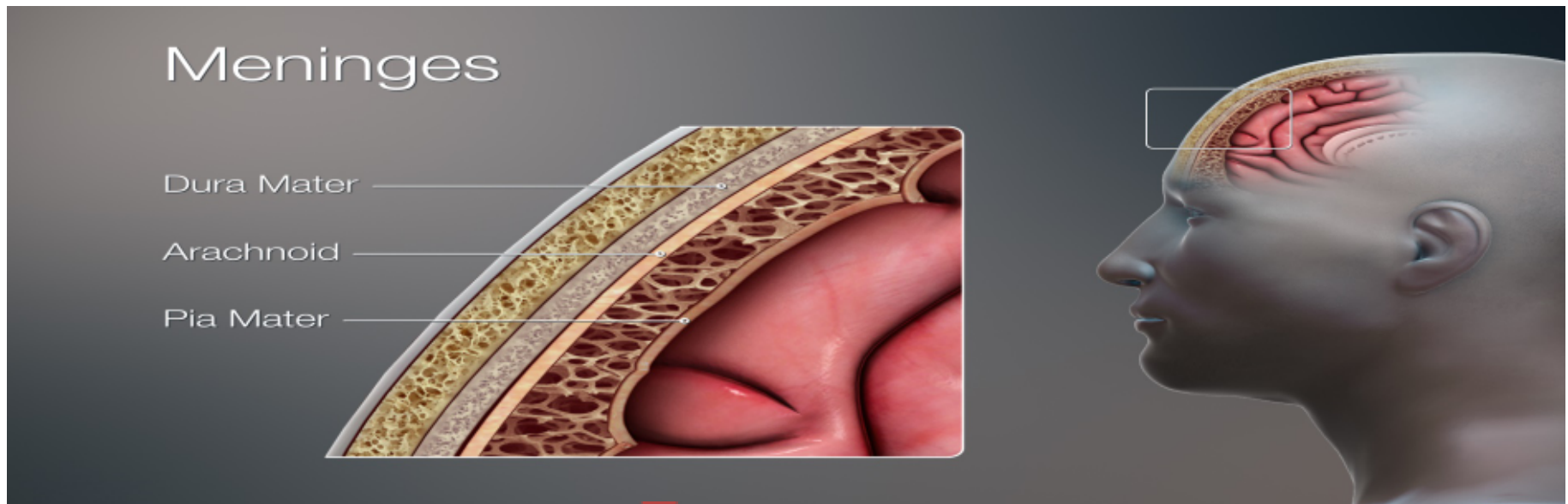
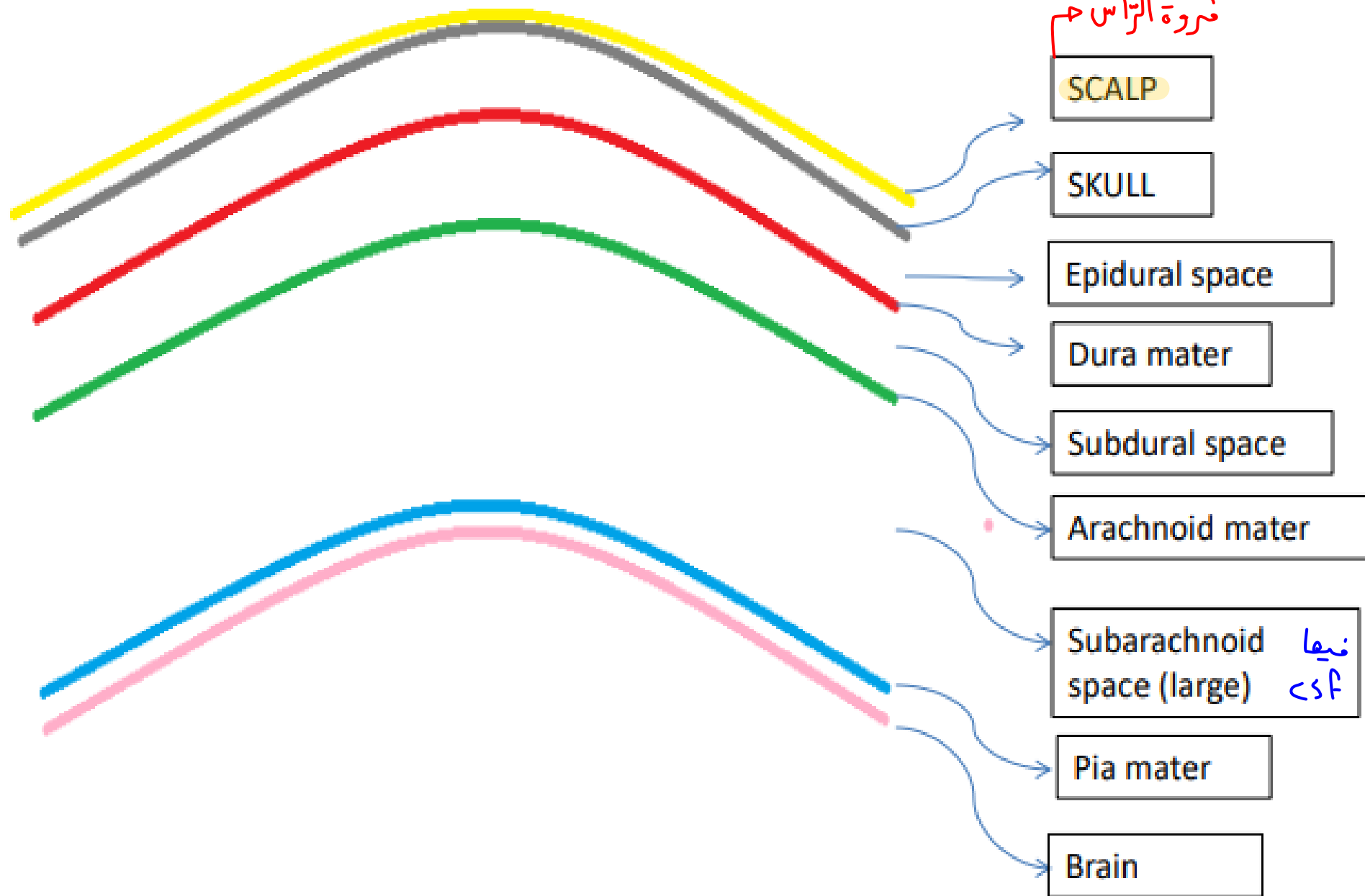


Cranial meninges

1. **Dura mater**: the hard outermost layer. Separated from the skull bones by the epidural space. The venous sinuses of the brain are located within the dura mater.
2. **Arachnoid mater**: the thin middle layer. Separated from the dura by the subdural space. Beneath the arachnoid, we have the large subarachnoid space.
3. **Pia mater**: thin innermost layer. Directly covers the brain.



