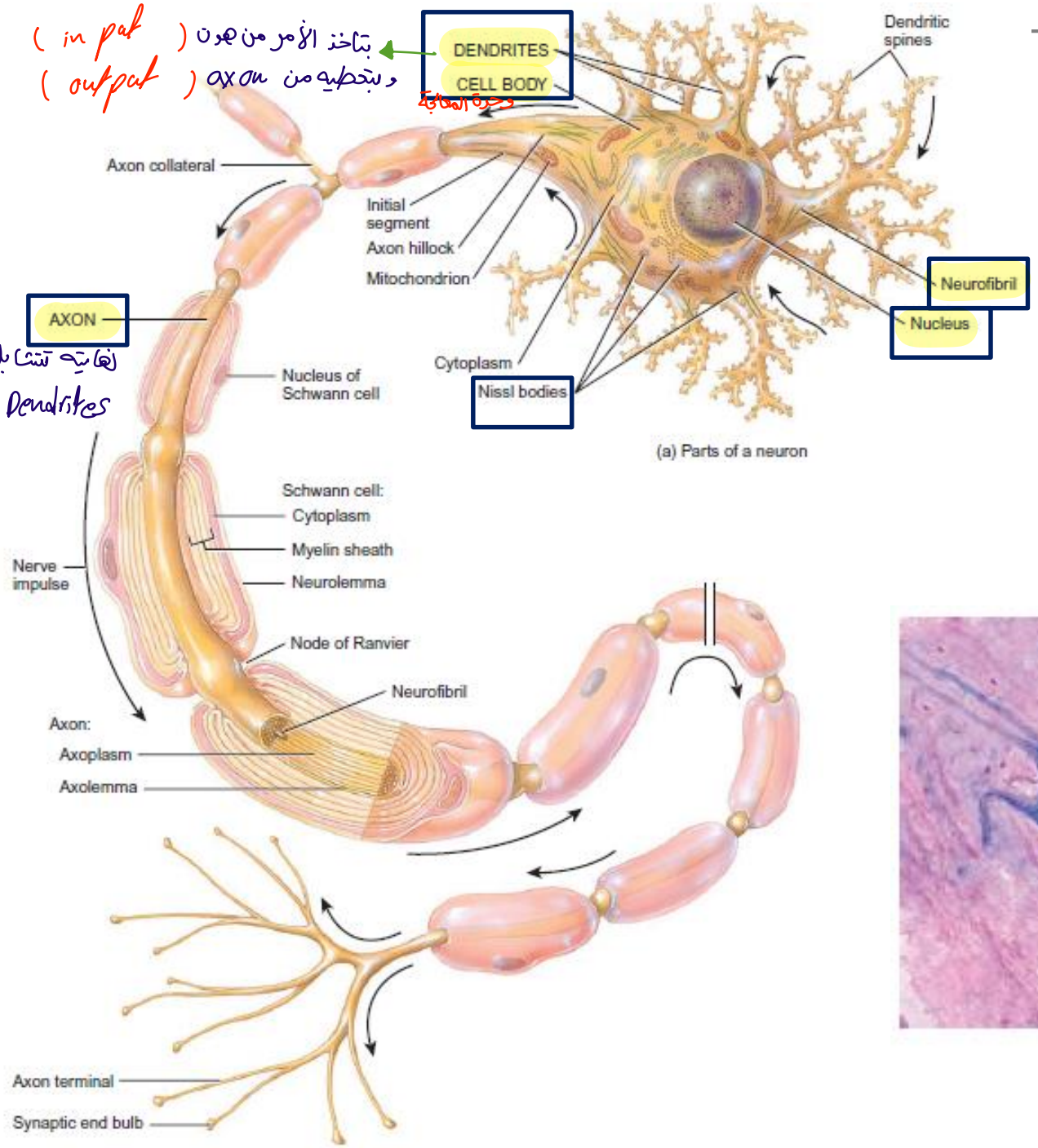
- The nervous tissue is formed of two types of cells:

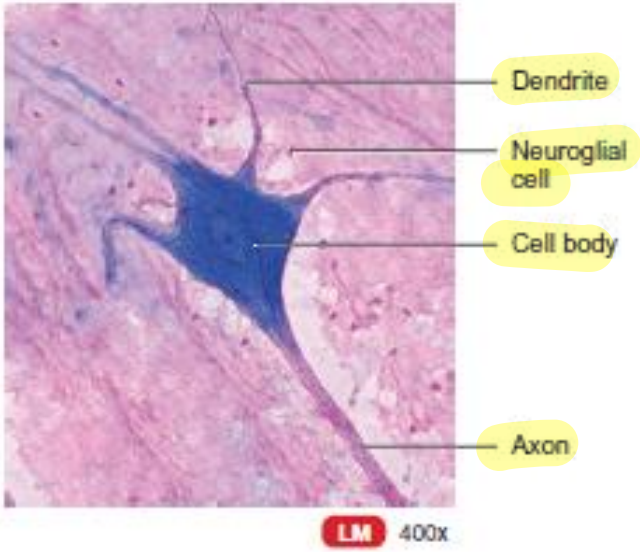
1. The nerve cell – Neurons
2. Supporting cells –Neuroglia or Glia cells

- In the nervous tissue there is ***no extracellular matrix***
- The space between the cells is called **neuropil** and is formed of the processes of both neurons and glia cells and some fluid
- ***Mature neurons cannot divide. A damaged neurons cannot be repaired and is replaced by fibrous tissue***

