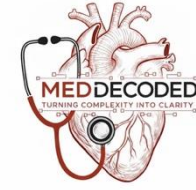


بِسْمِ اللَّهِ الرَّحْمَنِ الرَّحِيمِ



العلم



ANATOMY

MID | Lecture 11

وَلَقَدْ خَلَقْنَا الْإِنْسَانَ وَنَعَلَهُمَّا تَوْسُوسًا بِهِ نَفْسُهُ وَنَحْنُ أَقْرَبُ إِلَيْهِ مِنْ حَبْلِ الْوَرِيدِ

Nervous System 4

Written by : Omar Mahmoud
Khaled Abdalla



Reviewed by :

مهنا برهوم

Color coding used in the modified:



Black: the original slides



Blue: the doctor's explanation/words



Gray: additional information and explanation



Red: important information

Introduction to Anatomy

1st Year Medical Students

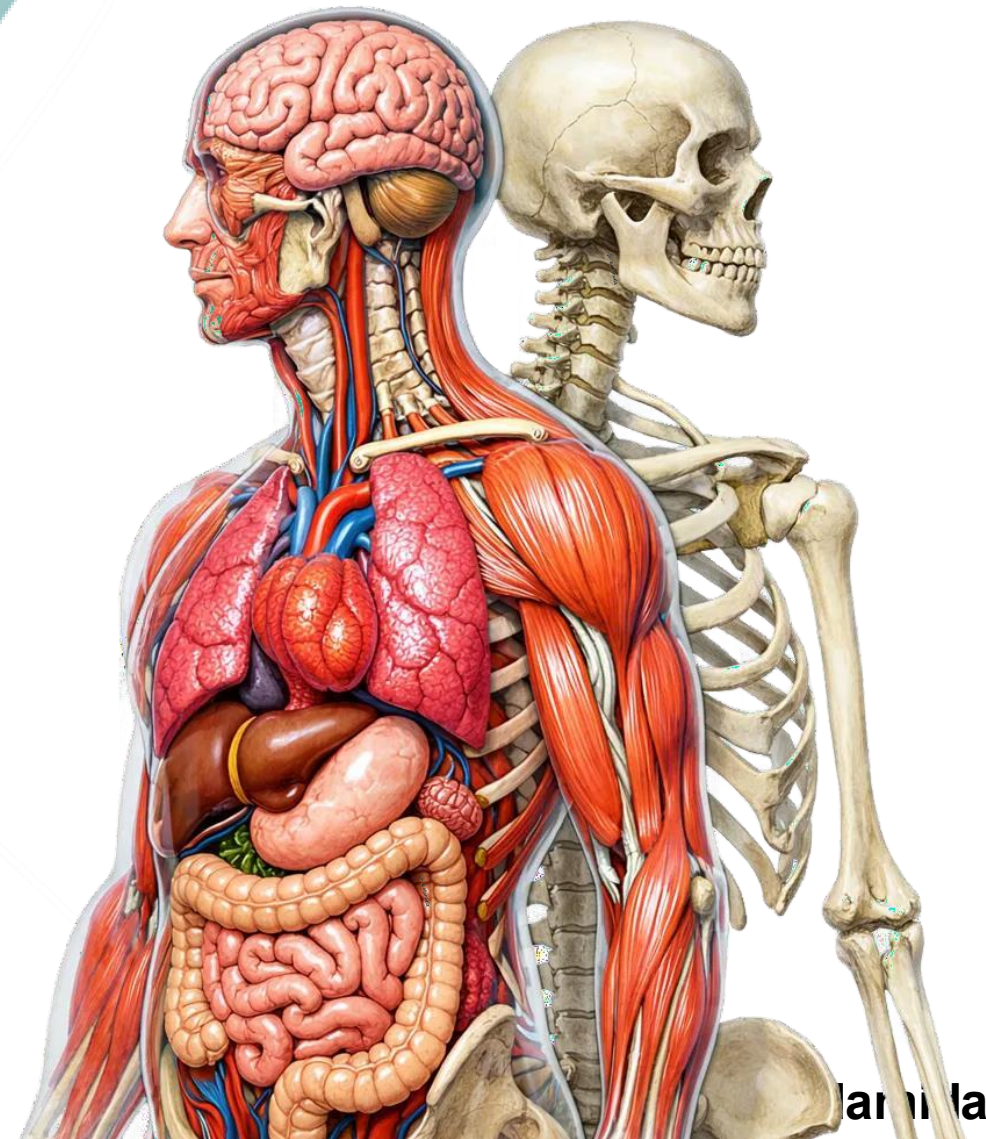
**2025-2026
Second Semester**

Dr. Abedallah Hamida, MBBS, PhD

Department of Anatomy and Histology

School of Medicine-The University of Jordan

a_hamida@ju.edu.jo



lanila

Course Outline:

1 Introduction and Terminology

2 Skeletal System

3 Cardiovascular System

4 Lymphatic System

5 Nervous System

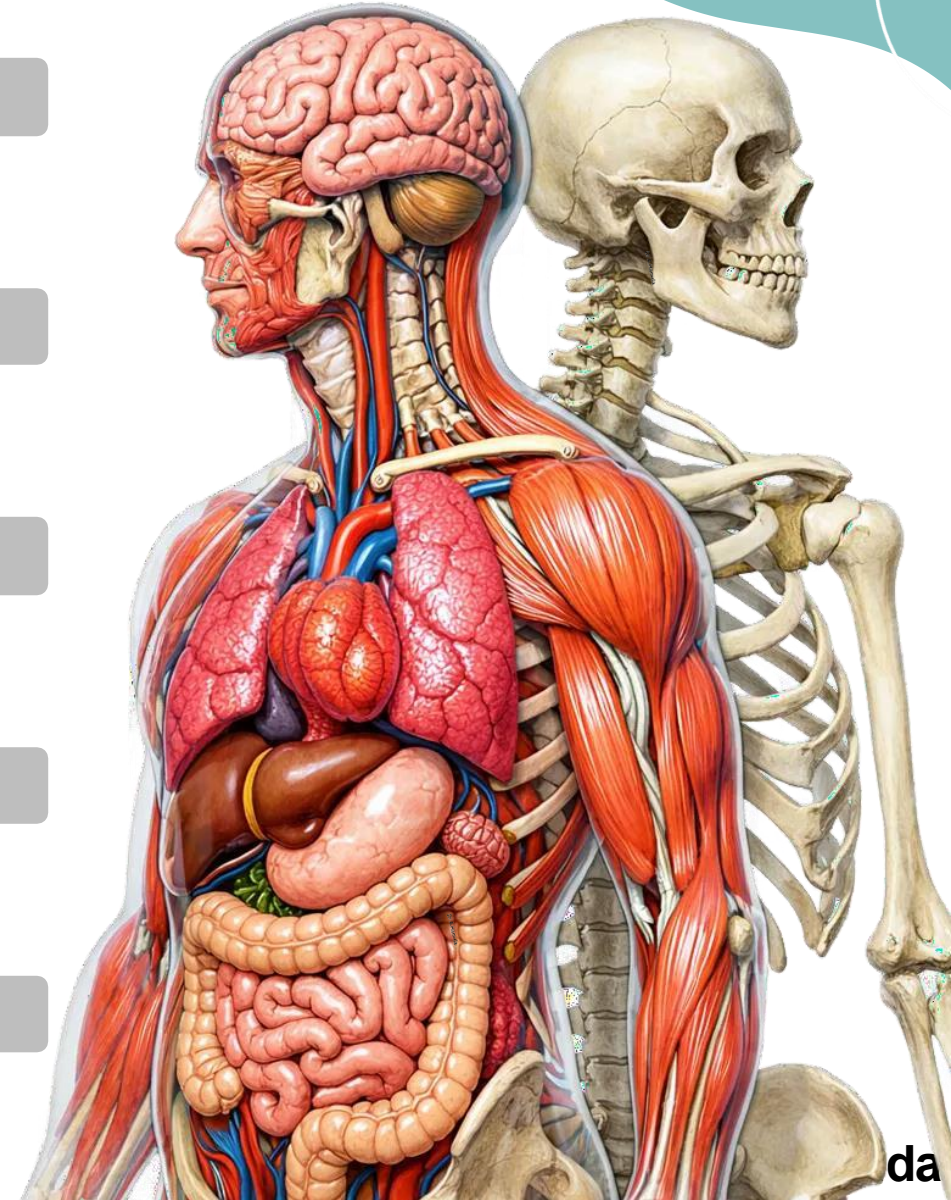
6 Muscular System

7 Respiratory System

8 Digestive System

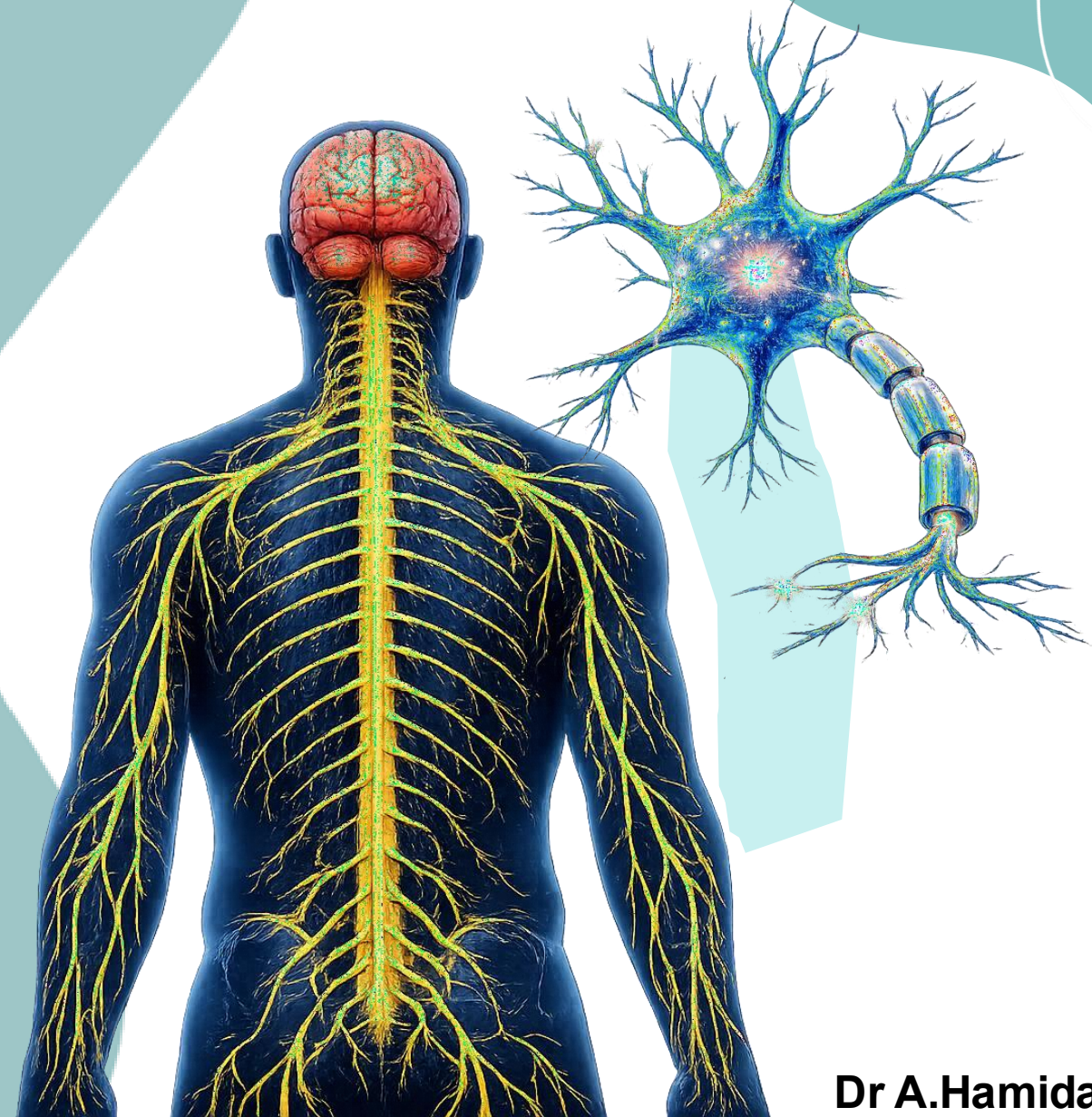
9 Urinary System

10 Endocrine System



5

Nervous System



5

Nervous System

❖ Divisions of the Nervous System

➤ Anatomically, the nervous system is divided into two parts:

