

# **Cranial Nerves**

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Human nervous system

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graph TD; A[Human nervous system] --> B[Central nervous system]; A --> C[Peripheral nervous system]; B --> D[Brain]; B --> E[Spinal cord]; C --> F[Cranial nerves]; C --> G[Spinal nerves];
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Central nervous system

Brain

Spinal cord

Peripheral nervous system

Cranial nerves

Spinal nerves

# Cranial Nerves

- There are 12 pairs of cranial nerves in our body.
- These are called as cranial nerve because they originated directly from the brain; inside the cranium.
- Only the first and the second pair emerge from the cerebrum; the remaining ten pairs emerge from the brainstem.

# Cranial Nerves

1. Olfactory nerve
2. Optic nerve
3. Oculomotor nerve
4. Trochlear nerve
5. Trigeminal nerve
6. Abducens nerve
7. Facial nerve
8. Vestibulocochlear nerve
9. Glossopharyngeal nerve
10. Vagus nerve
11. Accessory nerve
12. Hypoglossal nerve

# Classification

Pure Sensory Function: CN I, II and VIII

Pure Motor Function: CN III, IV, VI, XII

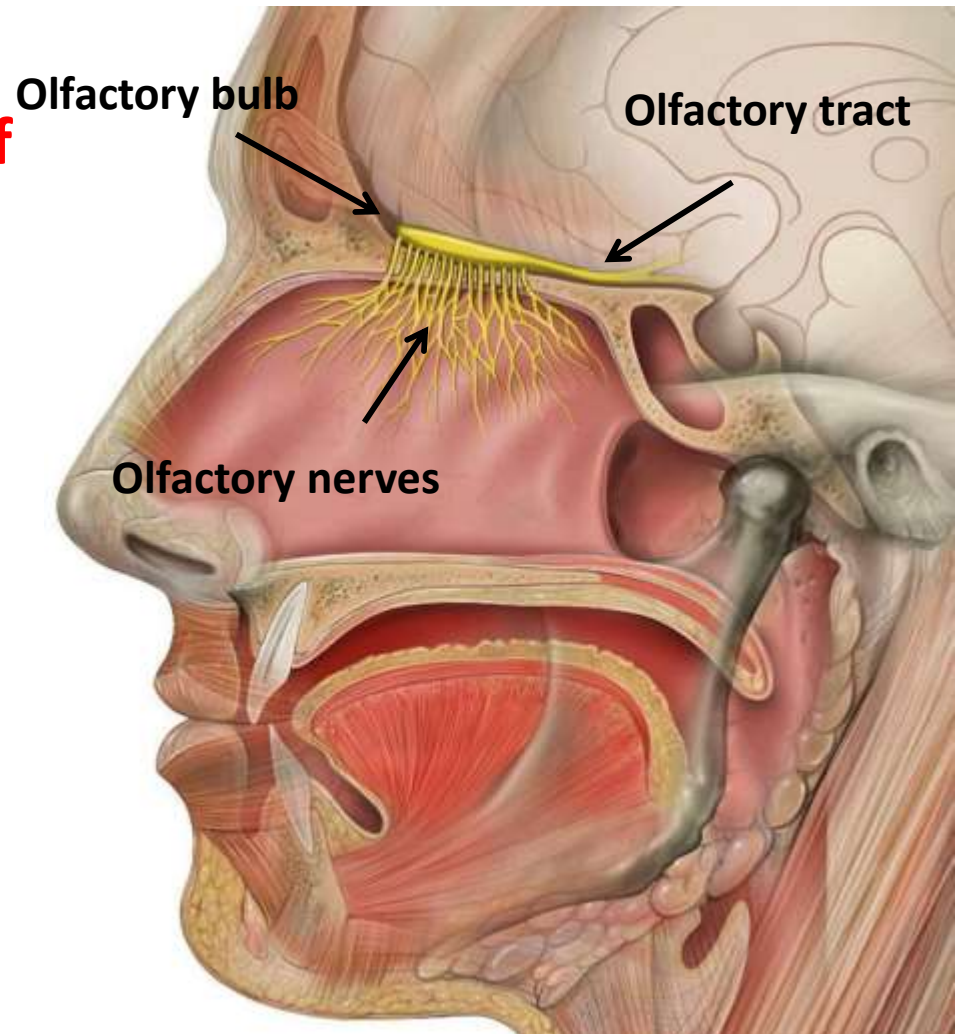
Mixed (Sensory and motor): CN V, VII, IX, X, XI

# Olfactory nerve

- Olfactory nerve is the first cranial nerve, which is pure sensory in function.
- It transmits the impulse that conveys the **sense of smell**.
- It is unique among the cranial nerves in that it is capable of regeneration if damaged.

