

Cranial nerves of the eyes

By Josefine Holum



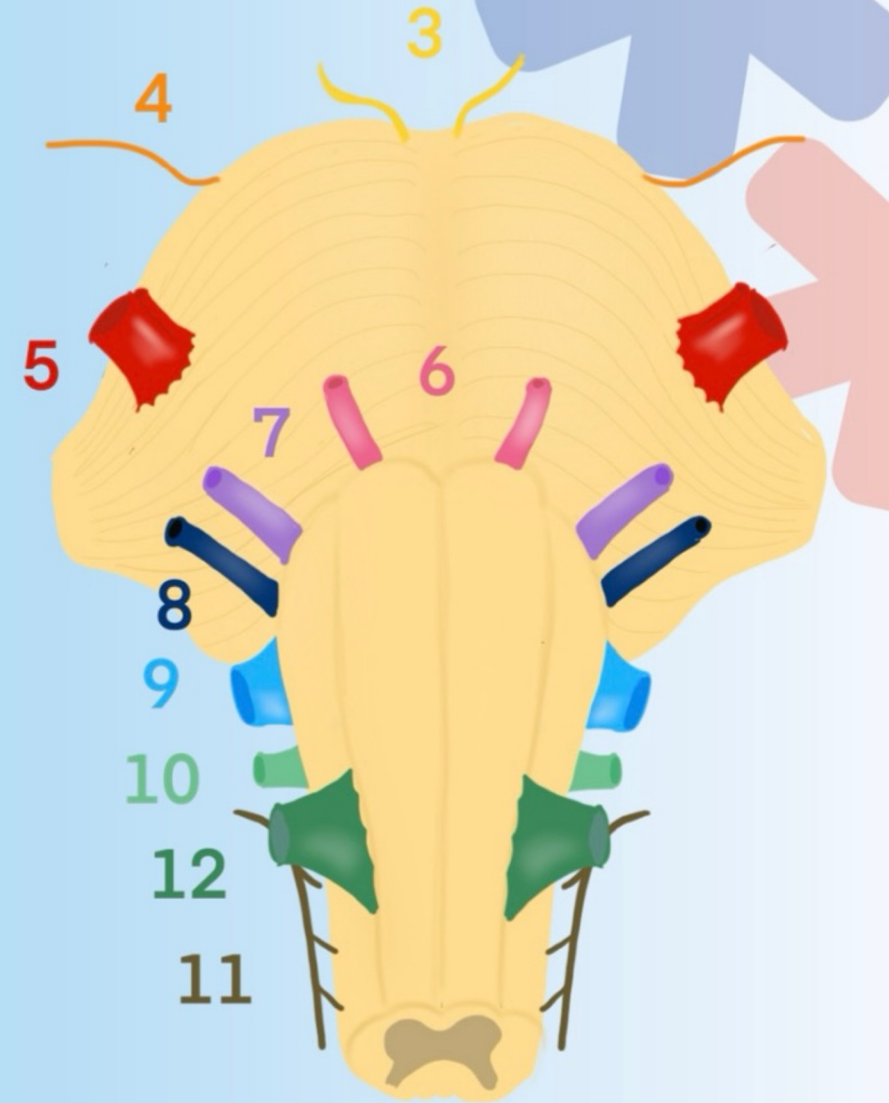
Cranial nerve mnemonics

Terminology

Cranial nerves one by one

Cranial nerves

I	Olfactory nerve	VII	Facial
II	Optic	VIII	Vestibulocochlear
III	Oculomotor	IX	Glossopharyngeal
IV	Trochlear	X	Vagus
	Trigeminal		Accessory
V	➤ Ophthalmic (V_1)	XI	- Cranial root
	➤ Maxillary (V_2)		- Spinal root
	➤ Mandibular (V_3)		
VI	Abducent	XII	Hypoglossal nerve



Oh, Oh, Oh, To Touch And Feel Very Good Velvet. Ah Heaven!

Functional components of the CN

- I Some
- II Say
- III Marry
- IV Money
- V But
- VI My
- VII Brother
- VIII Says
- IX Big
- X Brains (Boobs)
- XI Matter
- XII More

CN nerves can be either **S**ensory and/or **M**otor nerves.

- **M**otor meaning control of muscles
- **S**ensory meaning receiving information about sensation

They can also carry parasympathetic fibers.

