Al-Mustaqbal University

College of Engineering & Technology

Biomedical Engineering Department

Subject Name: Anatomy II

2nd Class, Second Semester

Subject Code: [UOMU011045]

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Lecture No.: - 2

Lecture Title: [Crainal Nerves]

ANATOMY / 2nd Stage

Head and Neck

Lec. 2

Cranial Nerves

Cranial Nerves

- Cranial nerves are **bundles of sensory or motor fibers** that innervate muscles or glands; carry impulses from sensory receptors, or show a combination of these fiber types.

- 12 pairs of cranial nerves are part of the peripheral nervous system arise from the base of the brain exit the cranium through foramina or fissures lead to muscles and sense organs located mainly in the head and neck.

Cranial Nerve Pathways

Mostly motor fibers in the cranial nerves begin:

In nuclei of brainstem and lead to glands and muscles.

Sensory fibers begin:

In receptors located mainly in head and neck and lead mainly to the brainstem.

Classification of cranial nerves

Sensory cranial nerves: contain only afferent (sensory) fibers:

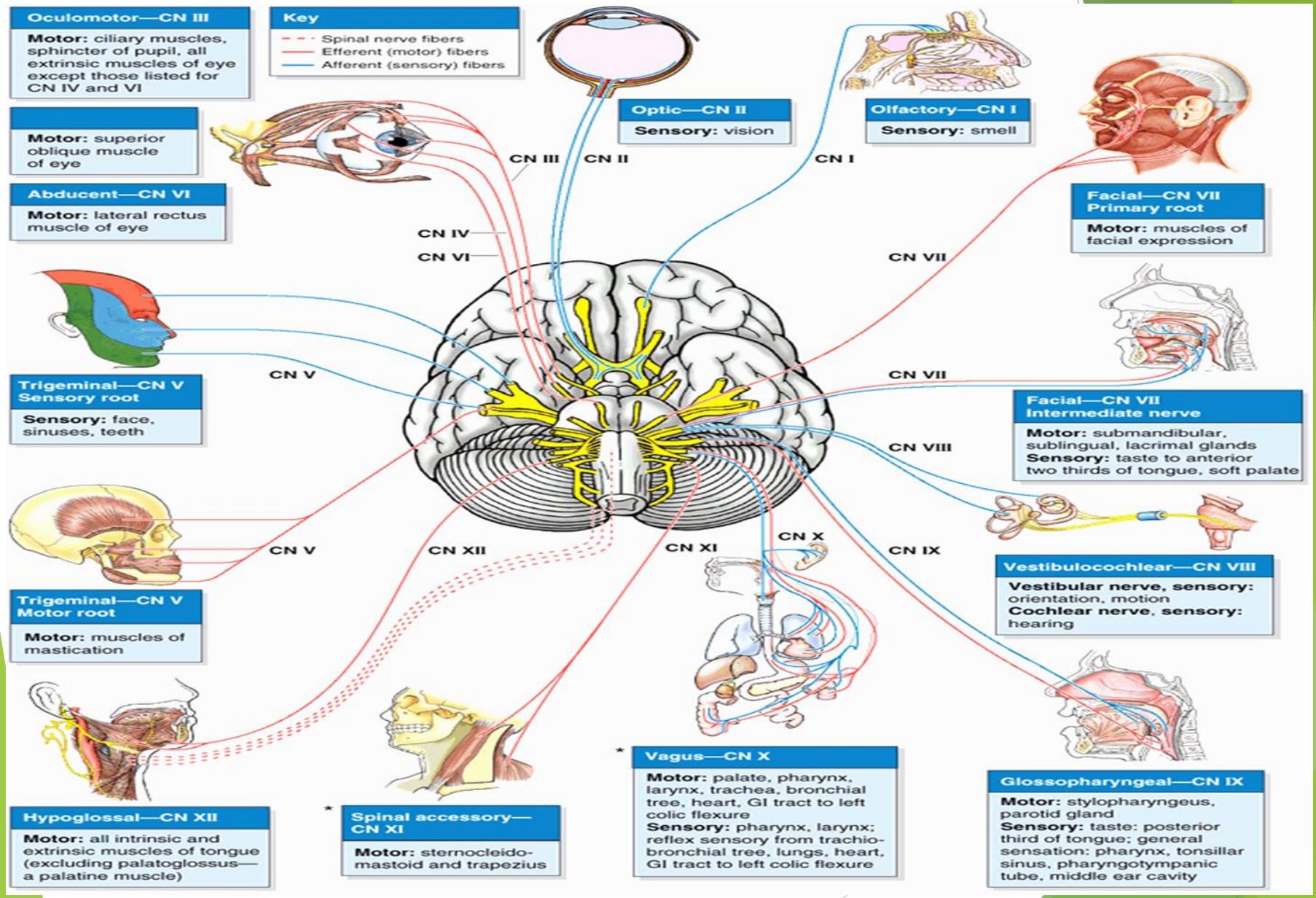
- Ⅰ Olfactory nerve (1)
- Ⅱ Optic nerve (2)
- Ⅷ Vestibulo-cochlear nerve (8)

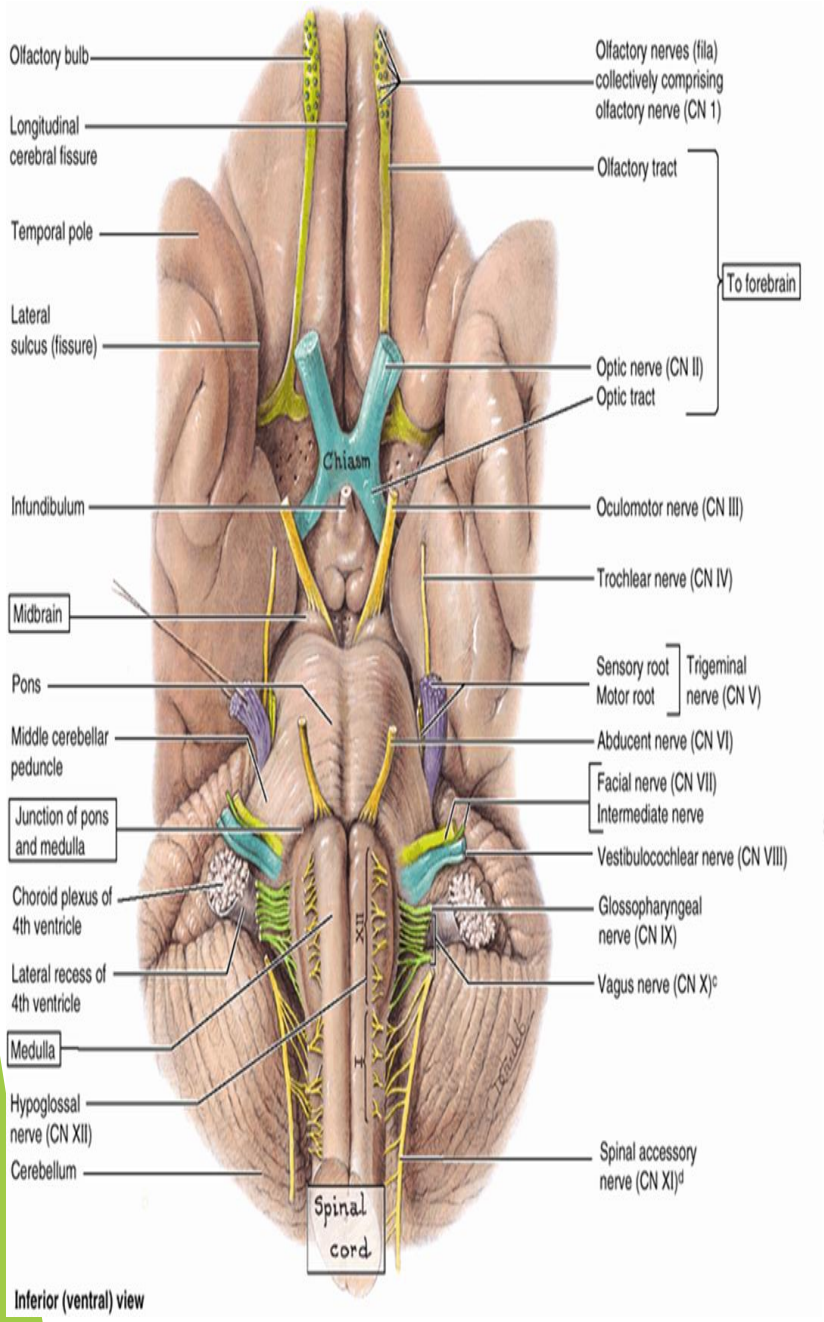
Motor cranial nerves: contain only efferent (motor) fibers:

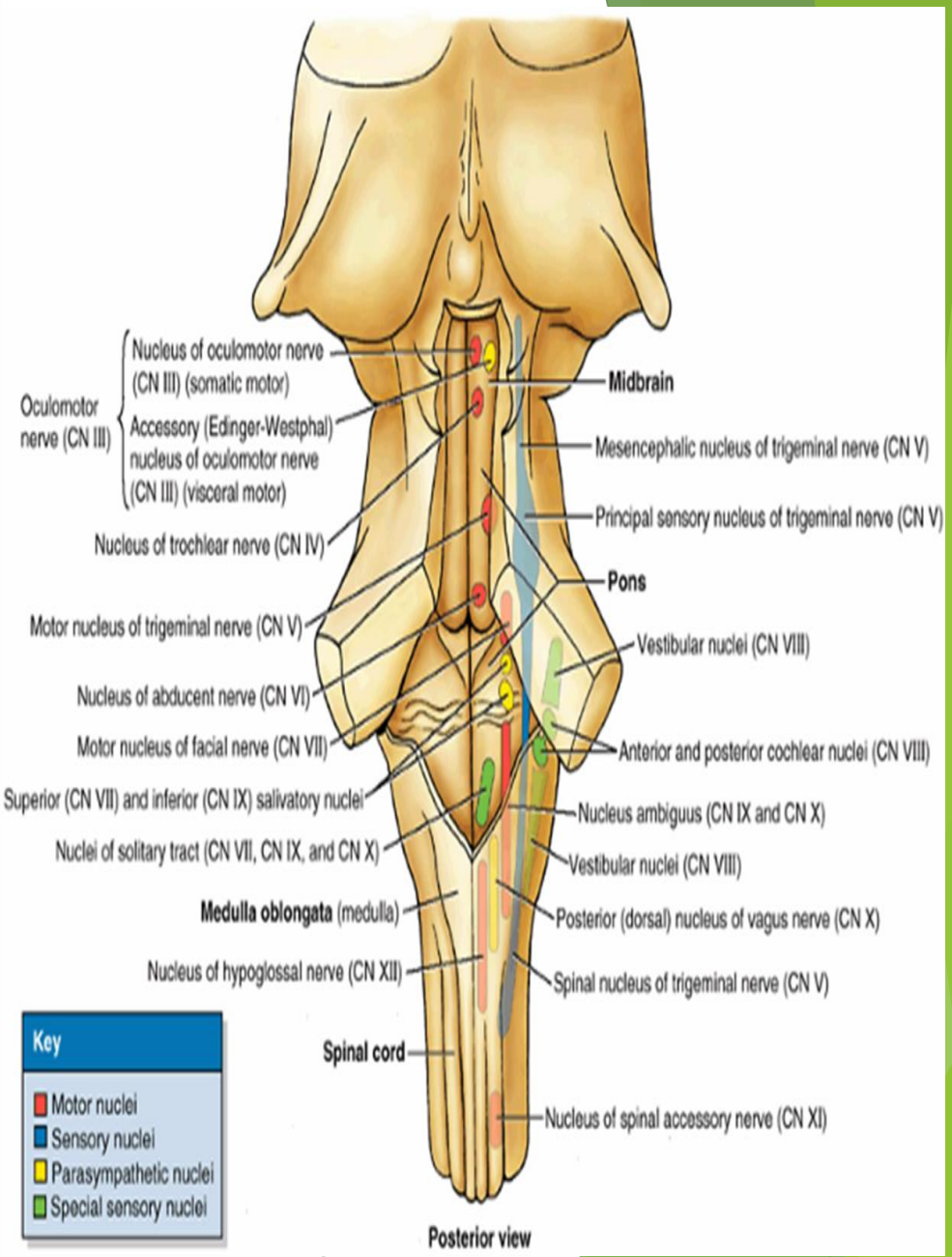
- Ⅲ Oculomotor nerve (3)
- Ⅳ Trochlear nerve (4)
- Ⅵ Abducent nerve (6)
- Ⅺ Accessory nerve (11)
- Ⅻ Hypoglossal nerve(12)

Mixed nerves: contain both sensory and motor fibers:

- Ⅴ Trigeminal nerve (5)
- Ⅶ Facial nerve (7)
- Ⅸ Glossopharyngeal nerve (9)
- Ⅹ Vagus nerve (10)

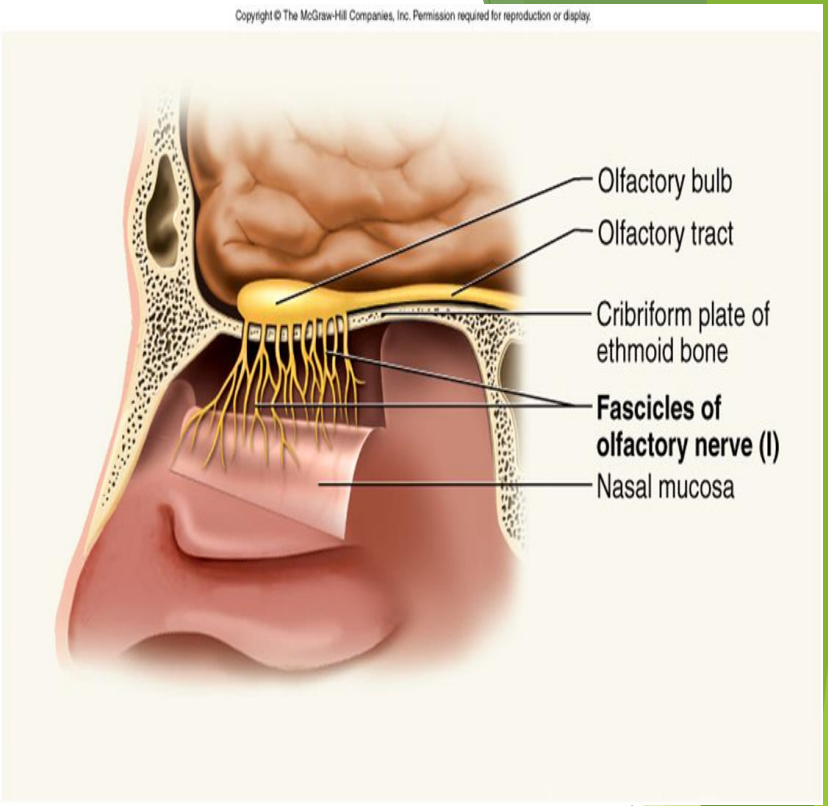

Oculomotor—CN III
Motor: ciliary muscles, sphincter of pupil, all extrinsic muscles of eye except those listed for CN IV and VI
Key
Spinal nerve fibers
Efferent (motor) fibers
Afferent (sensory) fibers
Optic—CN II
Sensory: vision
Olfactory—CN I
Sensory: smell
Motor: superior oblique muscle of eye
Abducent—CN VI
Motor: lateral rectus muscle of eye
CN III
CN II
CN I
CN IV
CN VI
CN VII
Facial—CN VII Primary root
Motor: muscles of facial expression
Trigeminal—CN V Sensory root
Sensory: face, sinuses, teeth
CN V
CN VII
Facial—CN VII Intermediate nerve
Motor: submandibular, sublingual, lacrimal glands
Sensory: taste to anterior two thirds of tongue, soft palate
CN VIII
CN V
CN XII
CN XI
CN X
CN IX
Vestibulocochlear—CN VIII
Vestibular nerve, sensory: orientation, motion
Cochlear nerve, sensory: hearing
Trigeminal—CN V Motor root
Motor: muscles of mastication
Hypoglossal—CN XII
Motor: all intrinsic and extrinsic muscles of tongue (excluding palatoglossus—a palatine muscle)
* Spinal accessory—CN XI
Motor: sternocleido-mastoid and trapezius
* Vagus—CN X
Motor: palate, pharynx, larynx, trachea, bronchial tree, heart, GI tract to left colic flexure
Sensory: pharynx, larynx; reflex sensory from trachio-bronchial tree, lungs, heart, GI tract to left colic flexure
Glossopharyngeal—CN IX
Motor: stylopharyngeus, parotid gland
Sensory: taste: posterior third of tongue; general sensation: pharynx, tonsillar sinus, pharyngotympanic tube, middle ear cavity

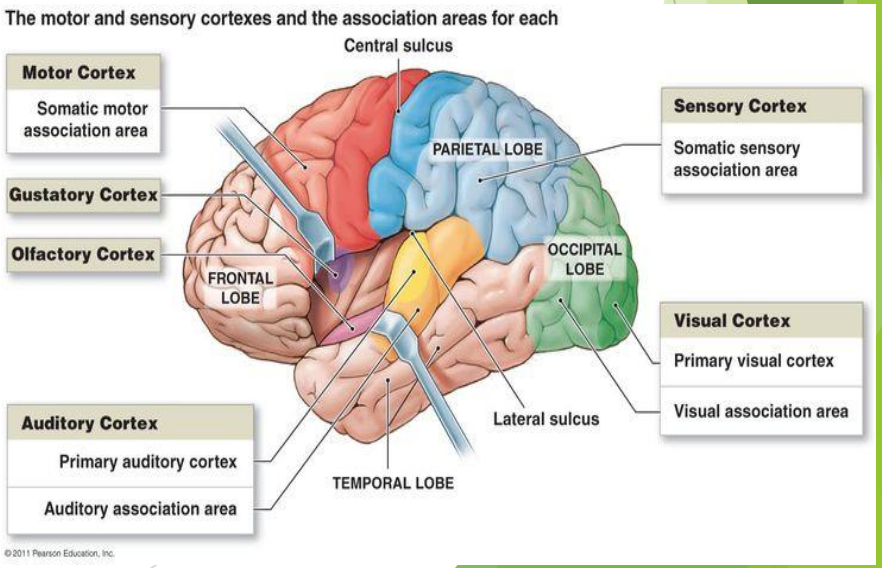

Olfactory bulb
Longitudinal cerebral fissure
Temporal pole
Lateral sulcus (fissure)
Infundibulum
Midbrain
Pons
Middle cerebellar peduncle
Junction of pons and medulla
Choroid plexus of 4th ventricle
Lateral recess of 4th ventricle
Medulla
Hypoglossal nerve (CN XII)
Cerebellum
Olfactory nerves (fila) collectively comprising olfactory nerve (CN 1)
Olfactory tract
To forebrain
Optic nerve (CN II)
Optic tract
Chiasm
Oculomotor nerve (CN III)
Trochlear nerve (CN IV)
Sensory root
Motor root
Trigeminal nerve (CN V)
Abducent nerve (CN VI)
Facial nerve (CN VII)
Intermediate nerve
Vestibulocochlear nerve (CN VIII)
Glossopharyngeal nerve (CN IX)
Vagus nerve (CN X)c
Spinal accessory nerve (CN XI)d
Spinal cord
Inferior (ventral) view