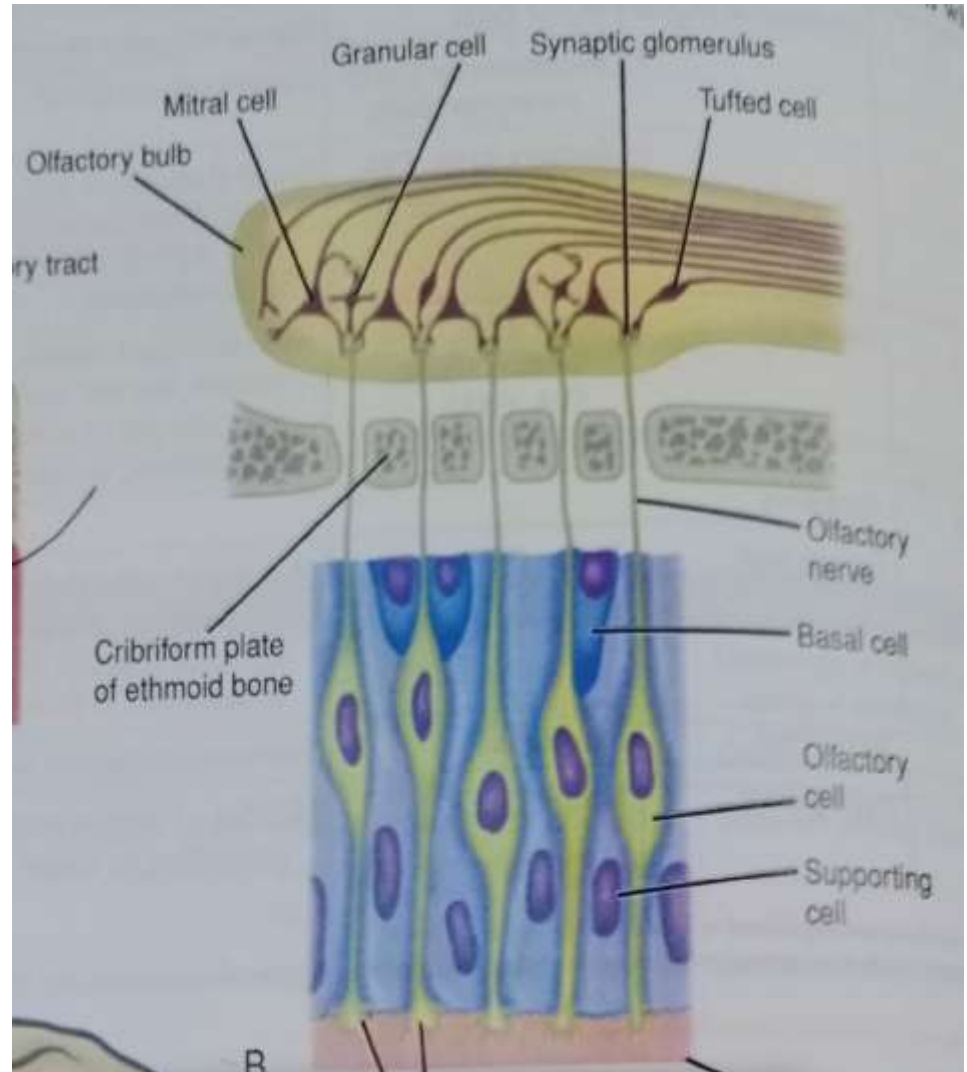
# Olfactory nerve

- It originates from the olfactory mucosa in the **roof of nasal cavity**.
- Nerves pass through the **cribriform plate of ethmoid bone** to reach the brain.
- Fibers run through the olfactory bulb and terminate in the **primary olfactory cortex**.



# Olfactory Bulb

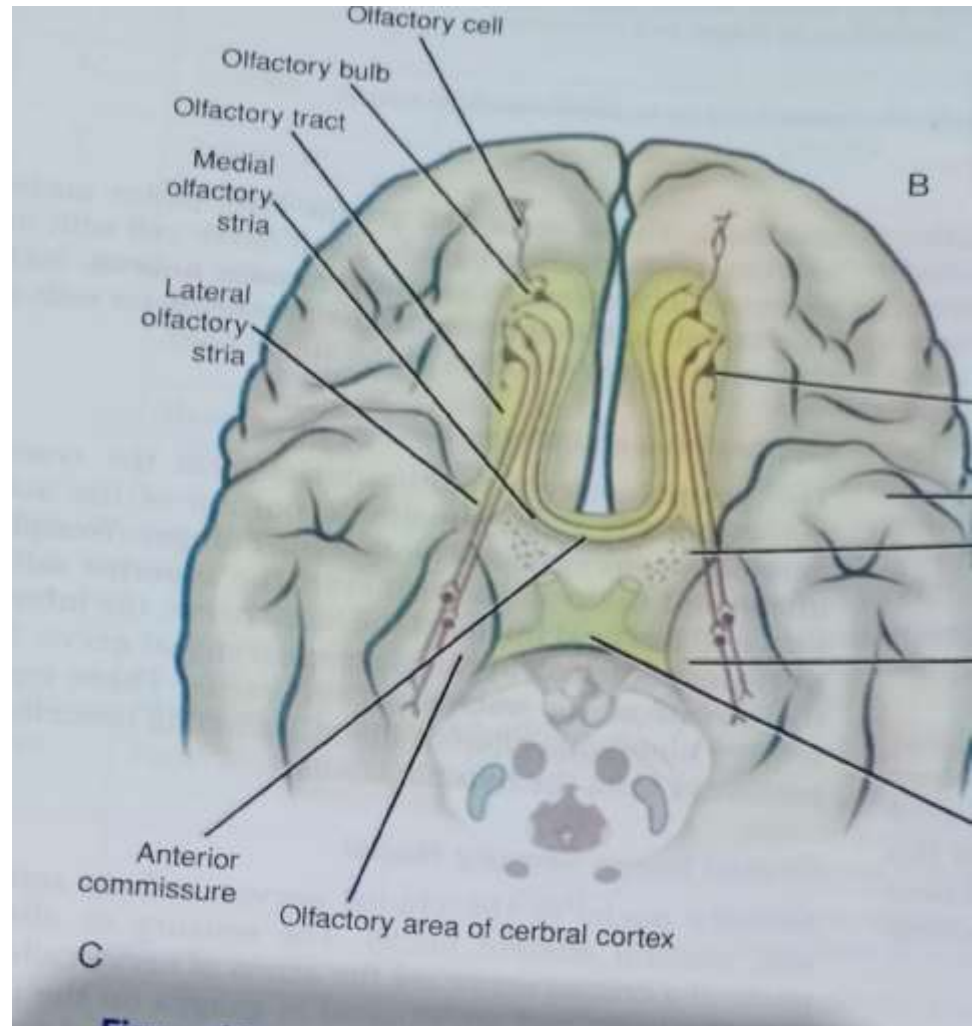
- The ovoid structure possess several types of nerves cells.
- The largest cells are **mitral cell** which form synapse with the incoming olfactory nerve and form a rounded area known as **synaptic glomeruli**.
- Smaller nerve cells called **tufted cells** and **granular cells** also synapse with mitral cell.