1. Central Nervous System (CNS),

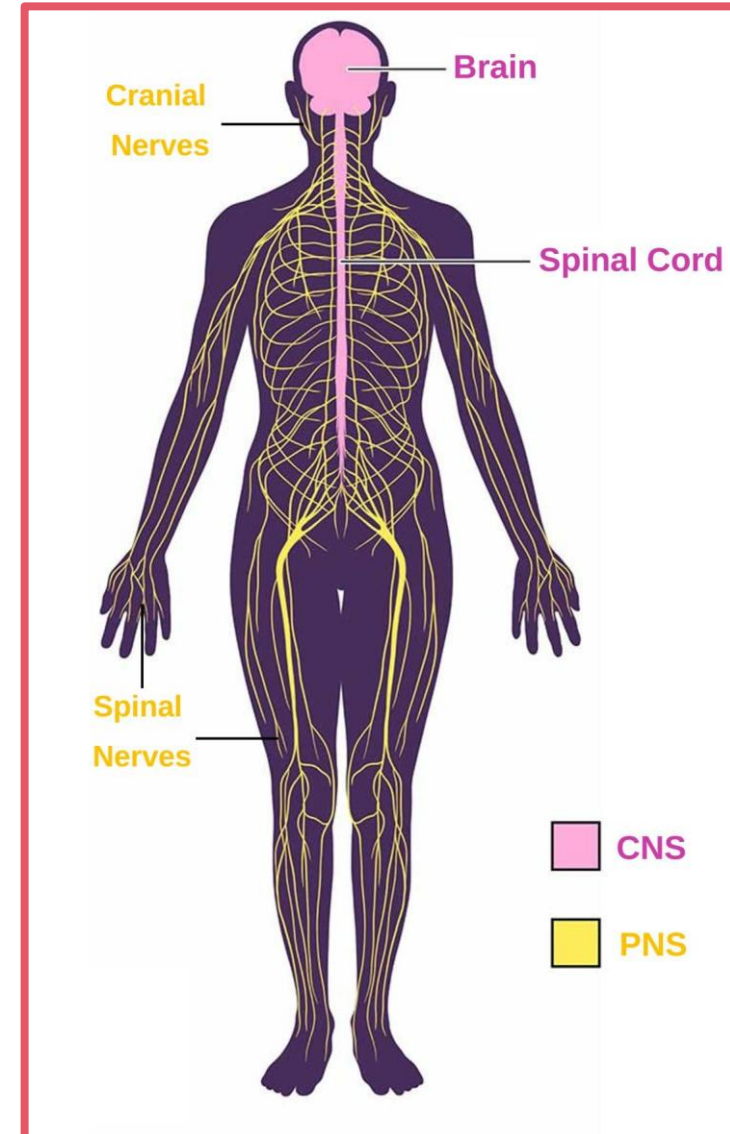
consists of:

- i. **Brain** (located in the cranial cavity)
- ii. **Spinal Cord** (located in the vertebral canal)

2. Peripheral Nervous System (PNS),

consists of nerves that exit from CNS:

- i. **Cranial nerves** (exit from the brain)
- ii. **Spinal nerves** (exit from the spinal cord)



5

Nervous System

System Outline:

5.1

Nervous Tissue

5.2

Central Nervous System - Brain

5.3

Central Nervous System - Spinal Cord

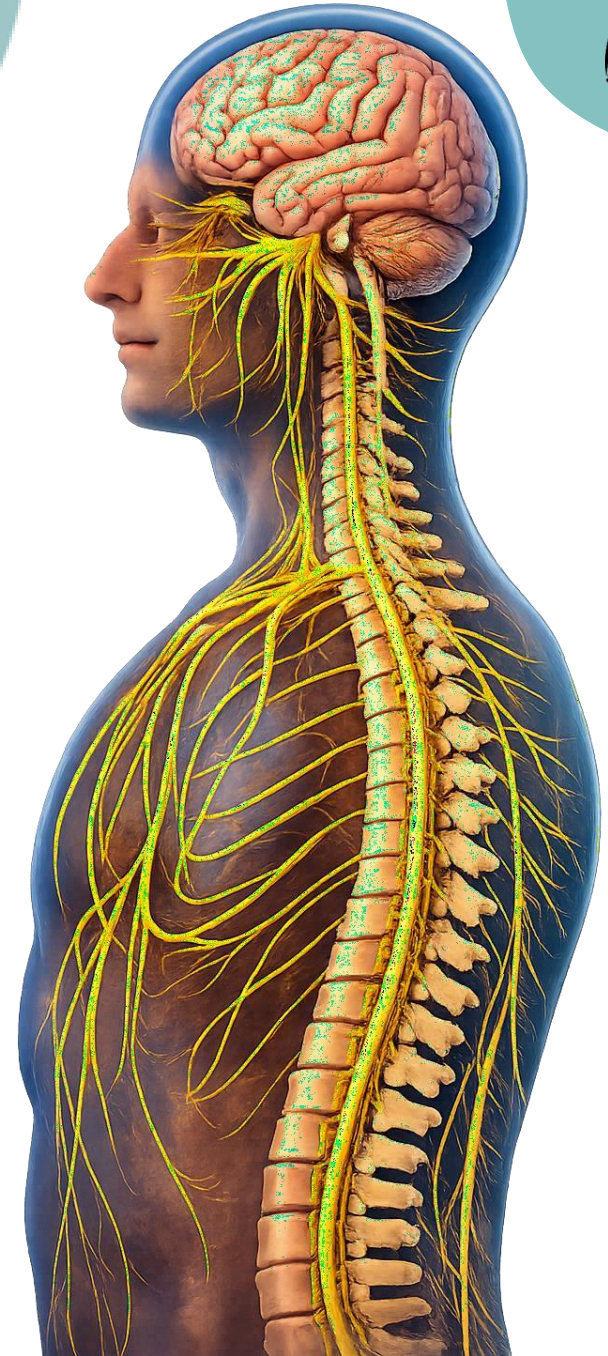
5.4

Peripheral Nervous System

5

Nervous System

4. Peripheral Nervous System



5.4 Nervous System – Peripheral Nervous System

Lecture Outline:

5.4.1

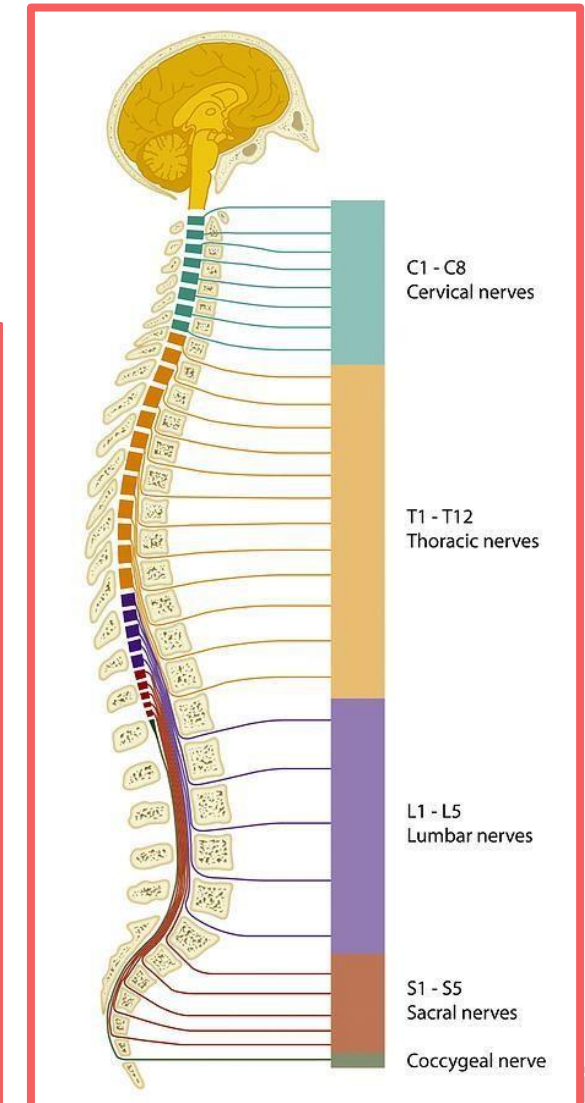
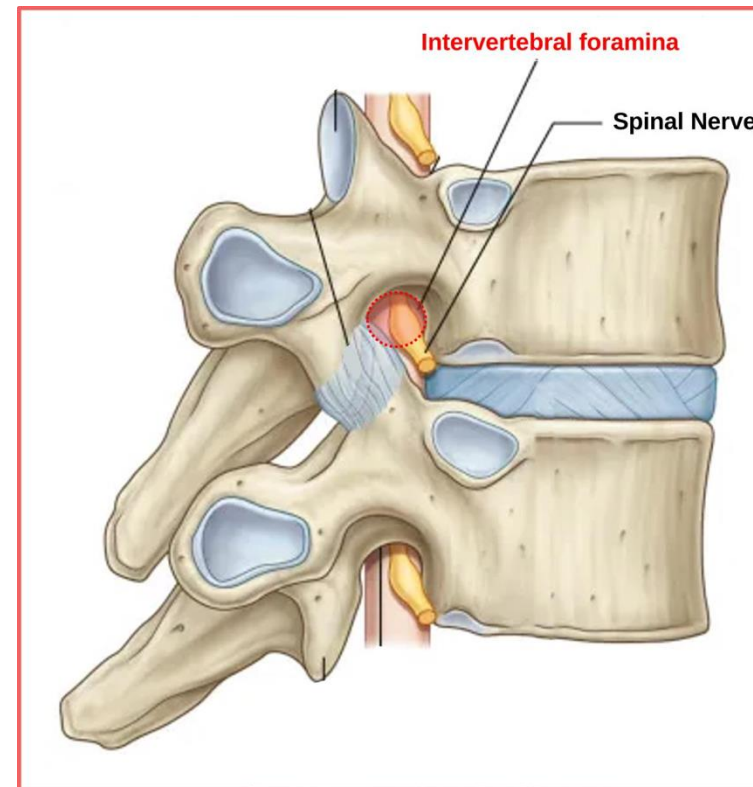
Spinal Nerves

5.4.2

Cranial Nerves

Spinal Nerves

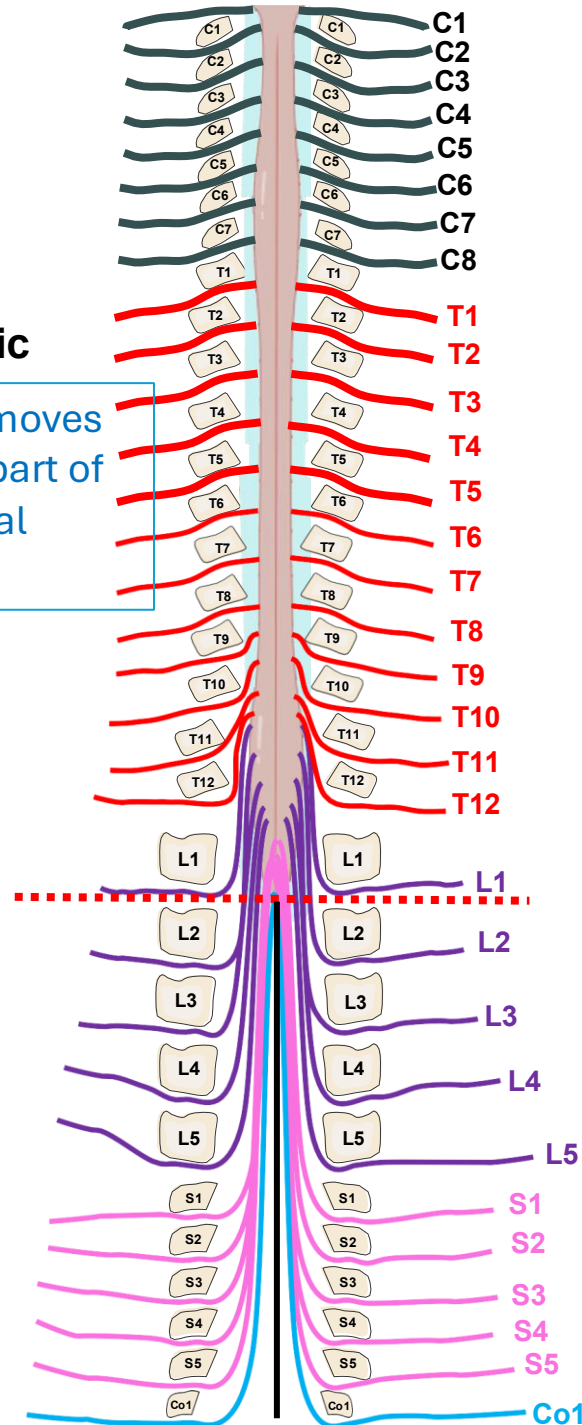
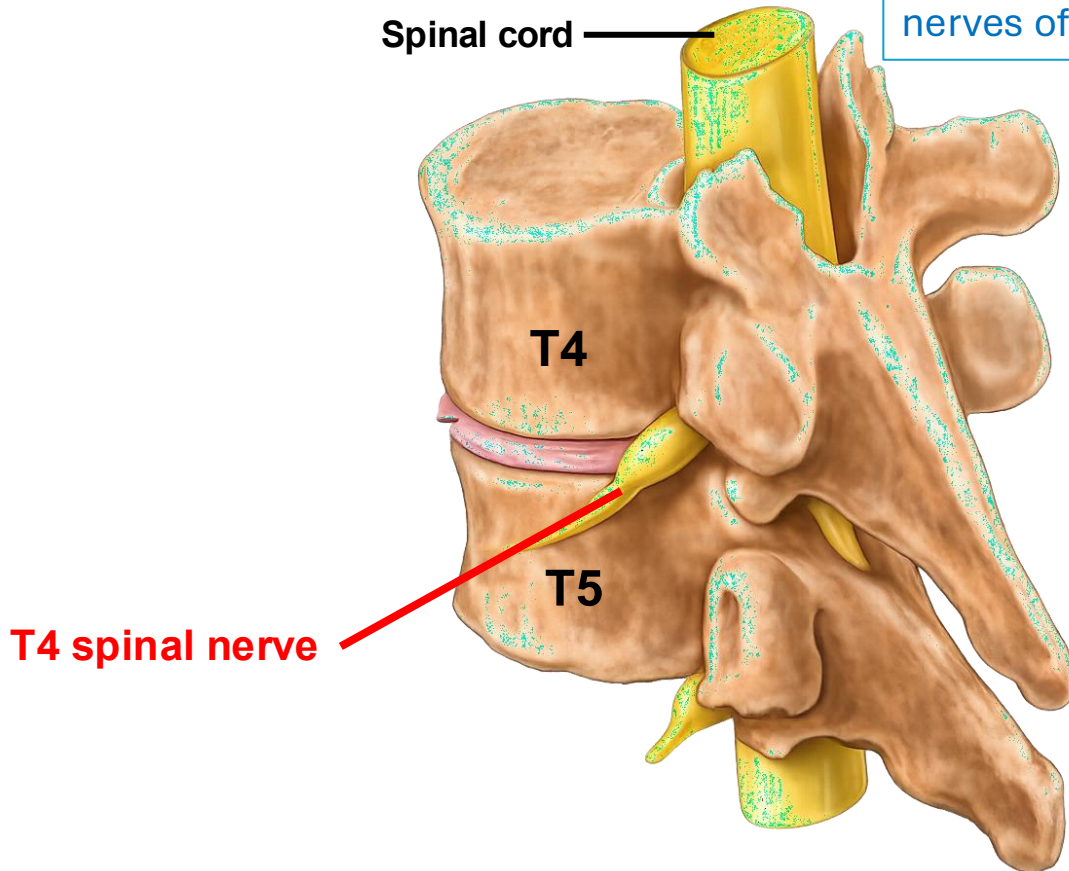
- 31 pairs of spinal nerves arise from the spinal cord and pass through intervertebral foramina in the vertebral column.
- The spinal nerves are named according to the region of the vertebral column:
 - Eight pairs of cervical nerves (C1 to C8),
 - Twelve pairs of thoracic nerves (T1 to T12),
 - Five pairs of lumbar nerves (L1 to L5),
 - Five pairs of sacral nerves (S1 to S5)
 - One pair of coccygeal nerves (Co1).