1973 (CN 10, 9, 7, 3)

- Rest and digest

	1	0		
		9		
			7	
				3
=	1	9	7	3



Cranial nerve mnemonics



Terminology



Cranial nerves one by one

Terminology

Special	Special sensations Smell: CN I Vision: CN II Hearing: CN VIII Balance: CN VIII
General	Not special
Visceral	Internal organs and reflexes
Somatic	Skeletal muscle
Afferent	Carries information from sensory receptors to the CNS
Efferent	Carries motor information from the CNS to muscles and glands

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Afferent = Absorbs

Efferent = Exits CNS





Cranial nerve mnemonics



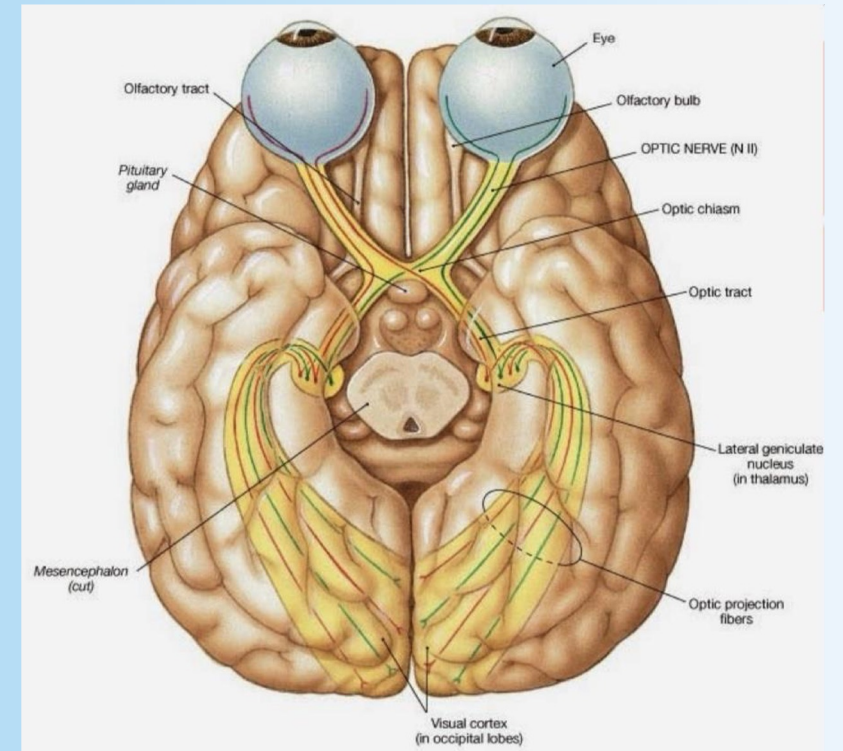
Terminology



Cranial nerves one by one

CN II - Optic nerve

- Sensory - Special Somatic Afferent
- Responsible for vision
- Exits the skull through the optic canal

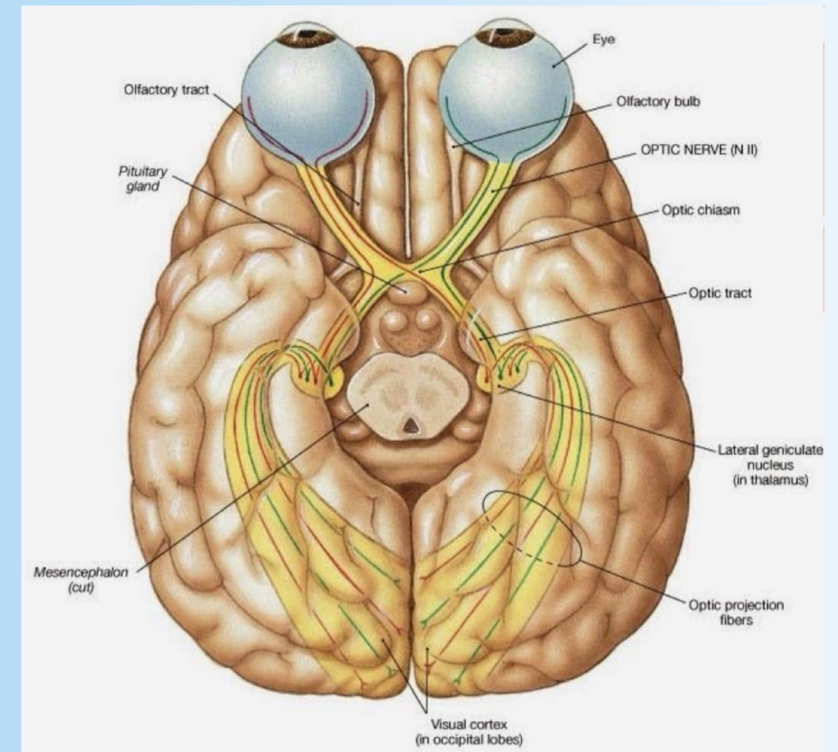


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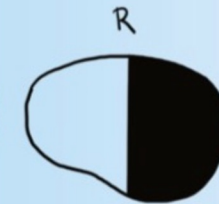
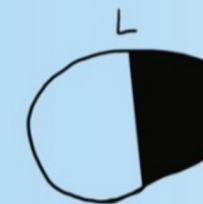
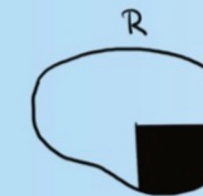
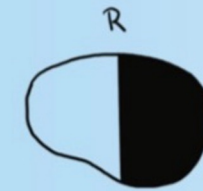
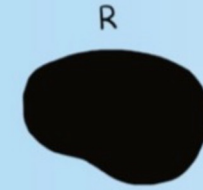
Lesions to the optic nerve