# Olfactory Tract

- Olfactory tract divides into **lateral** and **medial** olfactory striae.
- The **lateral stria** carries the axon to olfactory area of cerebral cortex.
- The **medial stria** carries the fibers that cross the median plane to pass to the olfactory bulb of opposite side.



# Optic Nerve

- The optic nerve is 2<sup>nd</sup> cranial nerve which carries the visual impulses from retina to the brain.
- To reach the brain it passes through the optic canal.
- The optic nerve starts from optic disc and ends at the chiasma.
- The optic nerve leaves the orbital cavity through the optic canal and unites with optic nerve of the opposite side to form **optic chiasma**.

# Optic Nerve

## Optic Chiasma:

- The optic chiasma is situated at the junction of the anterior wall and floor of the third ventricle.
- In the chiasma the fibers from nasal half of each retina cross the midline and enter the optic tract of the opposite side.
- The fibers from temporal half of retina pass posteriorly in the optic tract of the same side.

## **Optic tract:**

- It emerges from the optic chiasma and passes posterolaterally around the cerebral peduncle.
- Most of the fibers terminate by synapsing with nerve cells in the lateral geniculate body.

# Optic Nerve

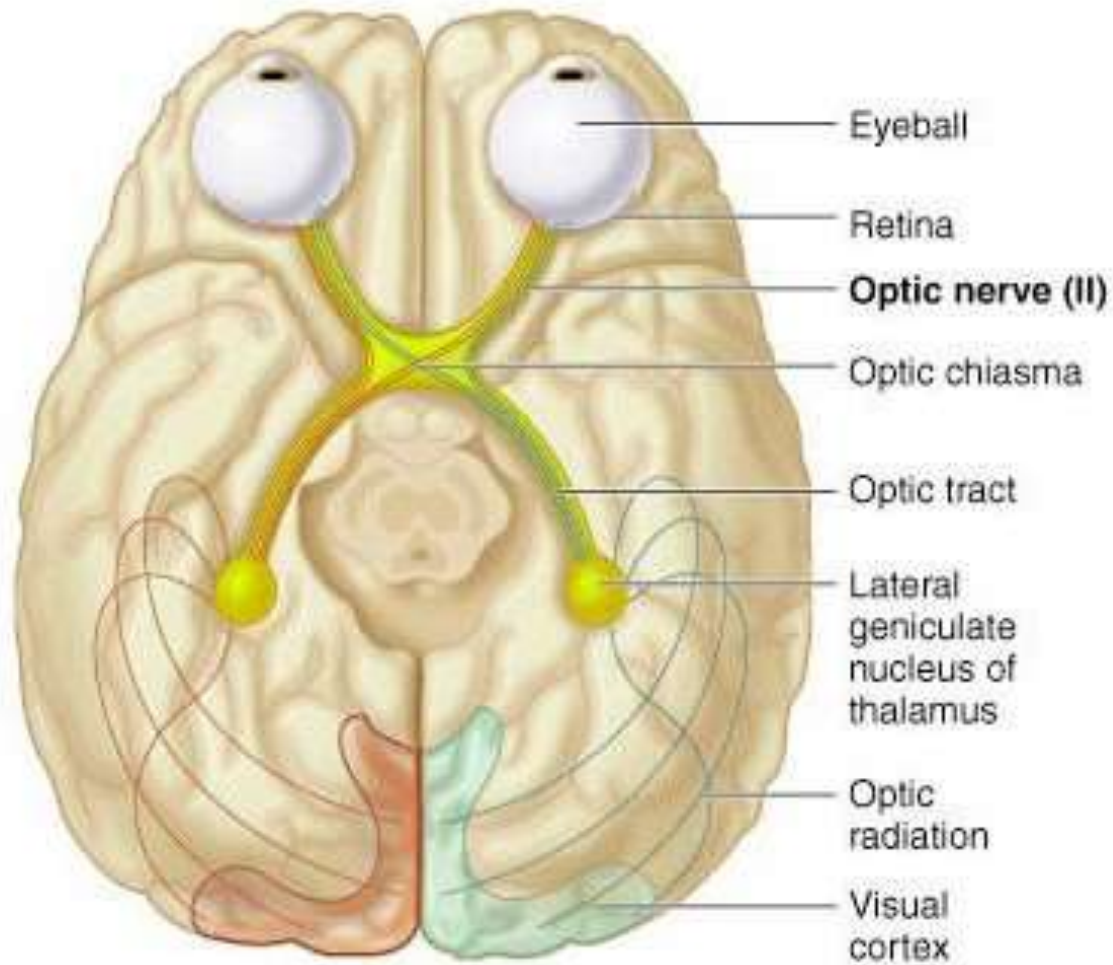
## Lateral Geniculate Body:

- Is a small, oval swelling projecting from thalamus.
- The axons of nerve cells within the geniculate body leave it to form optic radiation.

