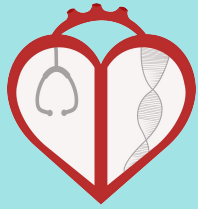




**Anatomy Team**  
**MED 439**



**MED439**  
KING SAUD UNIVERSITY

# Dr Essam Review

CNS Block

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Don't forget to check the [Editing File](#)

Color index:

Content  
**Important**  
Doctors notes  
Extra information, explanation

(: ملاحظه بسيطه  
في الملف هذا حطينا الاشياء المهمه اللي قالها الدكتور  
**لاااااا** تعتمدون عليه بالذاكره ، هذا فقط للمراجعة  
بليز .  
بالتوفيق ان شاء الله  
وقت الاختبار **لا اصيد اللي يذاكر منه**



# Lecture 3: The Sensory tract ( ascending tract )

## Dorsal Column

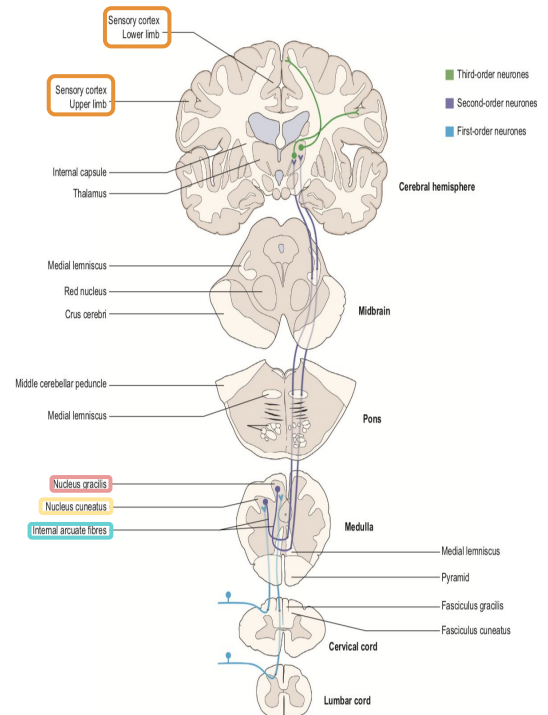
- Composed of two tracts:  
**Fasciculus Gracilis (FG)** (received at sacral , lumbar & lower thoracic levels) & **Fasciculus Cuneatus (FC)** (received at upper thoracic & cervical levels)
- They Carry the axons of primary afferent neurons that have entered cord through dorsal roots of spinal nerves, from ipsilateral side of the body
- They are concerned with:**
  - Discriminative Touch:** Ability to localise accurately the area of the body touched.
  - Two Point Discrimination:** To be aware that two points are touched simultaneously even they are close together.
  - Proprioception:** from muscles and joints for the movement & knowing the position of different parts of the body

The medial lemniscus terminates in the **Ventral Posterior Nucleus of the Thalamus** (3rd order neurons), which project to the **somatosensory cortex** (thalamocortical fibers)

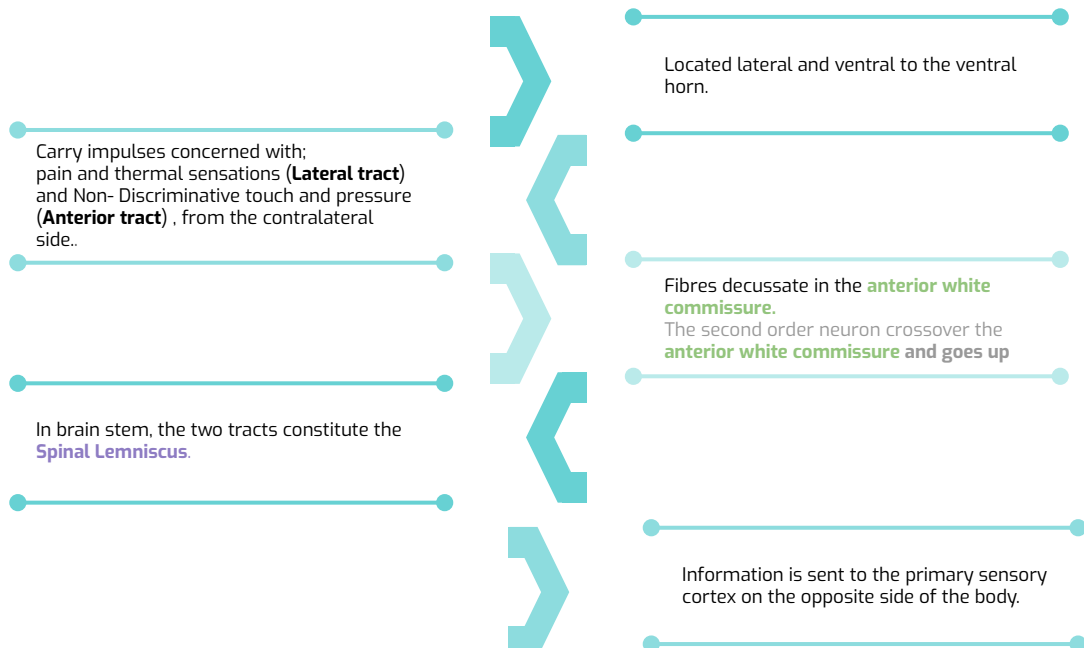
The axons of the 2nd order neurons decussate (cross over) in the medulla as **Internal Arcuate Fibers** and ascend through the brainstem as Medial Lemniscus.