فروة الرأس حم



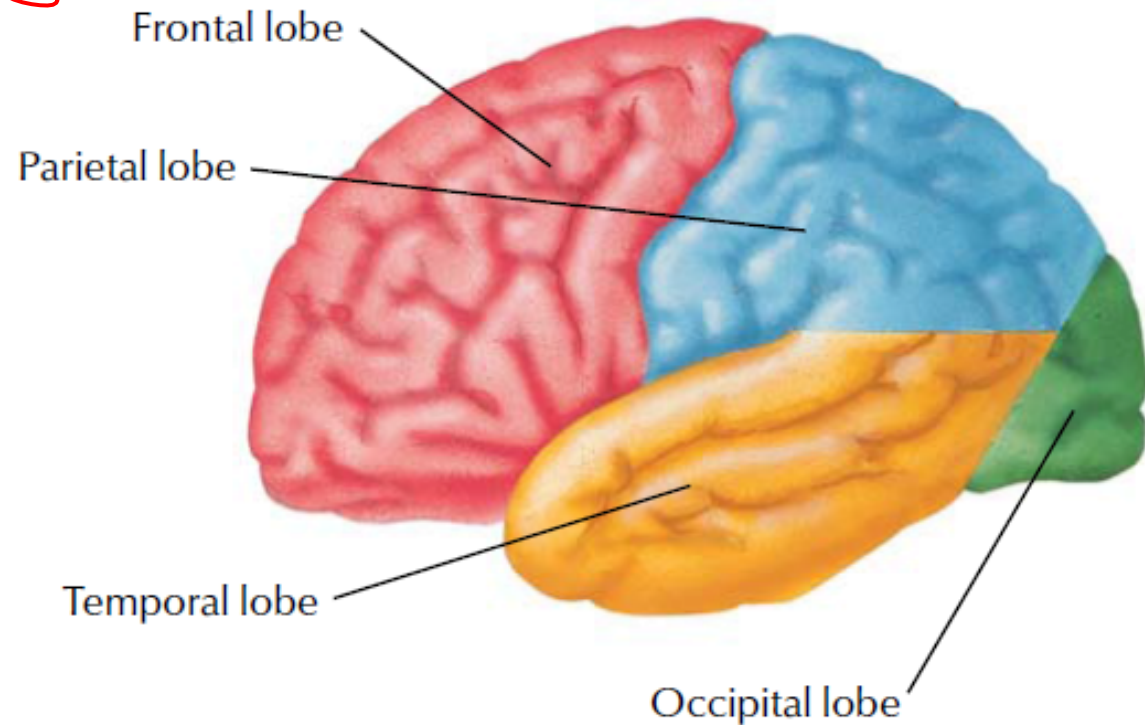
The Cerebrum

الدماغ

Fig.9: The Cerebrum (lateral view).

- All motor commands issue from the cerebrum. All sensations are perceived here. In addition, this part is responsible for emotions, **behavior** and memory.

السلوك



- The cerebrum is the largest part of the brain. It's formed of two parts (called hemispheres) each of which is formed of four lobes: frontal lobe, parietal lobe, temporal lobe, and occipital lobe.
- It's characterized by the presence of fissures called sulci and protrusions called gyri (Fig.11). 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**. Deep to it, we have the **white matter**, formed mainly of nerve fibers.
- In the **spinal cord**, the arrangement is reversed.

