



Cranial nerves

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Cranial nerves I-XII

- Location
- Types of fibers

CN's

- Functions
- Associated reflexes and damage
- Wooclap

Meet the cranial nerves:

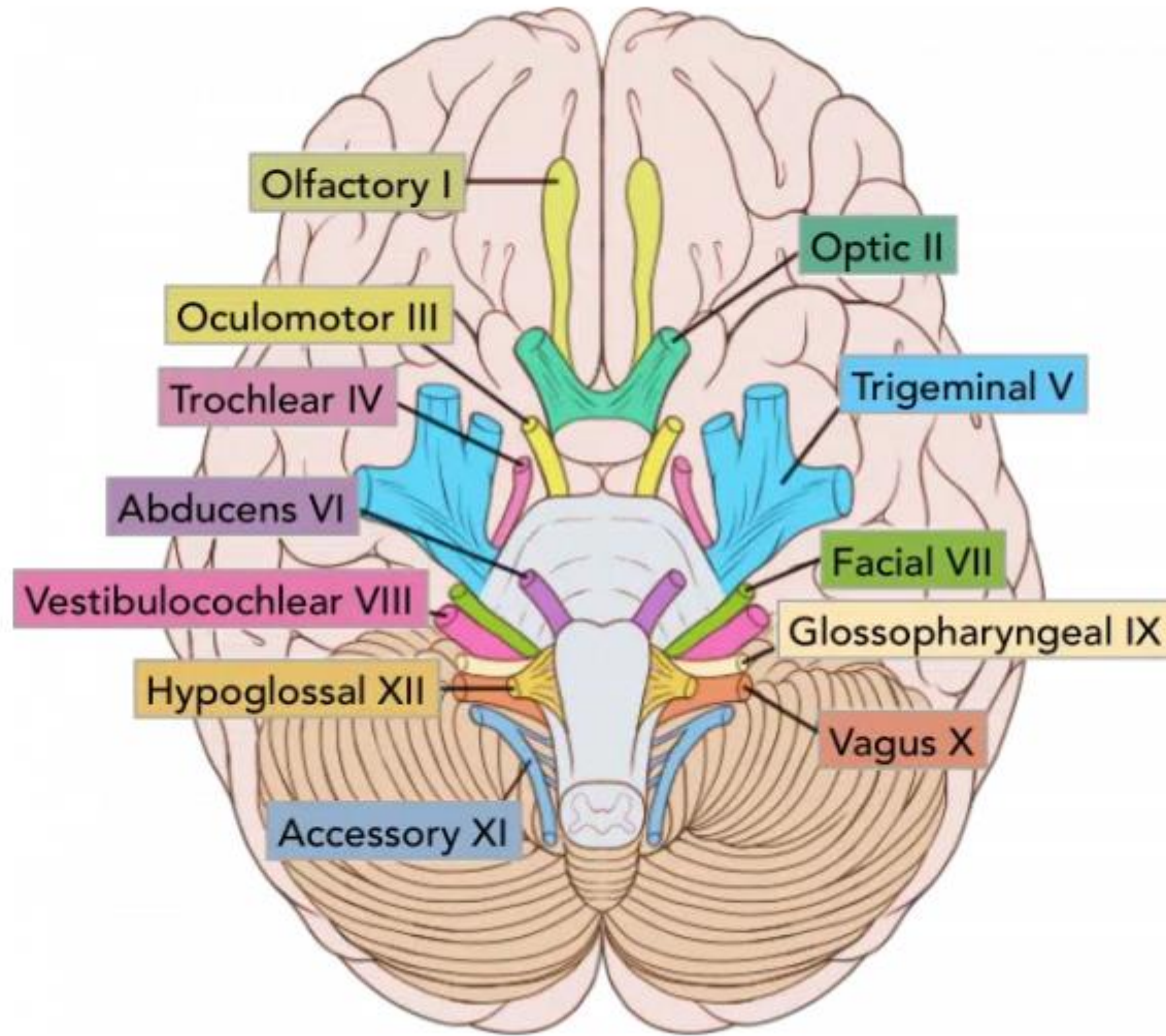


RULE OF 4's:

4 from Midbrain: I, II, III, IV

4 from Pons: V, VI, VII, VIII

4 from Medulla: IX, X, XI, XII



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Nerve fibers



Letter Symbol	Component	Function
	Afferent (to CNS)	Sensory
GSA	General somatic afferent	General sensation
GVA	General visceral afferent	Visceral sensation
SSA	Special somatic afferent	Vision, balance, hearing
SVA	Special visceral afferent	Smell, taste
	Efferent (from CNS)	Motor
GSE	General somatic efferent	Somatic striated muscle
GVE	General visceral efferent	Glands and smooth muscle (parasympathetic innervation)
SVE	Special visceral efferent	Branchial arch striated muscle

Efferent = signal from brain to periphery

Afferent = Signal from
periphery to brain

General fibers:

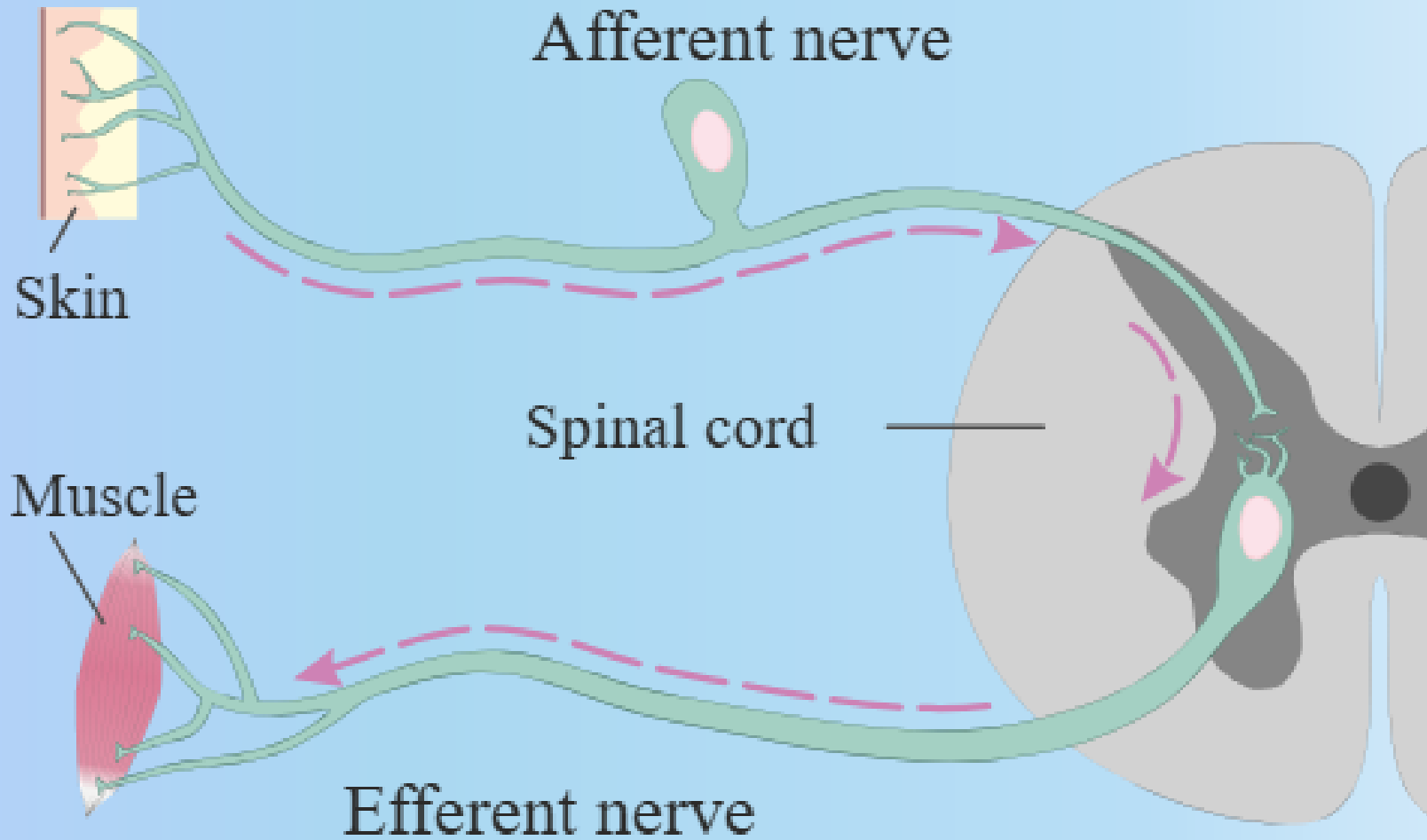
- **GSE** (General somatic efferent)
- **GSA** (General somatic afferent)
- **GVE** (General visceral efferent)
- **GSA** (General visceral afferent)