Spinal Nerves

- Each spinal nerve exits below the corresponding vertebra, except the cervical nerves, which exit above the corresponding vertebra (except of C8 nerve, which emerges between 7th cervical and 1st thoracic vertebrae).

Laminectomy: a process that removes the spinous process and lamina part of the vertebrae and shows the spinal nerves of the spinal cord

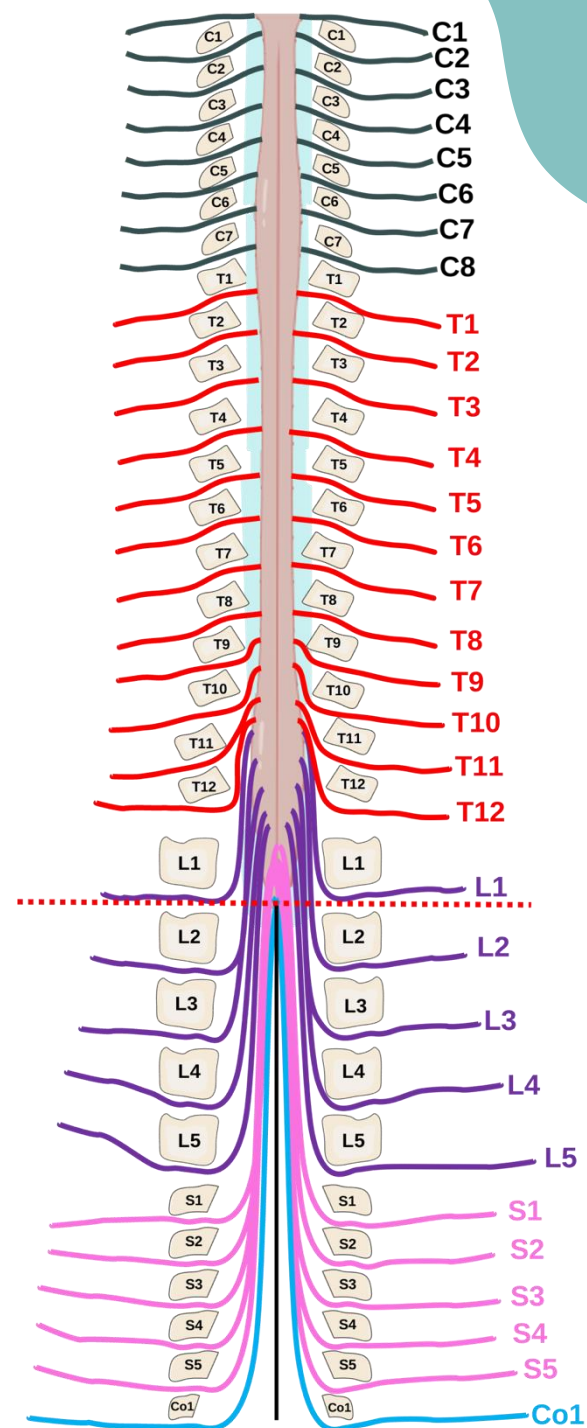


Spinal Nerves

➤ Cauda Equina

- Since the spinal cord is shorter than the vertebral column, the length of the spinal nerves increases progressively from above downward so they can reach their respective intervertebral foramina.
- The upper cervical nerves run almost horizontally; thoracic nerves run obliquely, while lumbar and sacral nerves descend almost vertically downwards.
- These descending lumbar, sacral, and coccygeal roots form a bundle around the filum terminale called the cauda equina, because it resembles a horse's tail

(cauda = tail, equina = horse).



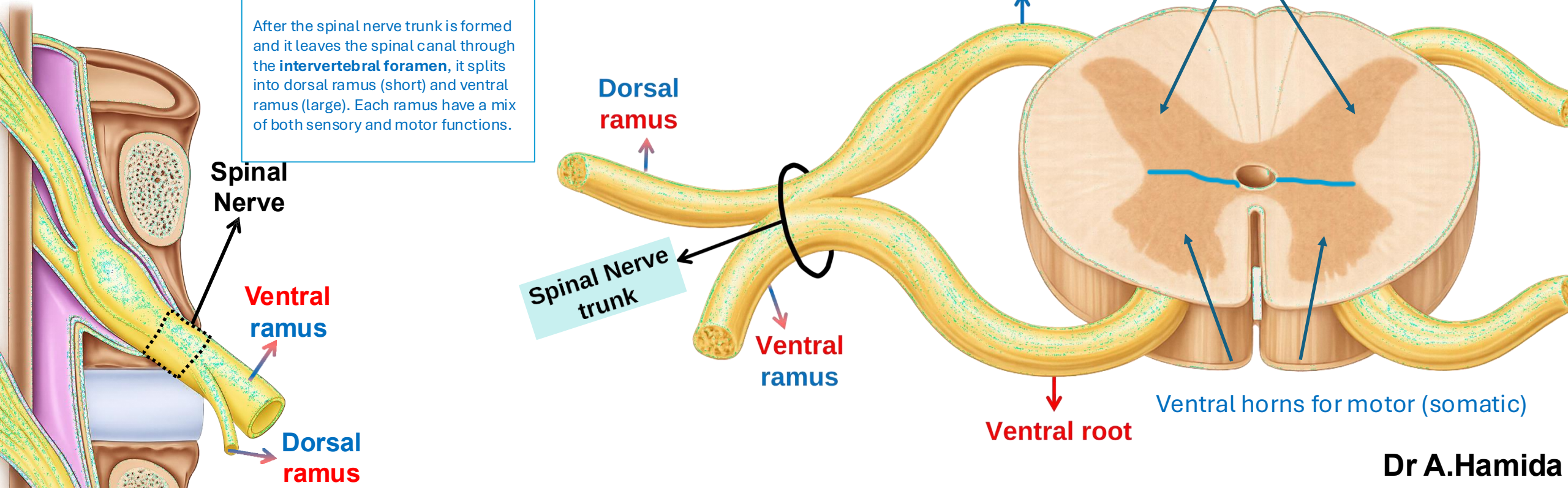
Spinal Nerves

- Each spinal nerve arises from spinal cord by two roots: **anterior root** and **posterior root**
- The two roots unite at the intervertebral foramen to form the **nerve trunk**.
- After emerging from the intervertebral foramen, each spinal nerve divides into **anterior ramus** and **posterior ramus**.

Spinal nerve trunk combines dorsal root and ventral root together at the intervertebral foramen, when they combine they function as a **mixed nerve** (has both sensory and motor functions).

After the spinal nerve trunk is formed and it leaves the spinal canal through the **intervertebral foramen**, it splits into dorsal ramus (short) and ventral ramus (large). Each ramus have a mix of both sensory and motor functions.

The length of a spinal nerve is about 0.5 to 1 cm

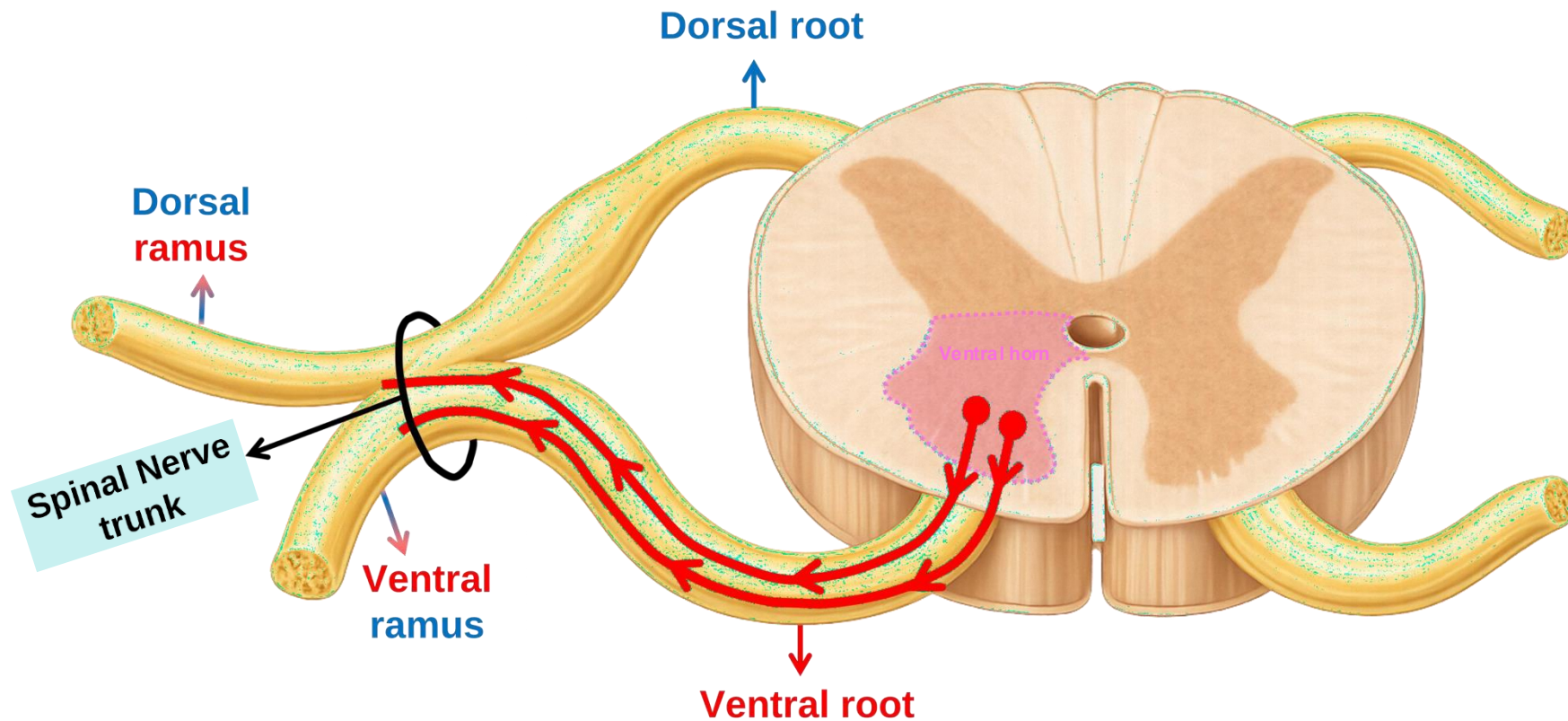


Spinal Nerves

➤ Each spinal nerve arises from spinal cord by two roots: anterior root and posterior root

1. Anterior Root: Efferent (motor) fibers

- Consists of bundles of nerve fibers that carry impulses away from the spinal cord; these fibers are called motor (efferent) fibers.
- The cell bodies of these fibers are located in the anterior horn of the spinal cord.