1st order Fibers ascend without interruption where they terminate upon 2nd order neurons in **Nucleus Gracilis** and **Nucleus Cuneatus**.

As first order neurons ascend, they stay at the Ipsilateral side



The **spinothalamic tracts** contain axons of **second-order neurons**, the cell bodies of which lie in the **contralateral dorsal horn**.



## Lateral spinothalamic tract

### FUNCTION:

- Carries pain & Temperature to thalamus and sensory area of the cerebral cortex.

### 3 Neurons are involved:

- Neuron I:** Small cells in the dorsal root ganglia. (First order neurons)
- Neuron II:** Cells of **substantia gelatinosa** of Rolandi in the (contralateral) posterior horn. (2nd order neurons. After 2nd order neurons the fibers decussate then ascend and are called lateral spinothalamic tract)
- Dr's note:** after it the crossing happens so when you have pain in your right side the left side of your brain receives the sensation
- Neuron III:** Cells of (VP) nucleus of the thalamus. ( then continue till the somatosensory cortex of the cerebral )

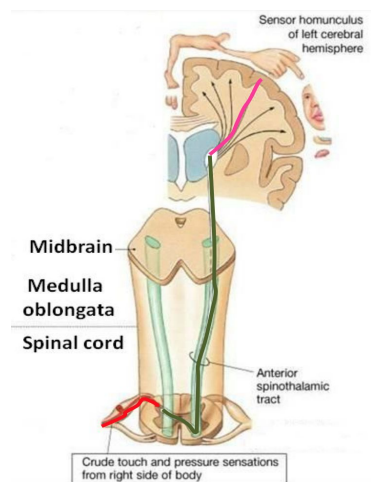
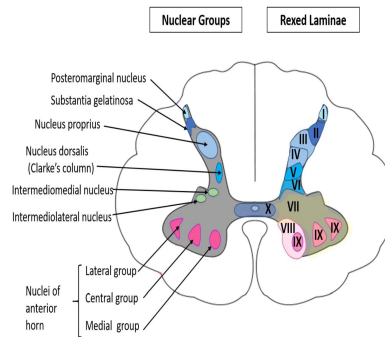
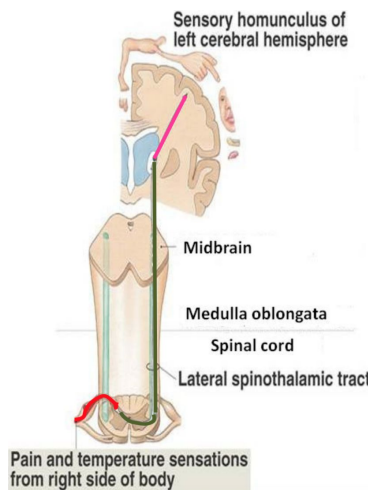
## Anterior Spinothalamic Tract

### FUNCTION:

- Carries Light, Crude Touch (non discriminative) & Pressure to thalamus and sensory cortex.

### 3 Neurons are involved:

- Neuron I:** Medium sized cells in the dorsal root ganglia. **Girls doctor:** the size of cells is not that important.
- Neuron II:** Cells of main sensory nucleus or (**Nucleus Proprius**). Fibers arising from Substantia Gelatinosa & Nucleus Proprius decussate in the Anterior White Commissure ( then ascend as anterior spinothalamic tract )
- Neuron III:** Cells of VP nucleus of thalamus.