Efferent: A signal going from the brain to a target. Eg. Muscles, glands.

Somatic = Innervates the «conscious and precise» parts of the body. Eg. Muscles, skin, joints.

Afferent: A signal going from the periphery to the brain. Eg. Pain, sensation

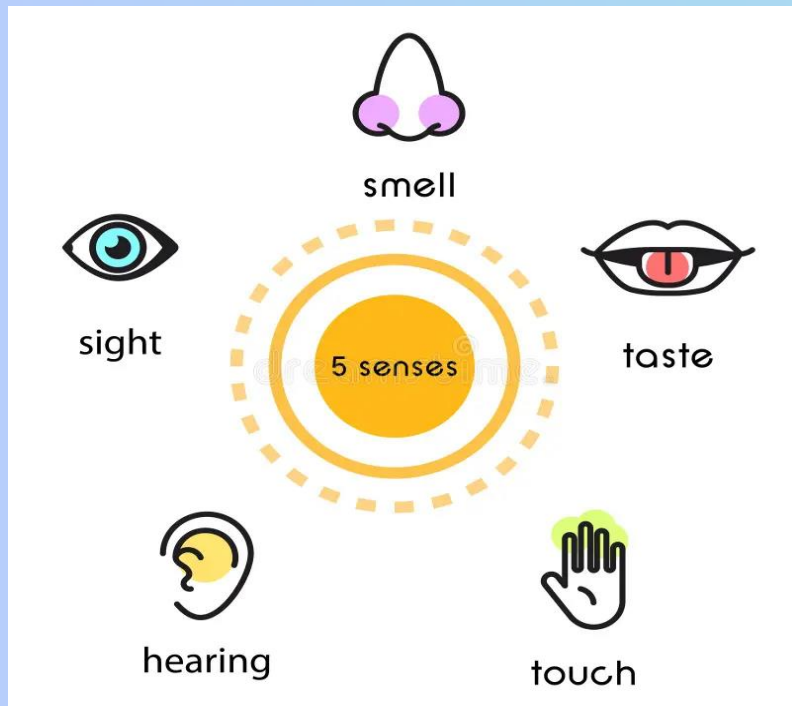
Visceral = Internal parts of body. Afferent fibers transfer pain from organs and efferent has autonomus control.



Special fibers:

- Transmit the **special** senses:
Taste, balance, vision, hearing and smell.

- **SVA** (Special visceral afferent):
Smell and taste
- **SSA** (Special somatic afferent):
Balance, hearing and vision.



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CN I - Olfactory Nerve

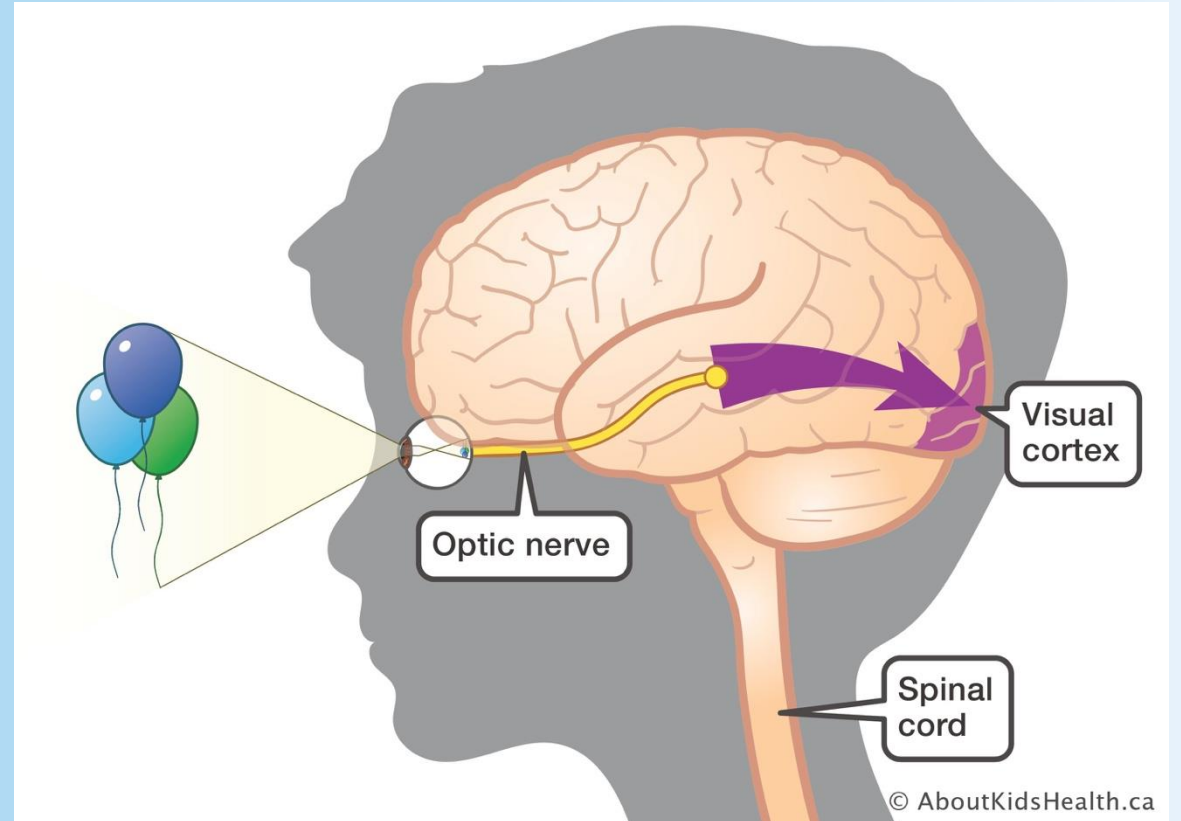
- Contains **SVA** (Special visceral **afferent**) fibers
- Goes through the cribriform foramina of the ethmoid bone
- Provides smell through chemical signals