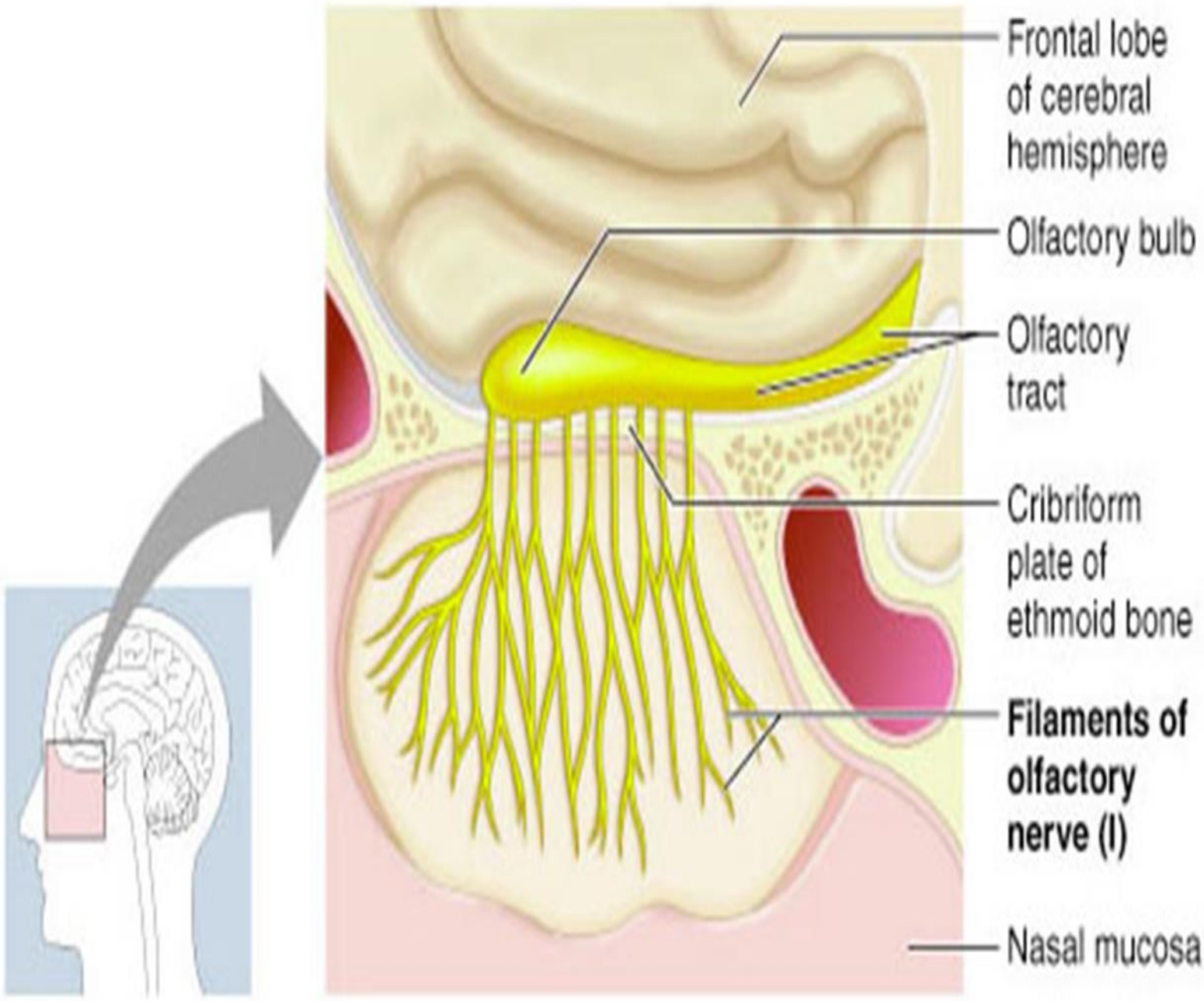

Oculomotor nerve (CN III)
Nucleus of oculomotor nerve (CN III) (somatic motor)
Accessory (Edinger-Westphal) nucleus of oculomotor nerve (CN III) (visceral motor)
Nucleus of trochlear nerve (CN IV)
Motor nucleus of trigeminal nerve (CN V)
Nucleus of abducent nerve (CN VI)
Motor nucleus of facial nerve (CN VII)
Superior (CN VII) and inferior (CN IX) salivatory nuclei
Nuclei of solitary tract (CN VII, CN IX, and CN X)
Medulla oblongata (medulla)
Nucleus of hypoglossal nerve (CN XII)
Midbrain
Mesencephalic nucleus of trigeminal nerve (CN V)
Principal sensory nucleus of trigeminal nerve (CN V)
Pons
Vestibular nuclei (CN VIII)
Anterior and posterior cochlear nuclei (CN VIII)
Nucleus ambiguus (CN IX and CN X)
Vestibular nuclei (CN VIII)
Posterior (dorsal) nucleus of vagus nerve (CN X)
Spinal nucleus of trigeminal nerve (CN V)
Spinal cord
Nucleus of spinal accessory nerve (CN XI)
Key
Motor nuclei
Sensory nuclei
Parasympathetic nuclei
Special sensory nuclei
Posterior view

Cranial Nerve I :
Olfactory nerve

Sensory- Sense of smell
Passes through cribriform plate of ethmoid.
The olfactory bulb is connected to the olfactory area of the cerebral cortex by the olfactory tract.





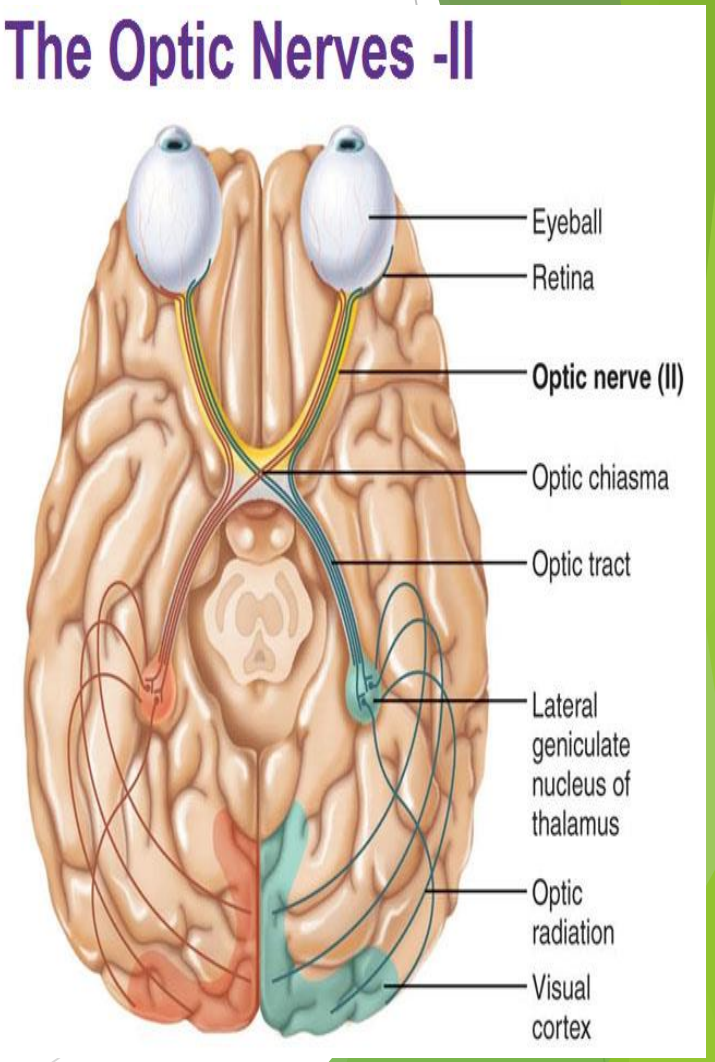

Frontal lobe of cerebral hemisphere
Olfactory bulb
Olfactory tract
Cribriform plate of ethmoid bone
Filaments of olfactory nerve (I)
Nasal mucosa

Cranial Nerve II : Optic Nerve

Sensory-Provides vision

The optic nerve, is a paired nerve that transmits visual information from the **retina to the brain.**

Optic nerves pass through the optic canals then unites with the optic nerve of the opposite side to form the **optic chiasma.**



In the chiasma, the fibers from the medial half of each retina cross the midline and enter the optic tract of the opposite side, whereas the fibers from the lateral half of each retina pass posteriorly in the optic tract of the same side.

the optic tract terminate by synapsing with nerve cells in the **lateral geniculate body.**

The axons of the nerve cells of the lateral geniculate body pass posteriorly as the **optic radiation** and terminate in the **visual cortex of the cerebral hemisphere.**