## Spinocerebellar Tracts

The spinocerebellar system consists of a sequence of only two neurons;

- Neuron I:** Large cells of dorsal root ganglia.
- Neuron II:** Cells of the nucleus dorsalis; **Clark's nucleus (column)**

### Two tracts: Dorsal & Ventral

- Located near the dorsolateral and ventrolateral surfaces of the cord
- Contain axons of the second order neurons
- Carry unconscious information derived from **muscle spindles, Golgi tendon organs, tactile receptors, joints, skin and subcutaneous tissue** to the cerebellum for the control of posture and coordination of movements.
- ( Cerebellum controls the same side of the body )

## Posterior Spinocerebellar Tract

Present only above level L3

- The cell bodies of 2nd order neuron lie in **Clark's column**
- Axons of 2nd order neuron terminate ipsilaterally** (uncrossed) in the cerebellar cortex by entering through the **inferior cerebellar peduncle**.
- Posterior spinocerebellar tract** convey sensory information to the same side of the cerebellum

## Ventral ( Anterior ) Spinocerebellar Tract

- The cell bodies of the **2nd order neuron** lies in base of the dorsal horn of the lumbosacral segments.
- Axons of the 2nd order neuron cross to opposite side, ascends as far as the midbrain the make a sharp turn caudally and enter the superior cerebellar peduncle.**
- The fibers cross the midline for a second time within cerebellum before it terminates in the cerebellar cortex.**
- So **ventral spinocerebellar tract** conveys sensory information to the same side of the cerebellum.

# Lecture 6: Internal Structures of the Brainstem

**Dr note : which of the following in the open,close etc:**

## Caudal (Closed) Medulla

- 1-Traversed by the central canal
- 2-Motor **decussation** (decussation of the pyramids)  
Also called corticospinal decussation
- 3-Trigeminal sensory nucleus

## Mid Medulla

- 1-Traversed by the central canal
- 2-Larger size **Gracile & Cuneate** nuclei, concerned with proprioceptive deep sensations of the body.
- 3-Axons of **Gracile & Cuneate** nuclei form the internal arcuate fibers; decussating forming **Sensory Decussation**

## Rostral (Open Medulla) 1-Nuclei

(beneath the floor of the 4th ventricle except 1,2)

### 1-Inferior Olivary Nucleus

It is concerned with the control of movement

### 2-Cochlear nuclei

concerning with hearing

### 3-Hypoglossal Nucleus

### 4-Dorsal vagal nucleus

contains preganglionic parasympathetic fibers.

### 5-Solitary nucleus

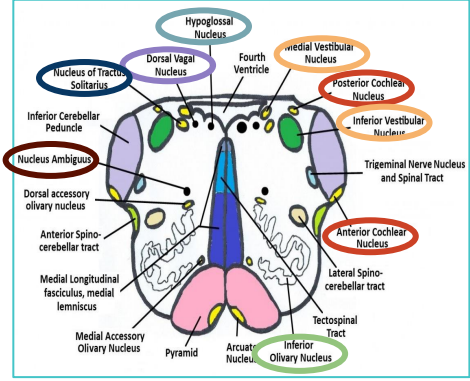
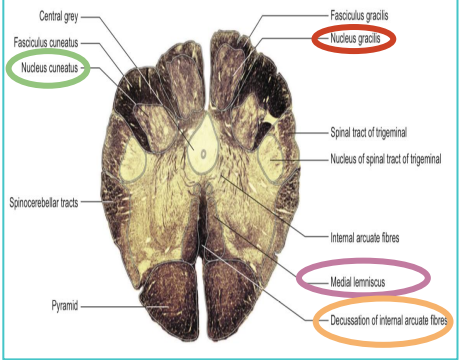
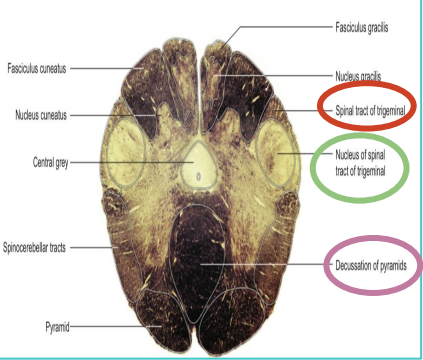
(sensory nucleus) receive taste sensation from the tongue along the 7th, 9th 10th CN

### 6- Vestibular nuclei complex

concerned with equilibrium

### 7- Nucleus Ambiguus

(motor nucleus) lies dorsal to olivary nucleus and gives motor fibers along 9th & 10th CN to Muscles of the pharynx, larynx & palate.