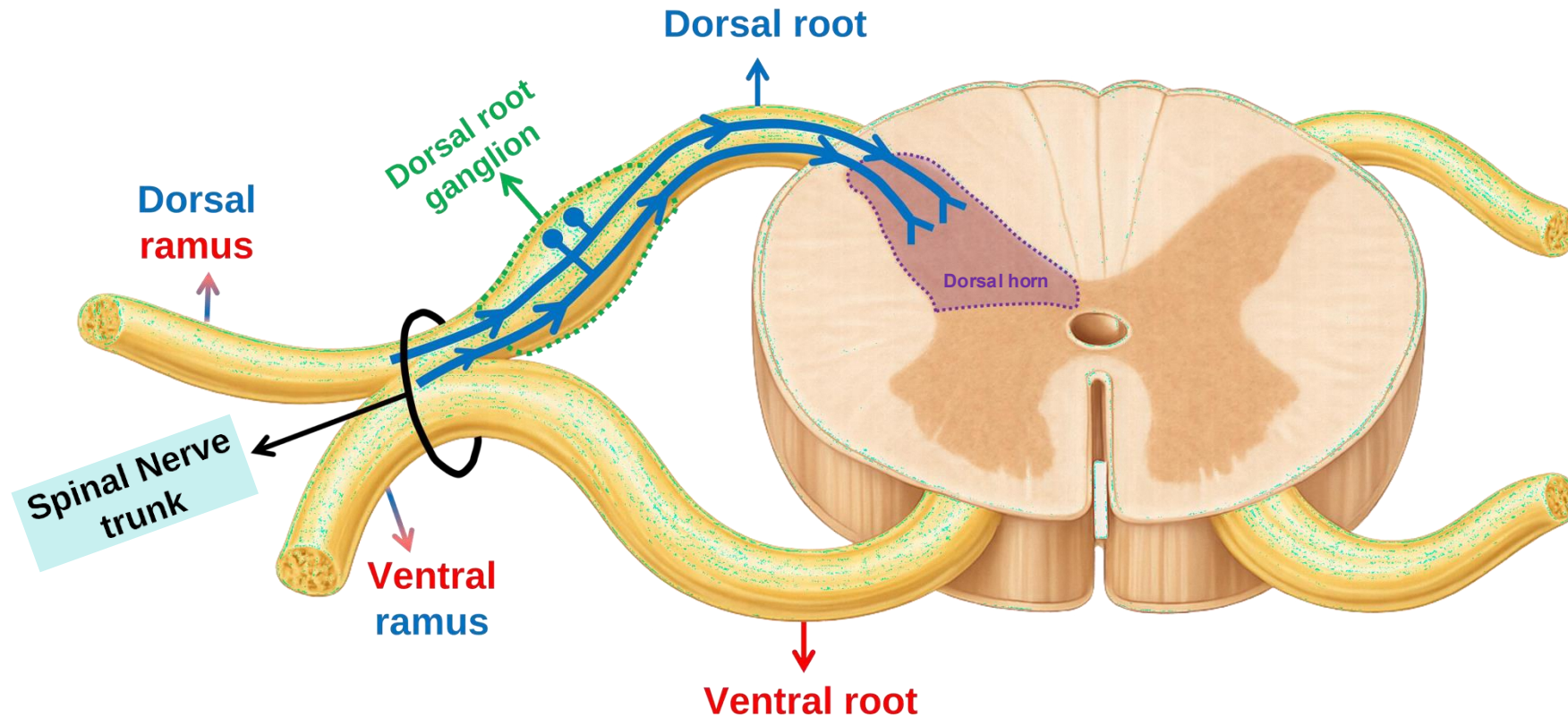


Spinal Nerves

➤ Each spinal nerve arises from spinal cord by two roots: anterior root and posterior root

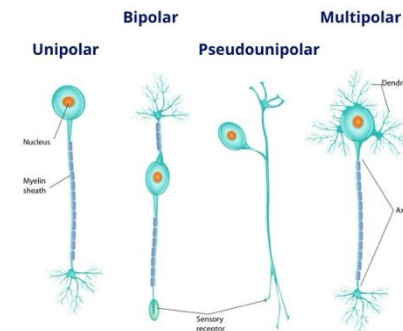
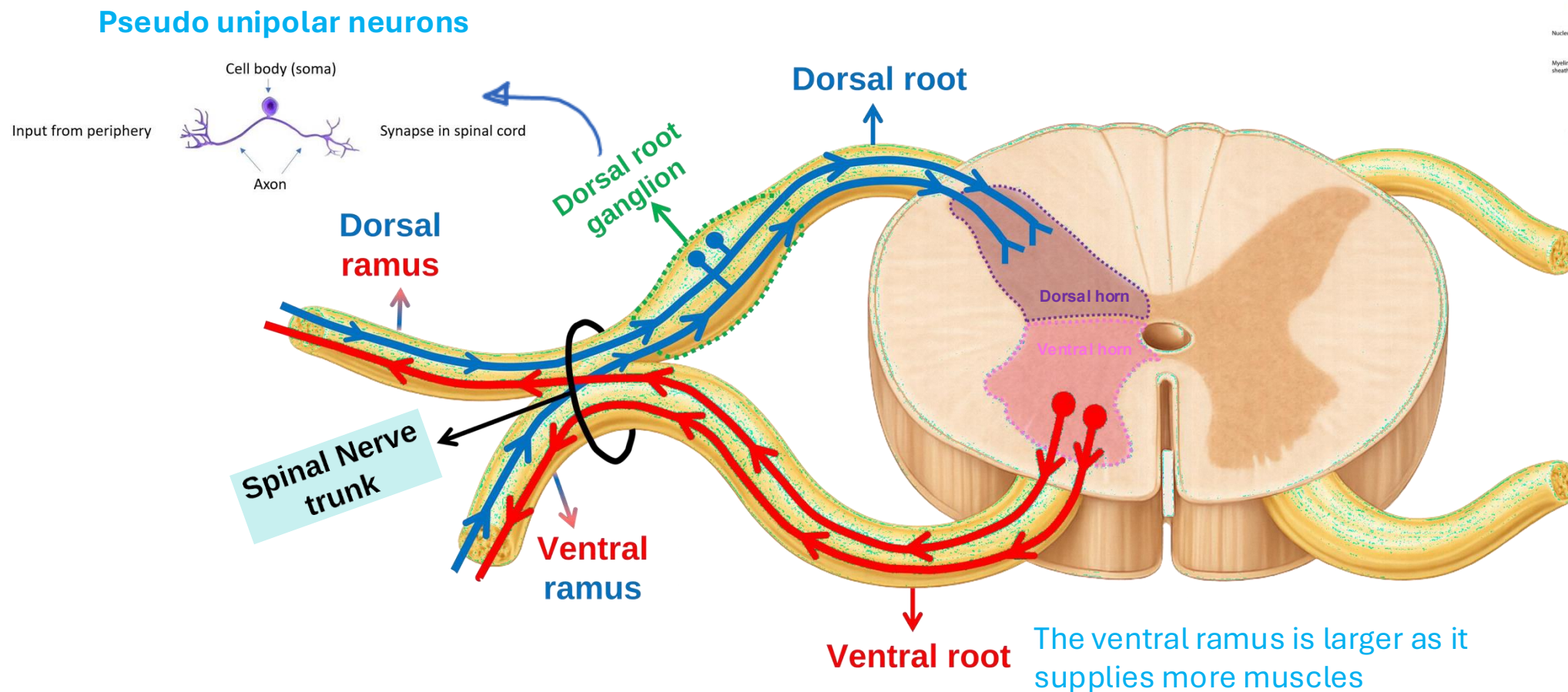
2. Posterior root:

- Consists of bundles of nerve fibers that carry impulses toward the spinal cord; these fibers are called sensory (afferent) fibers.
- The cell bodies of these fibers are located outside the spinal cord in a swelling on the posterior root called the dorsal root ganglion.



Spinal Nerves

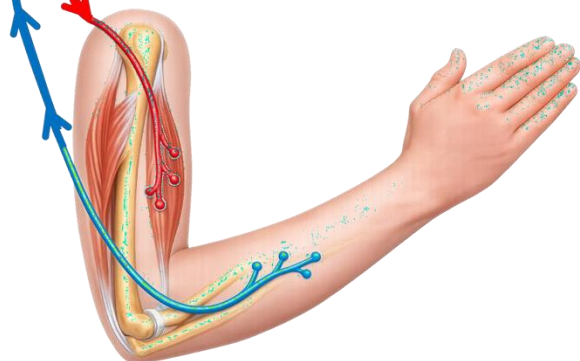
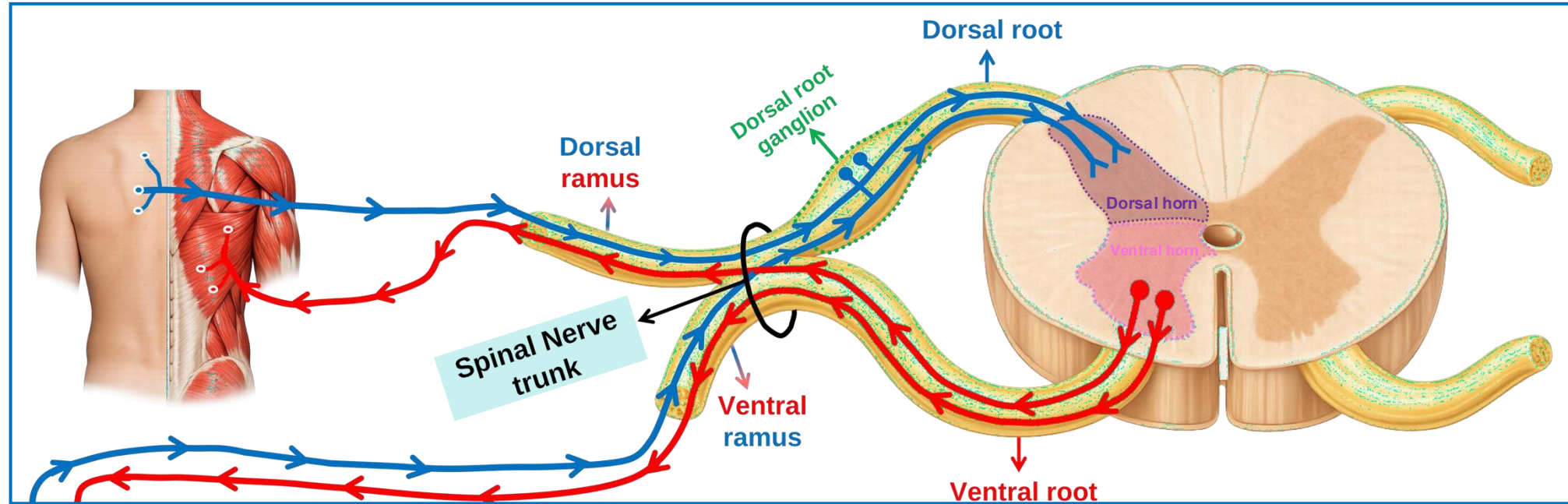
- The two roots unite at the intervertebral foramen to form the nerve trunk, which contains both motor and sensory fibers.
- After emerging from the intervertebral foramen, each spinal nerve divides into large anterior ramus and a smaller posterior ramus, each containing both motor and sensory fibers.



The doctor talked briefly about the types of neuron specially the type in the ganglion which is pseudounipolar don't focus too much, just for the knowledge

Spinal Nerves

- **Anterior ramus**: runs anteriorly to supply the muscles and skin over the anterolateral part of the body wall (larger).
- **Posterior ramus**: passes posteriorly to supply the muscles and skin of the back(smaller).



Ventral ramus supplies for the upper limb, lower limb, and the anterior of the body. This is the reason why its length is longer than the posterior ramus because the posterior ramus only covers the posterior of the body

The box represents the first order neuron (sensory pathway)

After the first order takes place (sensory signal -> dorsal horn of the spinal cord). The second order neuron occurs (dorsal horn of the spinal cord -> thalamus) then the third order neuron (thalamus -> cerebral cortex)

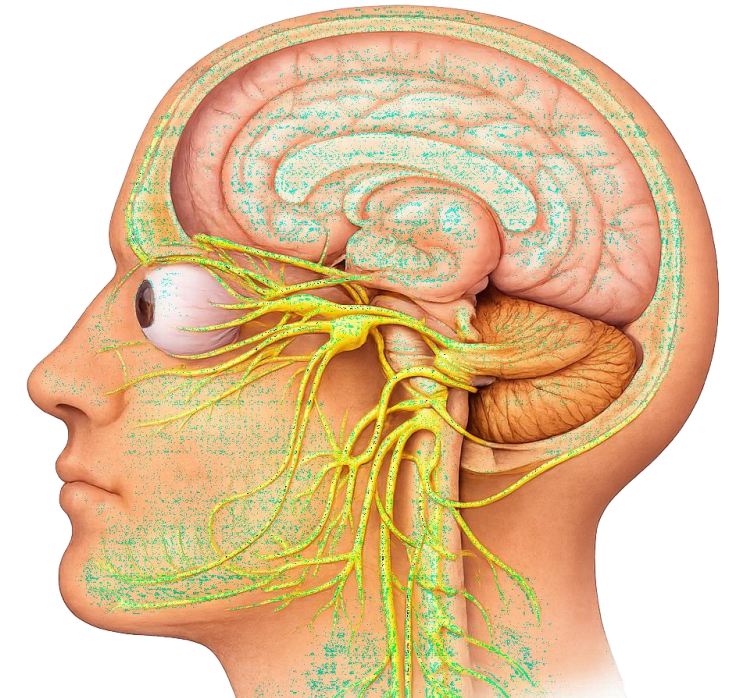
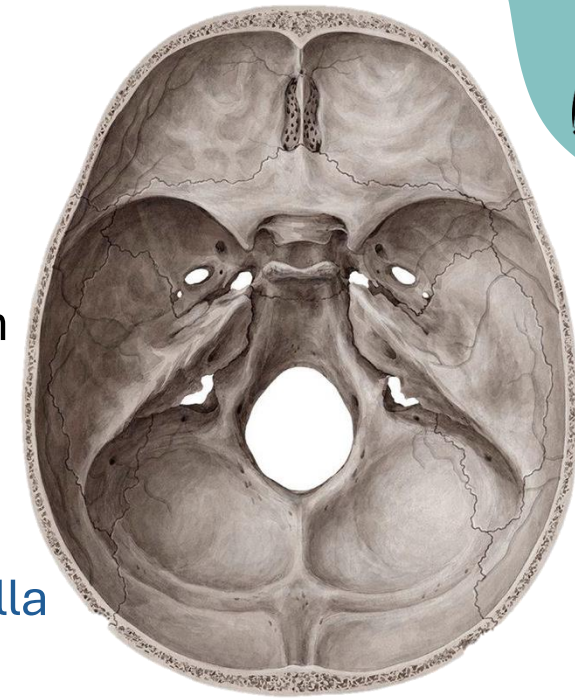
Cranial Nerves

➤ There are 12 pairs of cranial nerves (CNs) that arise from the brain and pass through foramina in the skull.