القشرة
الدماغية

الحبل الشوكي

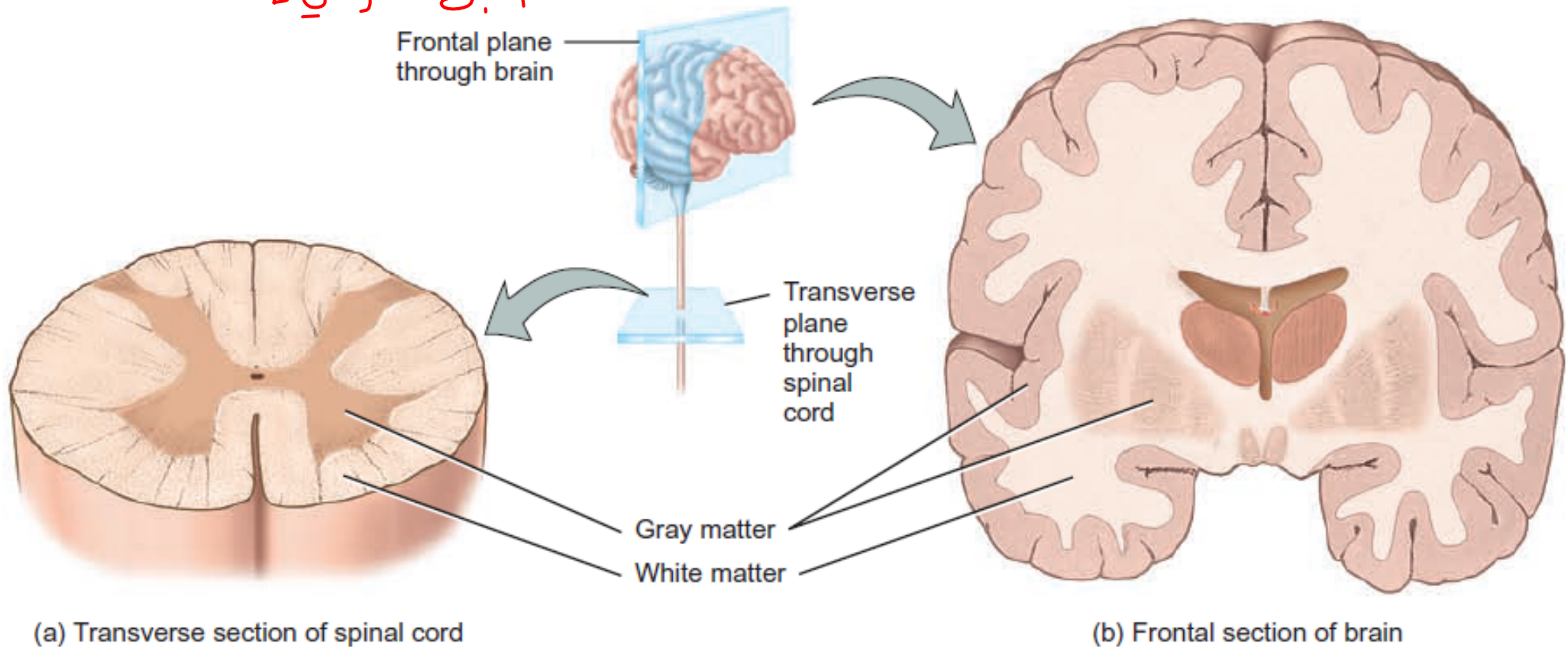
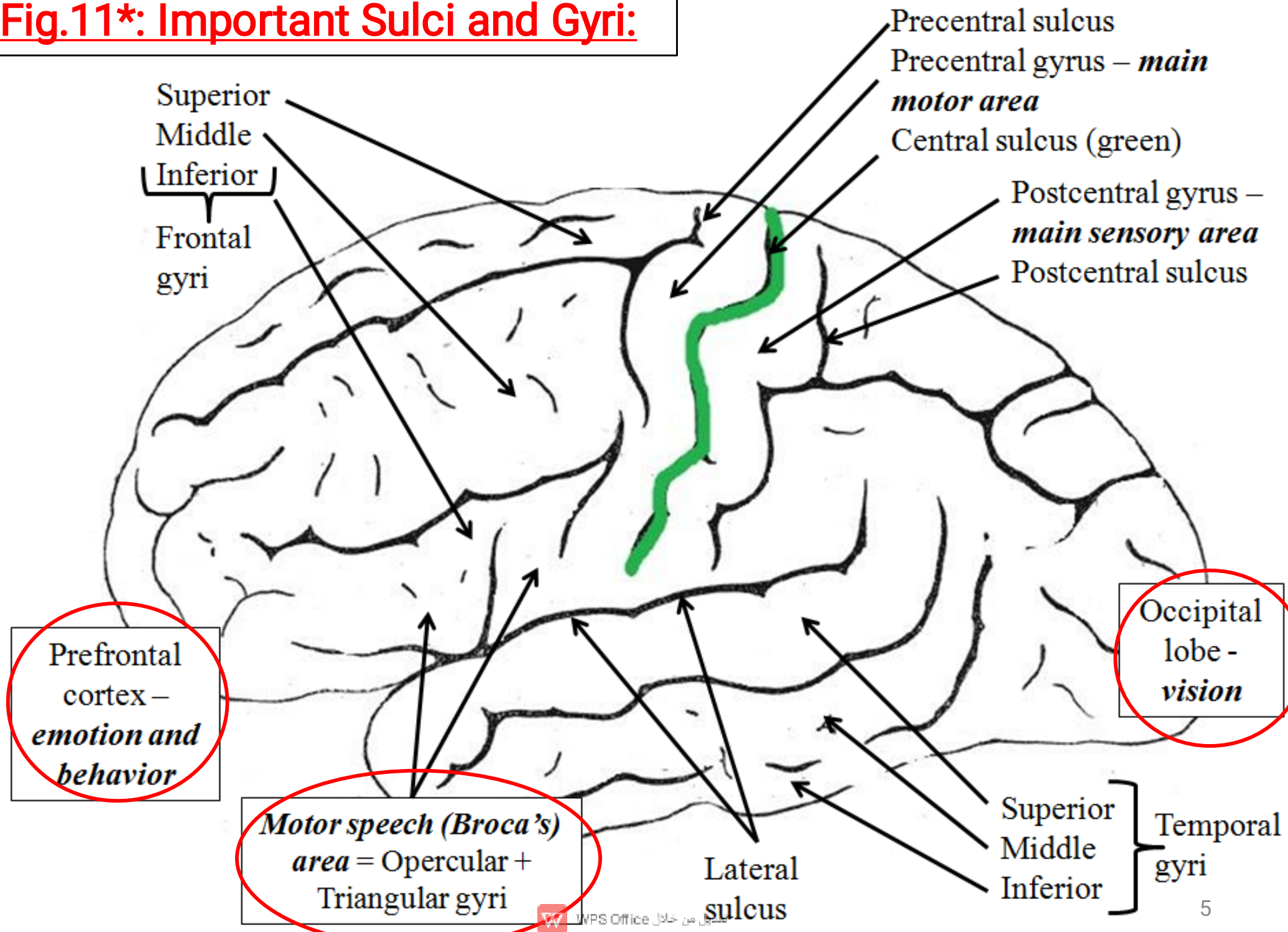


Fig.10: The arrangement of the gray and white matter in the cerebrum and spinal cord

Fig.11*: Important Sulci and Gyri:



The Diencephalon

الدماغ المتوسط

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

تجويف

- It's formed of the:

1. Thalamus ← المهاد
2. Hypothalamus ← تحت المهاد
3. Epithalamus ← ما فوق المهاد

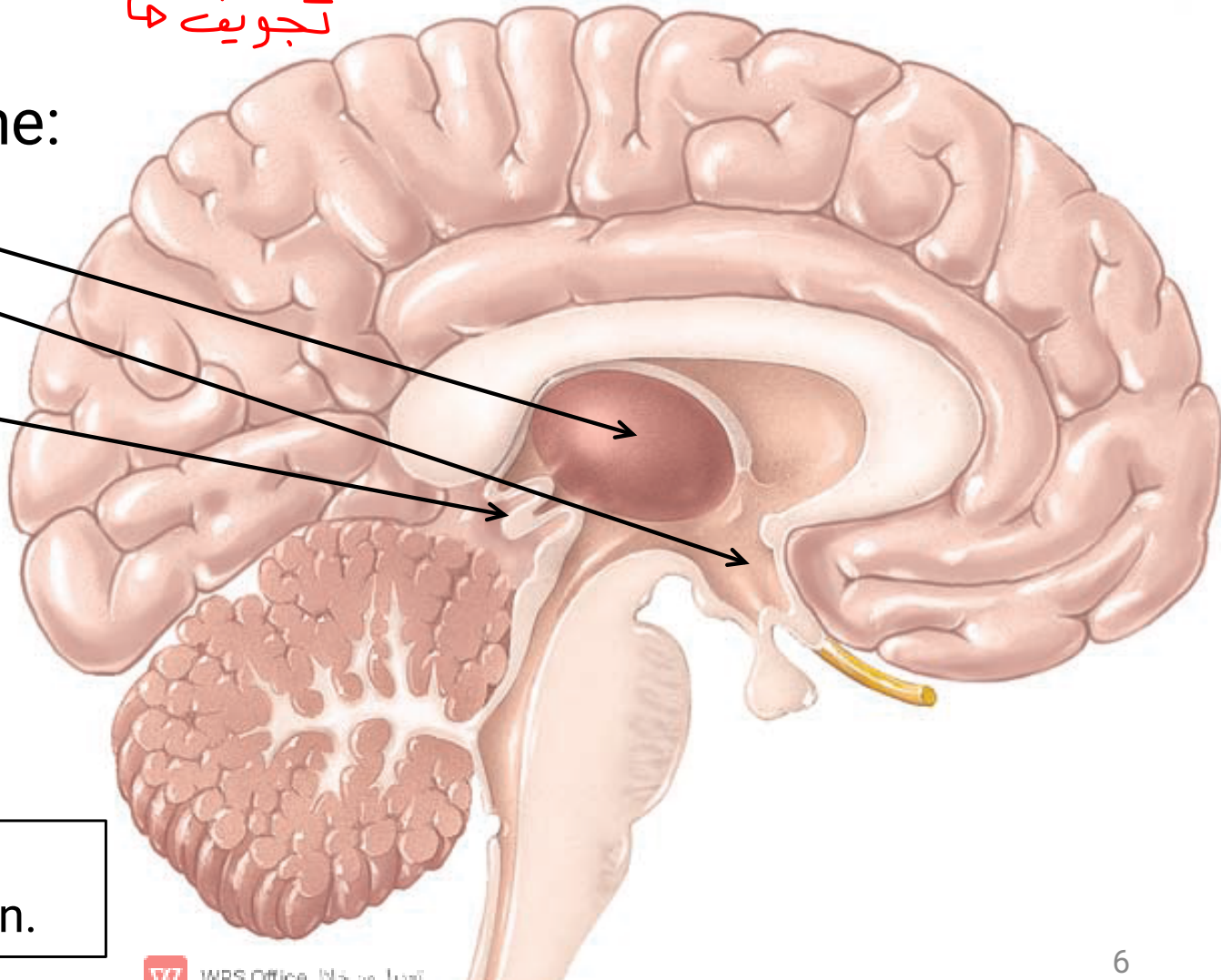


Fig.12: The location and parts of the diencephalon.

Part	Main Function
Thalamus	Relay station for most sensation ^{الإحساس}
Hypothalamus	1. Controls hormone secretions of all endocrine glands in the body 2. Control body temperature 3. Control eating and drinking
Pineal gland of the epithalamus	Secrete melatonin hormone which regulates diurnal (day-night) cycles

* تصنيع الكولسترول في الجسم mainly يحدث في فترة الليل.

The Cerebellum

المخيخ

- 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.
- *The function of the cerebellum is the coordination of movement and the maintaining of balance.*

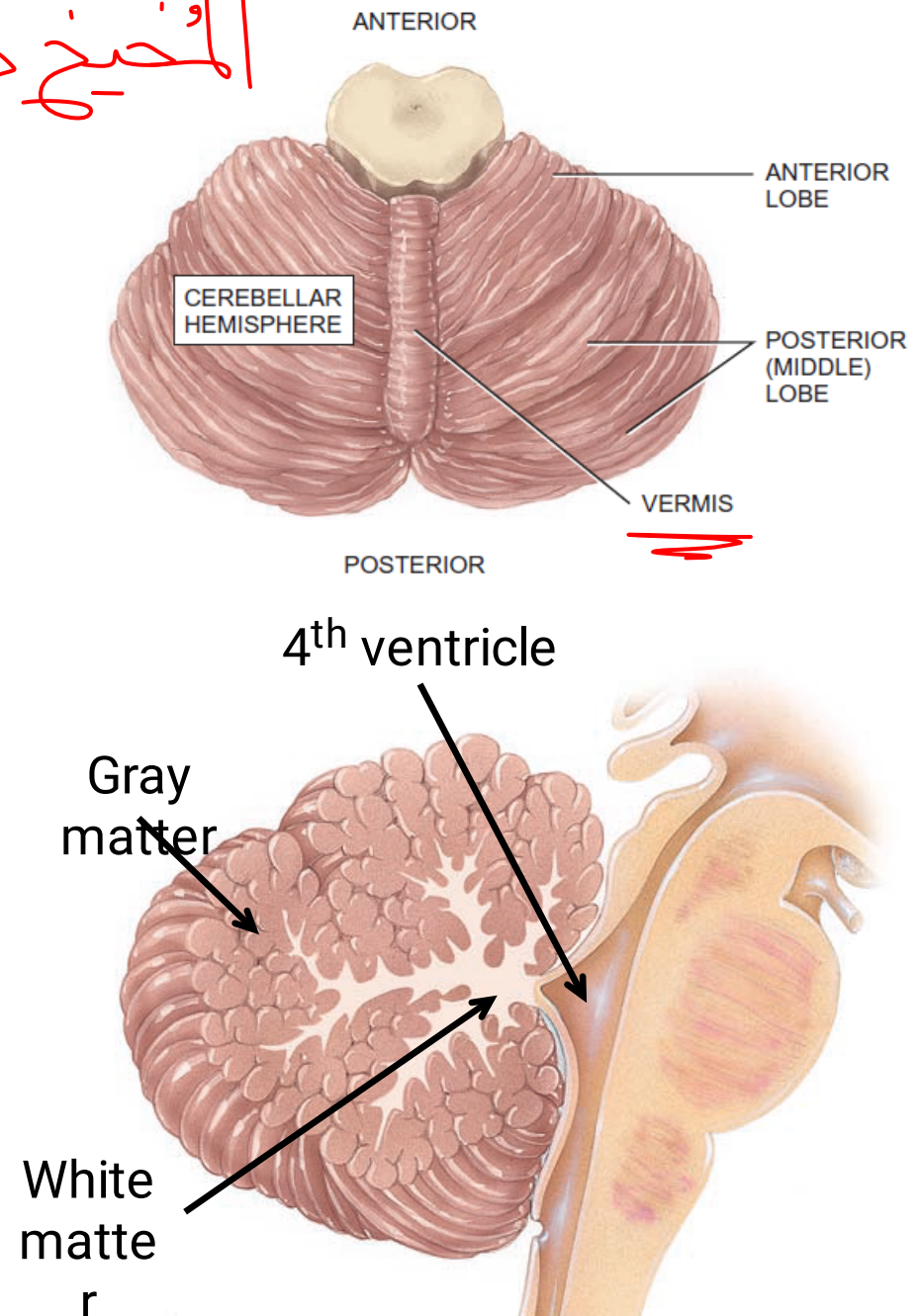


Fig.13: The cerebellum.