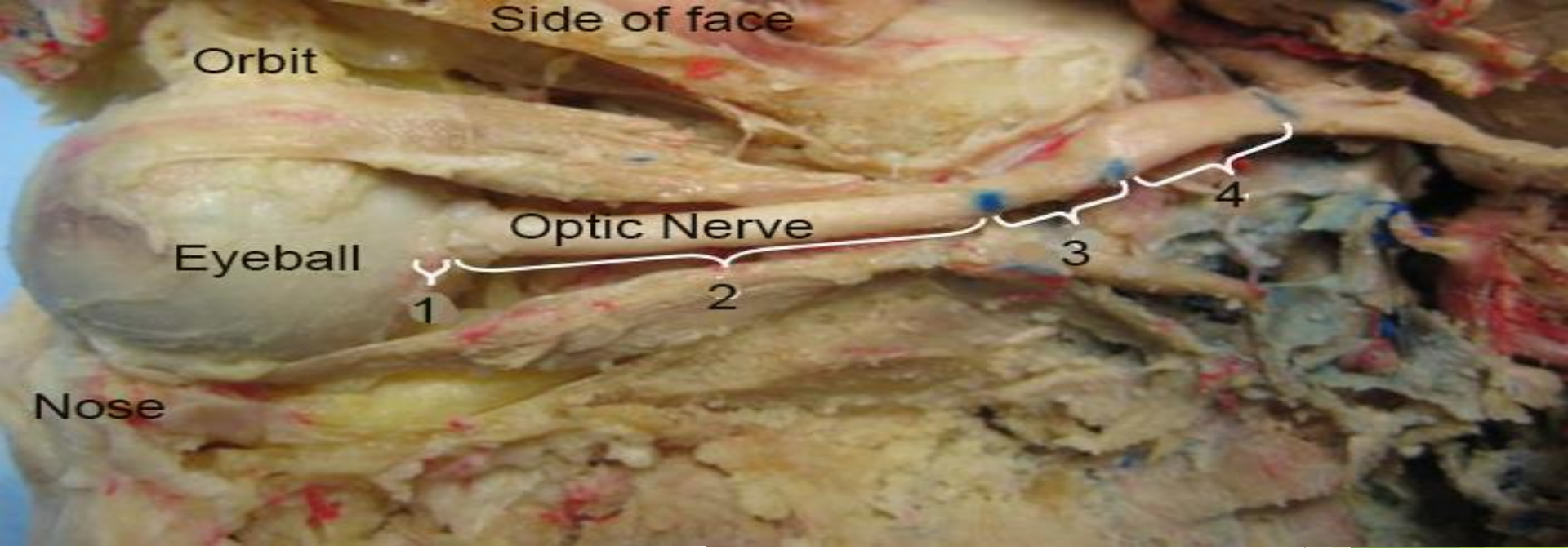
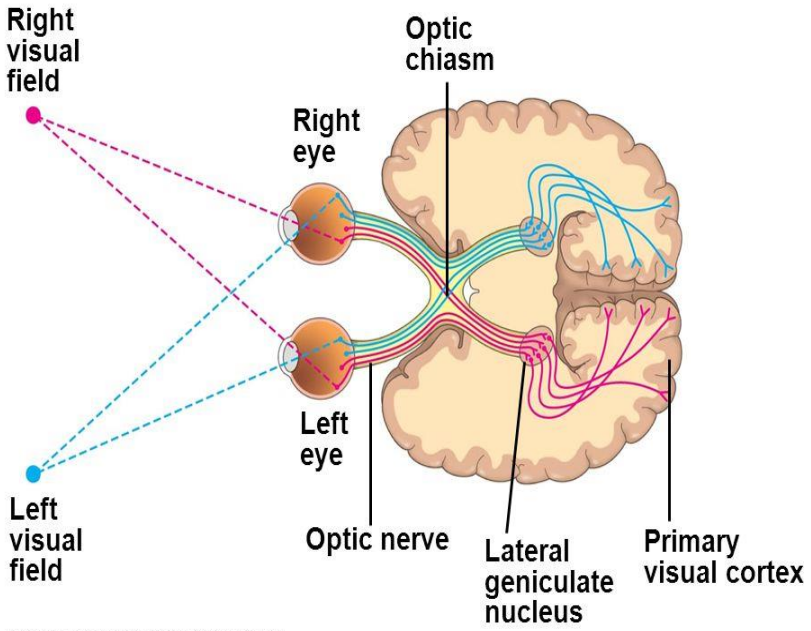
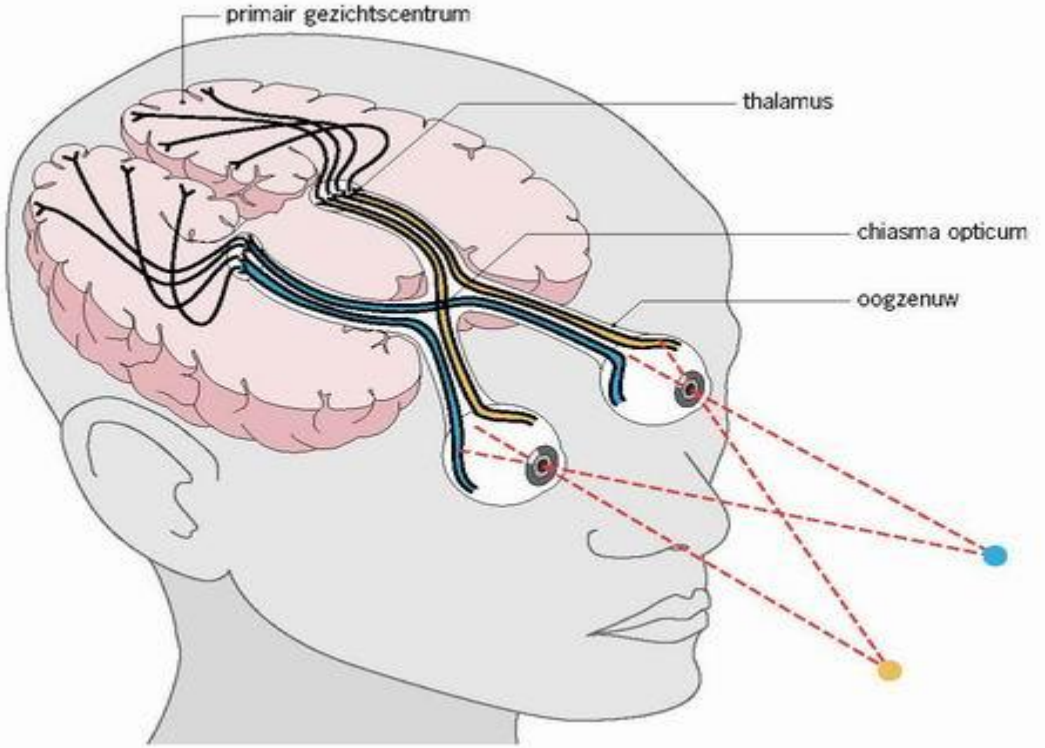


Fig. 50-24 **Neural Pathways for Vision**

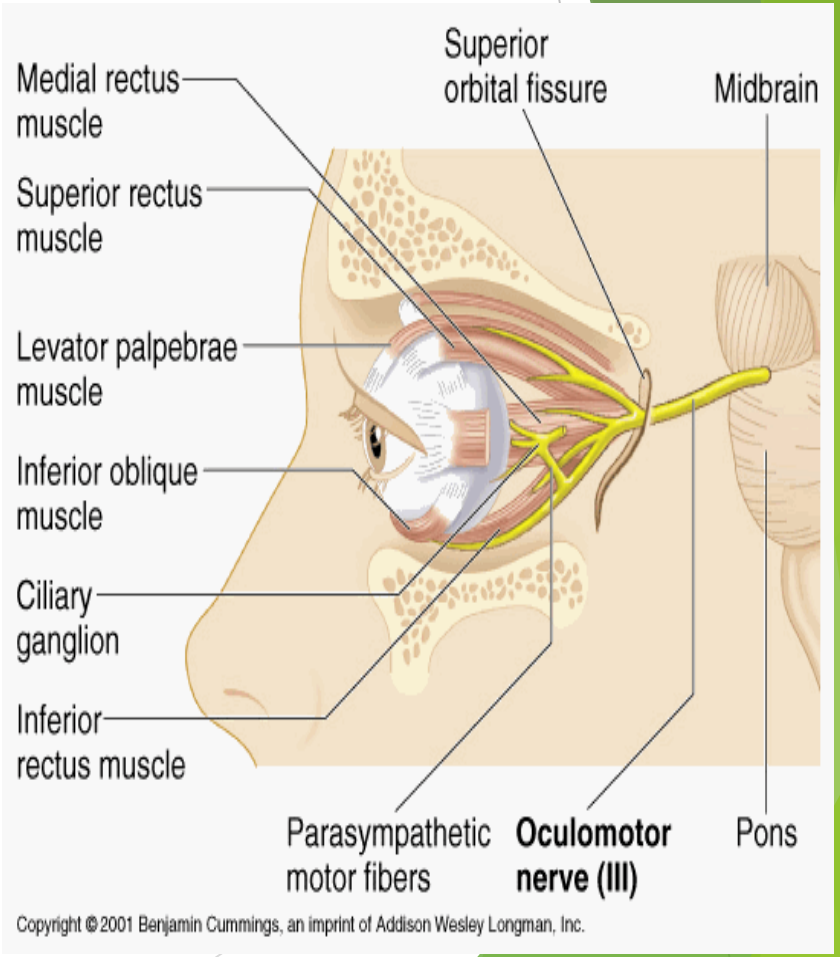


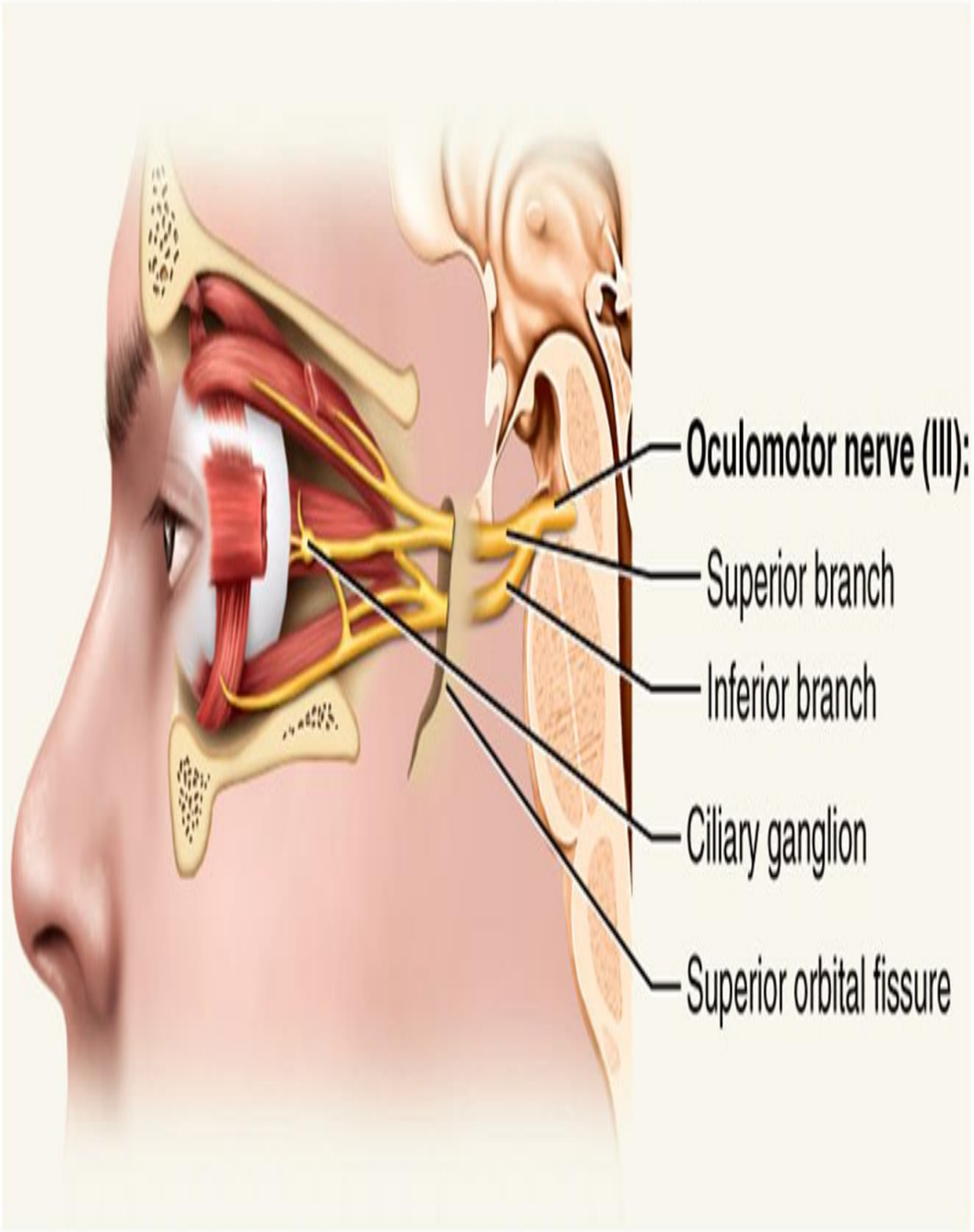


Cranial Nerve III: Oculomotor (Motor)

Fibers extend from the ventral midbrain, pass through the superior orbital fissure, and go to the extrinsic eye muscles.