➤ The first two arise from the forebrain, and the remaining ten arise from the brainstem. (The olfactory nerve (CN I) and the optic nerve (CN II) are either moving in or out of the forebrain)

➤ The Brainstem consists of three structures: Midbrain, Pons, and Medulla Oblongata.

➤ All cranial nerves supply structures in the head and neck, except the 10th CN (vagus nerve), which also supplies organs in the thorax and abdomen.



A cranial nerve may contain motor fibers (motor nerve),

- sensory fibers (sensory nerve) or both (mixed nerve).
- The type of the sensory fibers and motor fibers might be **somatic** (voluntary muscles such as skeletal muscles) or might be **autonomic** (Involuntary such as smooth muscles) .

Cranial Nerves

- The CNS are named as follows:
Good mnemonic for the names

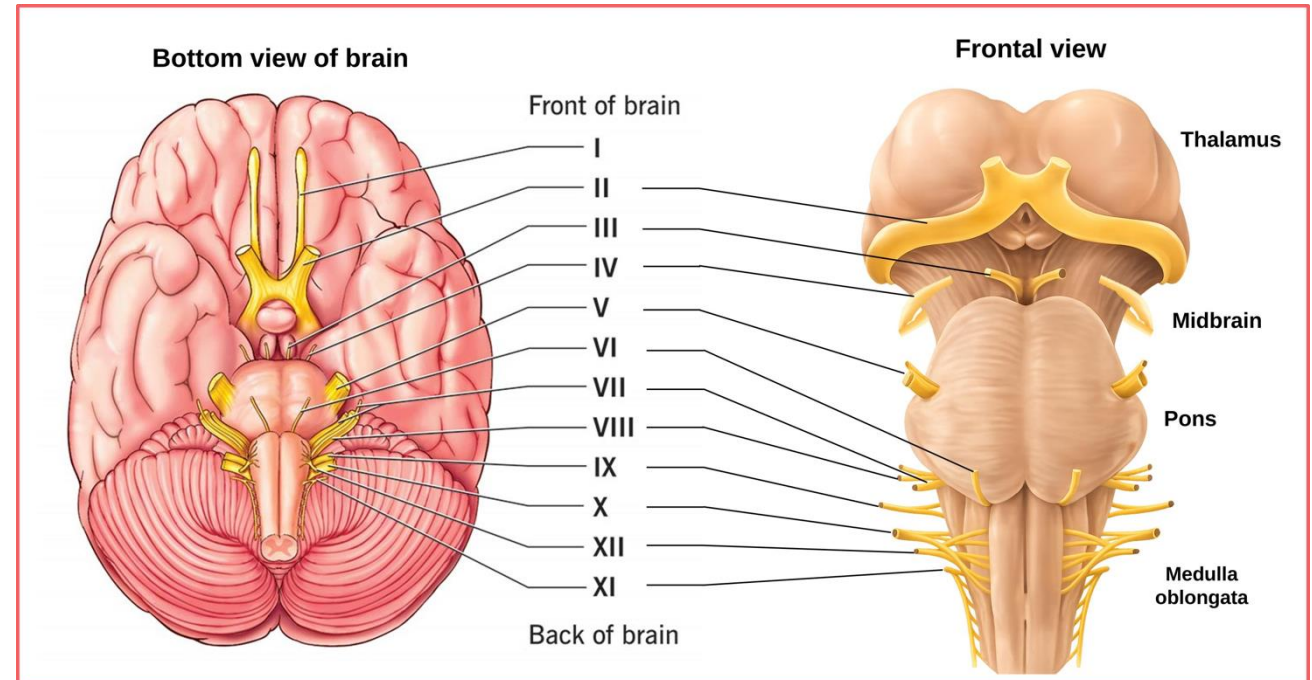
"Only One Of The Two Athletes Felt Very Good, Victorious, And Healthy"

1. Only = Olfactory
2. One = Optic
3. Of = Oculomotor
4. The = Trochlear
5. Two = Trigeminal
6. Athletes = Abducens
7. Felt = Facial
8. Very = Vestibulocochlear
9. Good = Glossopharyngeal
10. Victorious = Vagus
11. And = Abducens
12. Healthy = Hypoglossal



- I. **Olfactory Nerve.**
- II. **Optic Nerve.**
- III. **Oculomotor Nerve.**
- IV. **Trochlear Nerve.**
- V. **Trigeminal Nerve.**
- VI. **Abducens Nerve.**
- VII. **Facial Nerve.**
- VIII. **Vestibulocochlear Nerve.**
- IX. **Glossopharyngeal Nerve.**
- X. **Vagus Nerve.**
- XI. **Accessory Nerve.**
- XII. **Hypoglossal Nerve.**

Each nerve moves out from a particular foramen based on the nerve. (We will take it during the third year don't worry)



Good mnemonic for the functions in their right order

Some	————	Sensory	————	Olfactory
Say	————	Sensory	————	Optic
Marry	————	Motor	————	Oculomotor
Money	————	Motor	————	Trochlear
But	————	Both	————	Trigeminal
My	————	Motor	————	Abducens
Brother	————	Both	————	Facial
Says	————	Sensory	————	Vestibulocochlear
Bigger	————	Both	————	Glossopharyngeal
Brains	————	Both	————	Vagus
Matter	————	Motor	————	Accessory
Most	————	Motor	————	Hypoglossal

Cranial Nerves

1. Olfactory nerve

Type

- Sensory Nerve

Course

- Begins in the olfactory receptors in the roof of the nasal cavity, then fiber passes through the cribriform plate to enter the anterior cranial fossa.
- It ends in the olfactory bulb and continues as the olfactory tract, which terminates in the primary olfactory cortex in the medial temporal lobe.

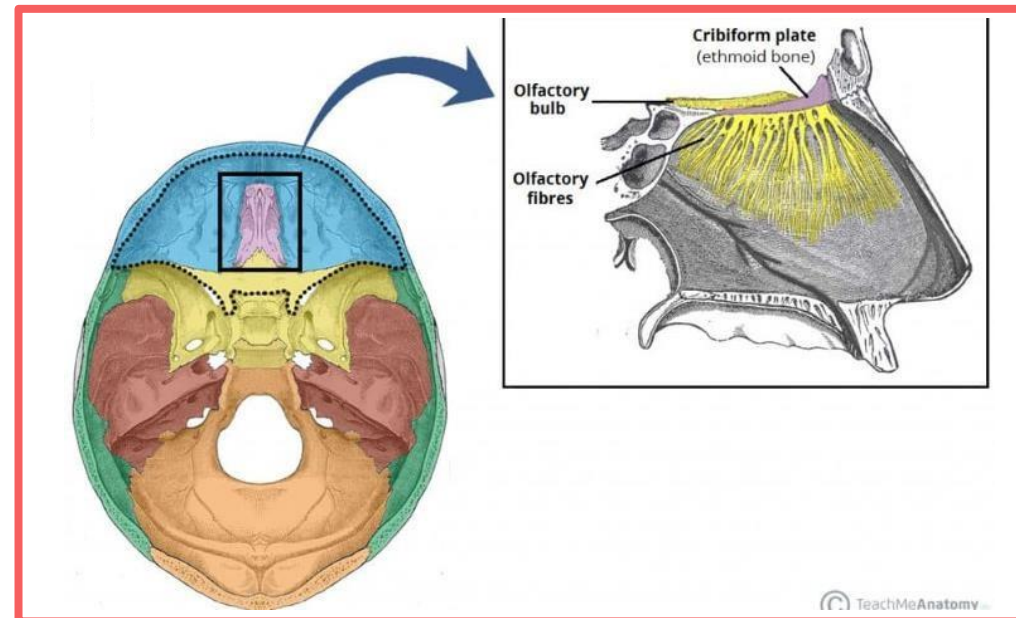
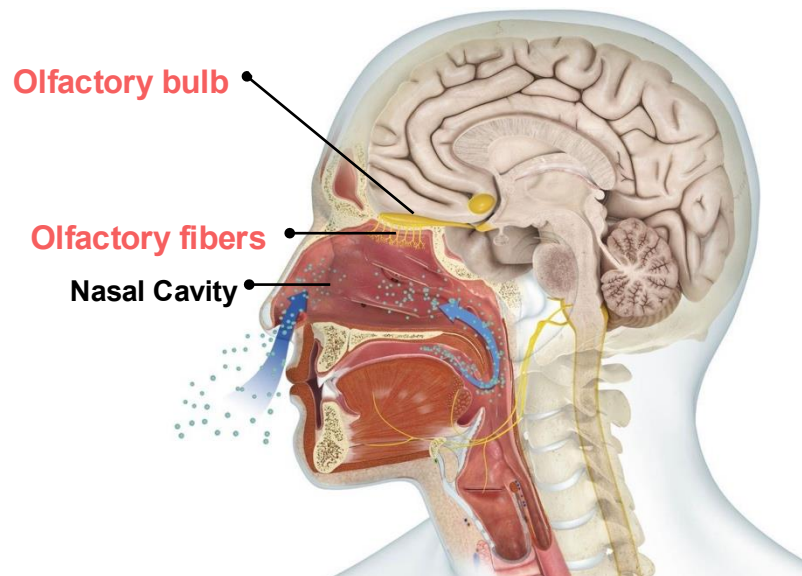
Function

- Carries the sense of smell from nasal cavity.

Olfactory fibers (bundles of fibers) range from 15 to 20 fibers.

Olfactory bulb : a swelling where the fibers will synapse with the olfactory nerve to move back to the temporal lobe.

Olfactory tract: transports action potential to the temporal lobe.

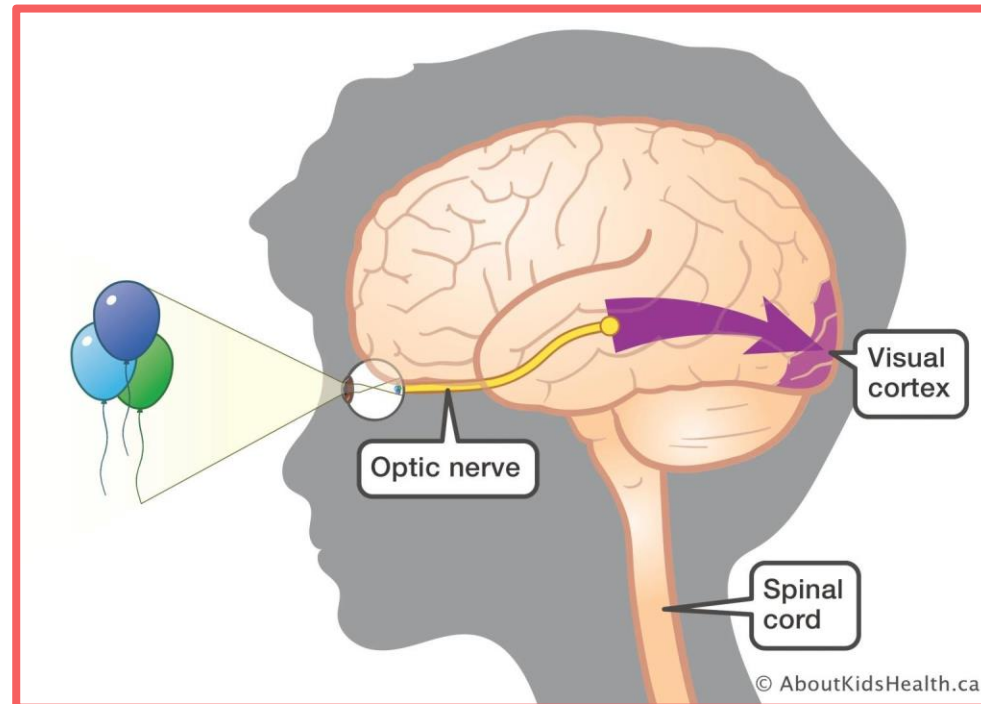


Cranial Nerves

2. Optic nerve

Type	<ul style="list-style-type: none">Sensory Nerve.
Course	<ul style="list-style-type: none">Arises from the retina of the eye, then passes posteriorly to enter the cranial cavity and terminates in the visual cortex in the occipital lobe.
Function	<ul style="list-style-type: none">Responsible for vision.

The optic nerve passes the posteriorly from the end of the retina and enters the middle cranial fossa, travelling posteriorly towards its final destination which is the visual cortex in the occipital lobe.