( in put ) بتاخد الأمر من هون

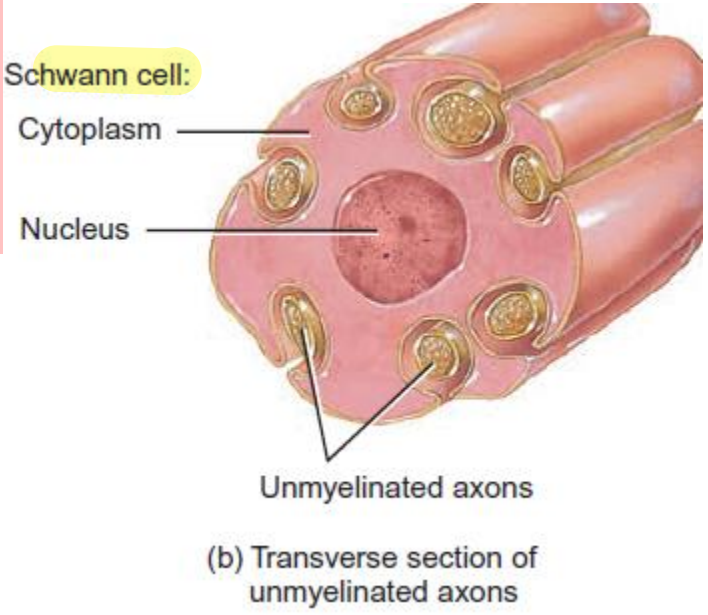
( output ) وبتحطيه من axon



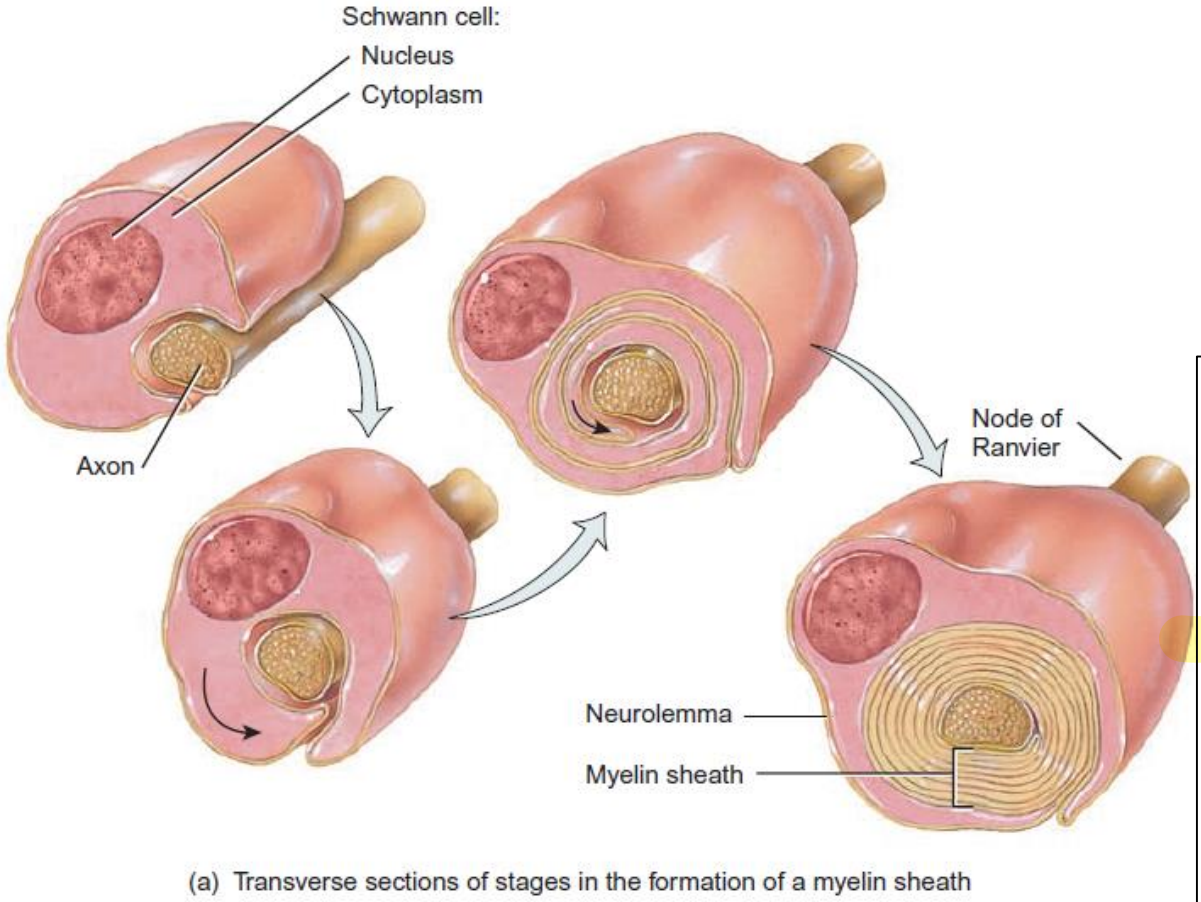



# Myelination

***Myelin = multiple layers of cell membrane*** خلايا خضبة بتغليف axons وبتساعد بزيادة سرعة الانتقال



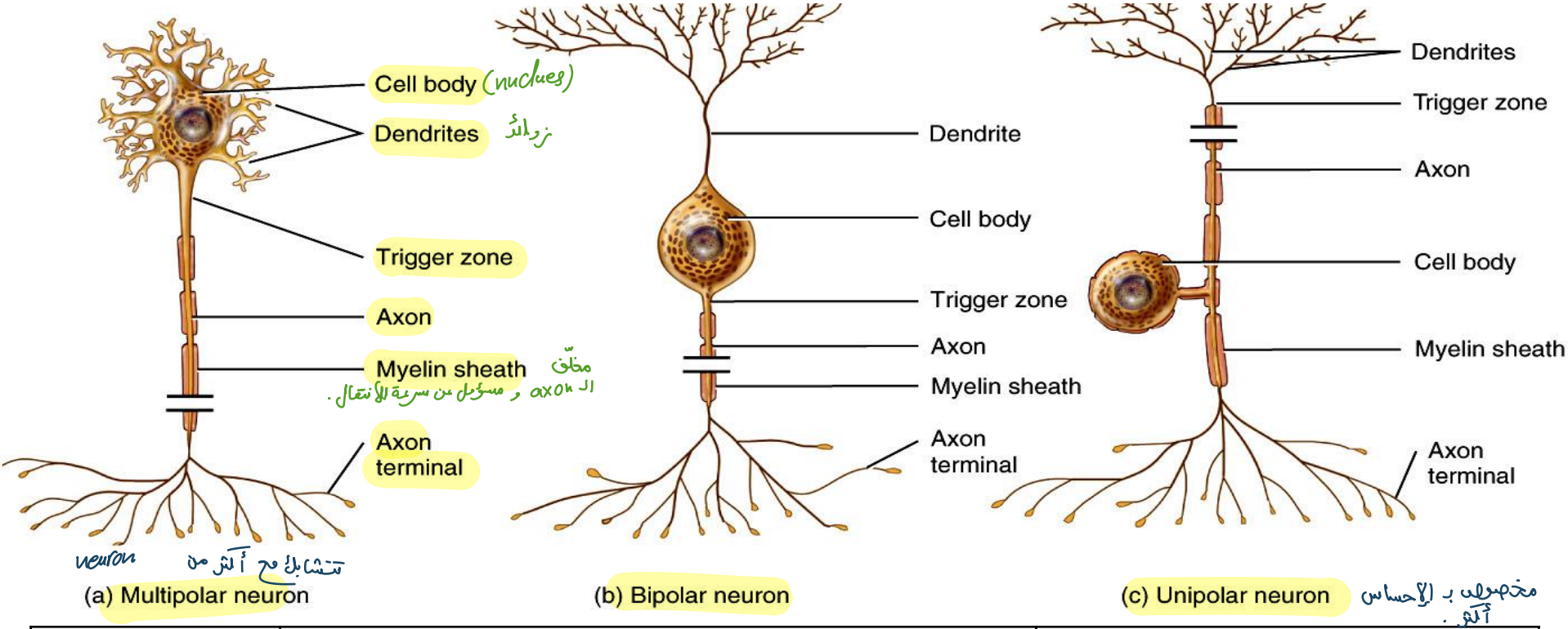

(b) Transverse section of unmyelinated axons




(a) Transverse sections of stages in the formation of a myelin sheath

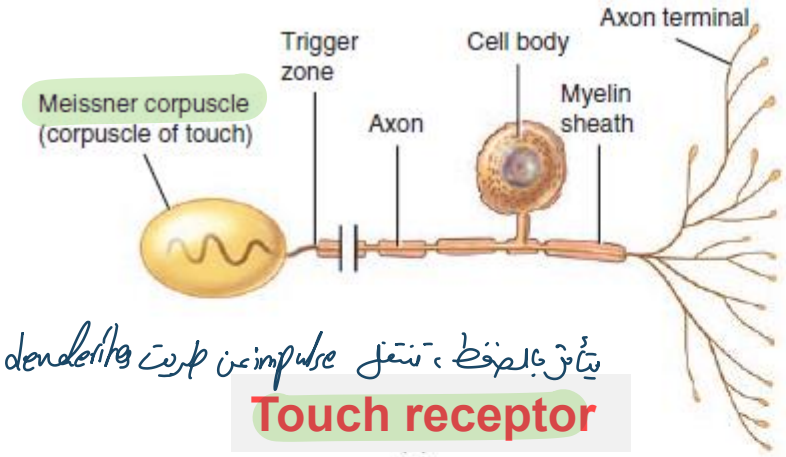
**In the PNS, Schwann cells surround both myelinated and unmyelinated fibers. In the CNS, oligodendrocytes surround myelinated fibers only**