The Brainstem

جذع الدماغ →

- ✓ The part of the brain that connects the diencephalon with the spinal cord
- ✓ Formed of 3 parts:
 - **Midbrain (MB)**
 - **Pons** – connect several parts of the CNS together.
Contains respiratory centers.
 - **Medulla oblongata**
- ✓ The brainstem contains several important control centers and the attachment of several cranial nerves.
- ✓ Also in the brainstem is the ***Reticular Formation*** which is related to **consciousness** and muscle tone.

الوعي →

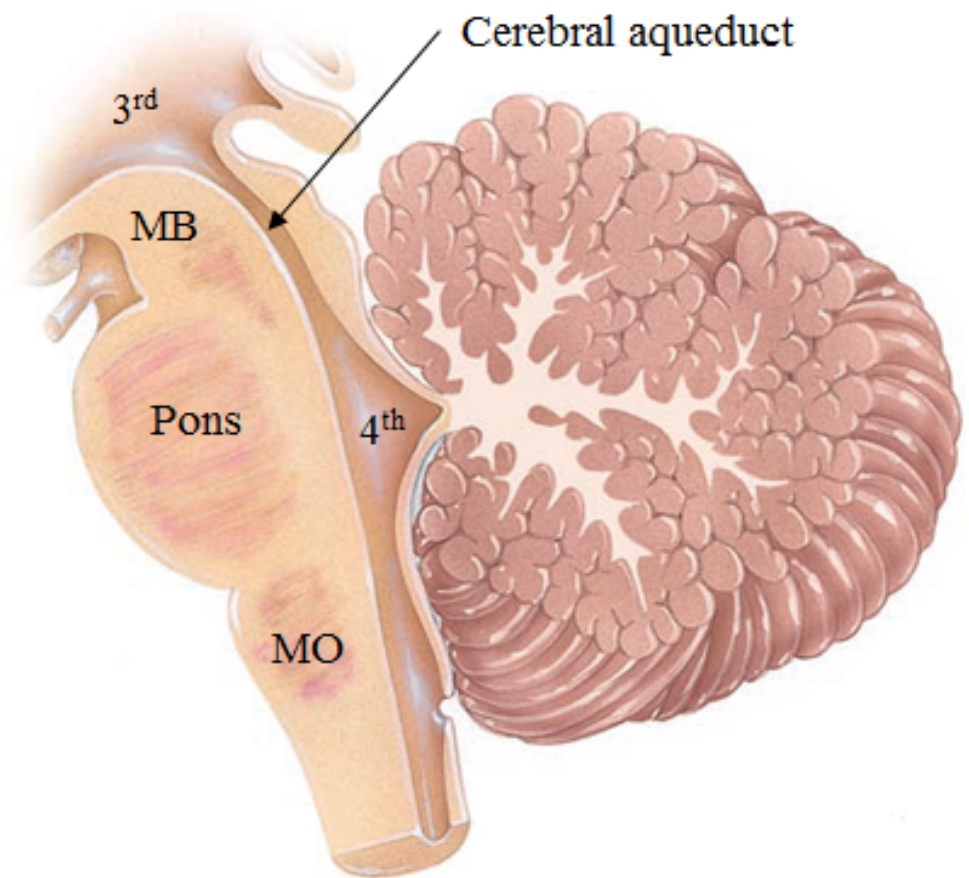
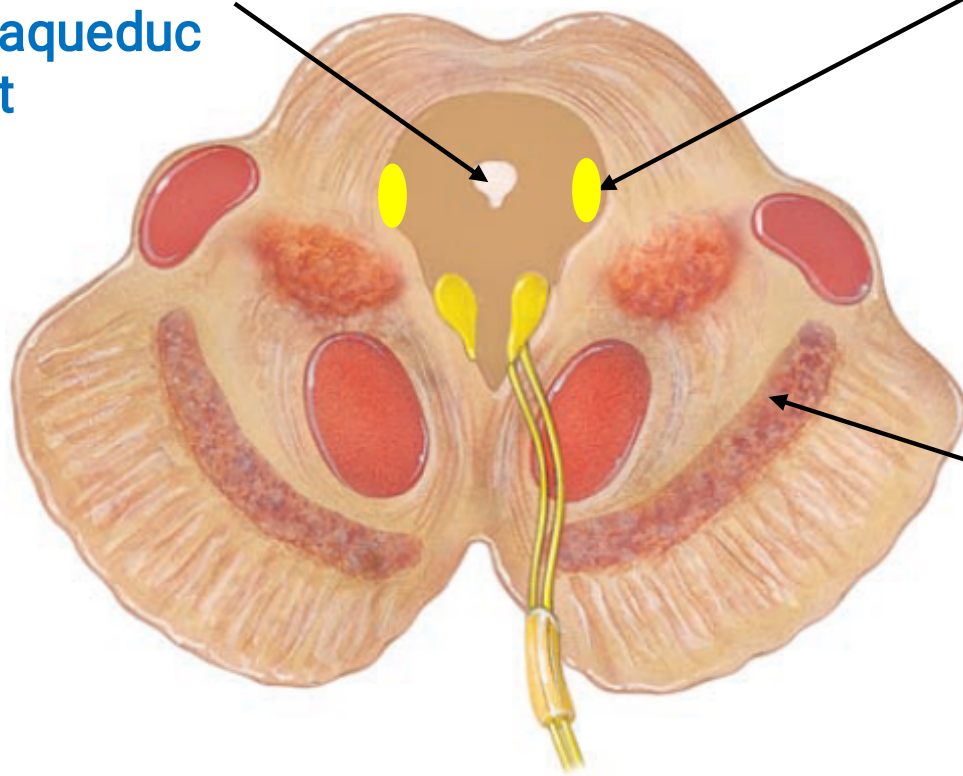


Fig.14: Location and parts of the brainstem.

The Midbrain

Cerebral
aqueduct



Mesencephalic nucleus – contains pseudounipolar neurons that carry sensations from the face. The only place in the CNS with such neurons; all other pseudounipolar neurons are located in peripheral ganglia.

Substantia nigra – neurons here release Dopamine and is involved in muscular activity. Lesion in this area is associated with Parkinson's disease.

Fig.15: Section through the midbrain.

The Medulla Oblongata

- ✓ Contains important control centers:
 - Cardiovascular center
 - Respiratory center
- ✓ Anteriorly, near the midline, are **the pyramids** which are formed by the **descending motor** tracts (group of nerve fibers in the CNS).
- ✓ At a certain point in the medulla, the majority of the fibers in these tracts will cross to the opposite side forming the **decussation of the pyramid**.
- ✓ This is why each half of the brain controls the opposite side of the body.