## Caudal part of the Pons

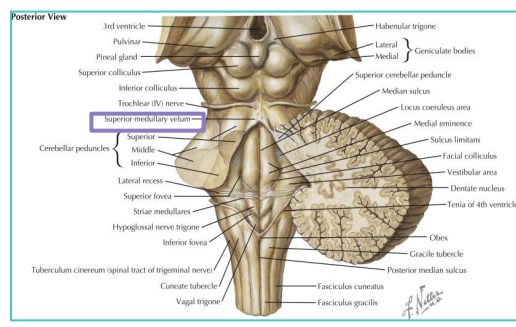
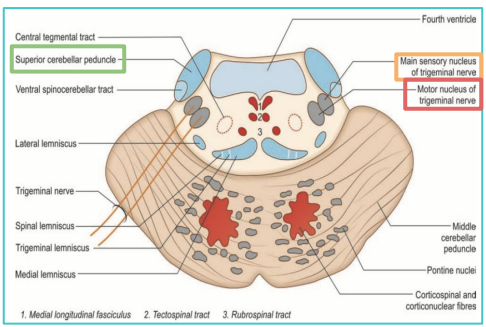
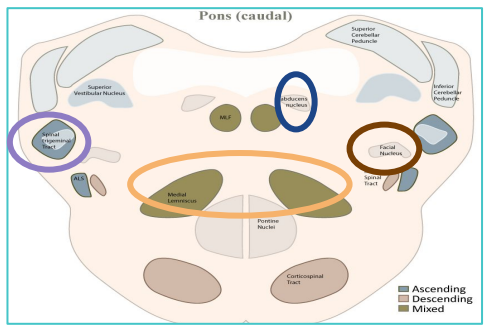
- 1-Pontine nuclei.
- 2-The ascending fibres of the **Medial lemniscus**
- 3-Bundles of **corticospinal** & corticonuclear fibres (Pyramidal fibres)
- 4-Spinal tract & nucleus of **Trigeminal**.
- 5-Deep origin of cranial nerve nuclei:
  - **Abducent nucleus**
  - **Facial motor nucleus**

## Mid pons ( At the level of the trigeminal nerve ) :

- 1- **Motor nucleus of the trigeminal nerve:** Lies in the lateral part of the floor of the 4th ventricle.
- 2- **Main sensory nucleus of the trigeminal nerve:** it lies lateral to the motor nucleus.
- 3- **Superior cerebellar peduncles** form the lateral boundary of the 4th ventricle

## Rostral Pons

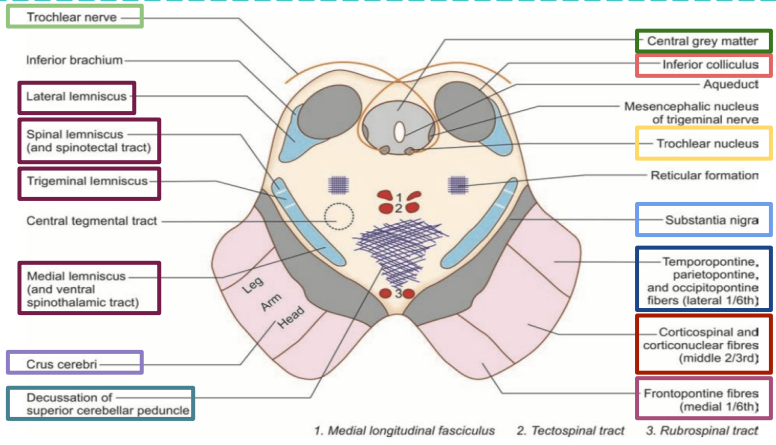
- 1- **Superior cerebellar peduncles .**
- 2- **Superior Medullary Velum:** Passes between the two peduncles & forms the roof of the 4th ventricle.
- 3- **Medial longitudinal fasciculus:** Lies close to the midline beneath the floor of the 4th ventricle



# Lecture 6: Internal Structures of the Brainstem - Midbrain

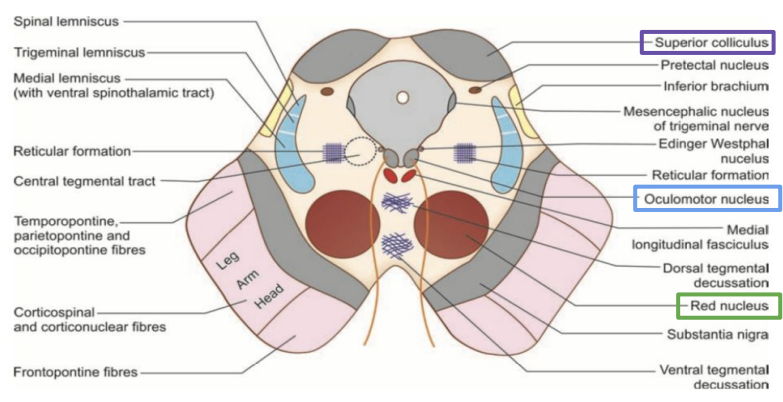
## Inferior Colliculus Level :