# Types of Neurons: Structural Classification

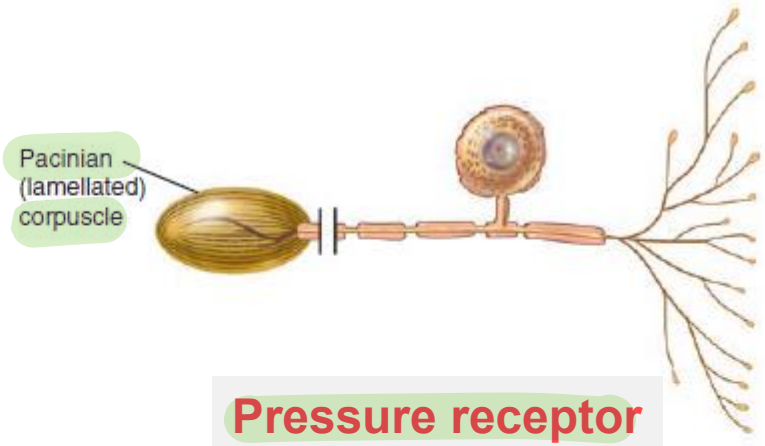



| | | |
|---|---|---|
| **Multipolar** | **One Axon + Multiple dendrites** | **Most motor neurons**<br>**Most CNS neurons** |
| **Purkinje cells (cerebellum) and Pyramidal cells (cerebral cortex)** | | |
| **Bipolar** | **One Axon + One Dendrite** | **Special sense organs (ear - nose – eye)** |
| **Unipolar** | **One Axon divides into a central and peripheral branch** | **Most sensory neurons** |

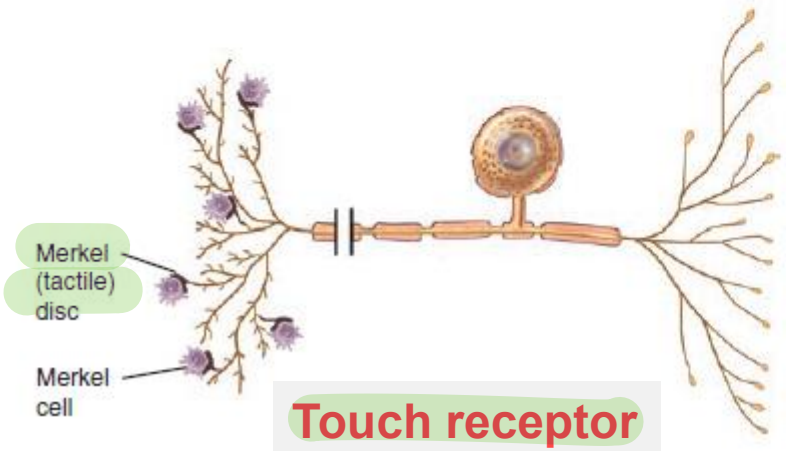
# Examples of sensory receptors



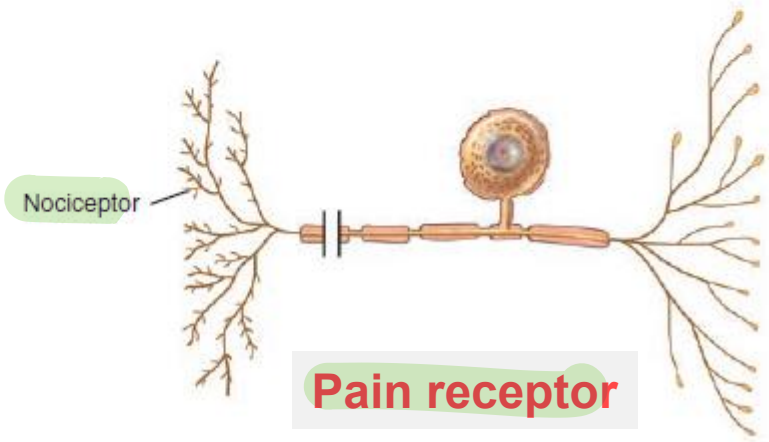

Touch receptor




Pressure receptor




Touch receptor



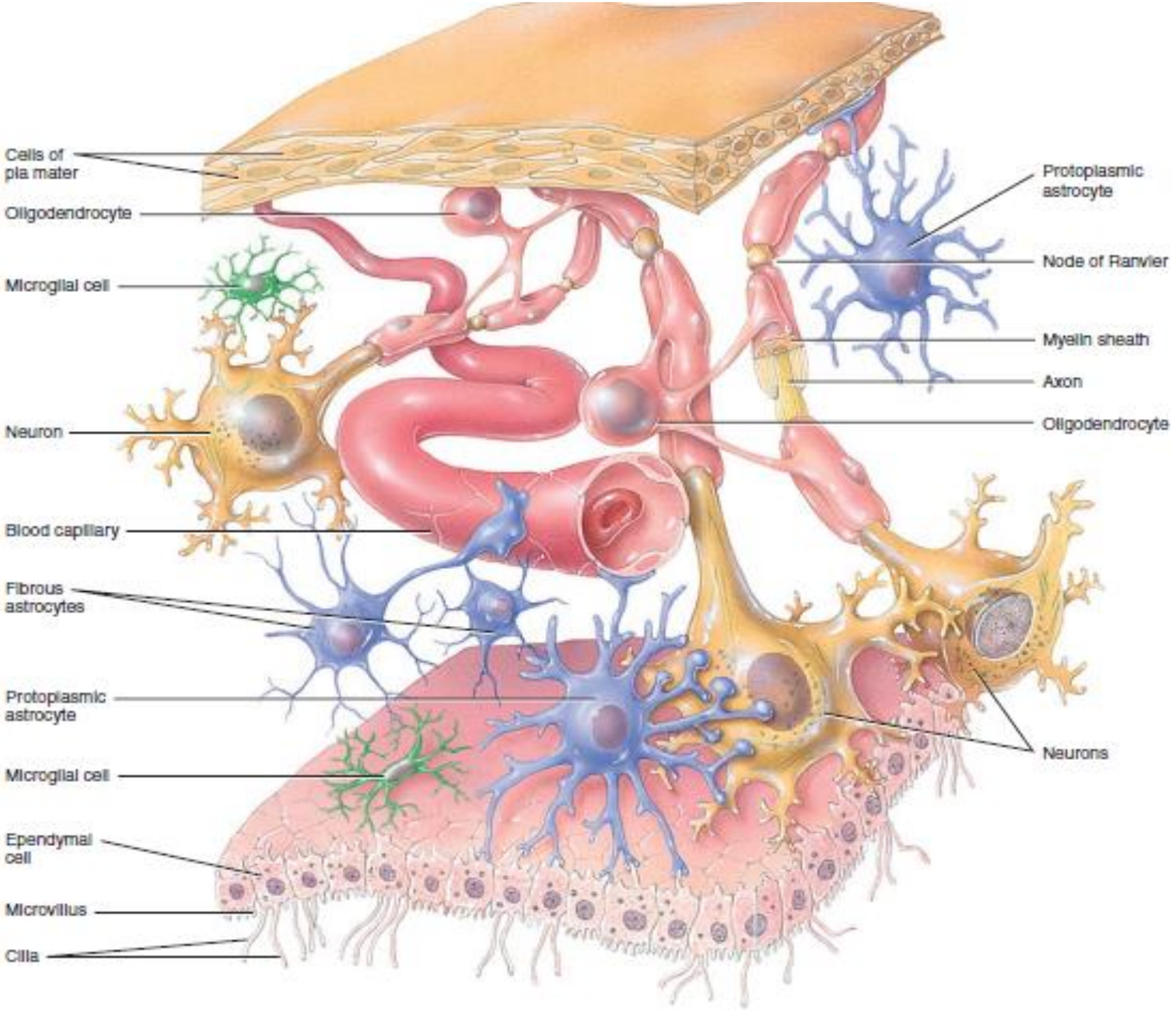

Pain receptor

The site of communication between two neurons or between a neuron and an effector cell is called **a synapse**

**Neurotransmitter is a chemical released at synapse.**

# Types of Neurons: Functional Classification

1. **Sensory or afferent neurons:** convey action potentials into the CNS through cranial or spinal nerves. Most sensory neurons are unipolar in structure.
2. **Motor or efferent neurons:** convey action potentials away from the CNS to effectors (muscles and glands) in the periphery (PNS) through cranial or spinal nerves. Motor neurons are multipolar in structure.
3. **Interneurons or association neurons**: mainly located within the CNS between sensory and motor neurons. Most interneurons are multipolar in structure.