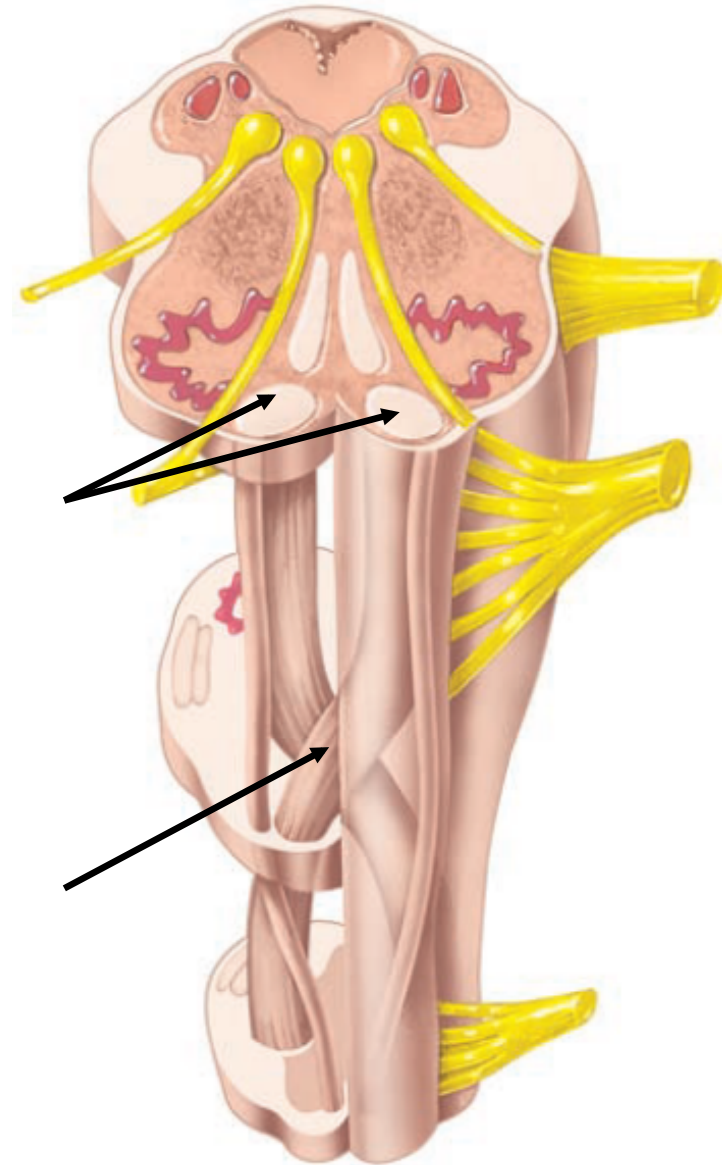


Fig.16: The medulla oblongata.

The Central Nervous System

The Spinal Cord

- A grayish-white **cylindrical** structure.
اسطوانى
- Starts at the foramen magnum and ends at lower border of L1 in adults. In children, it ends at L3.
المود الفقري
- Protected by the **vertebral column** and the three layers of **meninges**.
سحايا المخ
- The pia matter will continue after the termination of the spinal cord as a thin thread called the filum terminale.

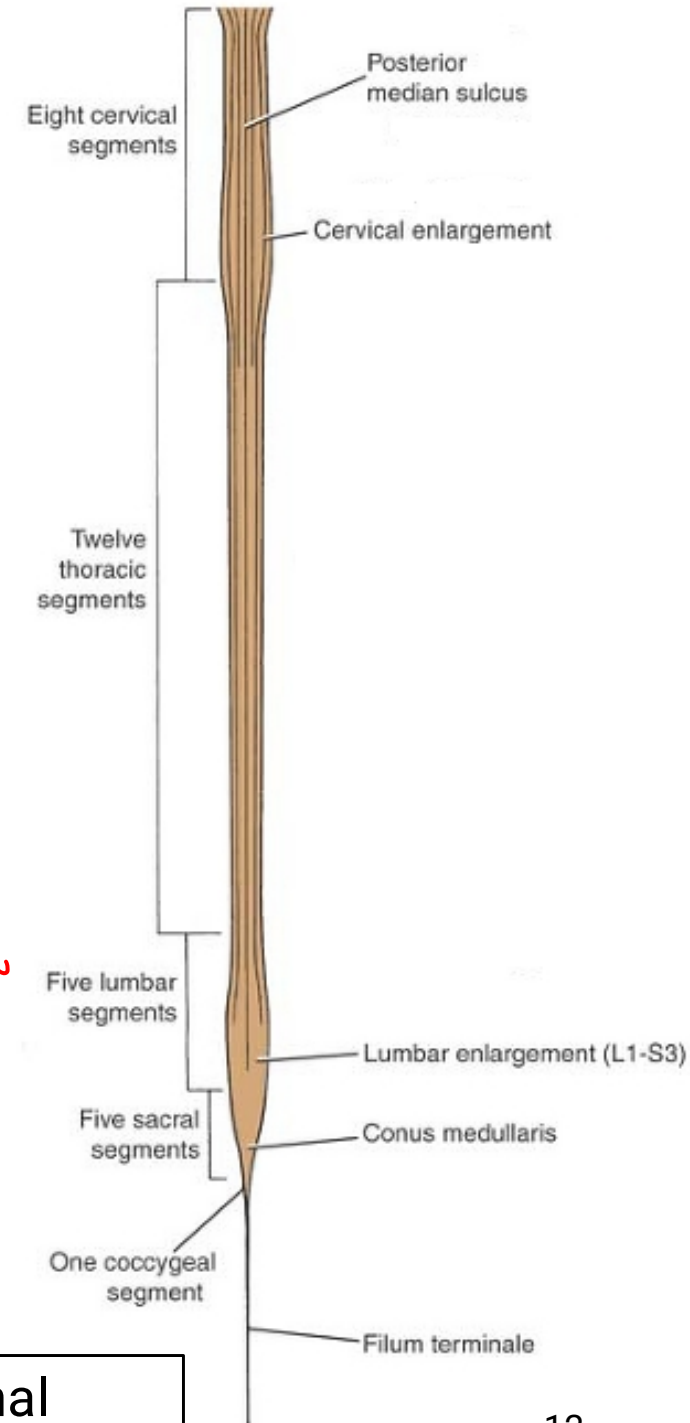


Fig.17: The spinal cord.