- **Inferior colliculus** is a large nucleus of gray matter that lies beneath a corresponding surface elevation.
  - It is part of the **auditory pathway**. It receives fibers from the **lateral lemniscus**. Its efferent fibers pass to the thalamus
- 1- Trochlear nucleus:** lies in the **central gray matter** close to the median plane. The fibers of the **trochlear nerve** decussate and emerge from posterior surface of midbrain.
- 2- Decussation of the superior cerebellar peduncles lies in the midline.**
- 3- Ascending Lemnisci :** composed of Medial, lateral & Spinal lemniscus (Lateral & anterior spinothalamic tracts), and Trigeminal (Lateral & medial).
- 4- Substantia nigra :** Occupies the most ventral part of the tegmentum. It consists of a pigmented, melanin neurons . It projects to the basal ganglia (basal ganglia is responsible for voluntary movements). **Its degeneration (Pars Compacta) is associated with Parkinson's disease.**
- 5- Crus cerebri :** It is a massive mass ventral to the substantia nigra. It consists entirely of descending cortical efferent fibers (**Frontopontine, Corticospinal & corticobulbar and Temporopontine Fibres**) to the motor cranial nerve nuclei and to anterior horn cells of spinal cord. **Involved in the coordination of movement . Present in both levels of colliculi.**



## Superior Colliculus Level :

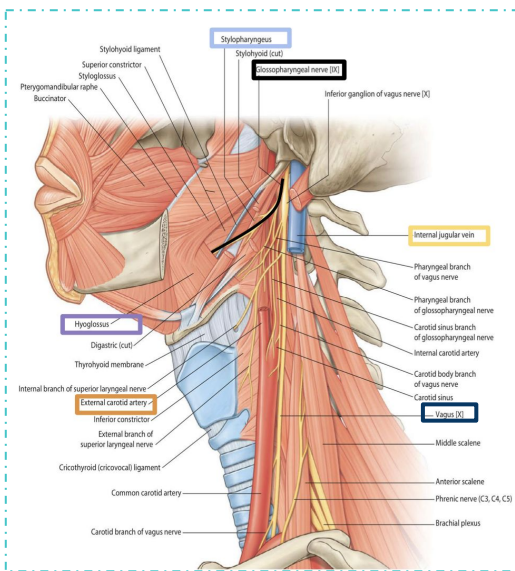
- Superior colliculus** is a large nucleus of gray matter that lies beneath corresponding elevation.
- It forms part of the **visual reflexes**.
  - Its efferent fibers go to the anterior horn cells & to **cranial nuclei 3, 4, 6, 7 & 11**.
  - It is responsible for the **reflex movements of the eyes**, head and neck in response to **visual stimuli**
- 1- Oculomotor nucleus:** Situated in the central gray matter. The fibers of the oculomotor nerve pass anteriorly through the **red nucleus** to emerge on the medial side of the crus cerebri (**In interpeduncular fossa**)
- 2- Red nucleus :** A rounded mass of gray matter that lies in the central portion of the tegmentum. Its red coloration is due to its vascularity and the presence of an iron containing pigment in the cytoplasm of its neurons. **It is involved in motor control**



# Lecture 8: CN 9 & 10

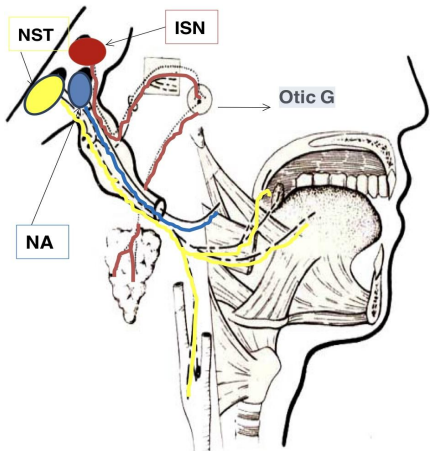
## Glossopharyngeal Nerve is a **mixed nerve** Superficial attachment

- It arises from the ventral aspect of the medulla by a linear series of small rootlets, in groove **between olive and inferior cerebellar peduncle**.
- It leaves the cranial cavity by passing through the **jugular foramen** in company with the **Vagus**, and the **Accessory nerves** and the **Internal jugular vein**.