Functions in raising the eyelid, directing the eyeball, constricting the iris, and controlling lens shape.

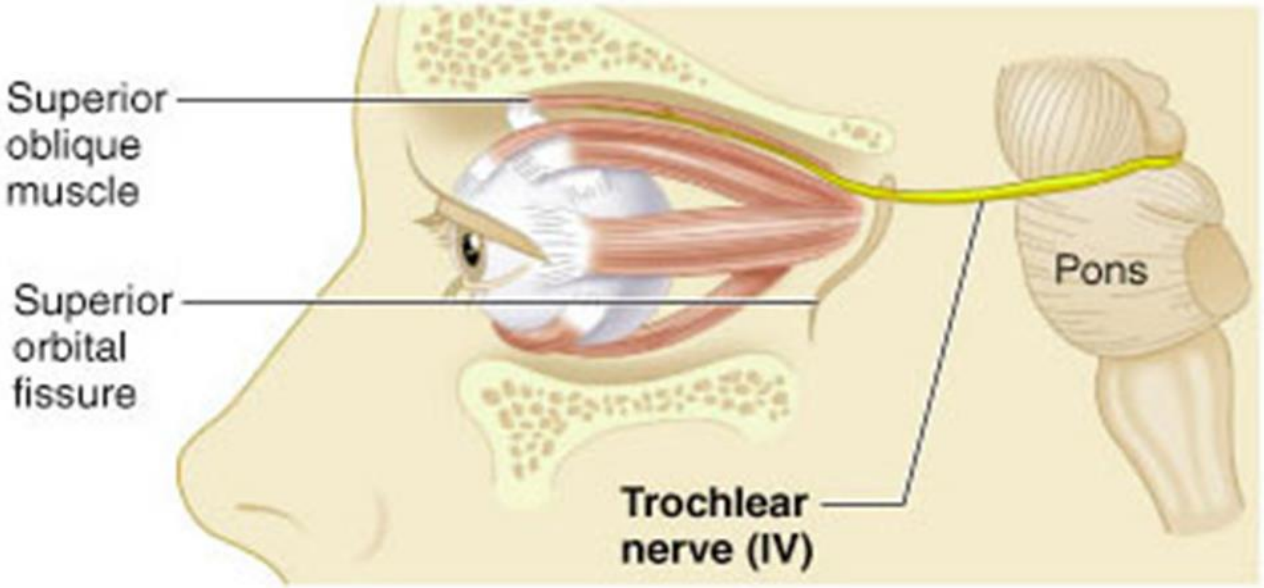




Oculamotor paralysis

Cranial Nerve IV: Trochlear (Motor)

Fibers emerge from the dorsal midbrain and enter the orbits via the superior orbital fissures; innervate the superior oblique muscle to direct the eyeball.



Cranial Nerve V: Trigeminal (sensory & motor)

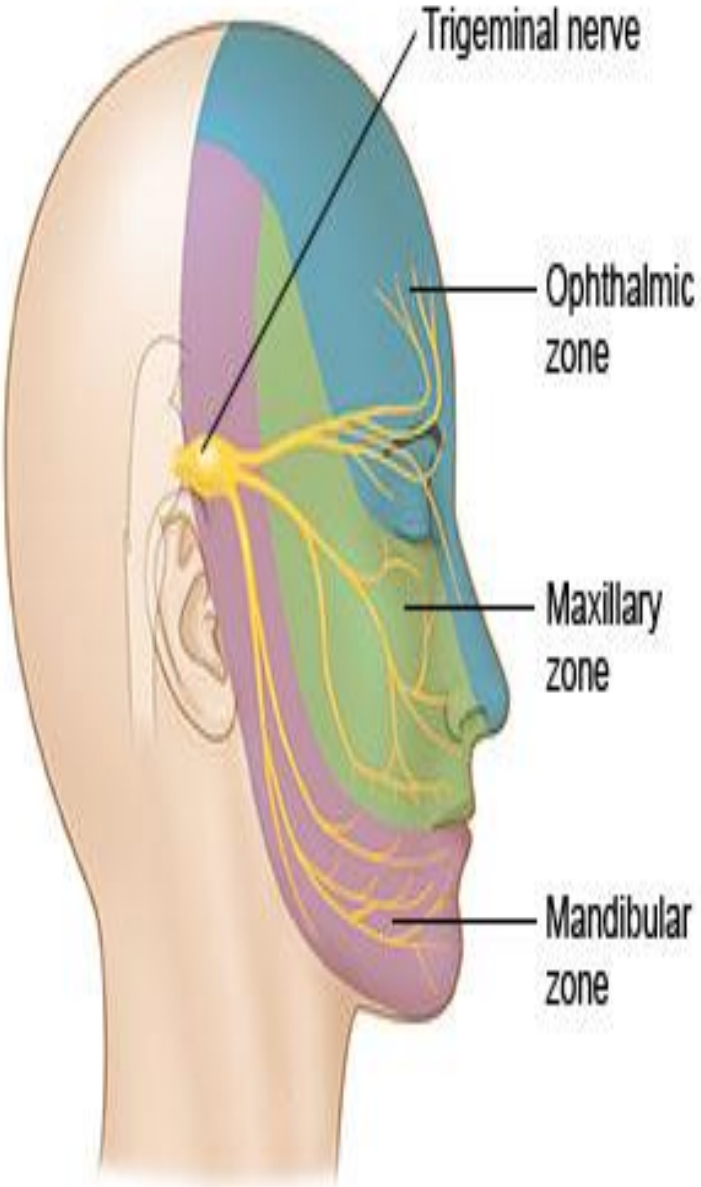
Ophthalmic branch(V_1): passes from the face to the pons through superior orbital fissure.
(sensory) sensations from nasal cavity, skin of forehead, upper eyelid, eyebrow, nose.

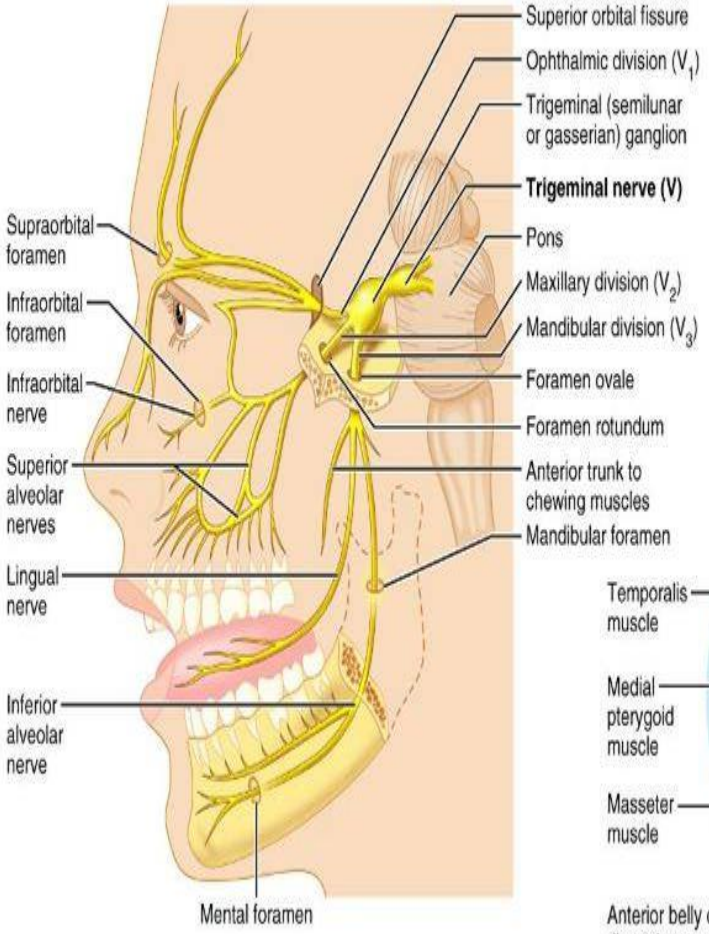
Maxillary branch(V_2): passes from the face to the pons through Foramen rotundum.
(sensory) sensations from lower eyelid, upper lips and gums, teeth of the maxilla, cheek, nose, palate, pharynx.

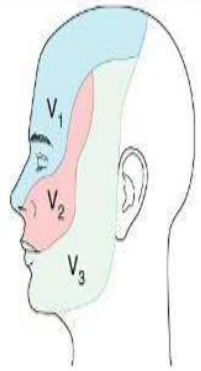
Mandibular branch (V_3) : passes from the face to the pons through Foramen ovale.
(sensory and motor) sensations from teeth of the mandible, lower gums and lips, palate, tongue. Motor function supplies Muscles of mastication.

Trigeminal nerve

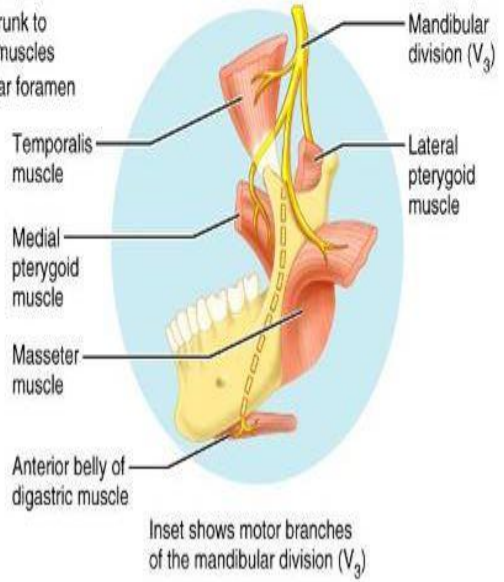
Cranial Nerve V: Trigeminal







Distribution of sensory fibers of each division



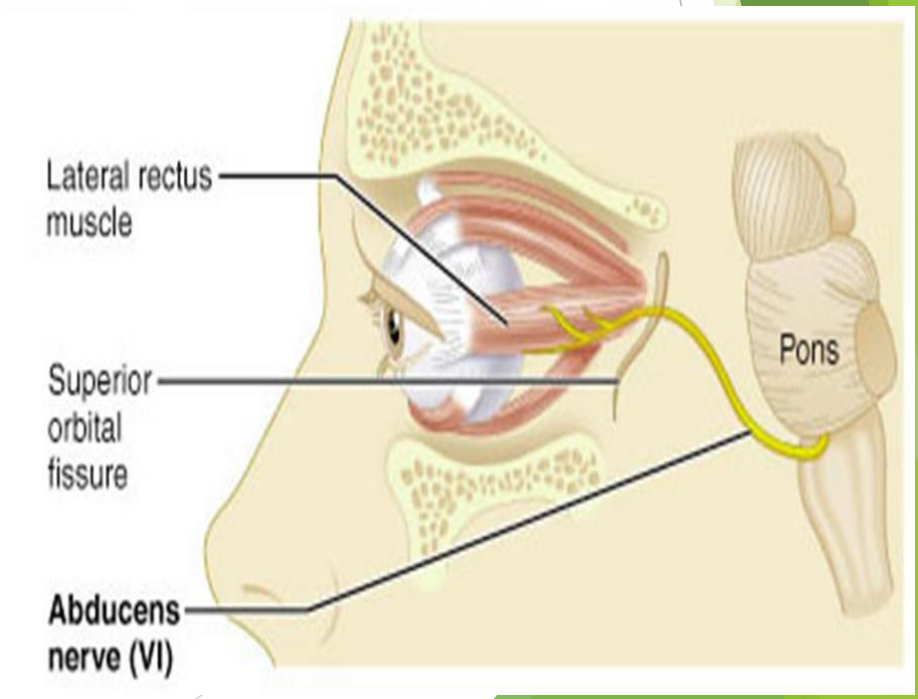
Inset shows motor branches of the mandibular division (V_3)