Cells of pia mater
Oligodendrocyte
Microglial cell
Neuron
Blood capillary
Fibrous astrocytes
Protoplasmic astrocyte
Microglial cell
Ependymal cell
Microvillus
Cilia
Protoplasmic astrocyte
Node of Ranvier
Myelin sheath
Axon
Oligodendrocyte
Neurons

# The Central Nervous System
# The Brain

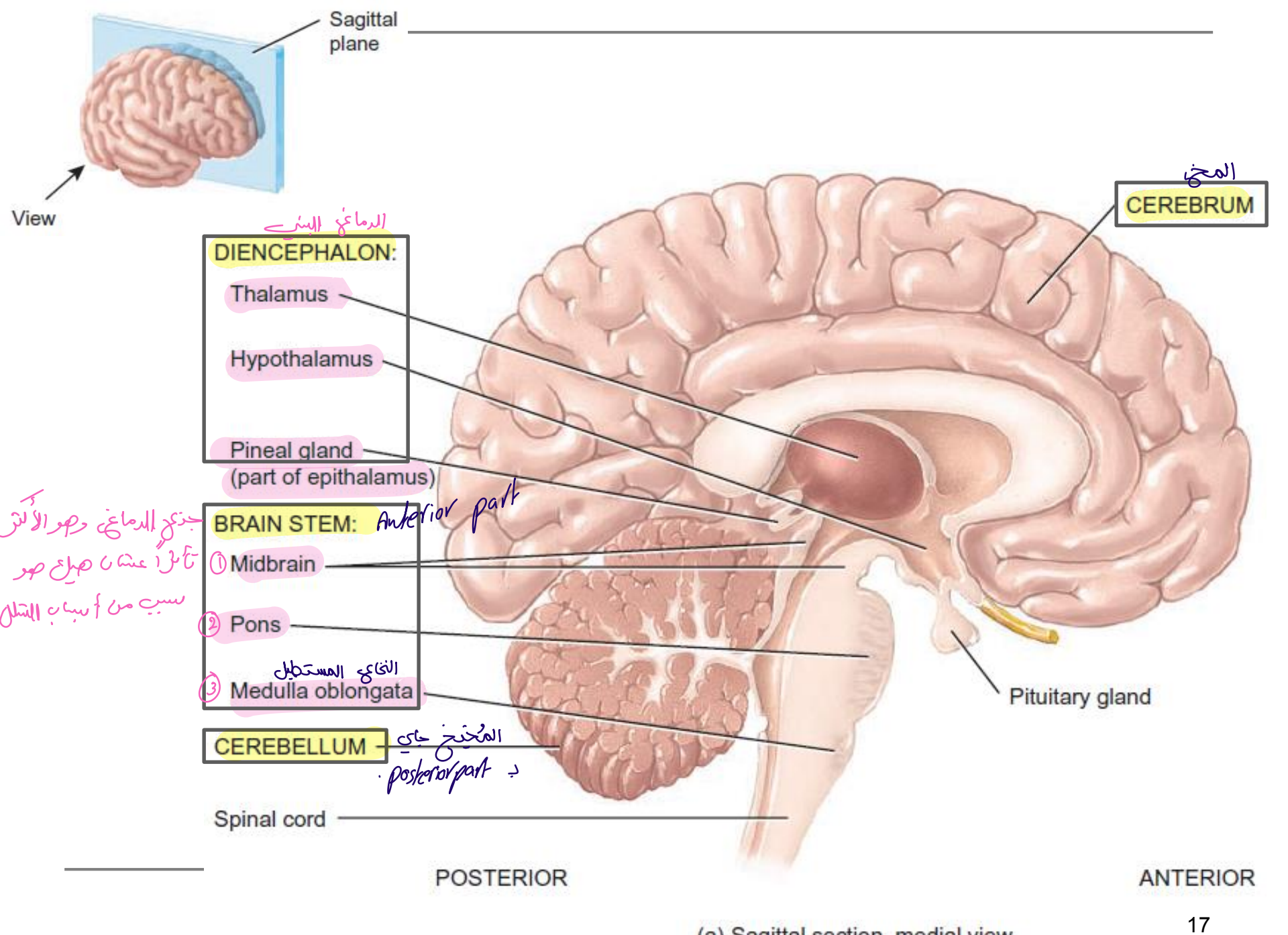
- The brain is the part of the nervous system present within the skull. The brain is formed of two halves which are similar to each other grossly. The two halves are connected with each by a number of nerve bundles

**The brain is formed of:** parts of the Brain

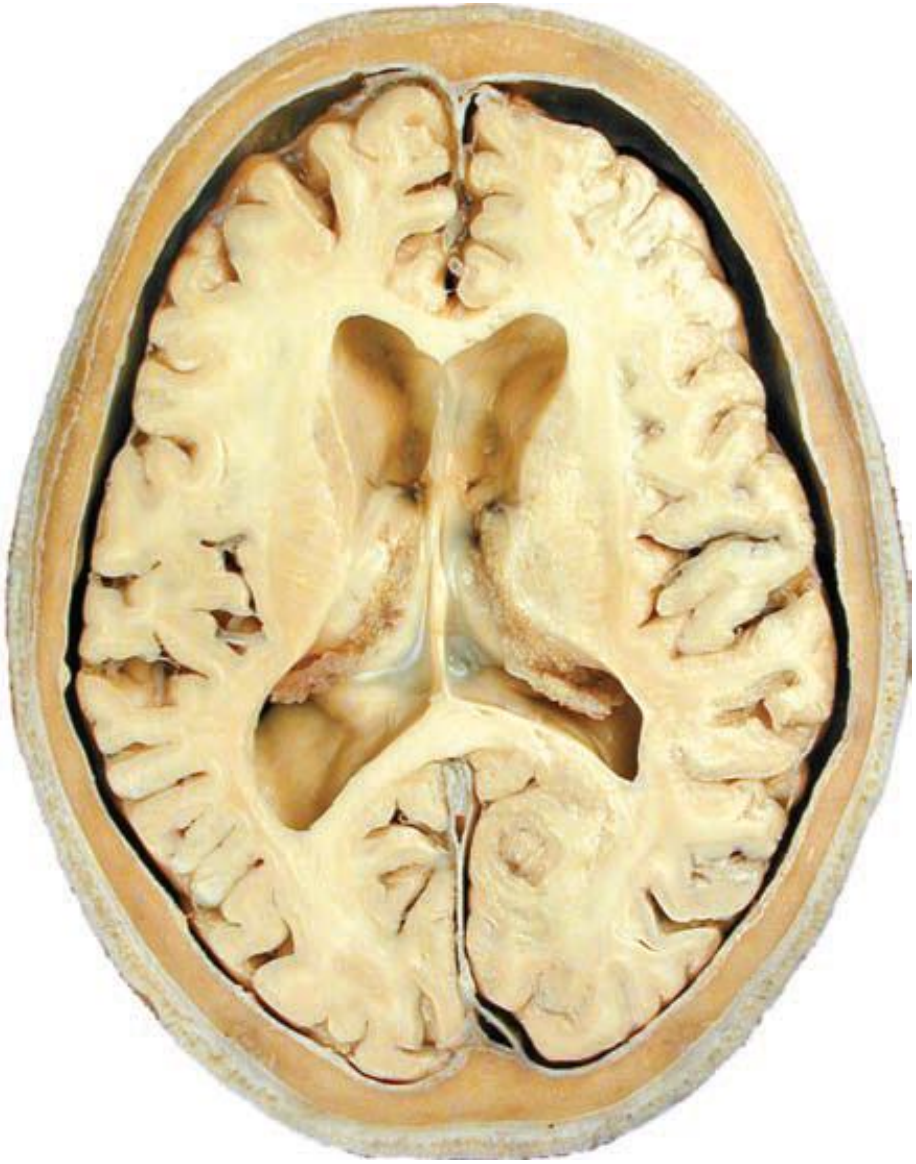
1) The Cerebrum
2) The Diencephalon
3) The Brainstem (midbrain and pons and medulla oblongata)
4) The Cerebellum

| Major Parts of the Brain | | Cavities of the Brain |
|---|---|---|
| Forebrain | Cerebrum | Right and left lateral ventricles |
| | Diencephalon | Third ventricle |
| Midbrain | | Cerebral aqueduct |
| Hindbrain | Pons | Fourth ventricle and central canal |
| | Medullaoblongata | |
| | Cerebellum | |

embryology slp




(a) Sagittal section, medial view



# Protective coverings of the brain

1. **The cranium** cranial cavity
2. **Cranial meninges** → membrane of brain.