## Components of the Fibers & Deep Origin

Type of fibers	Nuclei	Structure innervated
SVE fibers Special visceral efferent	<b>Nucleus ambiguus (NA)</b>	<b>Supply stylopharyngeus muscle</b>
GVE fibers: General Efferent Visceral	<b>Inferior salivatory nucleus (ISN).</b>	<b>Parasympathetic</b> Relay in otic ganglion. the postganglionic fibers supply <b>parotid gland</b> .
SVA fibers Special Visceral afferent	<b>Nucleus of solitary tract (NST).</b>	Originate from the cells of inferior ganglion, their 1- Central processes terminate in (NST). 2- Peripheral processes carry sensation from the <b>taste buds on posterior third of tongue</b> .
GVA fibers: General Visceral Afferent		Carry visceral sensation from mucosa of <b>posterior third of tongue, pharynx, auditory tube, tympanic cavity and carotid sinus</b> .



# Lecture 8: CN 9 & 10

## Branches

**1 Tympanic:**  
gives secretomotor to the **parotid gland**

**4 Tonsillar**

**2** Nerve to **Stylopharyngeus** muscle.  
**MOTOR ONLY**

**5 Lingual**  
Carries sensory branches, general and special (taste) from the posterior third of the tongue.

**3 Pharyngeal:**  
To the mucosa of pharynx .

**6** **Sensory** branches from the **carotid sinus and body** (pressoreceptors and chemoreceptors).



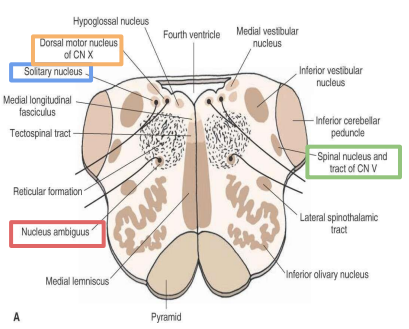
**Vagus nerve is also mixed**  
**Superficial attachment**

It's rootlets exit from medulla **between Olive and Inferior cerebellar peduncle**. Leaves the skull through jugular foramen.

It occupies the posterior aspect of the carotid sheath between the internal jugular vein laterally, and the internal and common carotid arteries medially.

### Components of fibers & deep origin

Type of fibers	Nuclei	Structure innervated
SVE fibers Special visceral efferent	<b>Nucleus ambiguus (NA)</b>	Muscles of : <b>pharynx(except stylopharyngeus)</b> <b>larynx palate (except the tensor palati)</b> upper part of esophagus
GVE fibers: General Efferent Visceral	<b>Dorsal nucleus of vagus</b>	Synapse in <b>parasympathetic</b> ganglia, short postganglionic fibers innervate cardiac muscle , smooth muscle respiratory, gastrointestinal systems and gland of viscera.
SVA fibers Special Visceral afferent	<b>Spinal tract &amp; nucleus of trigeminal</b>	Sensation from auricle , <b>external acoustic meatus and cerebral dura mater</b>
GVA fibers: General Visceral Afferent	<b>Nucleus of solitary tract (NST)</b>	Carry impulse from viscera in neck, thoracic and abdominal cavities