Cranial Nerve VI: Abducens (Motor)

Fibers leave the inferior pons and enter the orbit via the superior orbital fissure.

Primarily a motor nerve innervating the lateral rectus muscle.

Abducent nerve injury



Cranial Nerve VII: Facial (sensory & motor)

Fibers leave the pons, travel through the internal acoustic meatus, and emerge through the stylomastoid foramen to the lateral aspect of the face .

Motor - facial expressions and secretomotor salivary and lacrimal glands, mucous membranes of nasal and palatine mucosa.

Special Sensory - taste on anterior 2/3's of tongue.

The Facial Nerve

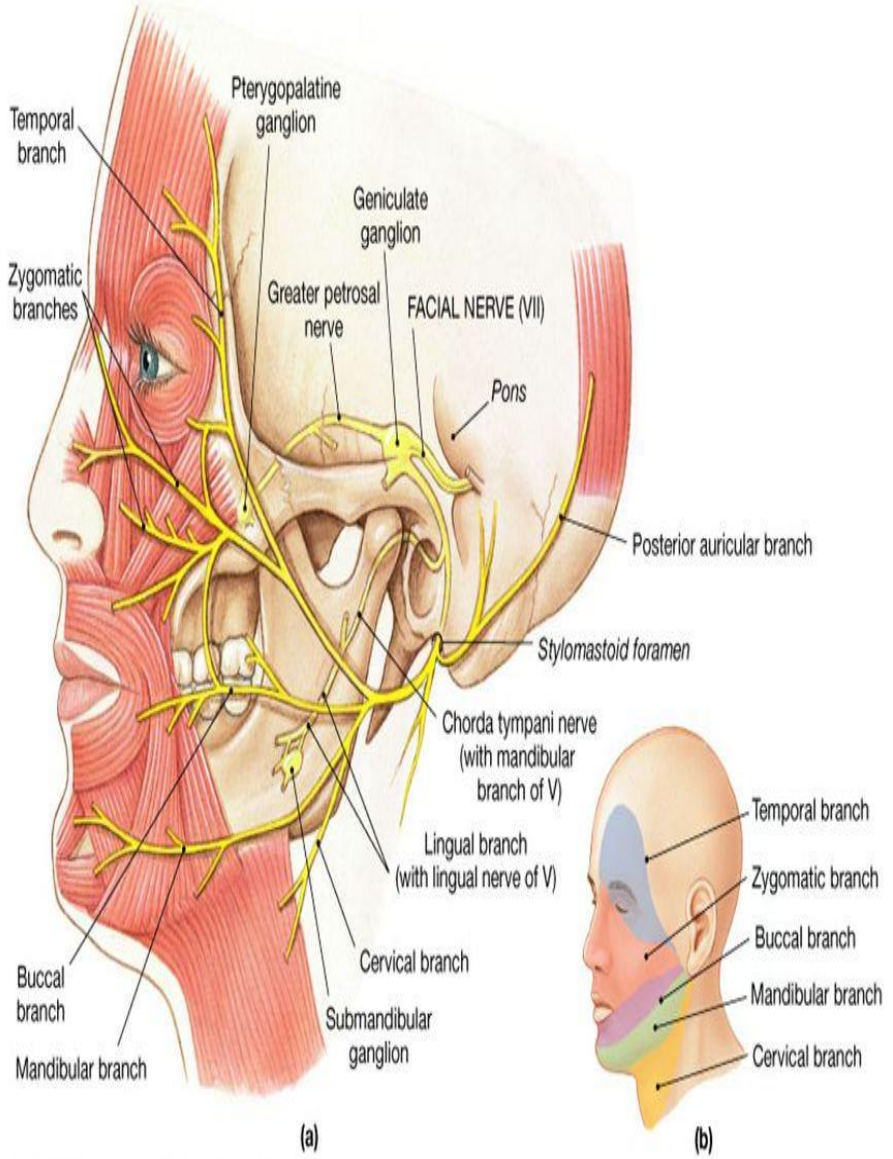
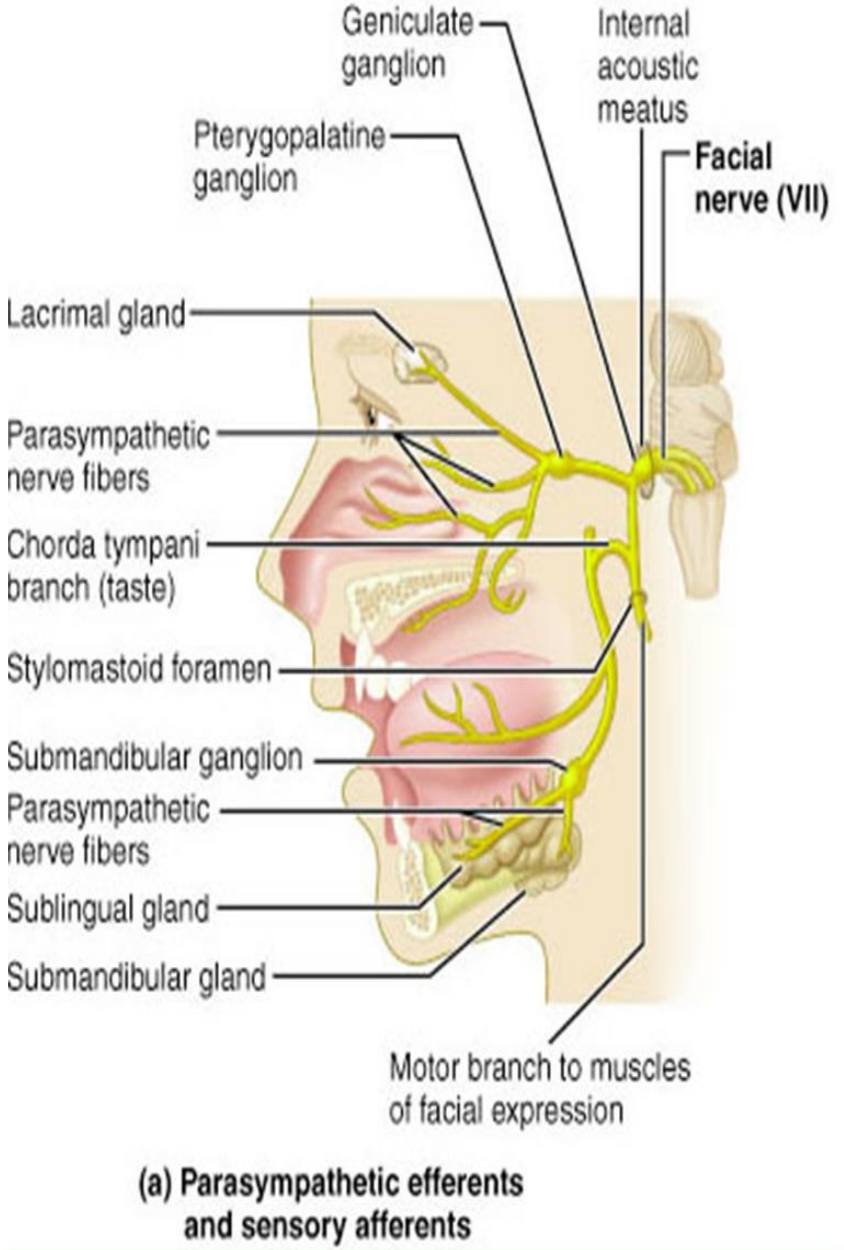
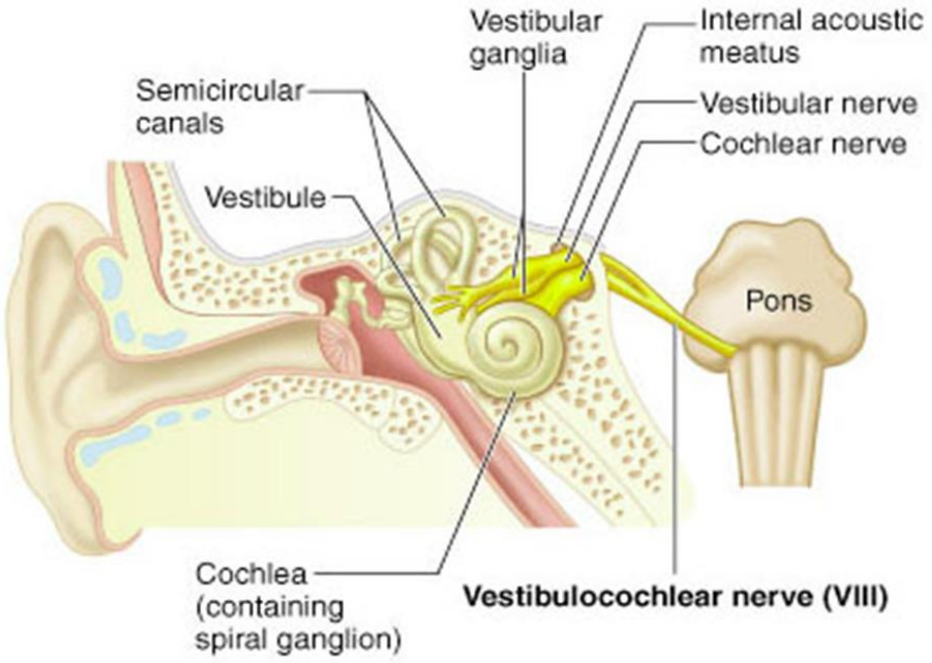