## Optic Radiation:

- The fibers of optic radiation are the axons of nerve cells of the lateral geniculate body.
- The tract passes posteriorly through the internal capsule and terminates in the visual cortex.

# Optic Nerve



# Oculomotor Nerve

- The 3<sup>rd</sup> cranial nerve is entirely motor in function.
- The oculomotor nerve has two motor nuclei
  1. Main motor nucleus
  2. Accessory parasympathetic nucleus

# Oculomotor Nerve

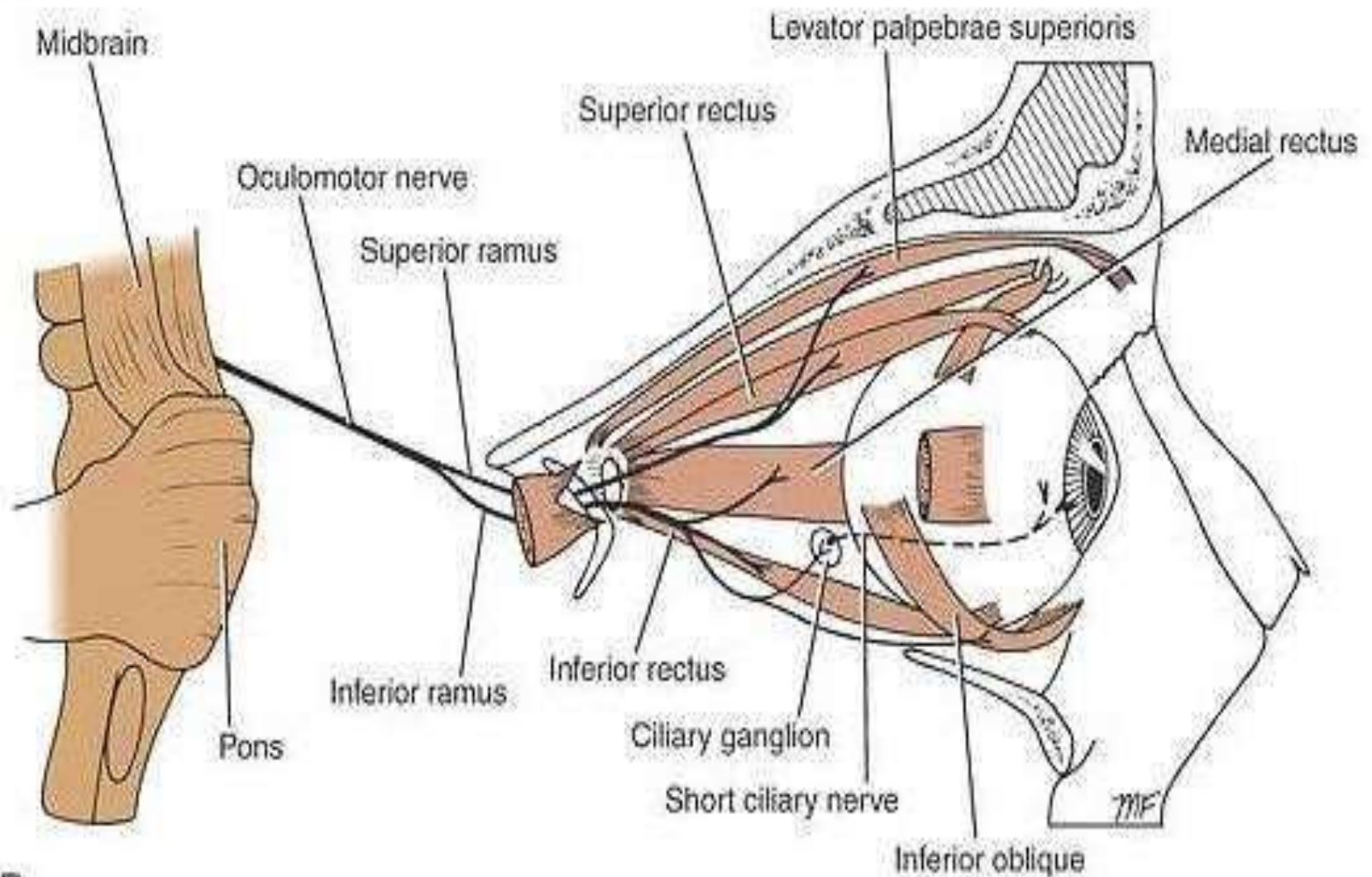
- The **main nucleus** is situated in the anterior part of the gray matter that surrounds the midbrain.
- It lies at the level of superior colliculus.
- The **accessory parasympathetic nucleus** is situated posterior to the main oculomotor nucleus.