- **Clinical relevance:**
- Damage can be due to ethmoidal fracture, **infection (like COVID-19)**, intracerebral damage, chronic sinusitis and neurodegenerative disease.
- **Anosmia** (loss of smell) and **Parosmia** (distorted sense of smell)
- **Ammonia test** in clinical practice

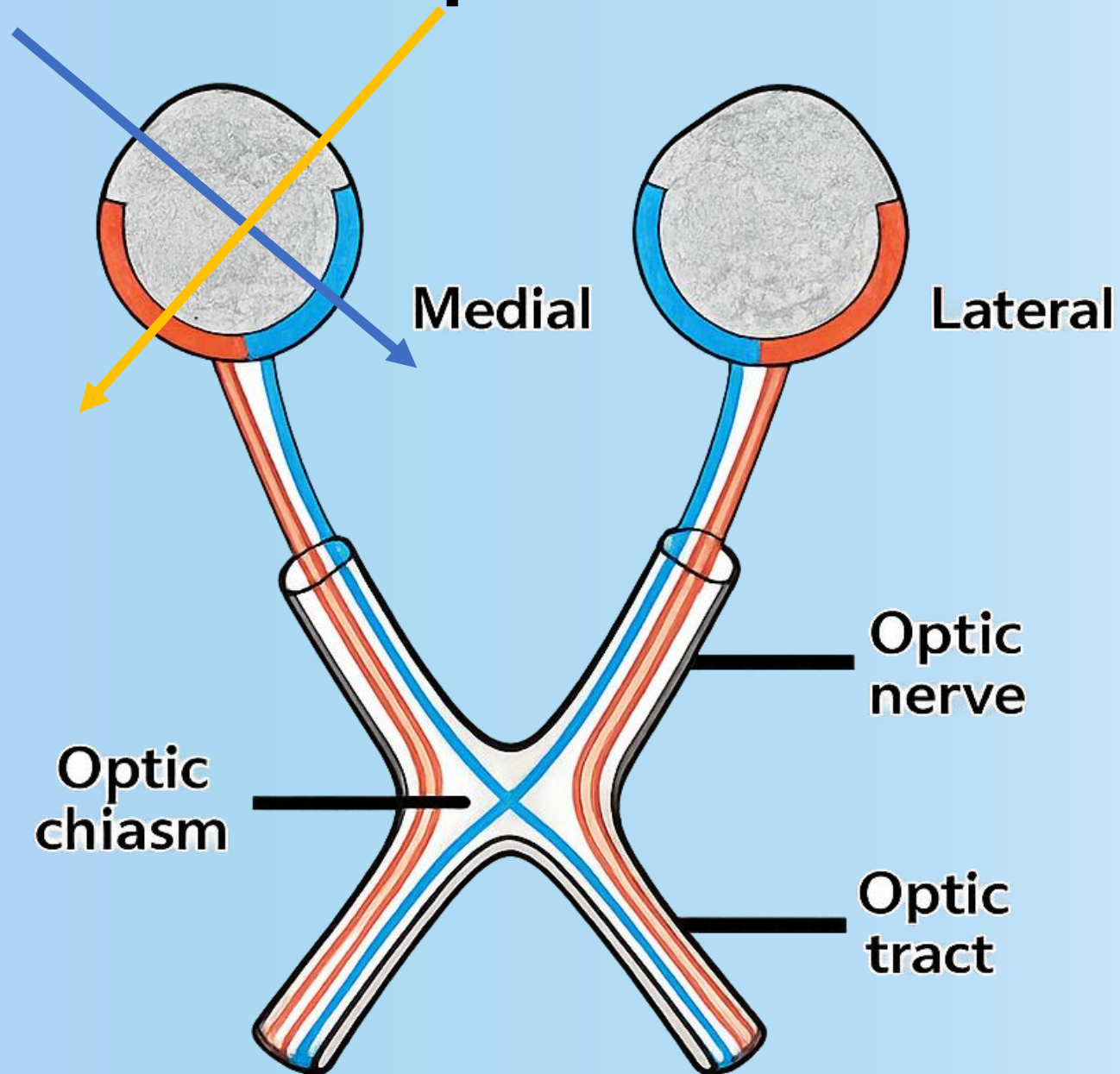


CN II- Optic Nerve

- Part of the CNS
- **SSA** (Special somatic **afferent**)
- Crosses the pituitary gland (tumors can cause symptoms) and leaves the skull through the optic canal.
- Responsible for transmitting vision to the visual cortex.
- **Afferent** nerve of the Pupillary light and Accommodation reflexes