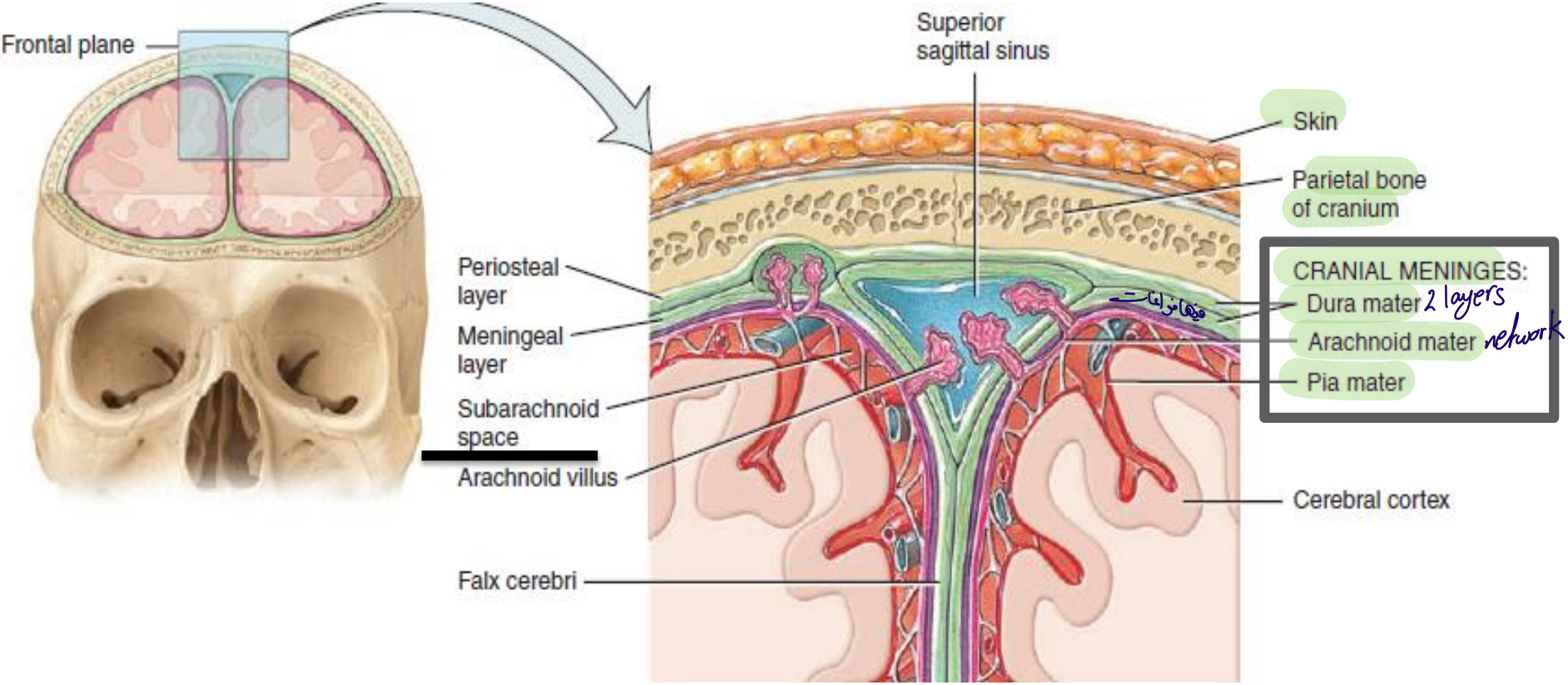
Bone الأم الجافية جاي مع

- **Dura mater**: the hard outermost layer. The **venous sinuses** of the brain are located within the dura mater

الأم العنكبوتية

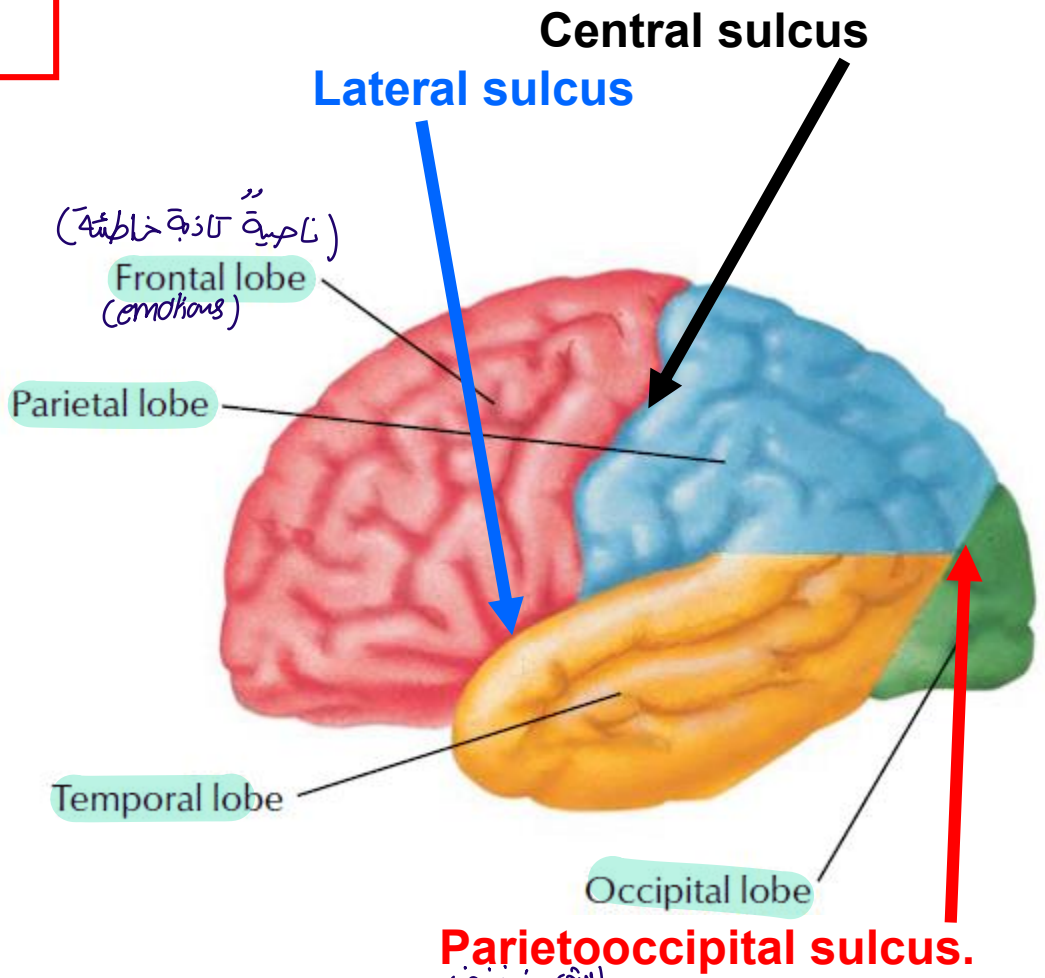
- **Arachnoid mater** : the thin middle layer. Beneath the arachnoid, we have the **Subarachnoid space**
- **Pia mater:** thin innermost layer. Covers the brain. جاي على الدماغ طري

الأم الحانية


Frontal plane
Superior sagittal sinus
Skin
Parietal bone of cranium
Periosteal layer
Meningeal layer
Subarachnoid space
Arachnoid villus
CRANIAL MENINGES:
Dura mater
Arachnoid mater
Pia mater
2 layers
network
Cerebral cortex
Falx cerebri