# Oculomotor nerve course

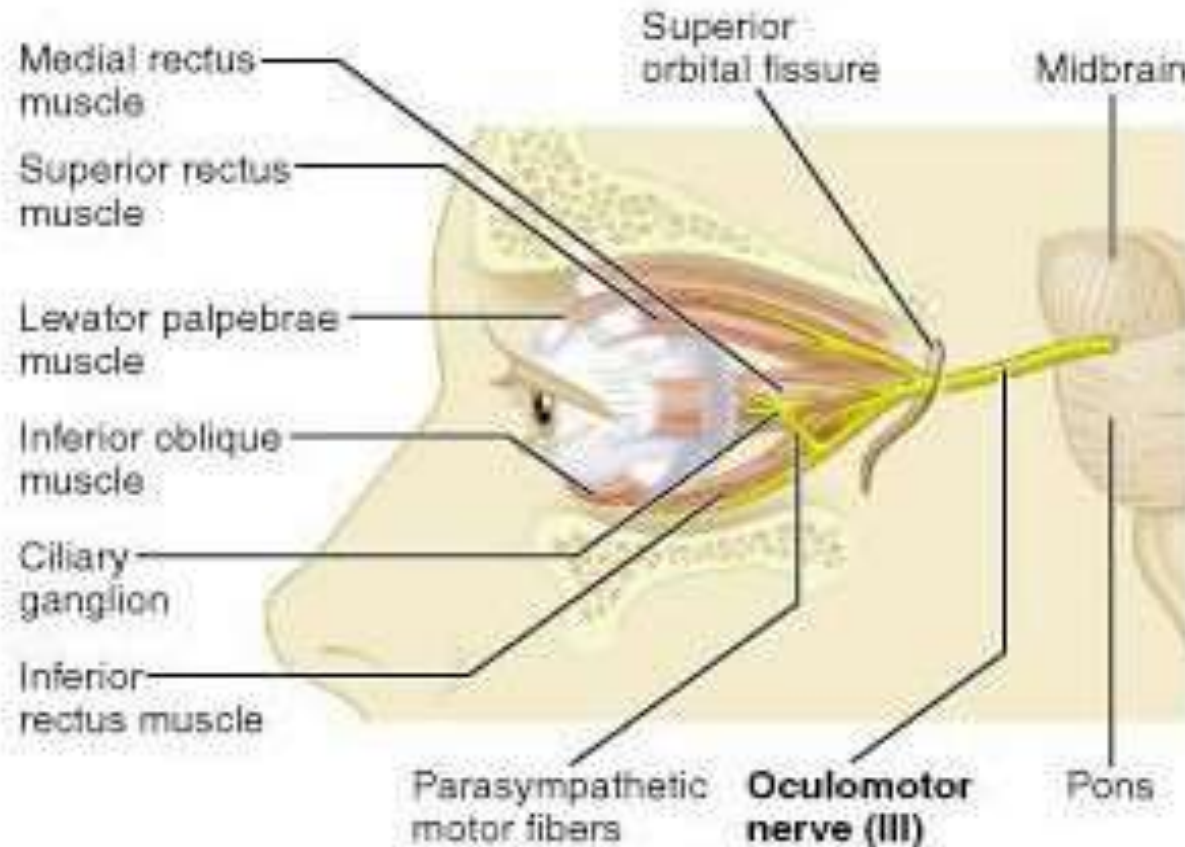
- It emerges on the anterior surface of the midbrain. It passes forward between the posterior and superior cerebellar arteries.
- Then it continues into the middle cranial fossa in the lateral wall of cavernous sinus.
- It divides into superior and inferior ramus which enter the cavity through superior orbital fissure.
- The 3<sup>rd</sup> cranial nerve supply all the extrinsic muscles of the eye except the superior oblique and the lateral rectus muscle.



# Oculomotor nerve



# Oculomotor Nerve



# Trochlear Nerve

- The trochlear nerve is purely motor nerve.
- It is only cranial nerve to emerge from dorsal aspect of brain