- Partial or complete loss of vision
- Lack of pupillary light reflex
- Decreased visual acuity

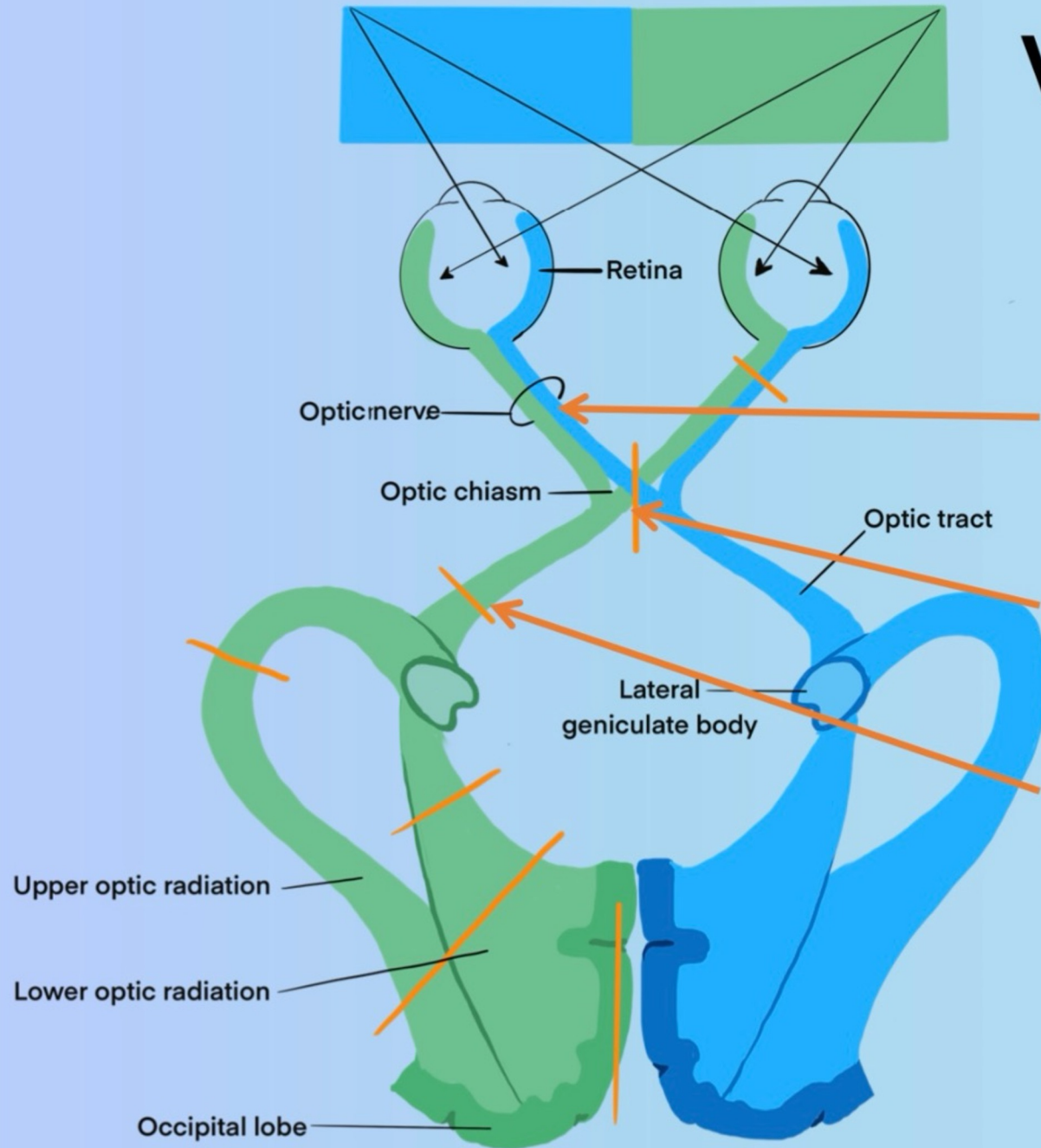


Terms for lack of vision

Anopia	Loss of vision
Hemianopia	Loss of vision in half of the visual field
Quadranopsia	Loss of vision in one fourth of the visual field (one quadrant)
Homonymous hemianopia	Loss of vision on half of the visual field, the two right or the two left, in both eyes