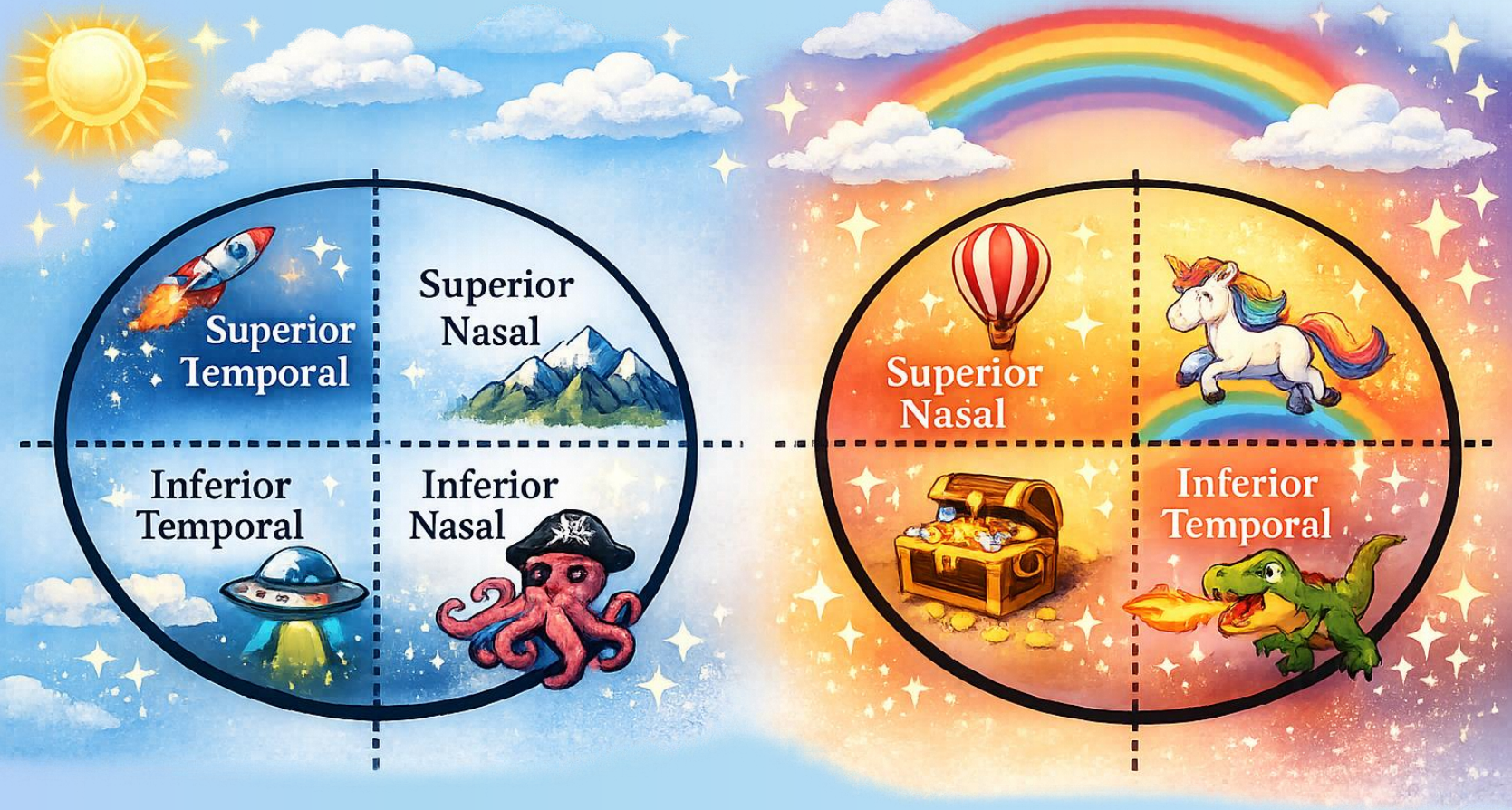


The optic tract:



Notice that the medial nerve fibers cross at the optic chiasm.

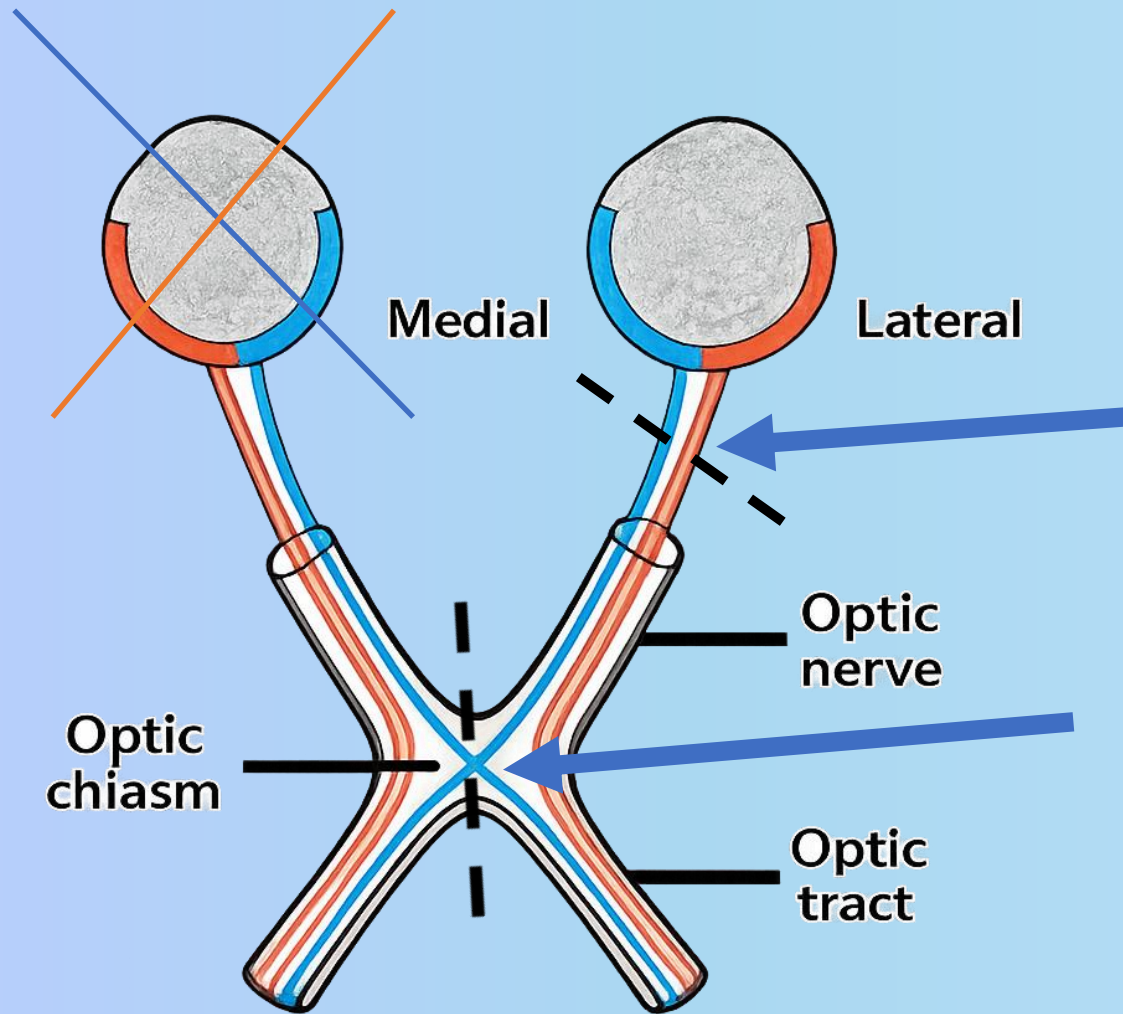
Visual fields:



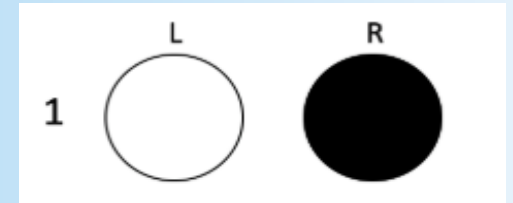
Patient's Right Eye

Patient's Left Eye

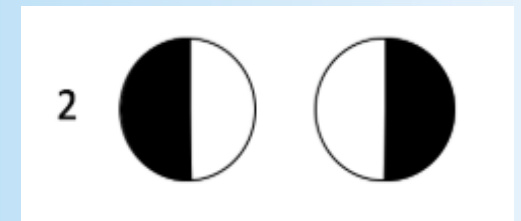
Visual damage:



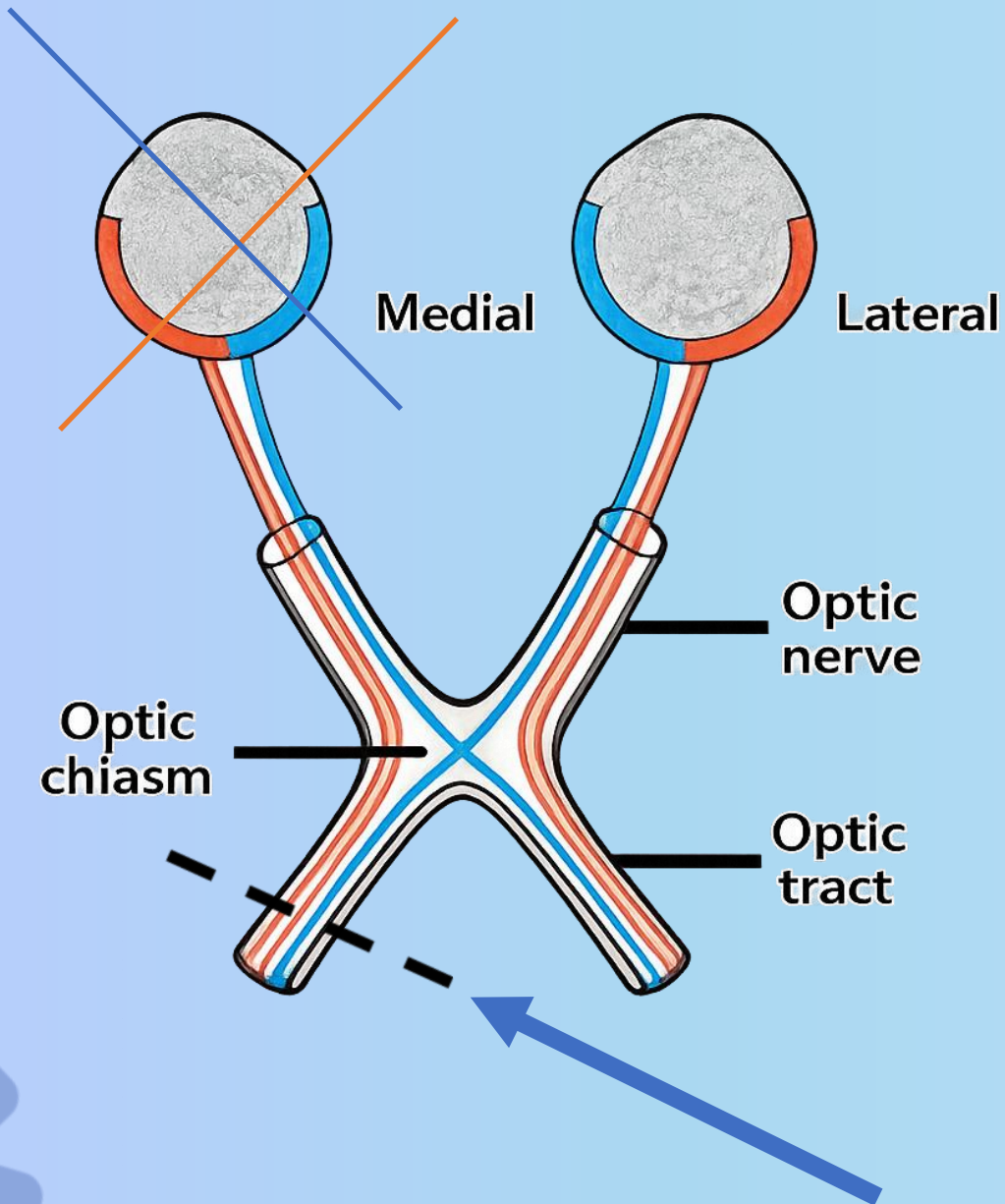
Lesion 1: Happens after the optic chiasm. This will lead total blindness in the affected eye



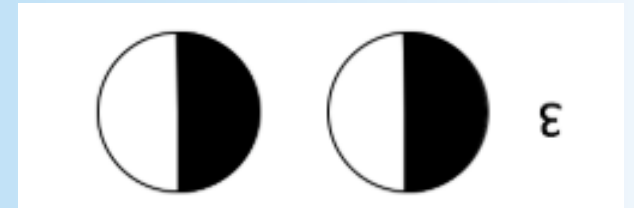
Lesion 2: Happens at the optic chiasm. Meaning that the two crossing (blue) fibers get cut. These both supply the medial portion of the eye, containing the temporal visual field.



Visual damage:



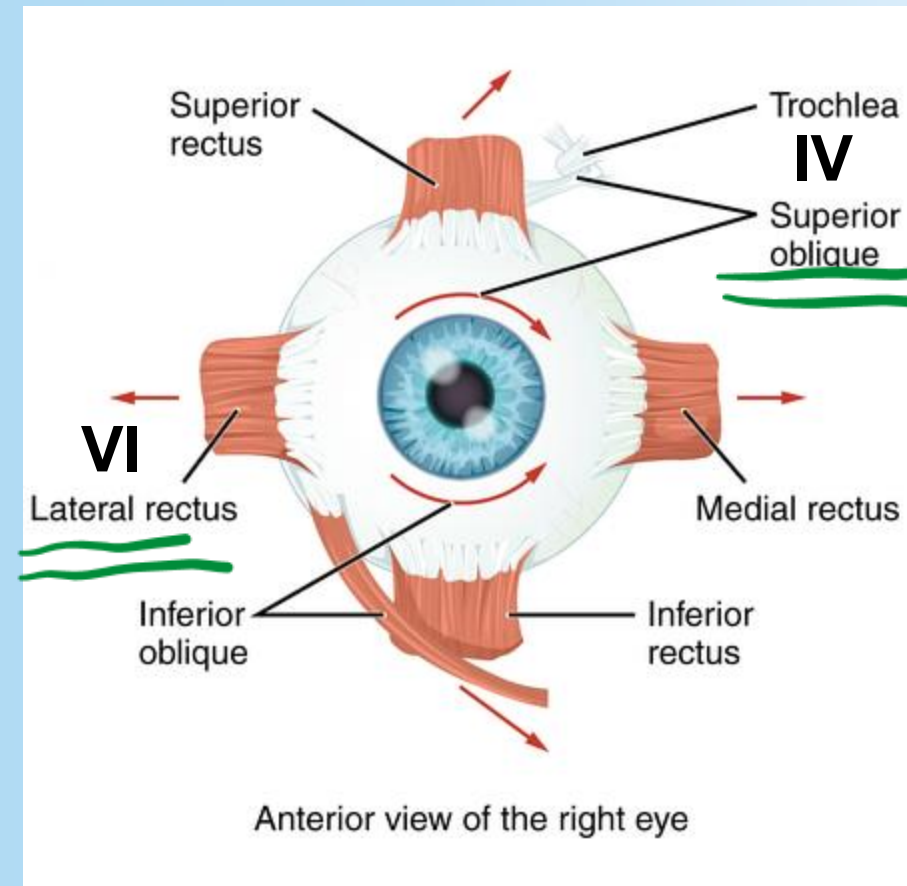
Lesion 3: Damage to the left lateral and crossing nerve will cause damage to the temporal vision of the right eye and the nasal vision of the left eye.



CN III, IV and VI

CN III (Oculomotor) - Midbrain
CN IV (Trochlear) - Midbrain
CN VI (Abducens) - Pons

- All of these nerves innervate the muscles of the eye.
- They all contain **GSE (General somatic efferent)** fibers.
- The oculomotor nerve has parasympathetic fibers as well.



CN III - Oculomotor nerve

- Responsible for all the eye muscles, EXCEPT the lateral rectus and superior oblique.=
- Damage leads to a «down and out» eye position and **ptosis** (drooping of the eyelid).

Clinical relevance:

- Responsible for the **parasympathetic** control of the pupils, damage = **dilation** due to **lack** of Parasympathetic control and a loss of accommodation

Efferent limb of the pupillary light reflex.