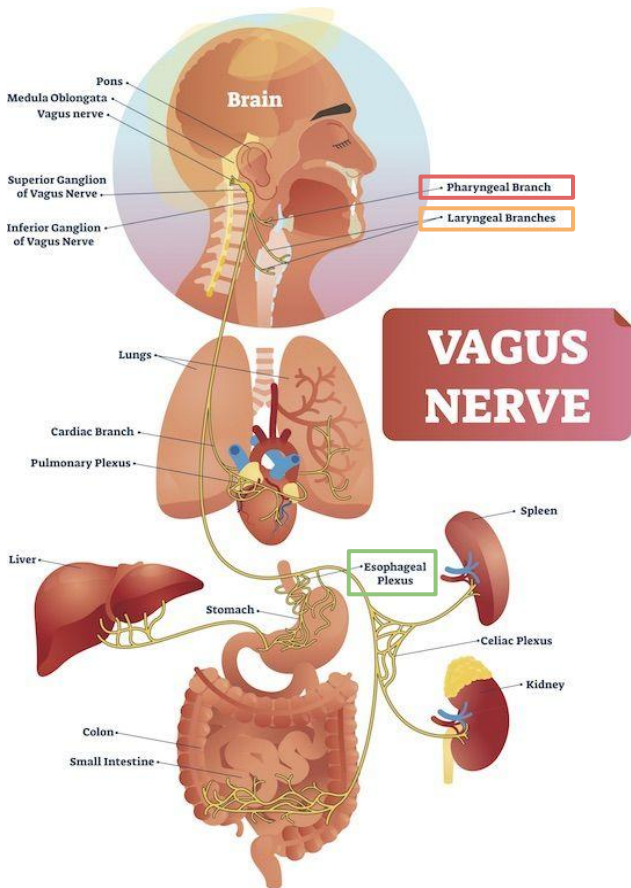
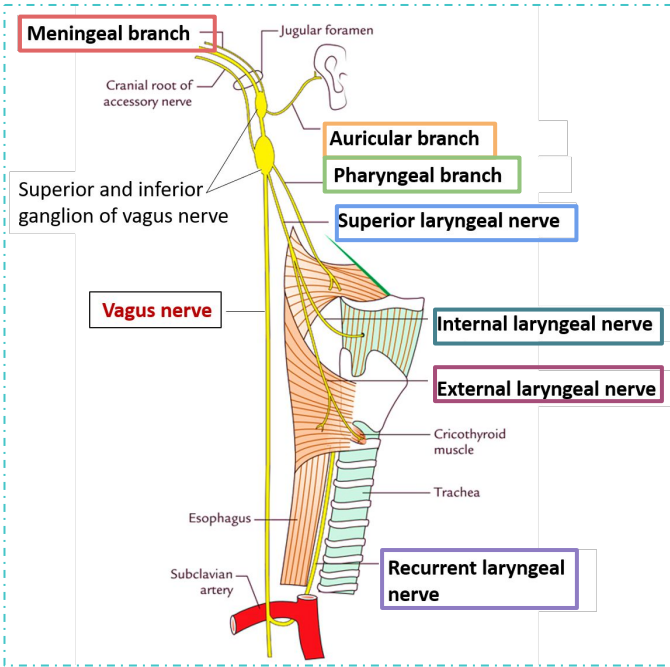




# Lecture 8: CN 9 & 10

## Branches of Vagus

<b>Meningeal</b>	To the dura
<b>Auricular nerve</b>	To the external acoustic meatus and tympanic membrane.
<b>To carotid body</b>	-
<b>Pharyngeal</b>	It enters the wall of pharynx, it supplies the mucous membrane of the pharynx, superior and middle constrictor muscles, and all the muscles of the palate except the tensor palati. The pharyngeal branch also forms the <b>pharyngeal plexuses</b>
<b>Superior laryngeal Sensory ,motor</b>	<b>Divides into:</b> <b>Internal laryngeal ( sensory ):</b> it provides sensation to the hypopharynx, the epiglottis, the part of larynx above vocal folds. <b>External laryngeal (motor):</b> supplies the cricothyroid muscles.
<b>Recurrent laryngeal Motor</b>	-The recurrent laryngeal nerve goes round the subclavian artery on the right, and round the arch of aorta on the left.  -It runs upwards and medially alongside the trachea and passes behind the lower pole of the thyroid gland -The recurrent laryngeal nerve gives motor <b>supply to all the muscles of the larynx except the cricothyroid</b> . It also provide sensation to the larynx below the vocal folds.



**Vagus nerve lesions**

Vagus nerve lesions produce palatal and **pharyngeal and laryngeal** paralysis.

Abnormalities of **esophageal** motility, gastric acid secretion, gallbladder emptying, and heart rate, and other autonomic dysfunction.

# Lecture 9: CN 11 & 12

Accessory (motor) Has two parts (roots):

## The Cranial Part

1 Origin	Carries fibres that originate in the caudal part of <b>nucleus ambiguus</b> .
2 Course	Emerges from lateral aspect of the medulla (between olive and inferior cerebellar peduncle) as a linear series of rootlets caudal to rootlets of the <b>vagus nerve</b> .
3 Course	At the side of medulla it joins the spinal root briefly.
4 Course	It separates once again as the nerve leaves the cranial cavity through the <b>Jugular foramen</b> .
5 Supply	At the level of jugular foramen these fibres join the vagus nerve and distribute with it to muscles of the <b>soft palate, esophagus, pharynx and larynx</b> .