External features of the spinal cord

- It has two enlargements: cervical and lumbar. The cervical enlargement is the origin of the cervical and brachial plexuses. The lumbar enlargement is the origin of the lumbar and sacral plexuses.
- The terminal part of the spinal cord is cone shaped and called the **Conus medullaris**.

المخروط النخاعي



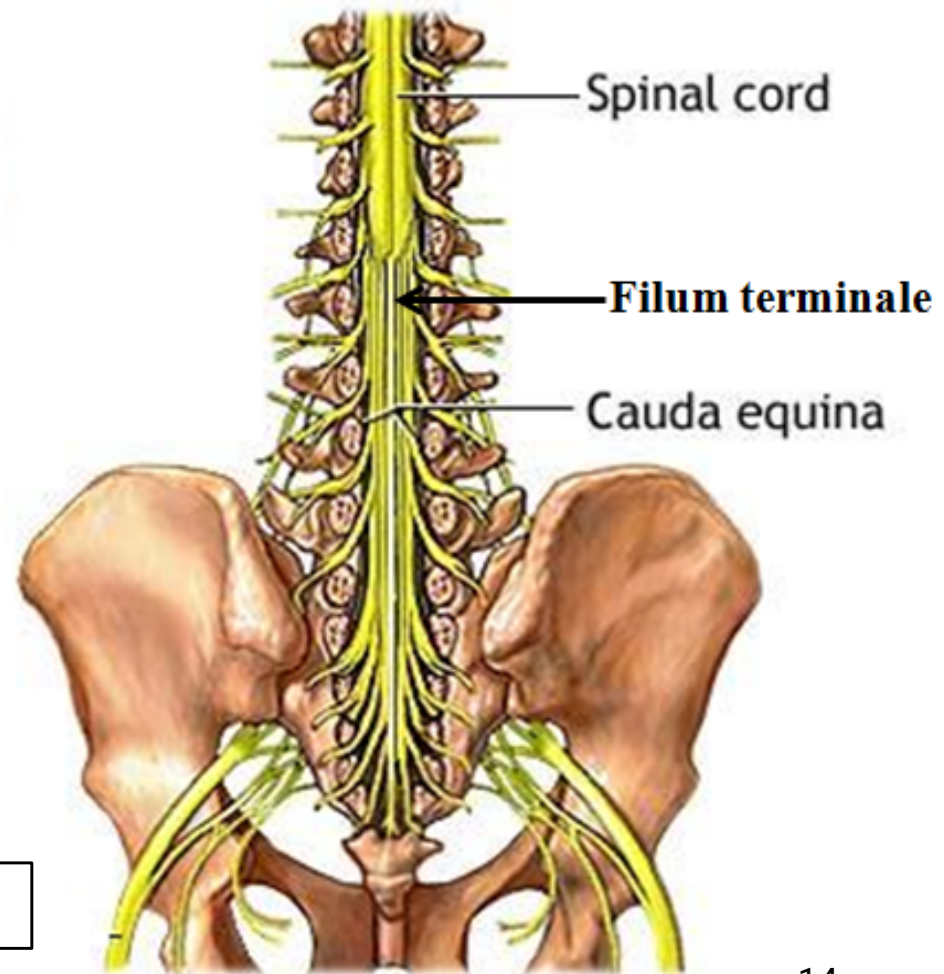
Fig.18: The conus medullaris.

- The spinal cord is divided into segments: 8 Cervical, 12 Thoracic, 5 Lumbar, 5 Sacral and 1 Coccygeal. From each segment arises a pair of spinal nerves. Thus, we have a total of 31 pairs of spinal nerves.

- The nerves pass laterally to exit the vertebral column. The spinal cord is shorter than the spine. Therefore the lower nerves must pass down for a distance before exiting. These will form a structure like a wisp of hair around the filum terminale called the Cauda Equina.

على شكل خضعة

Fig.19: The cauda equina.