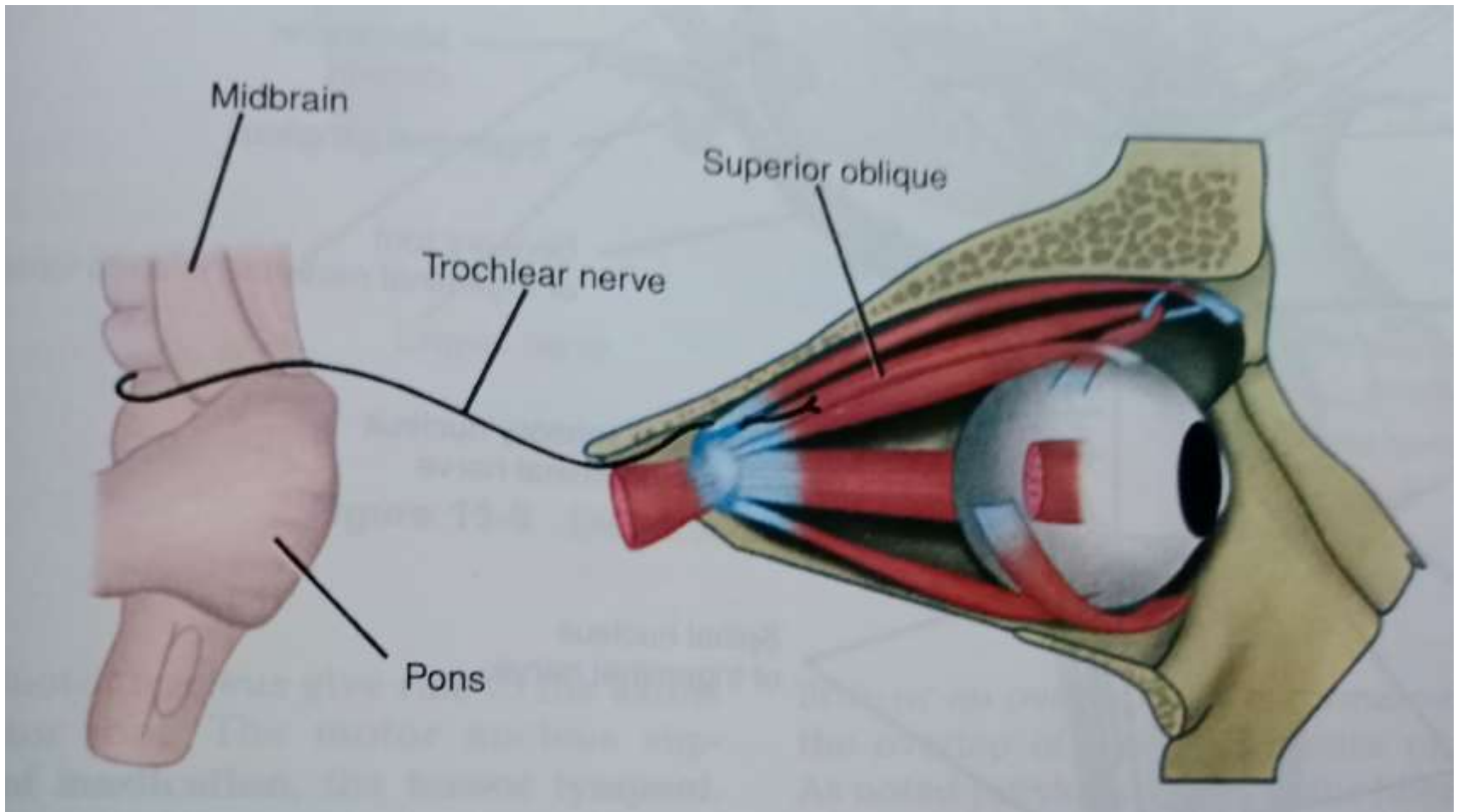
## **Trochlear nerve nucleus:**

- It is situated in the anterior part of gray matter .
- It lies inferior to the oculomotor nucleus at the level of inferior colliculus.
- The nerves fibers after leaving the nucleus, pass posteriorly around the central gray matter to reach the posterior surface of midbrain.

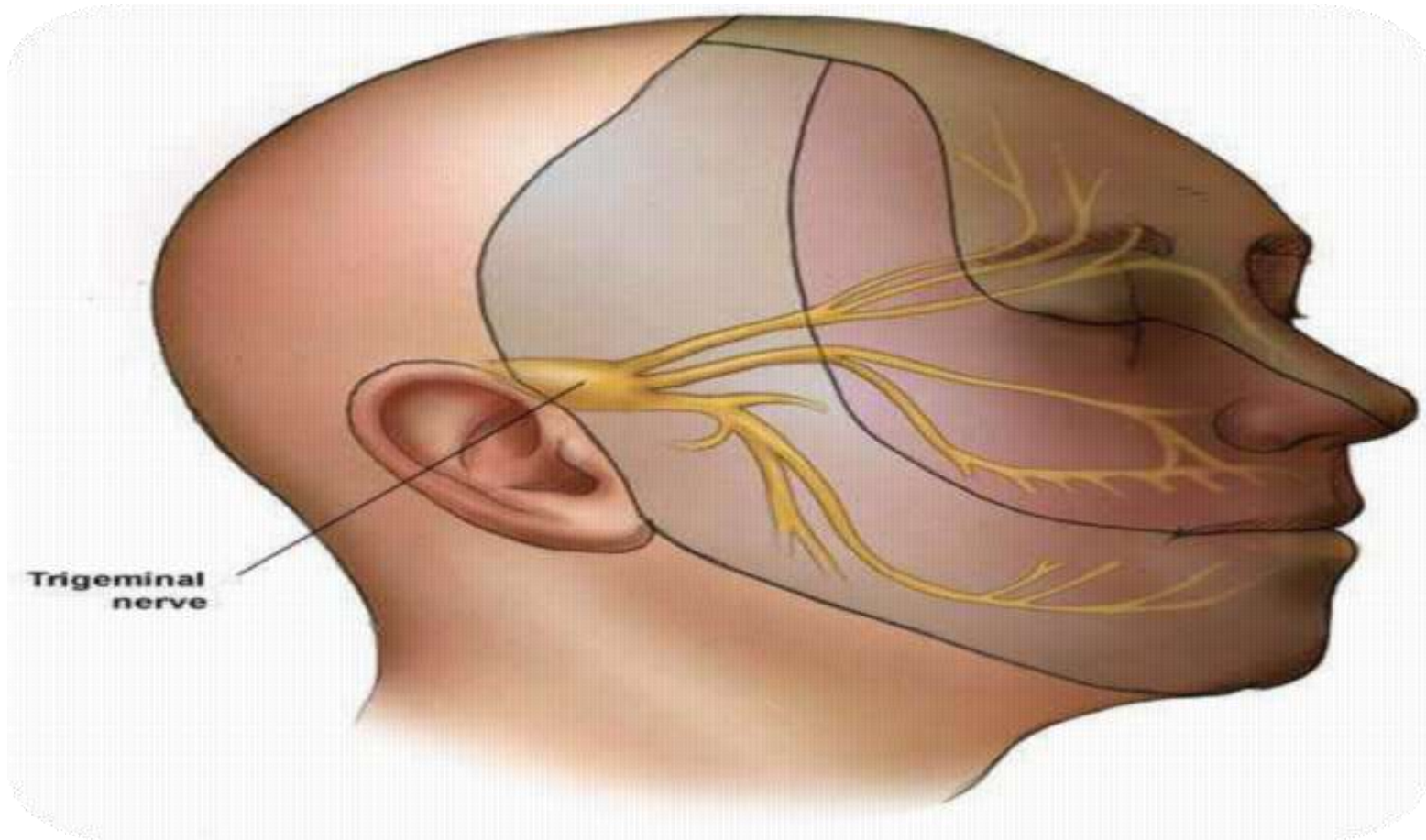
# Trochlear Nerve Course

- The 4<sup>th</sup> nerve emerges from the midbrain and immediately decussates with the nerve of the opposite side.
- The trochlear nerve passes forward through the middle cranial fossa in the lateral wall of cavernous sinus and enter the orbit via superior orbital fissure.
- It supplies the superior oblique muscle of eyeball and assists in turning the eye downward and laterally.