CN IV - Trochlear Nerve

- **Function:**
- Innervates the Superior Oblique muscle.
- Responsible for looking downwards and in.

- **Clinical relevance:**
- Damage leads to **vertical diplopia** And difficulty walking down stairs.

- A telltale sign is **head tilting** to compensate.

Bielschowsky head tilt test.



Fig. 17.17 **a** When the patient tilts her head to the left (toward the normal side), the right eye does not deviate upward when the normal left eye fixates.

b When the patient tilts her head to the right (toward the side of the paralyzed muscle), the right eye deviates upward when the normal left eye fixates.

CN VI - Abducens nerve

Function:

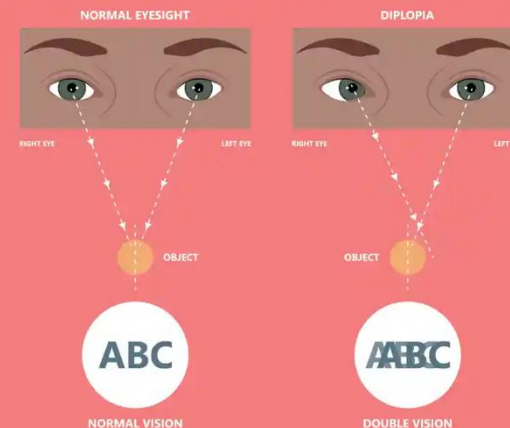
Responsible for the lateral rectus muscle. Abducts the eye.

Clinical relevance:

Damage leads to **diplopia**.



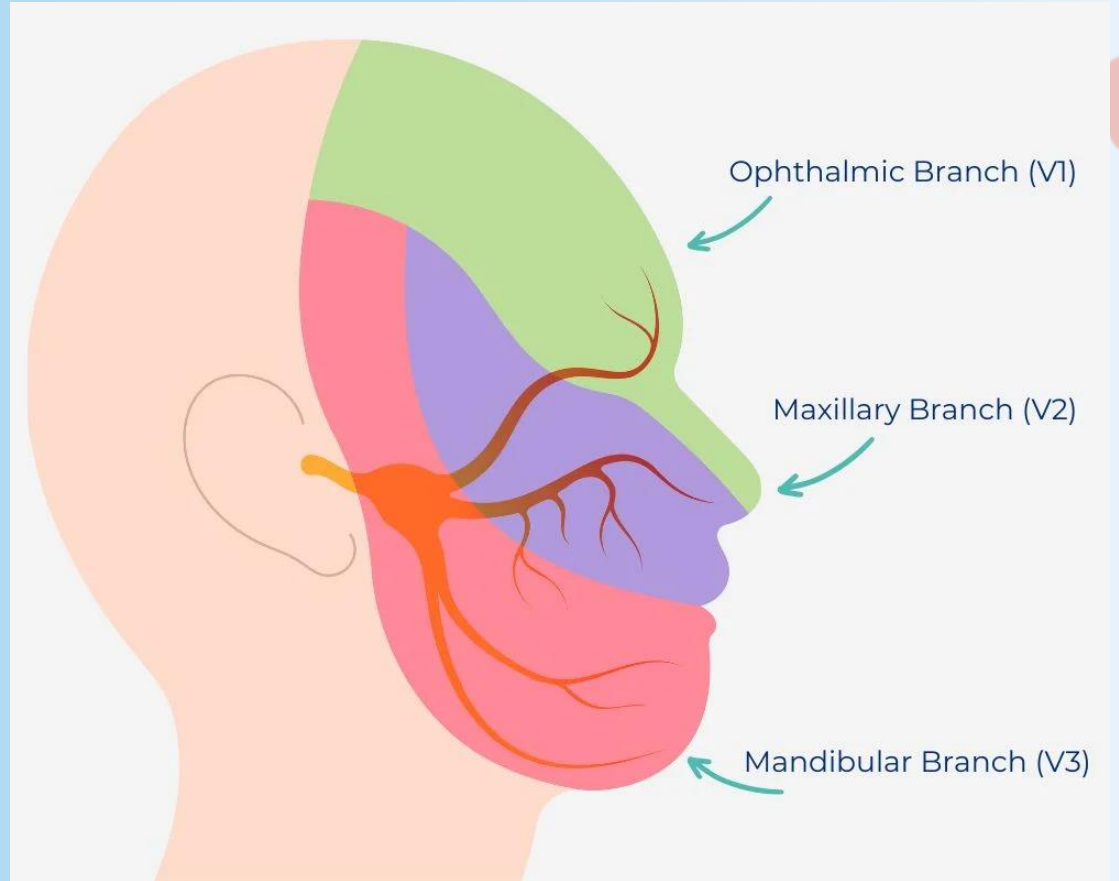
DOUBLE VISION (DIPLOPIA)



CN V- Trigeminal Nerve

- Arises from the pons and divides into three branches:
- V1- Ophthalmic nerve (**GSA**)
- V2- Maxillary nerve (**GSA**)
- V3- Mandibular nerve (**GSA**) AND (**GSE**)

- They all innervate their sensory part of the face:



CN V - V1 (Ophthalmic)

- **Afferent** limb of the corneal reflex
- **Clinical relevance:**
- Damage leads to loss of sensation of the upper third of the face.



CN V- V2 (Maxillary)

- **Afferent** limb of the sneeze reflex.
- **Clinical relevance:**
- Damage leads to loss of sensation on the **middle** third of the face.



CN V - V3 (Mandibular)