## The Spinal Part

1 Origin	Arises from motor neurons in ventral horn of the spinal gray matter at levels <b>C1-C5 (spinal nucleus)</b> .
3 Course	Courses rostrally and enter the cranial cavity through the <b>foramen magnum</b> , and joins the cranial root briefly.
4 Course	Separates once again as the nerve leaves the cranial cavity through the <b>Jugular Foramen</b> .
5 Supply	Supplies the <b>sternomastoid and trapezius</b> muscles.

Hypoglossal : motor located between the **pyramid** and the **olive**.

اعرف بس انه يغذي كل عضلات اللسان الا (palatoglossus) Dr:note

**(Controls the movements and shape of the tongue during speech and swallowing)**

Carries proprioceptive afferents from the tongue muscles.

lesions :

Both Hypoglossal nerves right & left pushing the tongue to opposite side so if there's lesion in the left the tongue will deviate to the left

# Lecture 10: Anatomy of the Ear

## Middle ear

- The Auricle (important)**
- It has a characteristic shape and it collects air vibrations
  - It consists of a thin plate of **elastic cartilage** covered by a double layer of skin
  - It receives the insertion of extrinsic muscles which are **supplied by the facial nerve. Sensation is carried by greater auricular & auriculotemporal nerves**

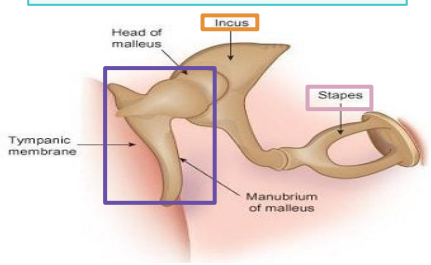
<p><b>Roof</b></p> <p>Formed by a thin plate of bone called <b>tegmen tympani</b>, which is part of the petrous temporal bone, it <b>separates the tympanic cavity from the temporal lobe of the brain</b></p>	<p><b>Floor</b></p> <p>Formed by a thin plate of bone which <b>separates the middle ear from the bulb of the internal jugular vein.</b></p>
<p><b>Medial Wall</b></p> <p><b>promontory oval window (Fenestra Vestibuli), which is closed by the base of the stapes. round window (Fenestra Cochleae), which is closed by the secondary tympanic membrane</b></p>	<p><b>Lateral Wall</b></p> <p><b>Nerve supply of the eardrum:</b></p> <p><b>Outer surface Or laterally:</b></p> <ul style="list-style-type: none"> <li>- Auriculotemporal nerve</li> <li>- Auricular branch of vagus nerve</li> </ul> <p><b>Inner surface or Medially:</b></p> <ul style="list-style-type: none"> <li>- Tympanic branch of the glossopharyngeal nerve</li> </ul>
<p><b>Posterior Wall</b></p> <p><b>aditus to mastoid antrum</b></p> <p>Below, a small, hollow, conical projection, the <b>pyramid</b> which houses the <b>stapedius muscle (one of the two muscles in the middle ear)</b> and its tendon</p>	<p><b>Anterior Wall</b></p> <p>At the upper part:</p> <ol style="list-style-type: none"> <li>1. <b>Upper smaller, which is the canal for the tensor tympani muscle. (one of the two muscles in the middle ear)</b></li> <li>2. <b>Lower larger, which is for the auditory tube.</b></li> </ol> <p>At the Lower part:</p> <p><b>internal carotid artery.</b></p>

## The Auditory Ossicles

**Malleus (Hammer)**

**Incus (Anvil)**

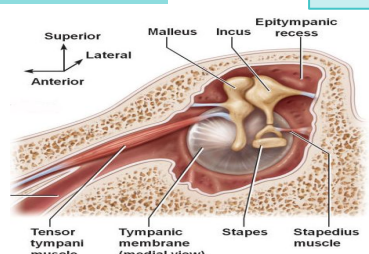
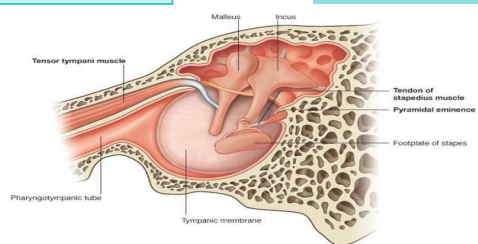
**Stapes (Stirrup)**



**Tensor Tympani**  
**Mandibular Nerve**

## Muscles Of the Ossicles

**Stapedius**  
**Facial Nerve**



**Done By:  
Rayan Alqahtani  
Abeer Awwad**

**We wish you all the best**