# Trochlear Nerve



# Trigeminal Nerve



# Trigeminal Nerve

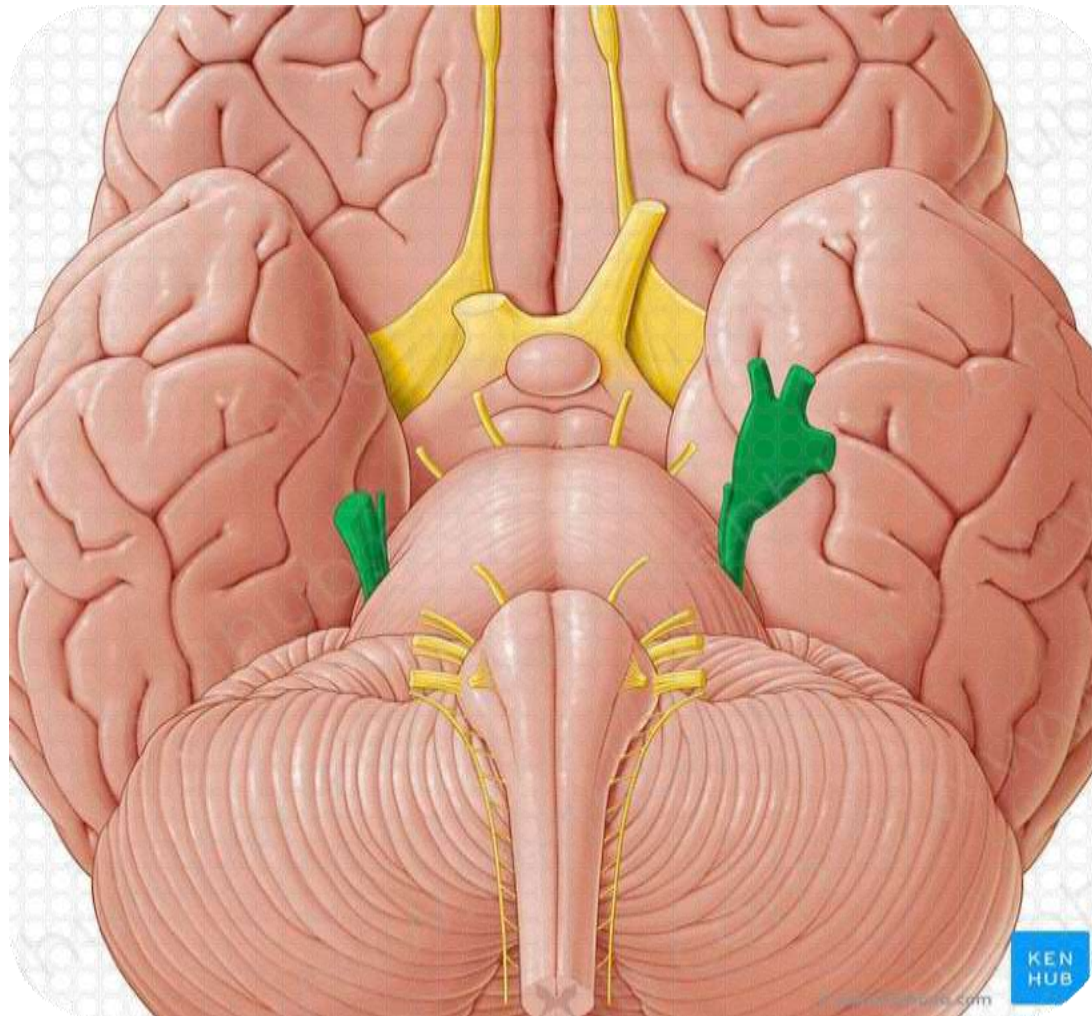
- 5th cranial nerve (CN5)
- Largest cranial nerve
- MIXED CRANIAL NERVE
- Sensory nerve to the greater part of the head.
- Motor nerve to several muscles including muscles of mastication.
- The trigeminal nerve has four nuclei:
  1. Main sensory nucleus
  2. Spinal nucleus
  3. Mesencephalic nucleus
  4. Motor nucleus

# Trigeminal Nerve

- **Main sensory nucleus:** Lies in the posterior part of the pons, lateral to the motor nucleus.
- **Main sensory nucleus:** The spinal nucleus is continuous superiorly with the main sensory nucleus in the pons and extends through medulla oblongata and into the upper part of spinal cord.
- **Mesencephalic nucleus:** is composed of column of unipolar nerve cells situated in the lateral part of gray matter.
- **Motor nucleus:** Is situated in the pons medial to the sensory nucleus.