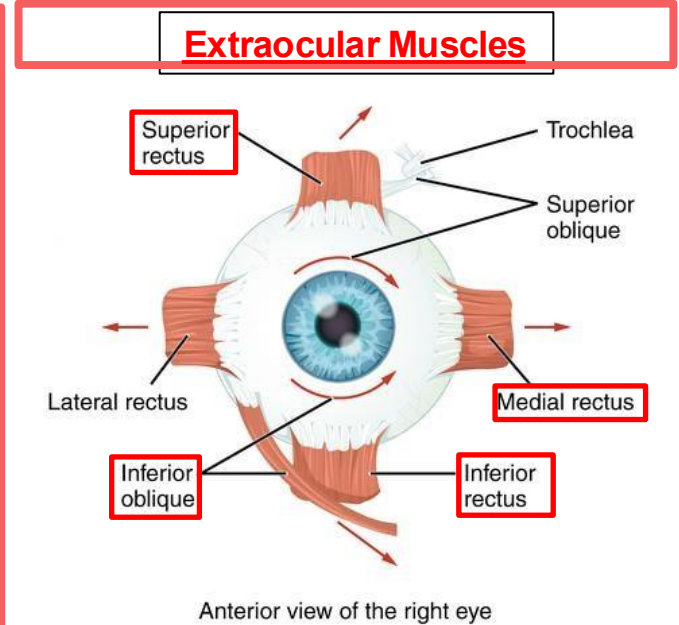
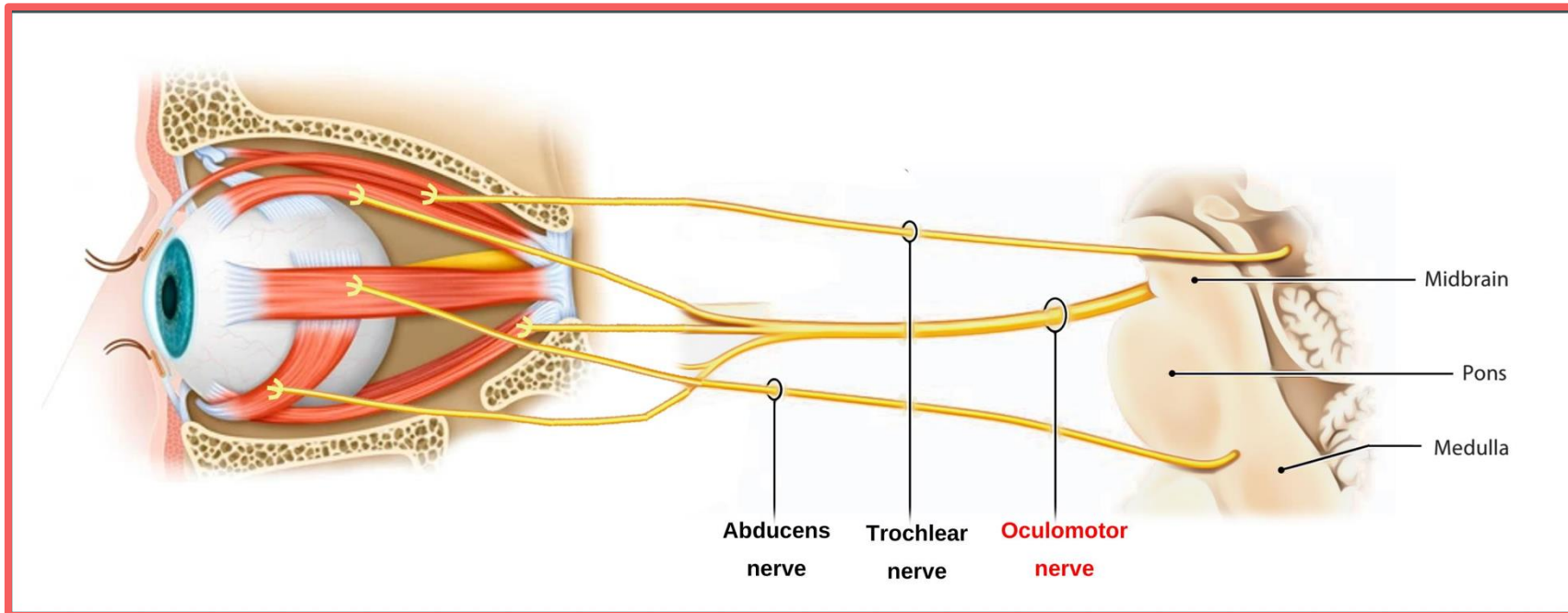


Cranial Nerves

3. Oculomotor Nerve

Type	<ul style="list-style-type: none"> Motor Nerve.
Course	<ul style="list-style-type: none"> Originates from the midbrain, then enters the orbital cavity to supply most of the extraocular muscles (muscles of the eye).
Function	<ul style="list-style-type: none"> Controls eye movements by supplying: Superior rectus (moves eye upward), Inferior rectus (moves eye downward), Medial rectus (moves eye medially), Inferior oblique (moves eye upward and laterally)

Usually CN III, CN IV, and CN VI are studied together because they control a group of muscles known as, extraocular muscles. Extraocular muscles are responsible for moving the eye in different directions. Rectus means straight line, meaning the muscles are straight.

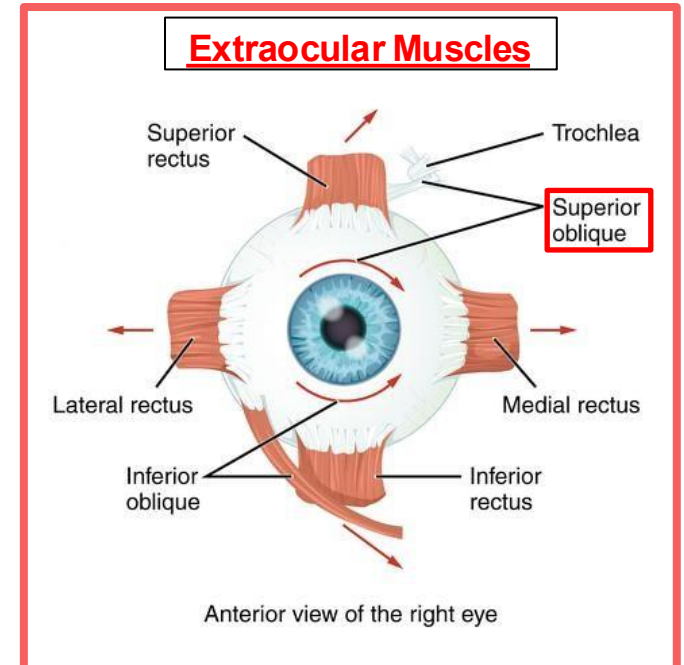
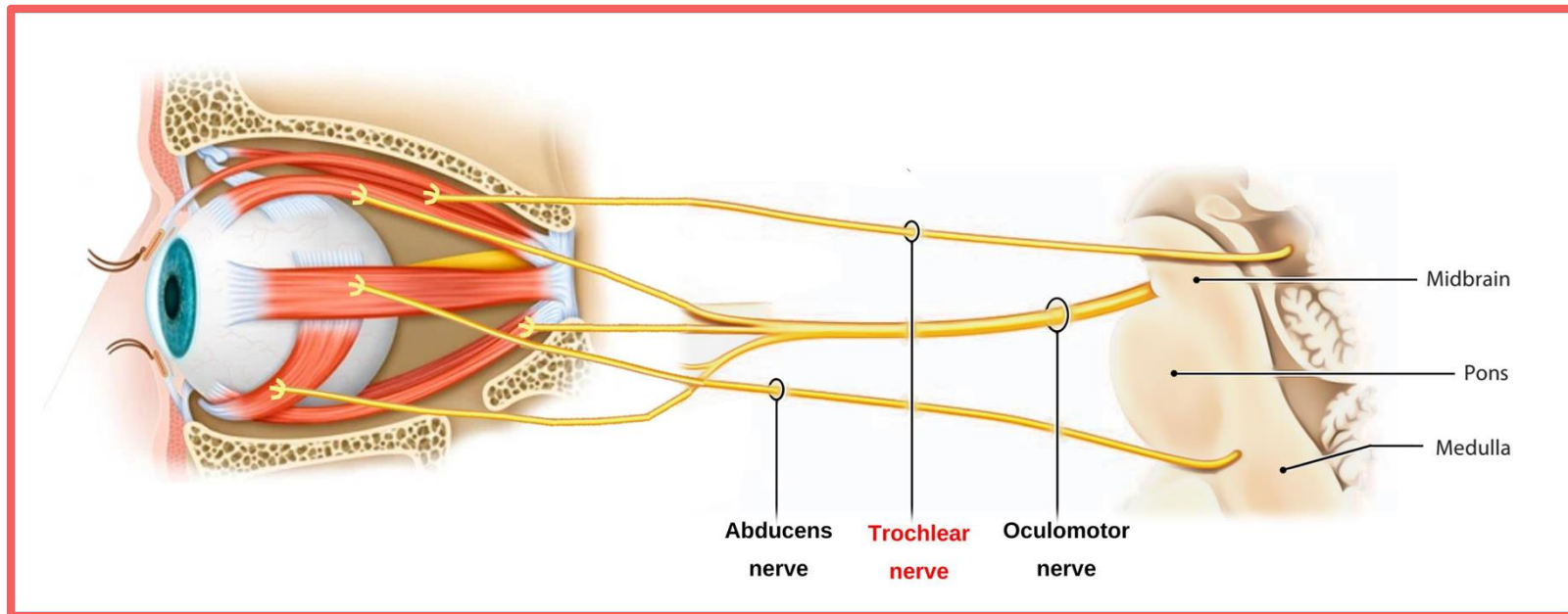


Cranial Nerves

4. Trochlear Nerve

Type	<ul style="list-style-type: none"> Motor Nerve.
Course	<ul style="list-style-type: none"> Originates from the midbrain, then enters the orbital cavity to supply the superior oblique muscle.
Function	<ul style="list-style-type: none"> Controls eye movement by supplying the <u>Superior oblique muscle</u> (moves the eye downward and laterally).

SO4 : Superior Oblique muscle supplied by the CN IV.

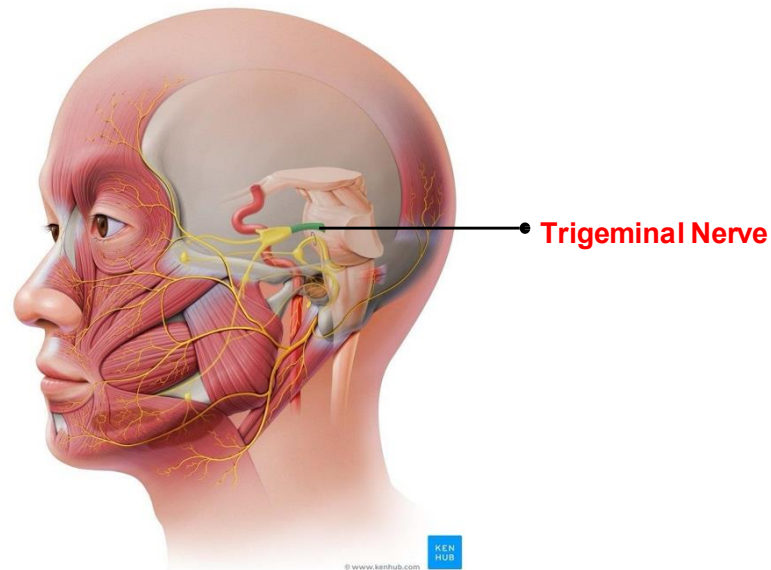


Cranial Nerves

5. Trigeminal Nerve

Type	<ul style="list-style-type: none"> Mixed nerve (motor and sensory).
Course	<ul style="list-style-type: none"> Originates from the pons and divides into 3 branches: V1 (ophthalmic), V2 (maxillary), and V3 (mandibular). These branches exit the cranial cavity to supply the head and face
Function	<ul style="list-style-type: none"> Carries sensory information from the head and face. Provide motor supply to the muscles of mastication.

- **V1 (Ophthalmic) :V1 (Ophthalmic branch):** This branch carries purely sensory fibers that provide sensation to the forehead, scalp, upper eyelid, and nose. It mainly supplies the orbital region and upper part of the face. **Supplies the area around the orbital cavities**
- **V2 (Maxillary branch):** This branch is also purely sensory, transmitting sensation from the midface, including the cheeks, upper lip, nasal cavity, and upper teeth. It exits through the foramen rotundum to reach these areas. **Supplies the area around the maxillae.**
- **V3 (Mandibular branch):** This branch is mixed, carrying both sensory and motor fibers. It provides sensation to the lower face, jaw, and tongue, while also supplying motor innervation to the muscles of mastication. **Supplies the area around the mandible.**



Originates from the **pons** = the nucleus or cell body (Soma) is in the pons.