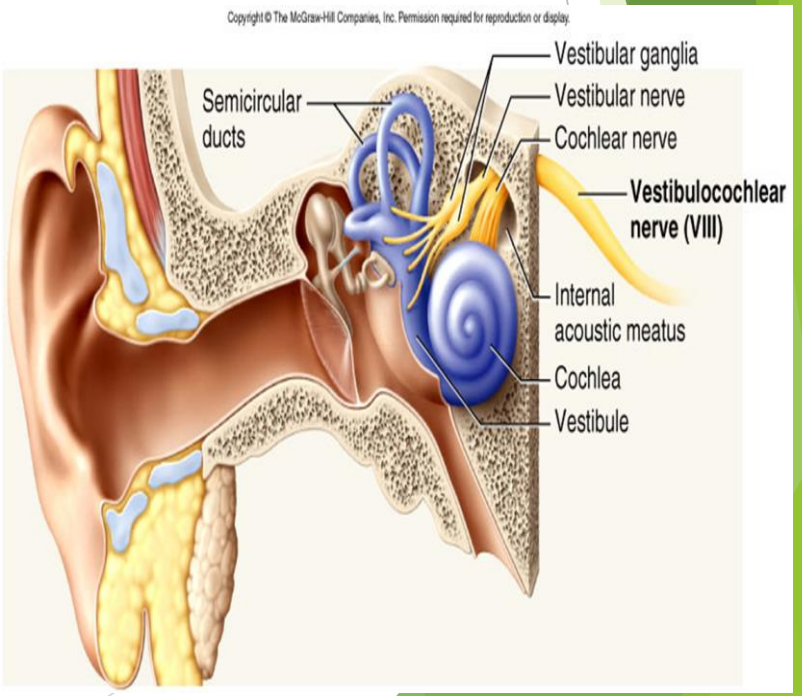
Figure 14.25a, b



Cranial Nerve VIII: Vestibulocochlear (Sensory)

Passes through Internal acoustic meatus-Special Sensory
Provides hearing (cochlear branch) and sense of balance (vestibular branch).
Damage produces deafness, dizziness, nausea and loss of balance .



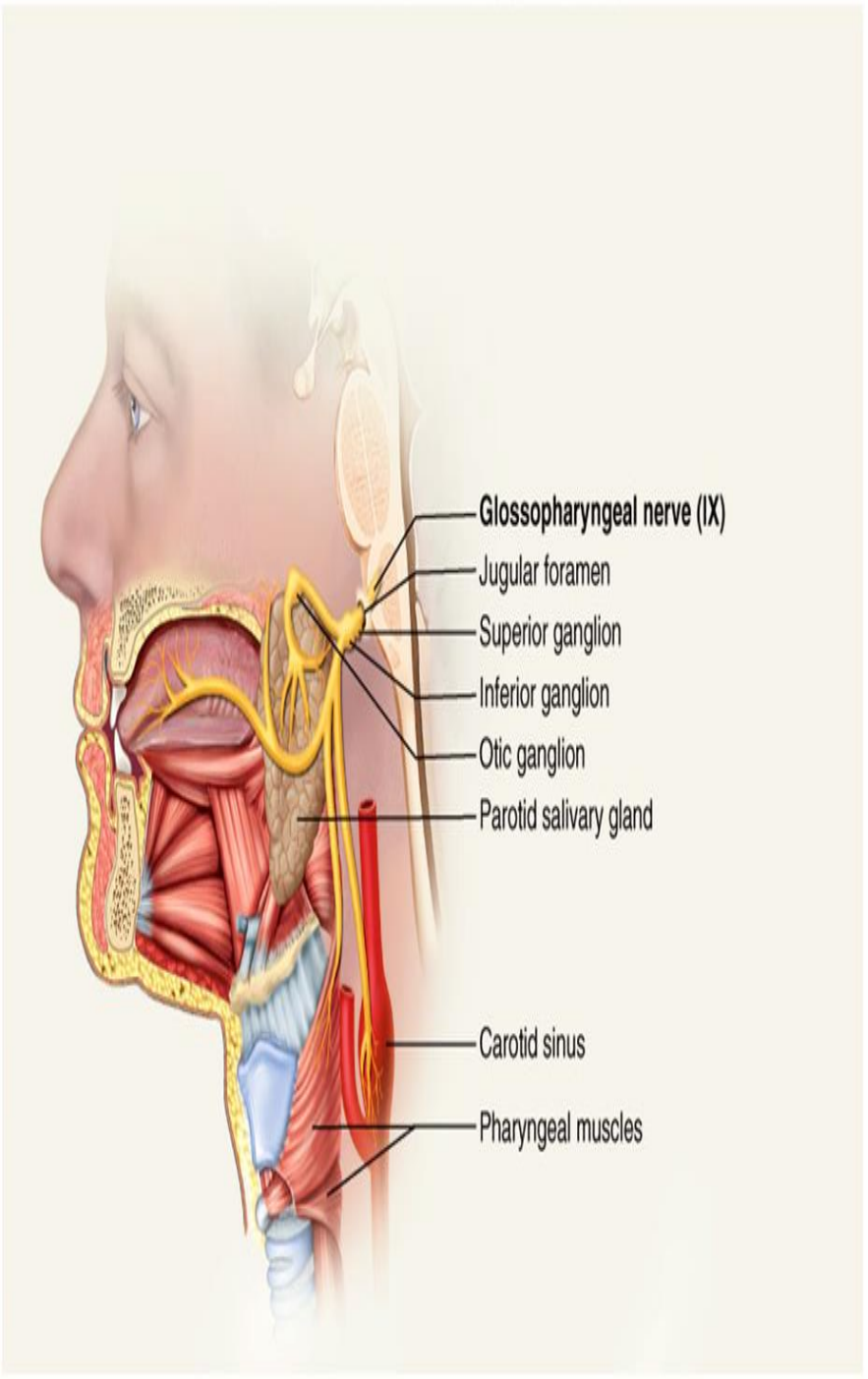


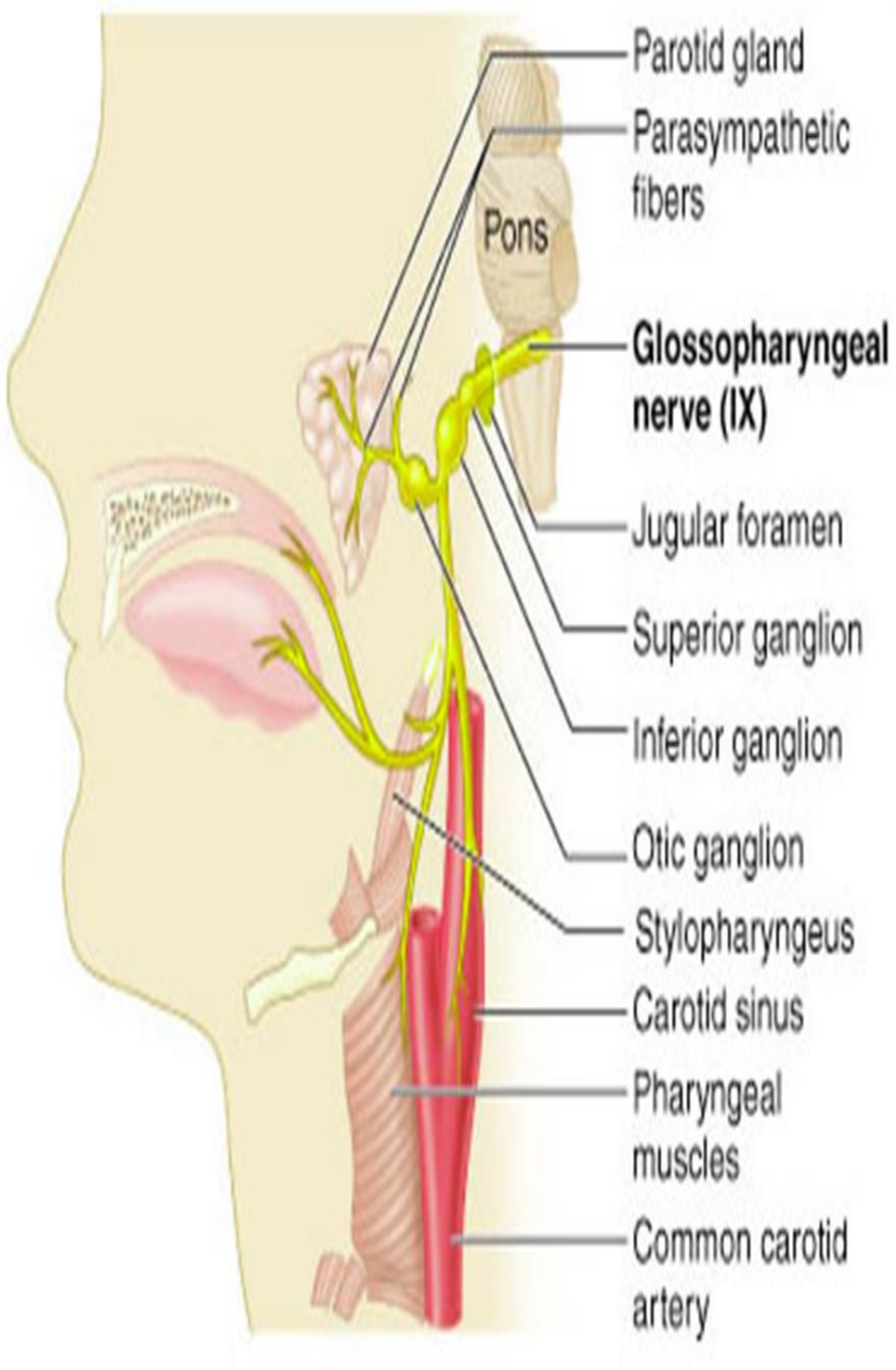
Cranial Nerve IX:
Glossopharyngeal
(sensory & motor)

Fibers emerge from the medulla, leave the skull via the **jugular foramen.**

motor innervates part of the tongue and pharynx, and provides motor fibers to the parotid salivary gland.