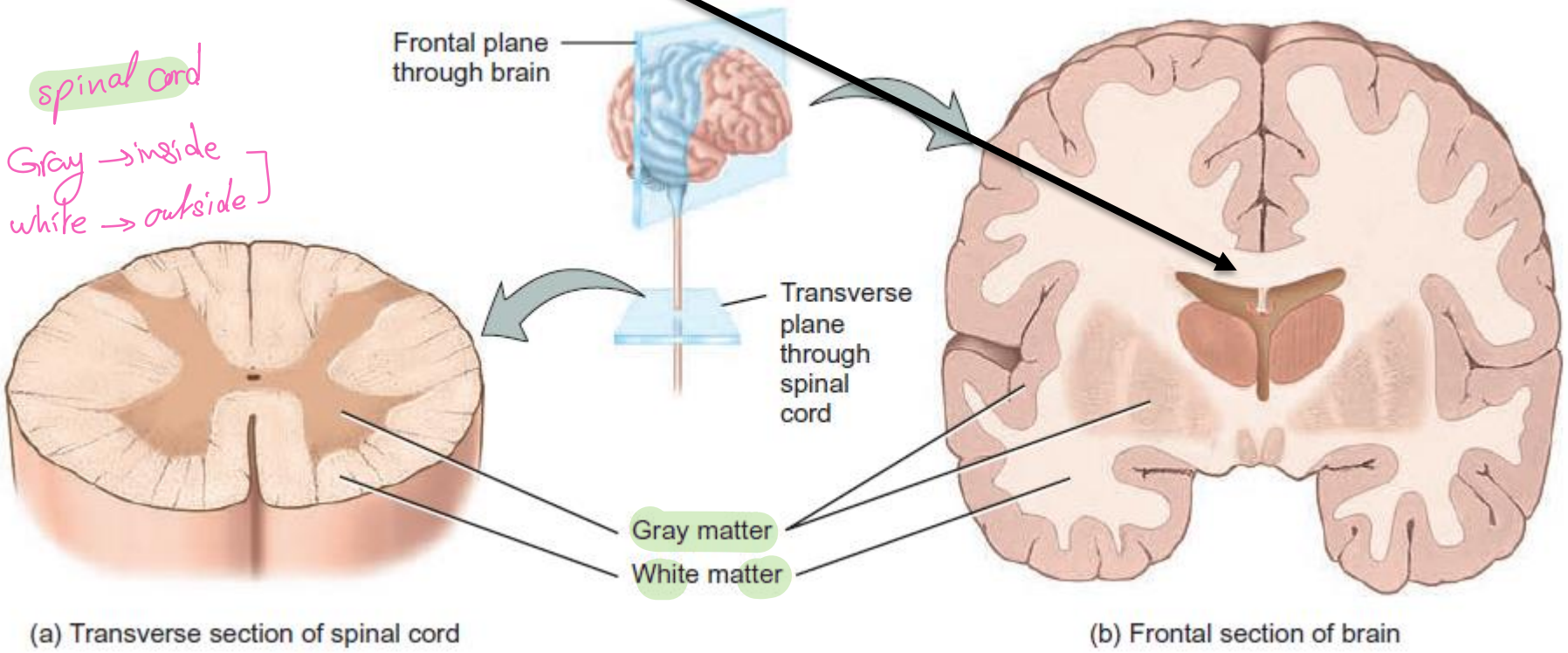
# The Cerebrum

- All **motor** commands issue from the cerebrum.
- All **sensations** are perceived here. In addition, this part is responsible for **emotions**, **behavior** and **memory**
- Each cerebrum is formed of four lobes: **frontal lobe, parietal lobe, temporal lobe and occipital lobe**.



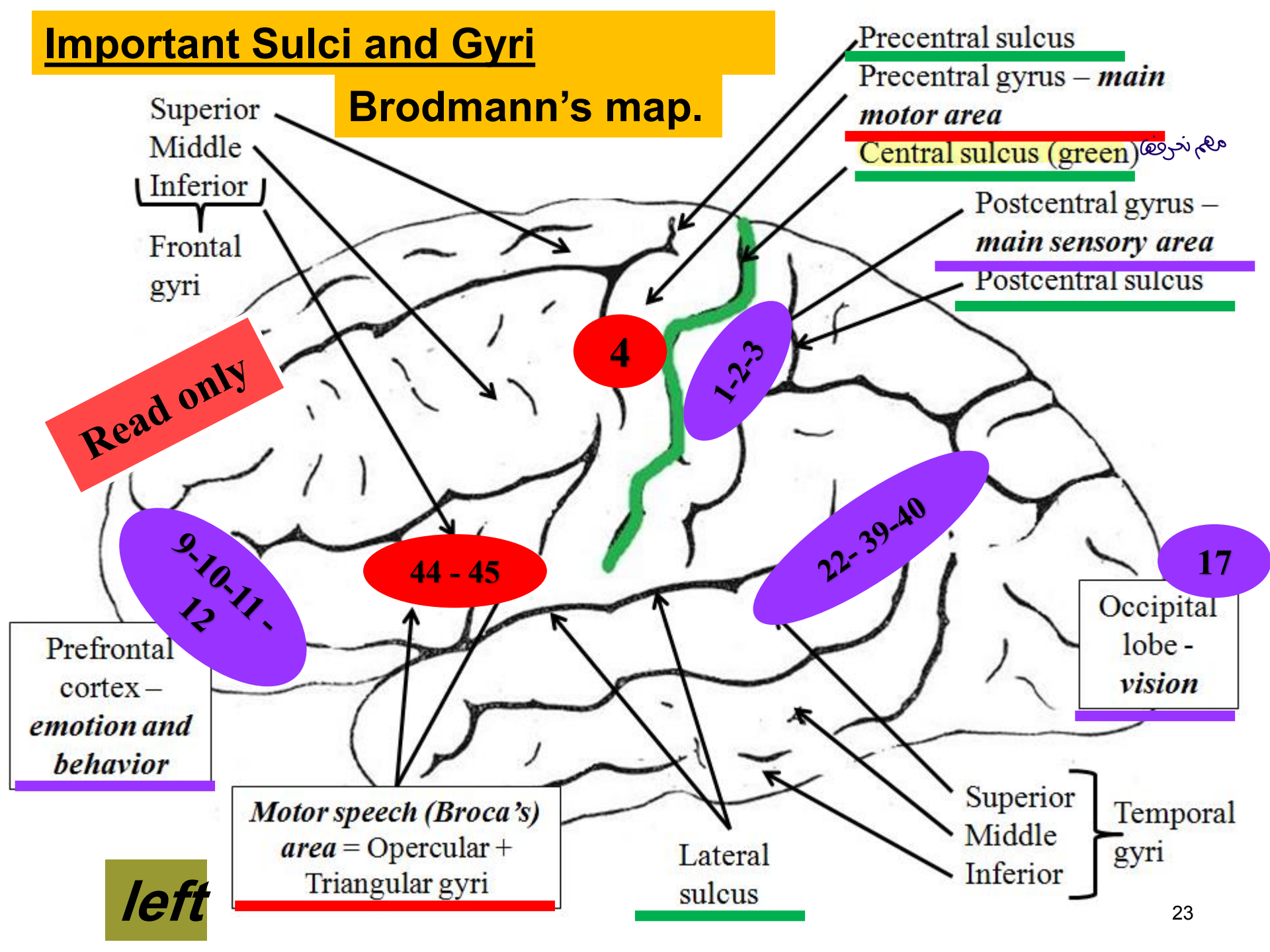

- It's characterized by the presence of **fissures**, **sulci** and protrusions called **gyri**.
- The cavity within it is the **lateral ventricle**

- The outer layer of the cerebrum is called the **cerebral cortex**. It's formed mainly of the **body of neurons** and therefore it's called the **gray matter**.
- Inside it, we have the **white matter** formed mainly of **nerve fibers (AXONS) (called tracts in CNS) (three types).** **corpus callosum**