Internal features of the spinal cord

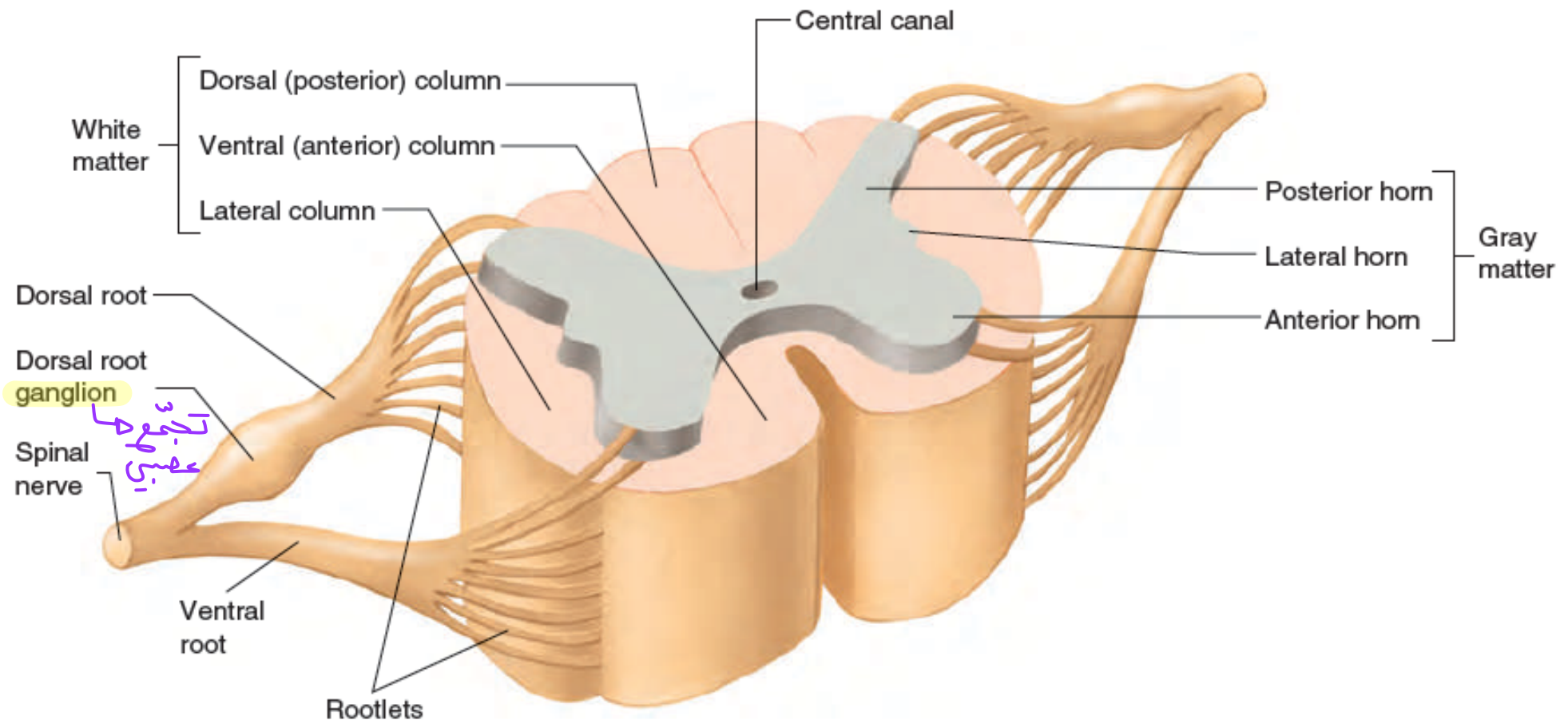


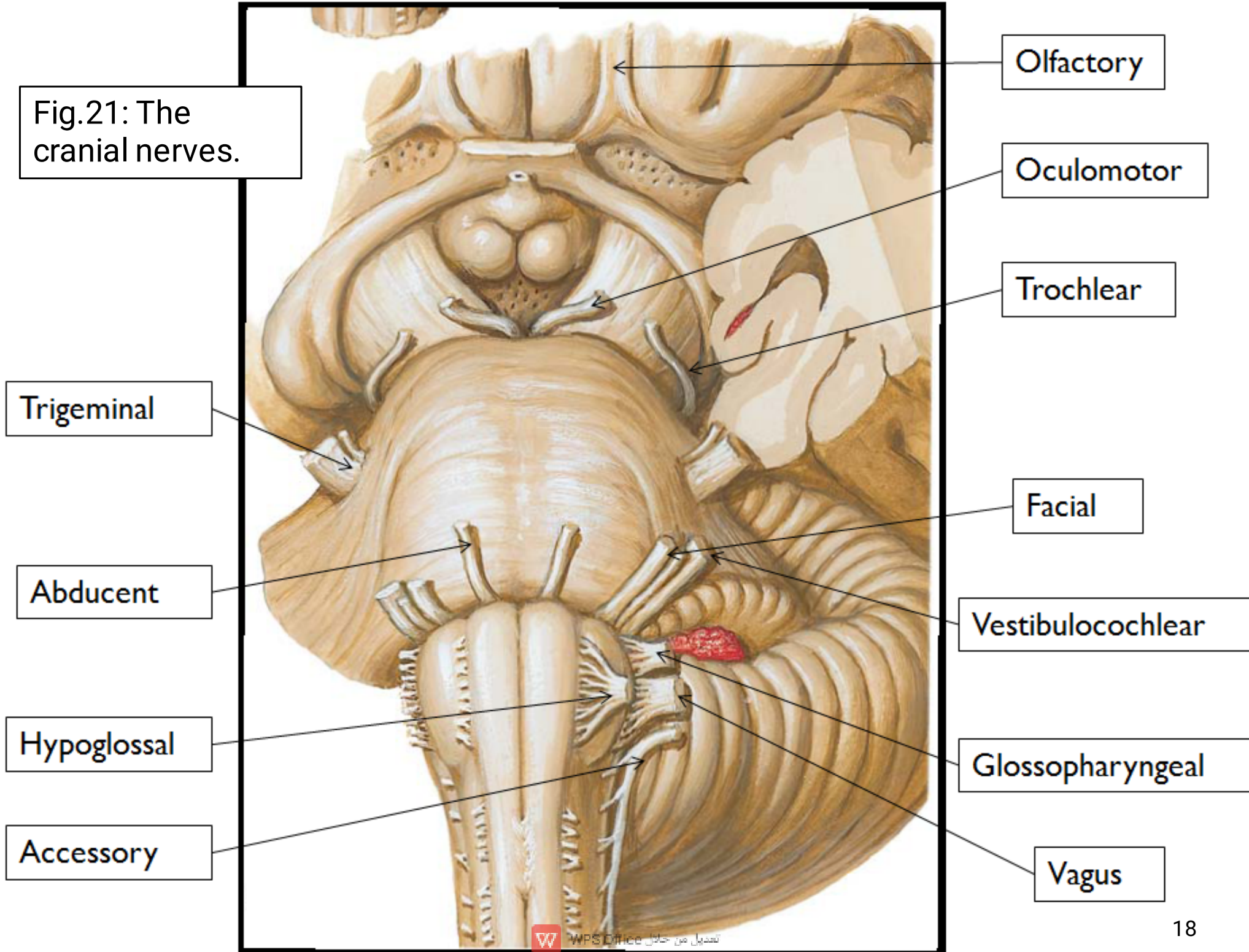
Fig.20*: Cross section through the spinal cord showing important internal features.

The Peripheral Nervous System - The Cranial Nerves

Cranial Nerve	Main Functions
I – Olfactory	Olfaction (Smelling) → الشم
II – Optic	Vision → الرؤية
III – Oculomotor	<u>Supplies extrinsic muscles of eye</u>
IV – Trochlear	
V – Trigeminal	<u>Carries sensation from face</u> <u>Supplies muscles of mastication</u> → مضغ
VI – Abducent	<u>Supplies extrinsic muscles of eye</u>

Cranial Nerve	Main Functions
VII – Facial	1. Supplies muscles of facial expression 2. Carries taste sensations from anterior 2/3 of tongue → لسان
VIII - Vestibulocochlear	Hearing and equilibrium
IX - Glossopharyngeal	1. Supplies some muscles 2. Carries taste sensation from posterior 1/3 of tongue
X – Vagus	1. Supplies various muscles 2. Carries various sensation 3. Supplies internal organs
XI – Accessory	Supplies the sternocleidomastoid and trapezius muscles
XII – Hypoglossal	Supplies all muscles of the tongue (except palatoglossus)

Fig.21: The cranial nerves.



The Peripheral Nervous System - The Spinal Nerves

- **31 pairs of mixed nerves** (sensory and motor): Cervical (C1-C8), thoracic (T1-T12), lumbar (L1-L5), sacral (S1-S5) and coccygeal (Co).
- A spinal nerve gives off two main branches: anterior ramus and posterior ramus. Anterior rami of spinal nerves are usually arranged in groups called plexuses.

Plexus	Main Branches
Cervical	Phrenic
Brachial	Axillary, Musculocutaneous, Radial, Median, Ulnar
Lumbar	Obturator, Femoral
Sacral	Sciatic (Largest nerve in the body)