# Trigeminal Nerve



# Trigeminal nerve course

- The 5<sup>th</sup> cranial nerves leaves the anterior aspect of the pons as a small motor root and a large sensory root.
- The large sensory root now expands to form the crescent shaped trigeminal ganglion.
- The **ophthalmic, maxillary and mandibular** nerves arise from the anterior border of ganglion.
- The **ophthalmic nerve** contains only sensory fibers and leaves the skull through superior orbital fissure to enter the orbital cavity.
- The **maxillary nerve** also contains only sensory fibers and leaves the skull through foramen rotundum.
- The **mandibular nerve** contains both sensory and motor fibers and leave the skull through the foramen ovale.

# Trigeminal Nerve Innervations

## Ophthalmic nerve:

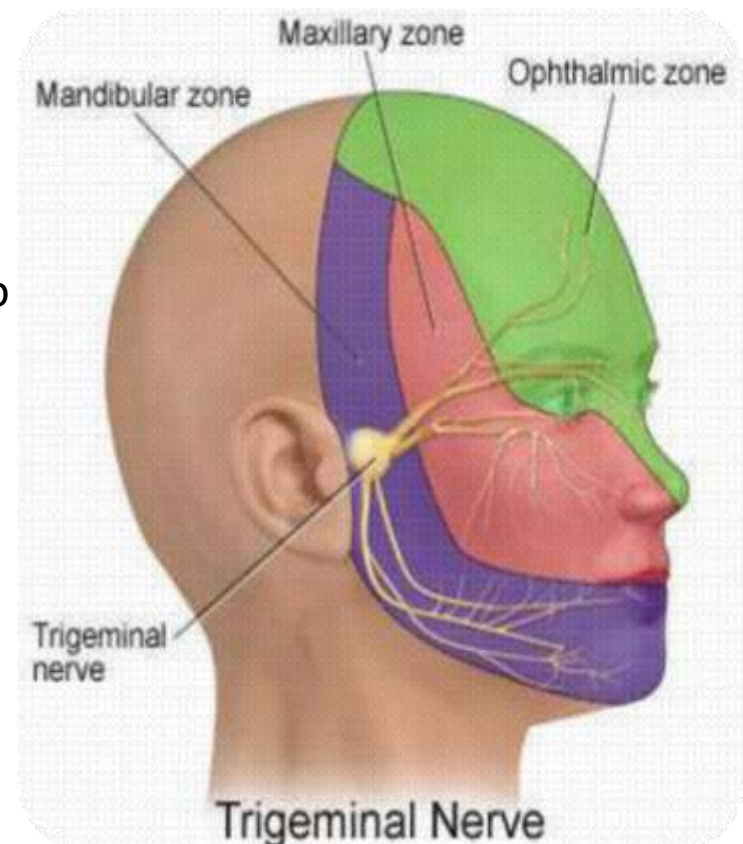
- Supply to the eyeball, lacrimal gland, conjunctiva, a portion of nasal mucosa and forehead.

## Maxillary nerve:

- Innervate the middle third of the face and upper teeth.

## Mandibular nerve:

- Divides into several branches to supply sensation to the lower third of face and tongue, floor of mouth and the jaw.
  - The motor part innervates the four muscle of mastication
1. Masseter
  2. Temporalis
  3. Lateral pterygoid
  4. Medial pterygoid



# Abducens Nerve

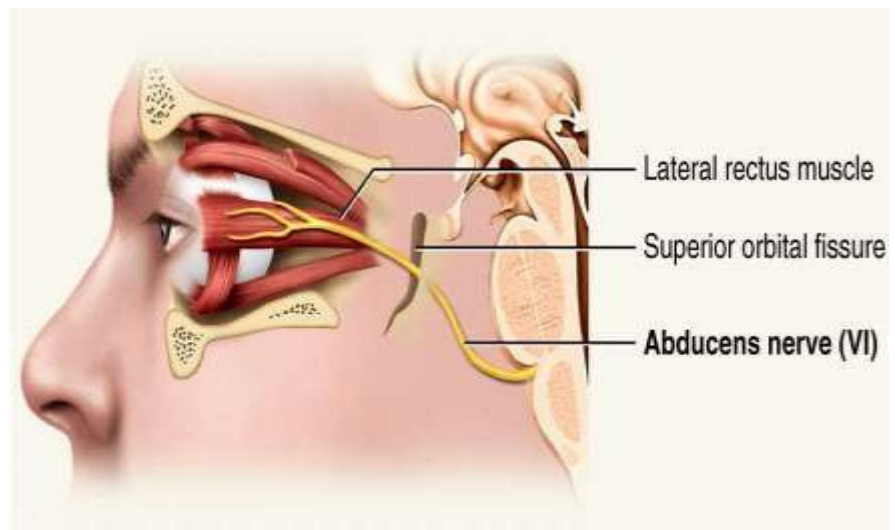
- The abducent nerve is a small, entirely motor nerve that supplies the lateral rectus muscle of the eyeball.

## Abducens nerve nucleus:

- Small motor nucleus is situated beneath the floor of fourth ventricle.
- The nucleus receives afferent corticonuclear fibers from both cerebral hemispheres .
- Also receives fibers from the medial longitudinal fasciculus , by which it is connected to the nuclei of 3<sup>rd</sup> ,4<sup>th</sup> , and 8<sup>th</sup> cranial nerves.

# Abducens Nerve Course

- It emerges in the groove between the lower border of pons and medulla oblongata.
- It passes forward through the cavernous sinus, lying below and lateral to the internal carotid artery.
- The nerve enters the orbit via superior orbital fissure and supplies the lateral rectus muscle.
- The nerve is responsible for lateral movement of eye.



# Abducens Nerve