# Important Sulci and Gyri

## Brodmann's map.

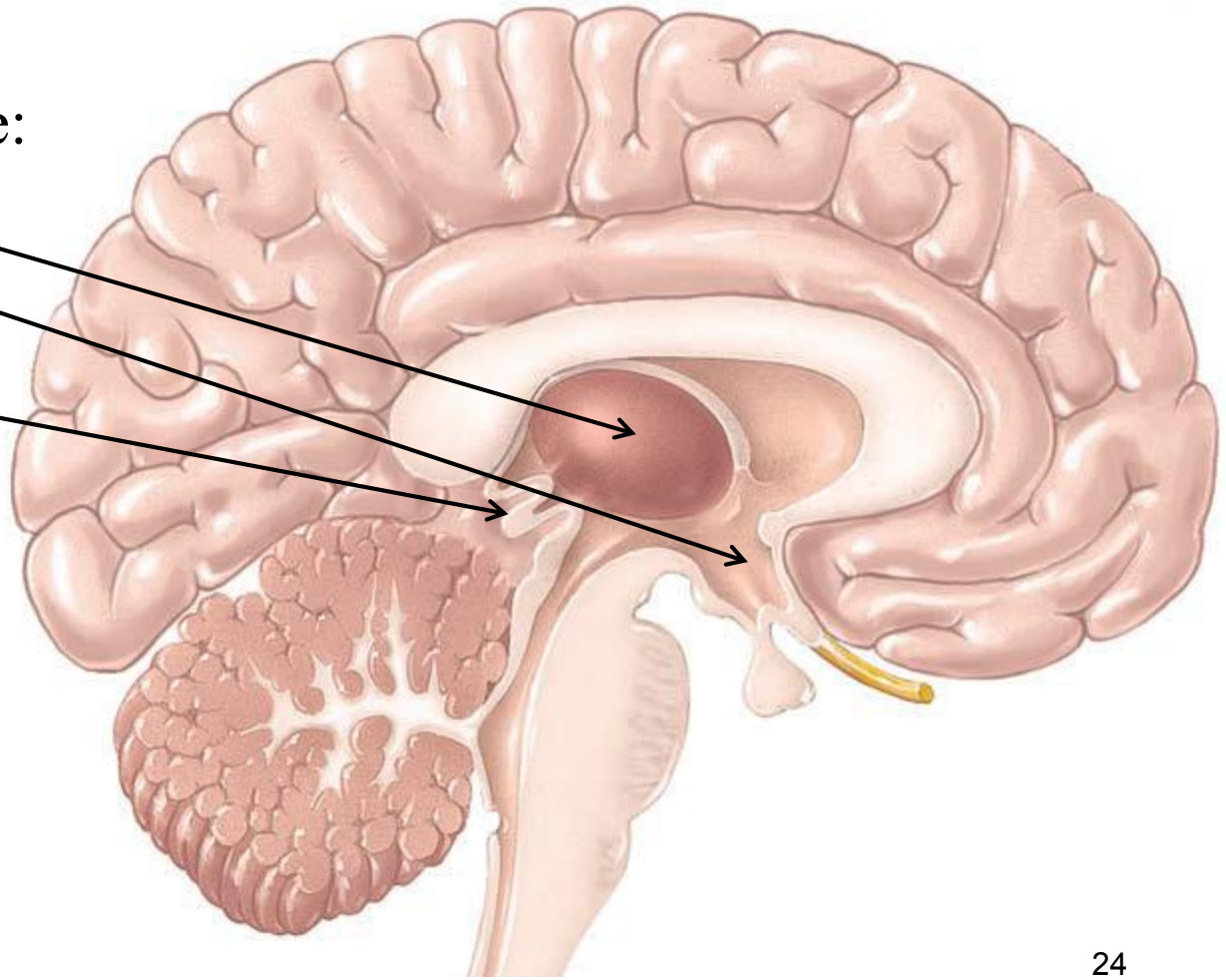


# The Diencephalon

- This part of the brain is located on the medial aspect of the cerebrum. The cavity here is the 3rd ventricle

- It's formed of the:

1. Thalamus
2. Hypothalamus
3. Epithalamus



| Part | Main Function |
| --- | --- |
| Thalamus | Relay station for most sensation to cerebral cortex. زي كأنها سكرتيرة الدماغ |
| Hypothalamus Related to **(anterior and posterior pituitary gland lobes)** هي اللي بتشتغل بوقت يكون عليها حرارة infection أو انحباب | 1. **Controls and integrates activities of ANS** (Autonomic nervous system)<br>2. Controls hormone secretions of all endocrine glands in the body (maestro gland)<br>3. Controls body temperature (**thermostat**)<br>4. Controls eating and satiety, and drinking centers |
| Pineal gland of the epithalamus | Secrete melatonin hormone which regulates sleep to restory activity of body. |