Sensations fibers responsible for taste and general sensory impulses from the tongue and pharynx.





Cranial Nerve X: Vagus (sensory & motor)

Fibers emerge from the medulla via the **jugular foramen.**

Motor- Constrictor muscles of pharynx and intrinsic muscles of larynx; involuntary muscle of trachea and bronchi, heart, alimentary tract from pharynx to spleen, flexure of colon; liver and pancreas

Sensory - Taste from epiglottis

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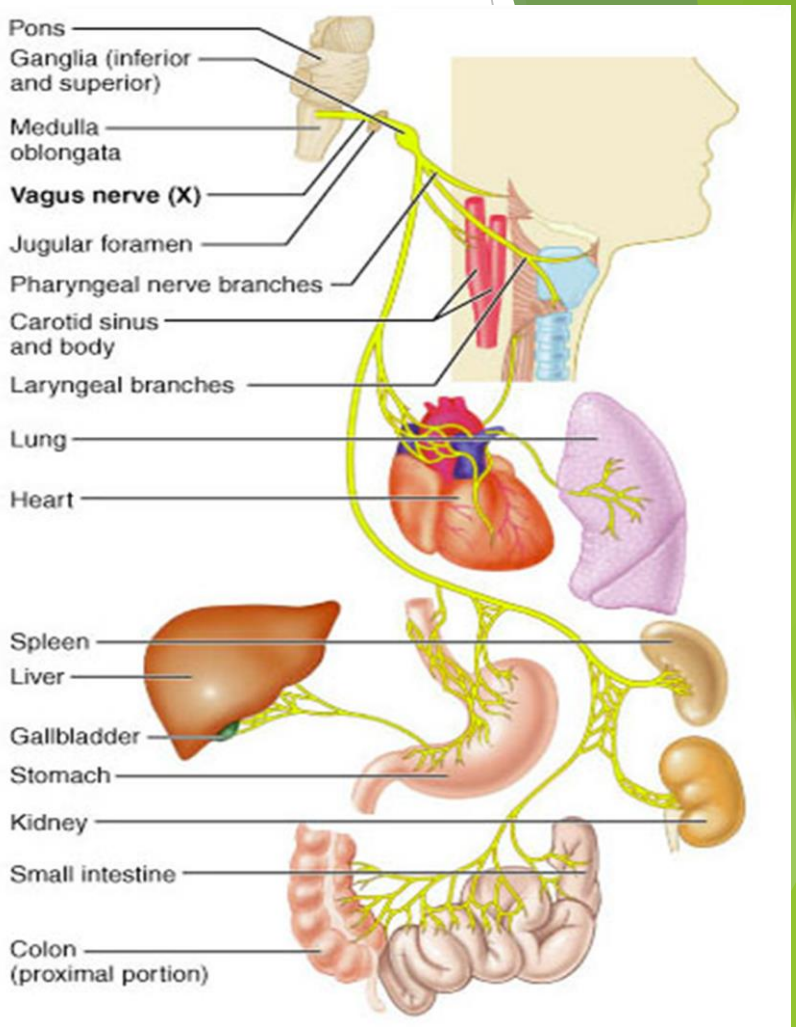


Cranial Nerve XI: Accessory (Motor)

Spinal root enters the skull through the **foramen magnum** to join the **cranial root.**

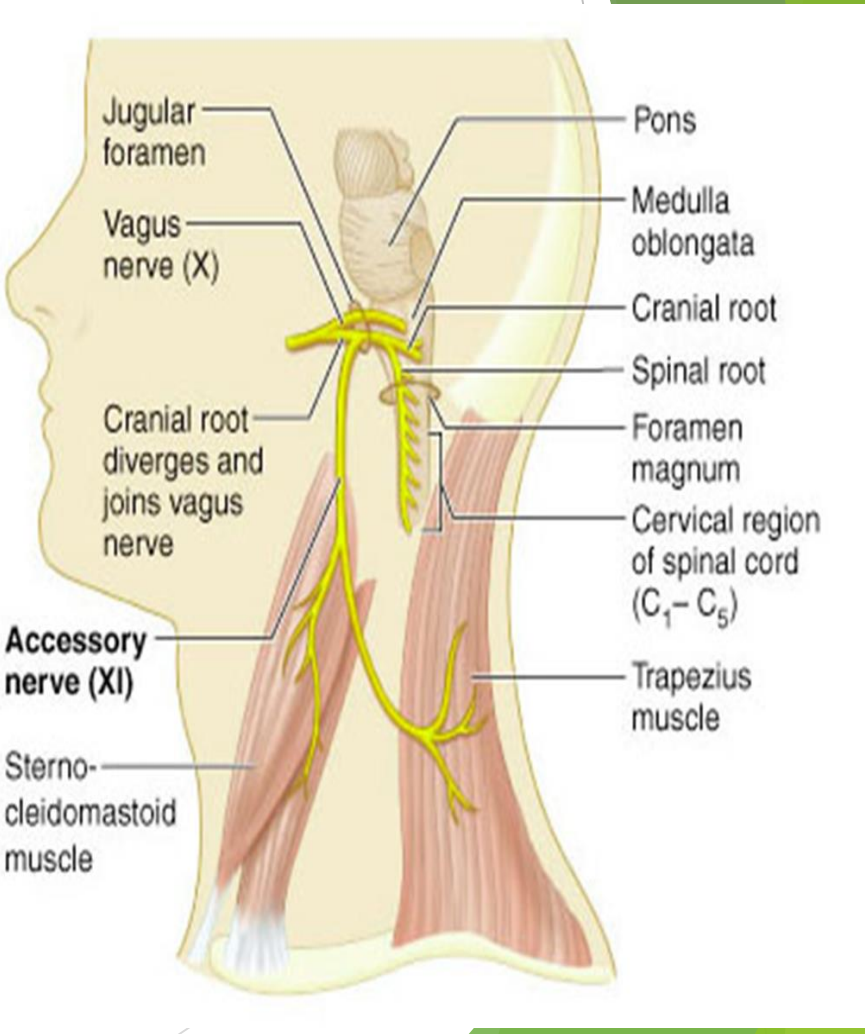
The two roots unite and leave the skull through the **jugular foramen.**

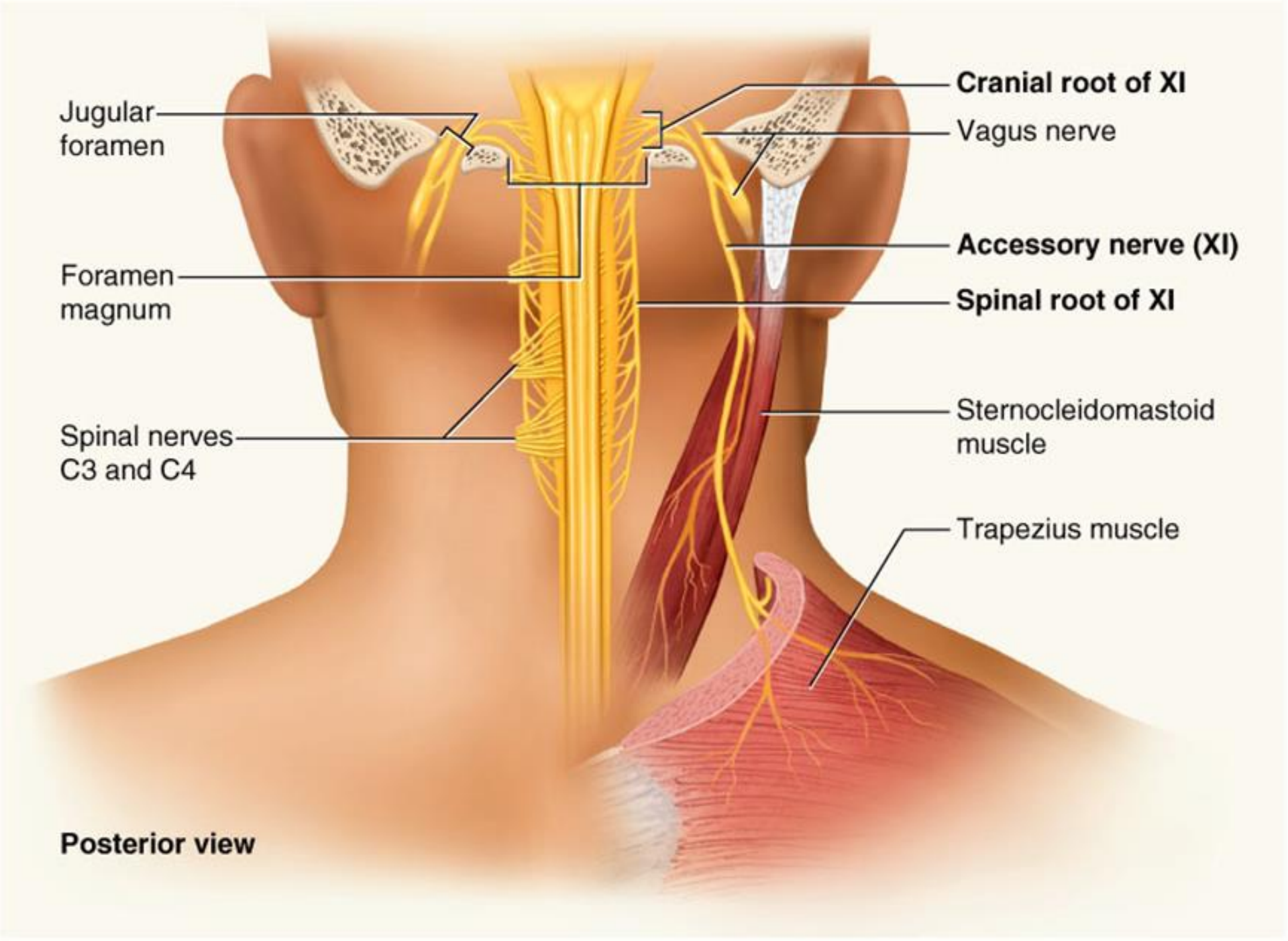
Cranial root - Motor-

Muscles of soft palate, pharynx, and larynx.

Spinal root – Motor-

Sternocleidomastoid and trapezius muscles.





Cranial Nerve XII: Hypoglossal (Motor)

Fibers arise from the medulla and exit the skull via the **hypoglossal canal**
Innervates muscles of the tongue, which contribute of swallowing and speech.