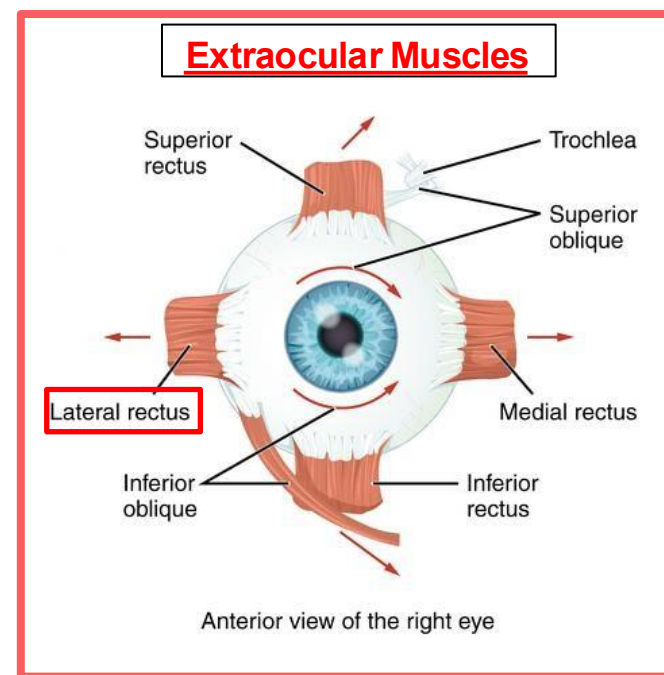
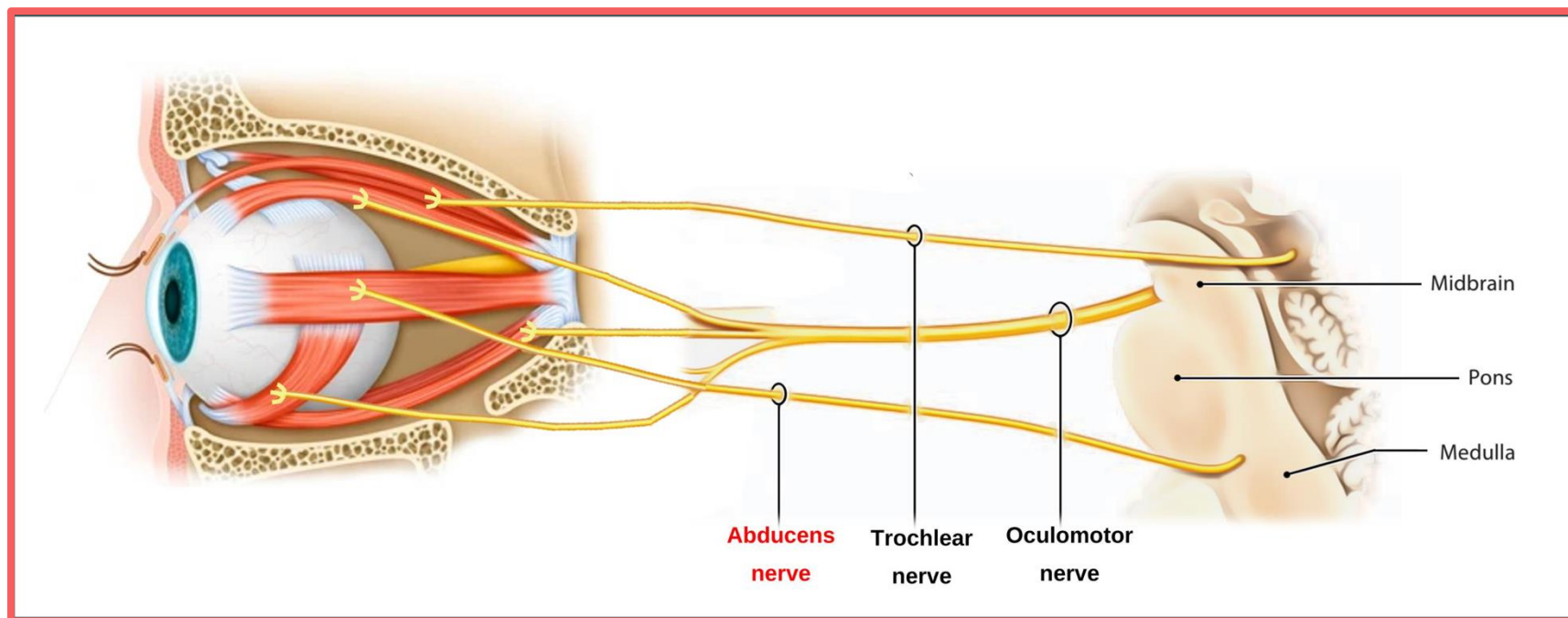
Cranial Nerves

There is a junction between the Pons and the Medulla Oblongata known as: **Pontomedullary Junction**.

6. Abducens Nerve

Type	<ul style="list-style-type: none"> Motor Nerve.
Course	<ul style="list-style-type: none"> Originates from the pontomedullary junction, then enters the orbital cavity to supply the lateral rectus muscle.
Function	<ul style="list-style-type: none"> Controls eye movement by supplying the lateral rectus muscle (moves the eye laterally).

LR6: Lateral Rectus Muscle supplied by CN VI.

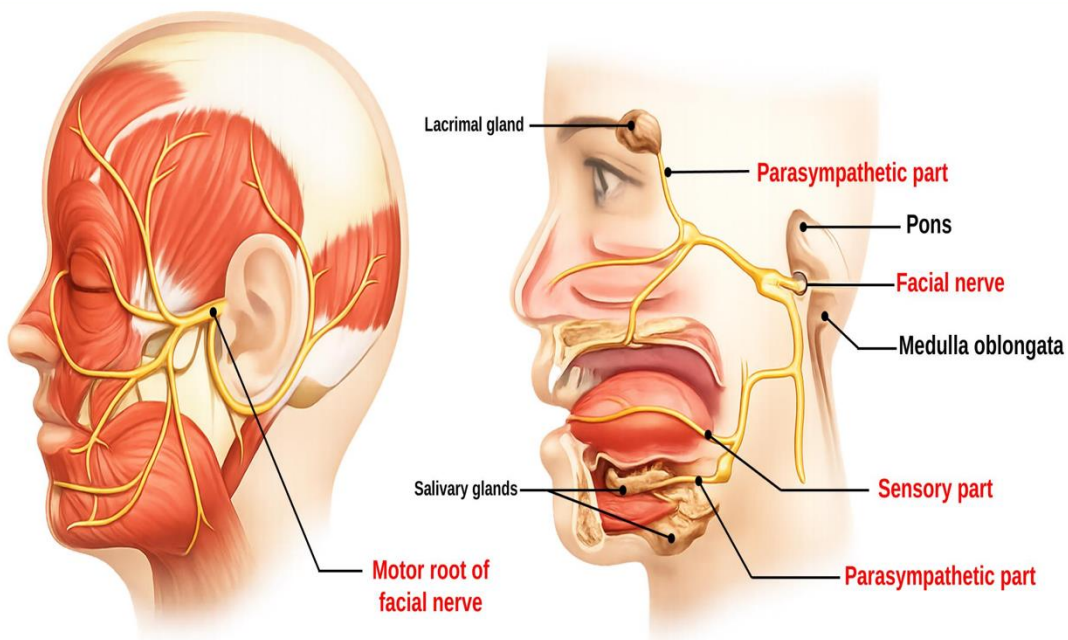


Cranial Nerves

7. Facial Nerve

Type	<ul style="list-style-type: none"> Mixed nerve (motor and sensory)
Course	<ul style="list-style-type: none"> Originates from the pontomedullary junction, exits the cranial cavity, and ends in the face.
Function	<ul style="list-style-type: none"> Carries taste sensations from the anterior two-thirds of the tongue. Provides motor supply to the muscles of facial expression. Provides parasympathetic supply to the submandibular and sublingual glands, and lacrimal gland. Increases the secretion of the saliva to promote digestion.

Muscles that allow you to smile, close your eye, or blow air into an area to let it appear swollen are all motor-supplied by the CN VII (Facial Nerve.)



Extra Information: Facial nerve disorders refer to conditions that affect the facial nerve, also known as the seventh cranial nerve. This nerve is responsible for controlling the muscles in your face and plays a vital role in facial expressions, taste sensations, and tear and saliva production. Facial nerve disorder symptoms, such as weakness or paralysis, may develop because of a stroke, surgery, trauma, viral infection, or tumor formation. Getting treatment as quickly as possible after symptoms begin can help prevent complications and improve outcomes for individuals with facial nerve disorders.

Types of facial nerve disorders include:

- **Bell's palsy:** A sudden weakness or paralysis of the facial muscles on one side of the face, it's often temporary and can result from inflammation, compression, or damage to the facial nerve.
- **Facial nerve compression:** Conditions like hemifacial spasm or trigeminal neuralgia can result in compression of the facial nerve, leading to involuntary muscle spasms, twitching, or pain.
- **Facial nerve trauma:** Any trauma to the head or face, such as fractures or surgical procedures, can damage the facial nerve and lead to weakness or paralysis of facial muscles.
- **Facial spasms:** This unexpected facial muscle twitching is caused by irritated nerves or pressure from blood vessels in the brain.
- **Neuroma:** A slow-growing tumor that can compress or invade the facial nerve, it causes facial weakness or paralysis. It's also referred to as schwannoma.
- **Ramsay Hunt syndrome:** Pain and blistering in and around the ear and ear canal, it happens when the facial nerve near one of the ears gets affected by a shingles outbreak.

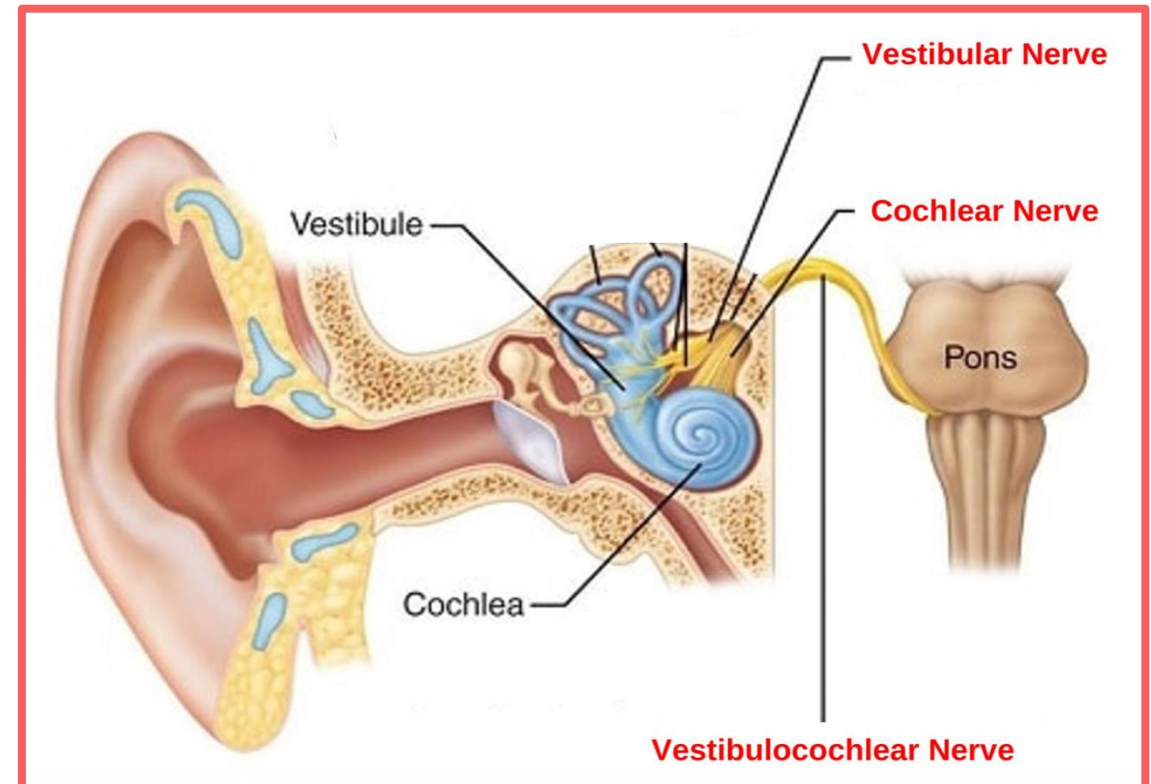
Cranial Nerves

8. Vestibulocochlear Nerve: 2 in 1 nerve

Type	<ul style="list-style-type: none"> Sensory Nerve.
Course	<ul style="list-style-type: none"> Arises from the cochlea and vestibular apparatus of the inner ear, then enters the cranial cavity to terminate at the pontomedullary junction.
Function	<ul style="list-style-type: none"> Responsible for hearing (cochlear part) and balance (vestibular part).

There are two apparatus in the inner ear: Vestibule (responsible for providing balance) and cochlea (responsible for hearing). The nerve coming out from the vestibule is known as, Vestibular Nerve. The nerve coming out from the cochlea is known as, Cochlear Nerve, The Vestibular Nerve is going to unite with the Cochlear Nerve to form the Vestibulocochlear Nerve.

That is why it is called a 2 in 1 nerve.