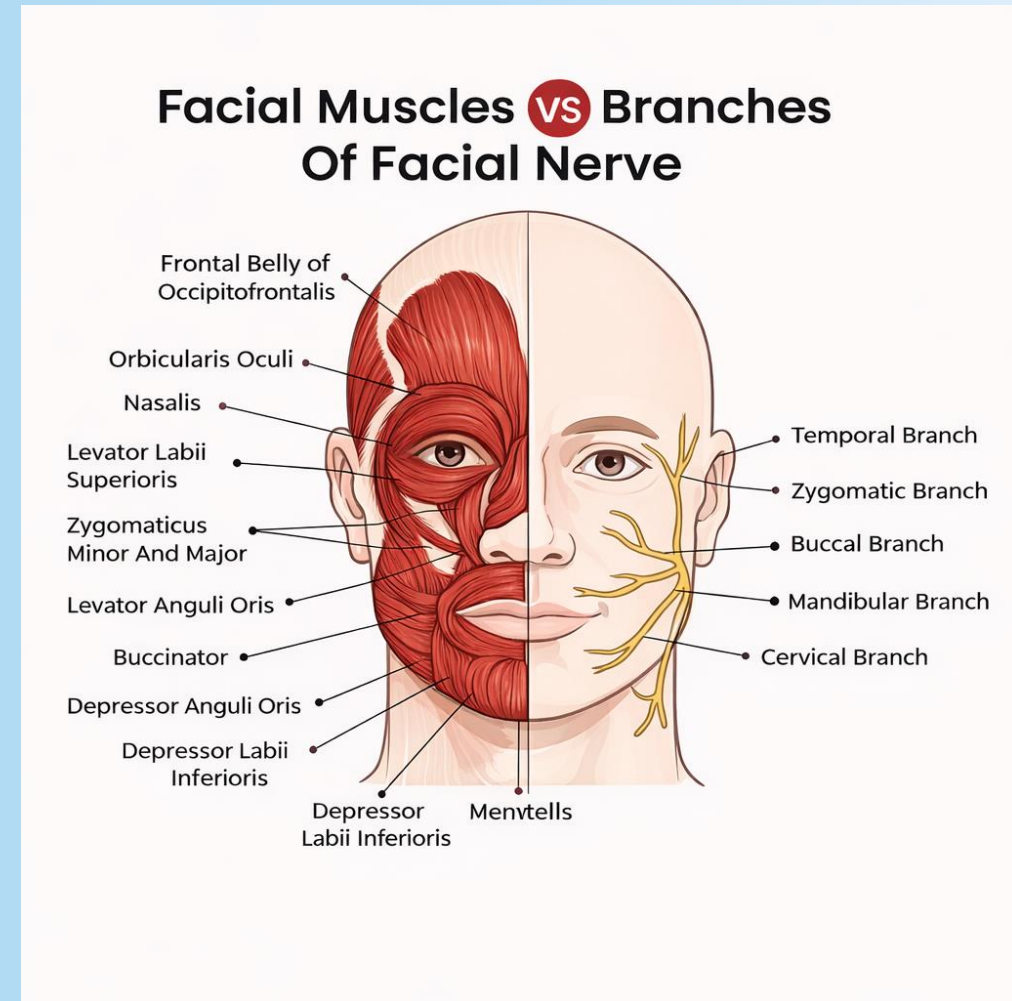
- **Afferent** and **efferent** nerve of the **jaw jerk** reflex.
- Only part of the trigeminal nerve that innervates muscles.

- **Clinical relevance:**
- Damage could lead to loss of sensation of lower third of face. And problems with **mastication** (chewing).



CN VII- Facial nerve

- **Mixed nerve**
- **GSA:** Transmits sensation from a small part of the ear.
- **GSE:** All muscles of the face (**except** mastication)
- **SVA:** Taste for the anterior 2/3 of the tongue
- **GVE:** PS fibers to some salivary glands



Reflex and lesions

- **Efferent** nerve of the corneal reflex
- **Clinical relevance:**
 - Loss of taste.
 - Facial drooping/Bells palsy
 - Dry mouth

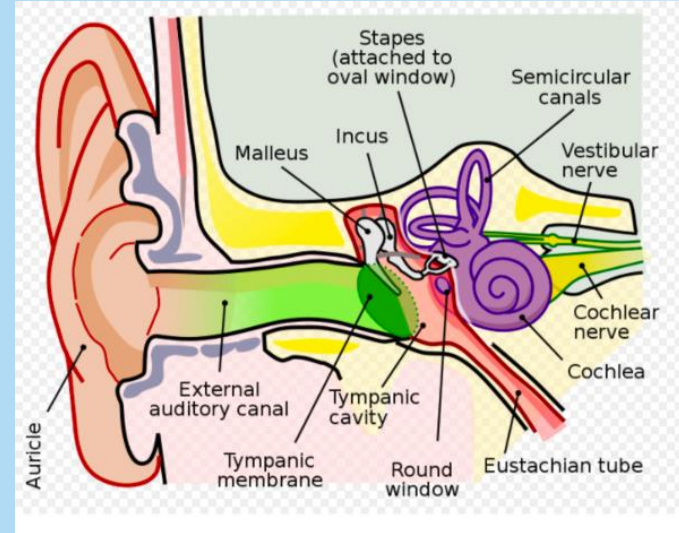


CN VIII- Vestibulocochlear nerve

Contains **SSA**

Divided into two parts:

- **Vestibular part** - Responsible for balance and spacial orientation.
- **Cochlear part** - Resposible for hearing.

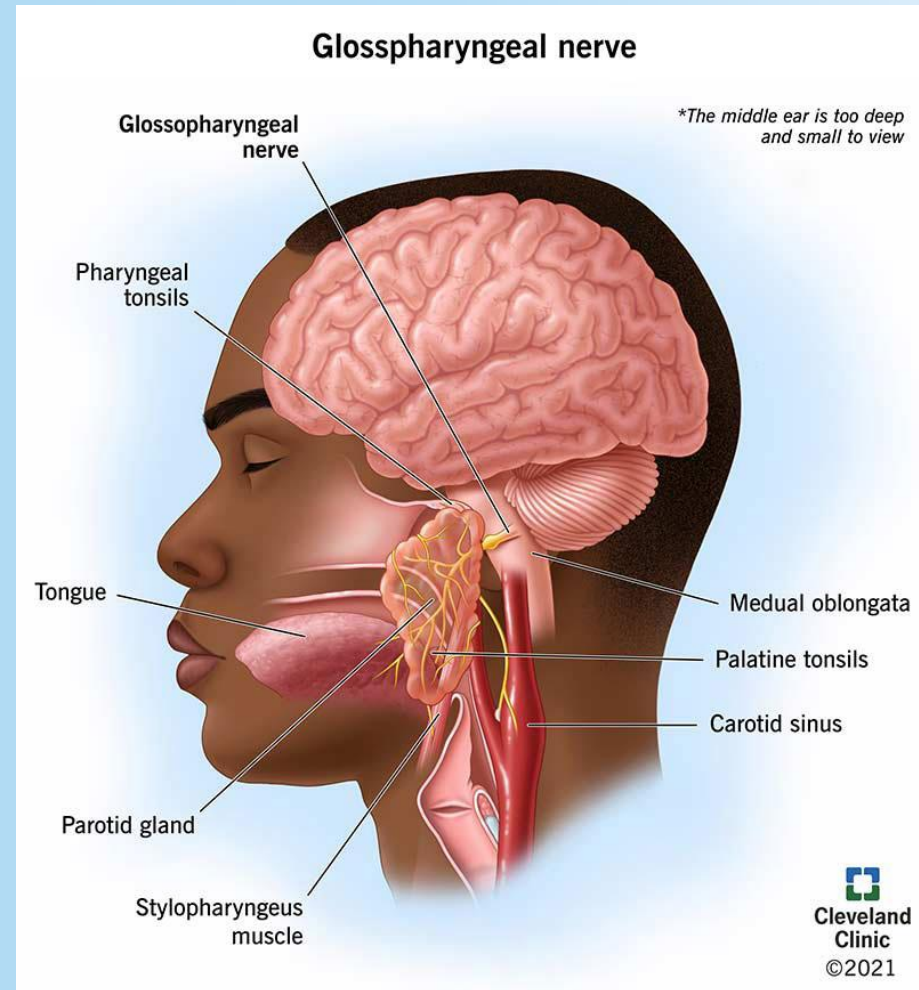


Damage to vestibular nerve = **Vertigo** (dizziness) and **Nystagmus** (involuntary eye movements).

Damage to the cochlear nerve = Hearing loss and **tinnitus**.