**Hypothalamus: Body's internal biological clock**

**Circadian (daily) rhythms**

# The Cerebellum

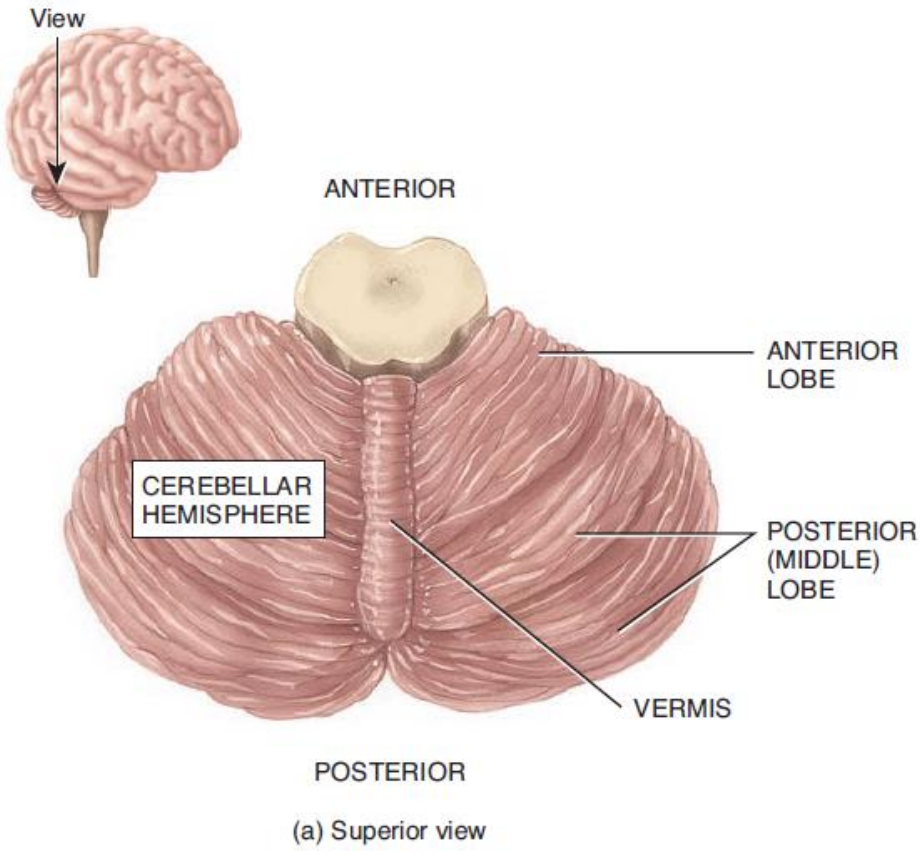
مسؤول عن coordination وعملية التوازن

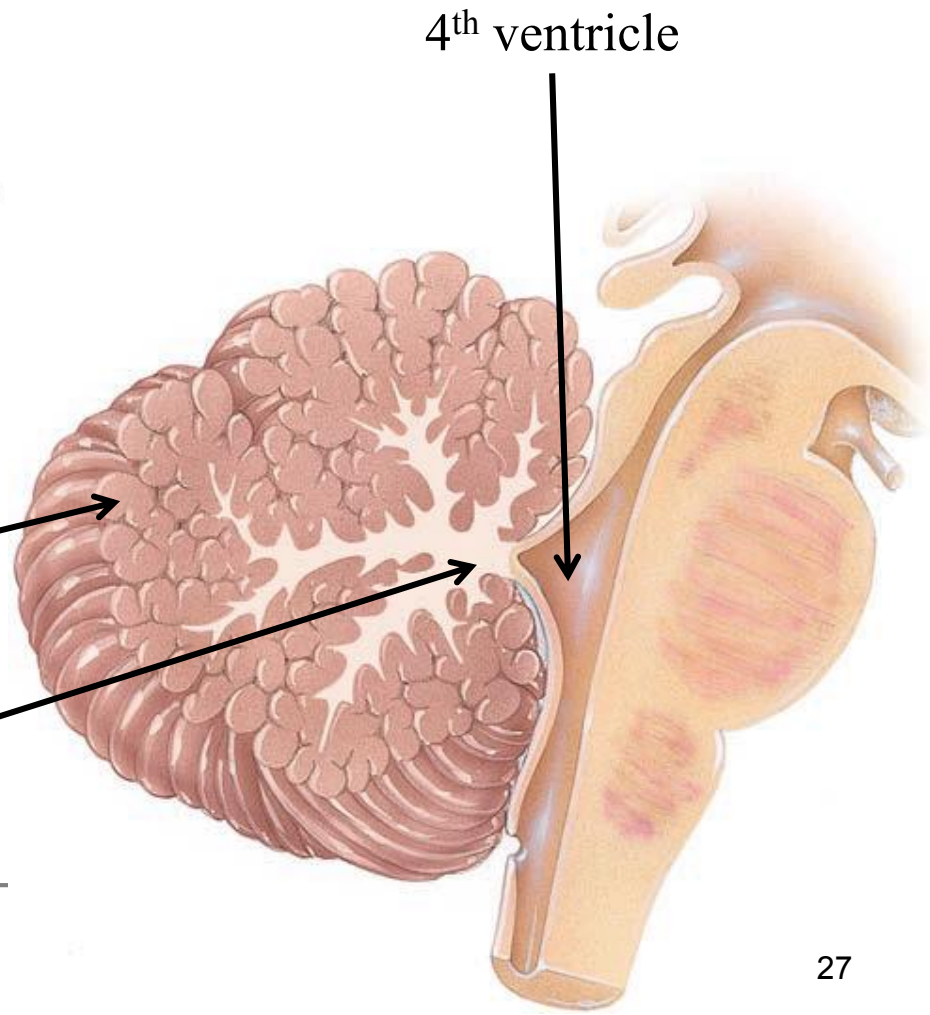
- Second largest part of the brain.
- The central constricted area is the **vermis**. On each side of the vermis, we have the expanded **cerebellar hemispheres**
- The cerebellum is located inferior to the occipital lobe and posterior to the brainstem. It's separated from the brainstem by **the 4th ventricle**

under

- ***The function of the cerebellum is the coordination of movement and the maintaining of balance on the same side of the body.***

1. **Smooths and coordinates contractions of skeletal muscles**
2. **Regulates posture and balance.**

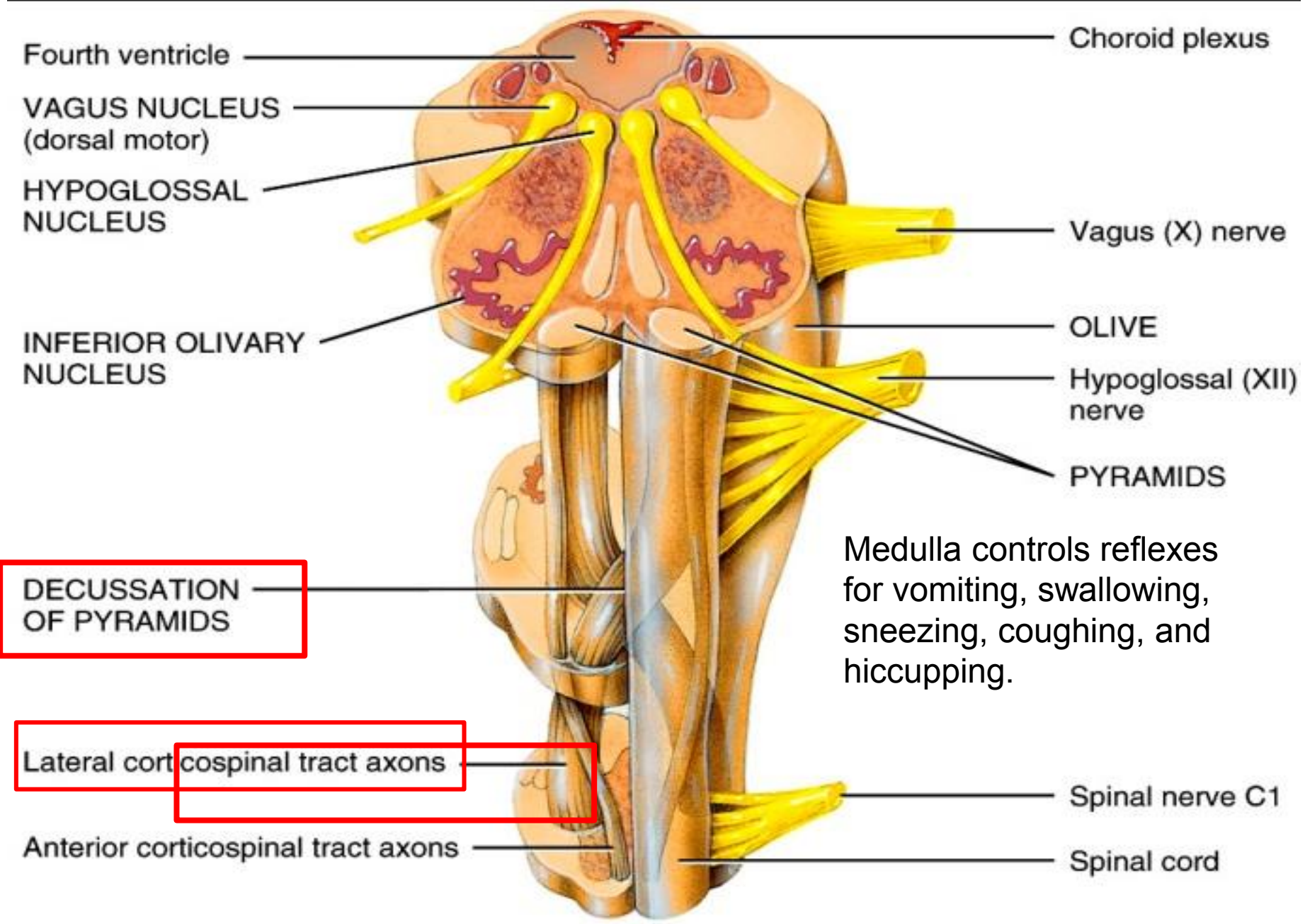

View
ANTERIOR
ANTERIOR LOBE
CEREBELLAR HEMISPHERE
POSTERIOR (MIDDLE) LOBE
VERMIS
POSTERIOR
(a) Superior view


4th ventricle
Gray matter
White matter

# The Brainstem Anteriorly

- ✓ The part of the brain that connects the diencephalon with the spinal cord
- ✓ Formed of 3 parts: midbrain, pons and the medulla oblongata
- ✓ Contains several important **control centers** and the **origin of several cranial nerves (nuclei = Cell bodies in CNS)**
- ✓ **Several sensory and motor tracts**

| Part | Important Centers | Notes |
|---|---|---|
| Midbrain | ❖ Substantia nigra<br>❖ Red nucleus | The cavity here is the cerebral aqueduct |
| Pons | ❖ Pontine nuclei<br>❖ Tracts | Relays between cerebrum and cerebellum |
| Medulla oblongata | ❖ Cardiovascular center<br>❖ Respiratory center<br>❖ Pyramids: site of decussation of motor tract **90%** | Exits the skull through the foramen magnum to become continuous with the spinal cord |




Medulla controls reflexes for vomiting, swallowing, sneezing, coughing, and hiccupping.

Transverse section and anterior surface of medulla oblongata

شكرا