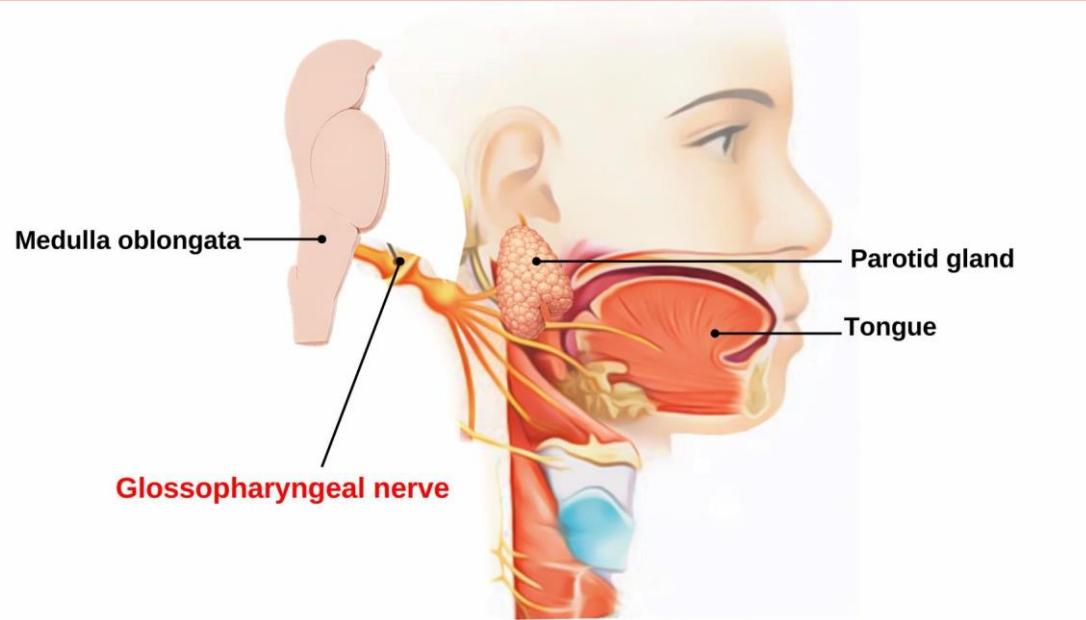
Cranial Nerves

9. Glossopharyngeal Nerve

Type	<ul style="list-style-type: none"> Mixed nerve (motor and sensory)
Course	<ul style="list-style-type: none"> Originates from the medulla oblongata and ends in the tongue and pharynx.
Function	<ul style="list-style-type: none"> Carries taste sensations from the posterior one-third of the tongue. Provides motor supply to a muscle of the pharynx (stylopharyngeus muscle) that assists in swallowing Provides parasympathetic supply to the parotid gland.

Glosso : Tongue
Pharyngeal : Pharynx

The Pharynx is a tube made up of 6 muscles. The Glossopharyngeal nerve supplies the stylopharyngeus muscle.



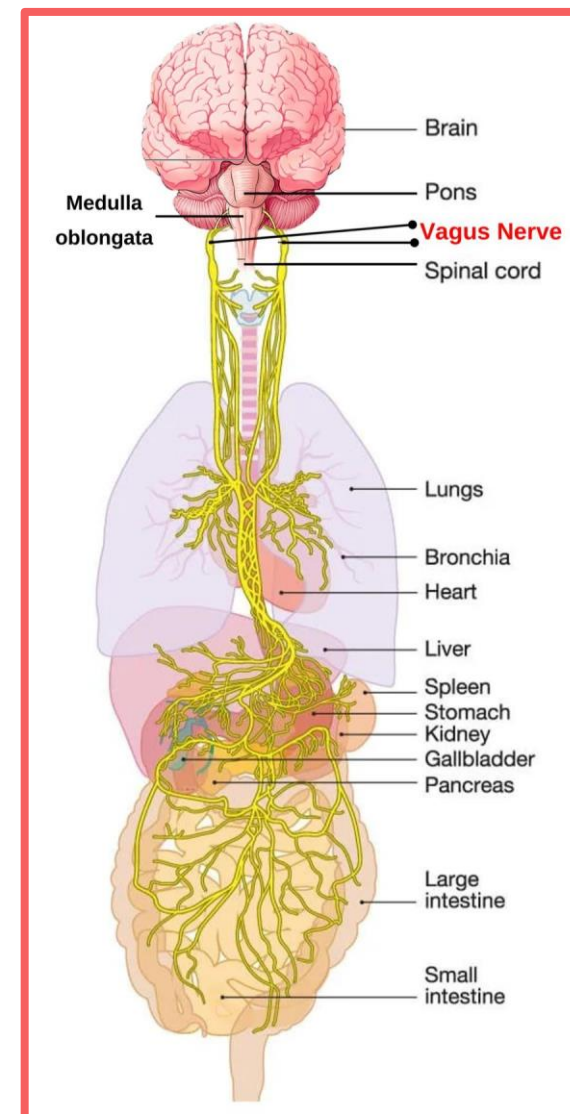
Cranial Nerves

10. Vagus Nerve

Type	<ul style="list-style-type: none"> • Mixed nerve (motor and sensory).
Course	<ul style="list-style-type: none"> • Originates from the medulla oblongata, exits the cranial cavity, and travels through the neck to the thorax and abdomen.
Function	<ul style="list-style-type: none"> • Carries sensory information from the larynx and gastrointestinal tract. • Provides motor supply to the muscles of the larynx (voice). • Provides motor supply to the muscles of the pharynx (swallowing), except the stylopharyngeus. • Provides parasympathetic supply to thoracic (heart and lungs) and abdominal viscera.

The **Vagus Nerve** provides motor supply to the muscles of the larynx in order to move the vocal cords to produce sound (voice).

Provides parasympathetic supply to thoracic (heart and lungs) by decreasing the heart rate, and by inducing bronchoconstriction (tightening of airway muscles. Abdomen: Increase peristalsis. Parasympathetic = rest and digest = body wants to move and process food efficiently. Parasympathetic (via vagus nerve) releases Acetylcholine. Acetylcholine acts on M3 receptors which stimulates mucus production.



11. Accessory Nerve

Type

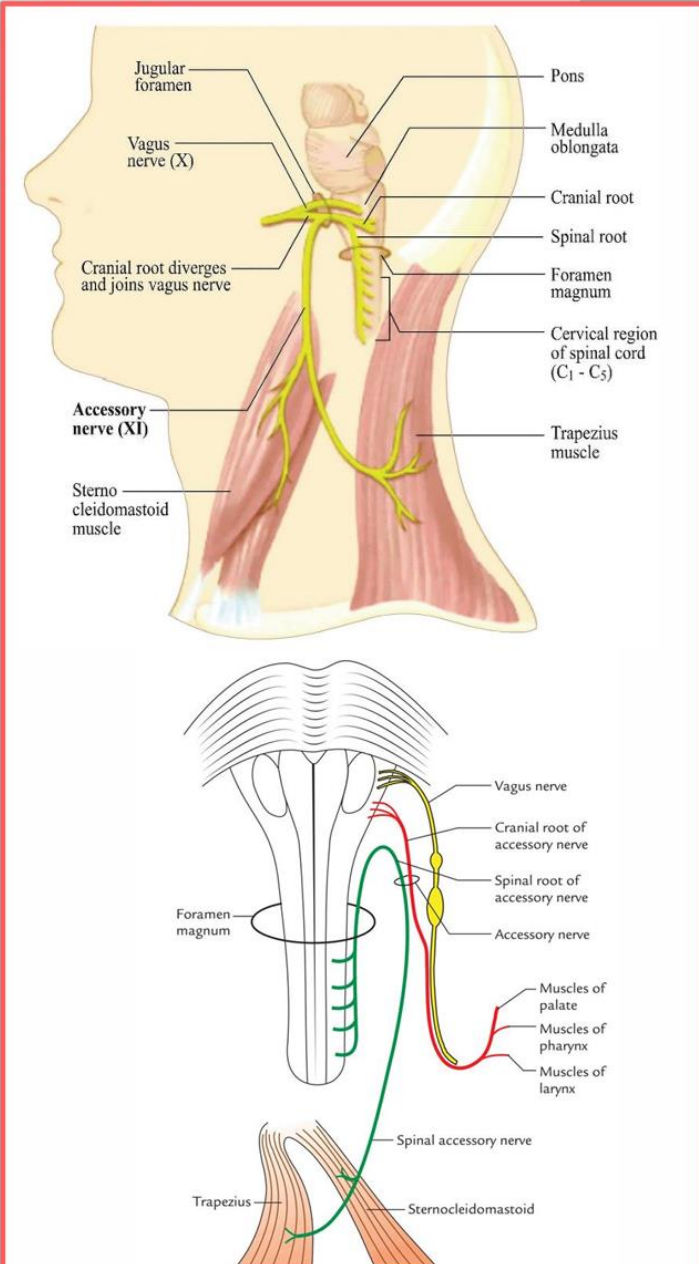
- Motor Nerve.

Course

- Consists of two roots: **cranial** and **spinal**.
- **The spinal root** originates from the spinal cord (C1–C5) and ascends through the foramen magnum to enter the cranial cavity.
- **The cranial root** originates from the medulla oblongata.
- Within the cranial cavity, the two roots briefly unite and then exit the skull together.
- Shortly after, they separate: the cranial root joins the vagus nerve, while the spinal root continues independently as the accessory nerve.

Function

- The spinal root supplies the sternocleidomastoid and trapezius muscles.
- The cranial root joins the vagus nerve and is distributed to muscles of the palate, pharynx, and larynx.



Why is the **accessory nerve** called so? Because the cranial root helps the vagus nerve in its motor function.

Cranial Nerves

12. Hypoglossal Nerve

Type

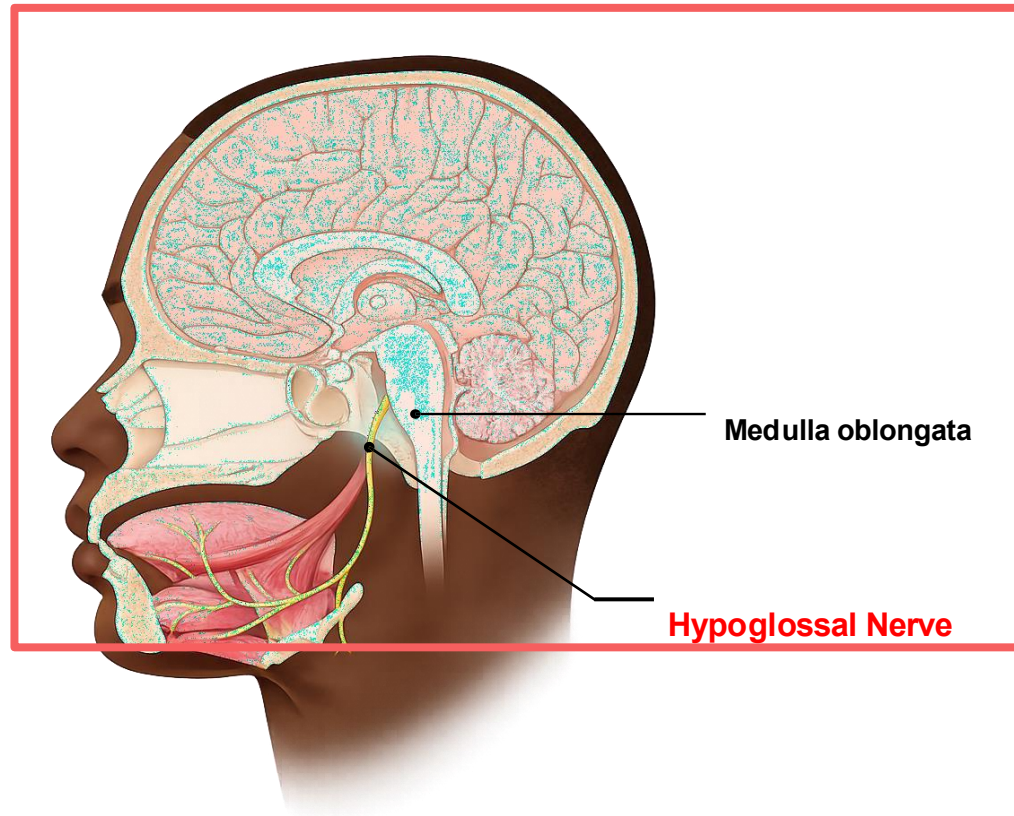
- **Motor Nerve**

Course

- **Originates from the medulla oblongata, exits the cranial cavity, and ends in the muscles of the tongue.**

Function

- **Controls tongue movements.**



Time to test your knowledge!

<https://forms.gle/2YqdNfaijwUYfqby9>

رسالة من الفريق العلمي:

تفسير السعدي:

والتذكير نوعان:

تذكير بما لم يعرف تفصيله، مما عرف مجمله بالفطر والعقول فإن الله فطر العقول على محبة الخير وإيثاره، وكرهه الشر والزهد فيه، وشرعه موافق لذلك، فكل أمر ونهي من الشرع، فإنه من التذكير، وتمام التذكير، أن يذكر ما في الأمور به، من الخير والحسن والمصالح، وما في المنهي عنه، من المضار

تذكير بما هو معلوم للمؤمنين، ولكن: والنوع الثاني من التذكير انسحبت عليه الغفلة والذهول، فيذكرون بذلك، ويكرر عليهم ليرسخ في أذهانهم، وينتبهوا ويعملوا بما تذكروه، من ذلك، وليحدث لهم نشاطاً وهمة، توجب لهم الانتفاع والارتفاع

{وَذَكِّرْ فَإِنَّ الذِّكْرَى تَنْفَعُ الْمُؤْمِنِينَ }

سُبْحَانَ اللَّهِ -

الْحَمْدُ لِلَّهِ -

لَا إِلَهَ إِلَّا اللَّهُ -

اللَّهُ أَكْبَرُ -

أَسْتَغْفِرُ اللَّهَ -

لَا حَوْلَ وَ لَا قُوَّةَ إِلَّا بِاللَّهِ -

سُبْحَانَ اللَّهِ وَ بِحَمْدِهِ -

سُبْحَانَ اللَّهِ الْعَظِيمِ -

اللَّهُمَّ صَلِّ وَسَلِّمْ عَلَى نَبِيِّنَا مُحَمَّدٍ -

For any feedback, scan the code or click on i



Corrections from previous versions:

Versions	Slide # and Place of Error	Before Correction	After Correction
V0 → V1			
V1 → V2			