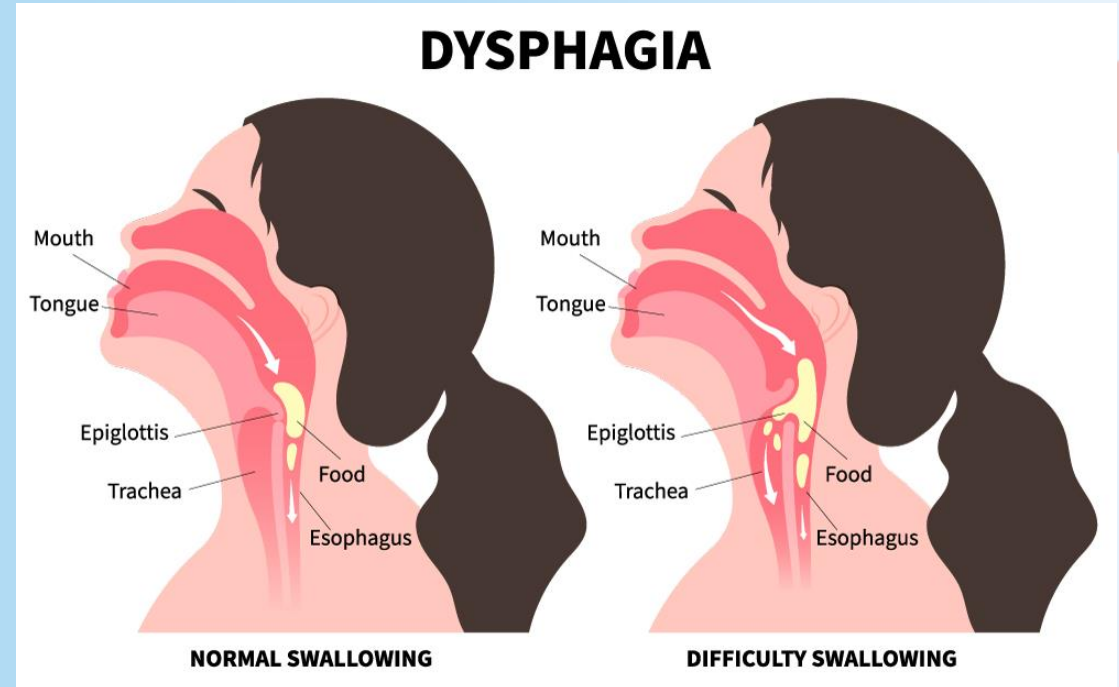
CN IX - Glossopharyngeal nerve

- Contains **GSA**: Sensation of oropharynx, posterior tongue and middle ear.
- Contains **GSE**: Muscles needed for swallowing.
- Contains **SVA**: Taste from posterior 1/3 of tongue.
- Contains **GVE**: Gland secretion of mouth
- Contains **GVA**: Carotid sinus (Blood pressure) and the Carotid body (Blood PH).



CN IX

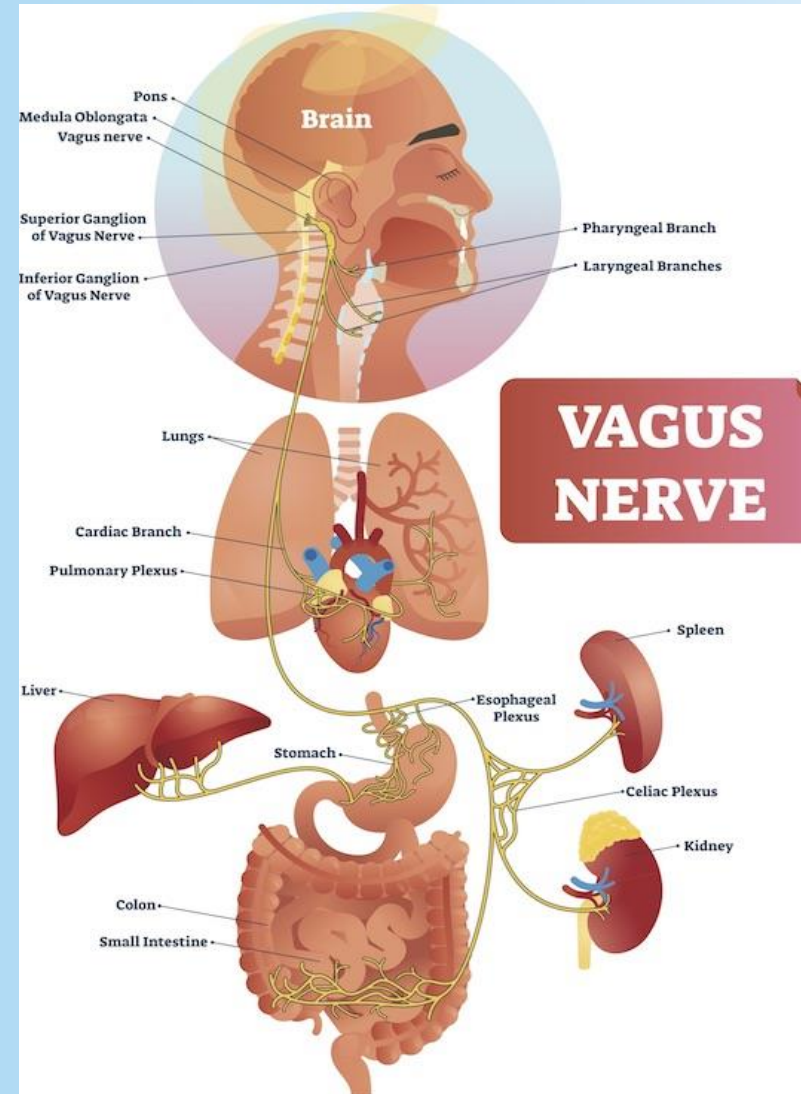
- Clinical relevance:
- Its the **afferent** limb of the **gag reflex**.
- Damage to CN IX leads to **dysphagia**.
- Loss of **gag reflex** and potential loss of the carotid sinus reflex.
- Loss of taste for the **posterior 1/3** of the tongue.



Also has SVA fibers receiving taste from epiglottis (not important)

CN X - Vagus Nerve

- Contains **GSA** - Sensation of pharynx, larynx and outer ear.
- Contains **GSE** - Motor function of palate, pharynx and larynx.
- Contains **GVE** - Parasympathetic activity to the heart, lungs, and G.I tract.
- Contains **GVA** - Sensation from internal organs in abdomen and thorax.



CN X - Lesions

- **Efferent** nerve of the gag reflex.
- **Clinical relevance:**
- Key findings in lesions are loss of gag reflex, **hoarsness** and dysphagia and uvula deviation.



CN X



**I innervate the
larynx,
esophagus, lungs, heart,
liver and the stomach**

CN VI



**I innervate
the lateral
rectus muscle**

CN XI- Spinal accessory nerve

- **Function:**
- Contains **GSE** fibers - Innervates muscles of head rotation.

- **Clinical relevance:**
- Damage results in problems with rotating the head and shoulder drooping/ inability to lift shoulders.



CN XII - Hypoglossal nerve

- **Function:**
- Contains **GSE** fibers - Controls muscles of tongue.

- **Clinical relevance:**
- Damage leads to deviation of the tongue towards affected side.



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Thank you!

Wooclap: MZTGSP