Visual pathway

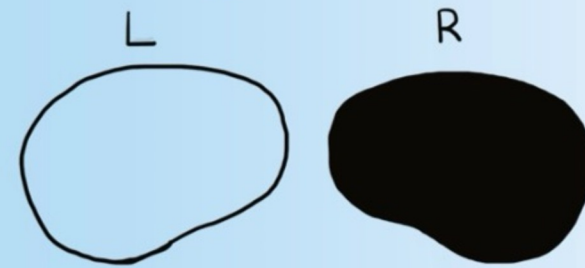


- Nasal retina = temporal visual field
 - Temporal retina = nasal visual field
1. Optic nerve
 - Nasal and temporal fibers from the same eye
 2. Optic chiasm
 - Crossing nasal fibers
 - Straight temporal fibers
 3. Optic tract
 - Nasal fibers from **contralateral** eye
 - Temporal fibers from **ipsilateral** eye

Optic nerve lesion

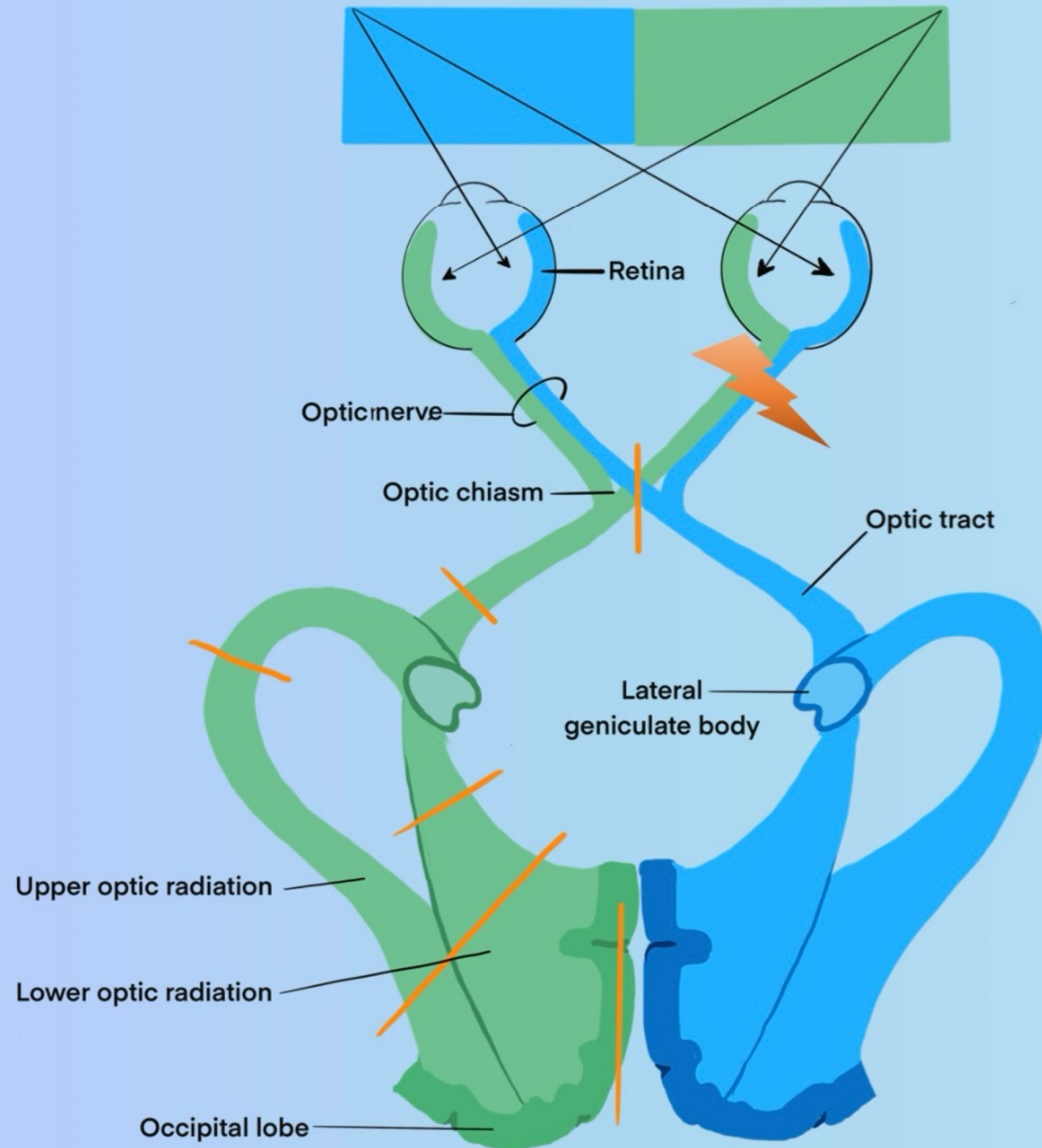
Ipsilateral monocular anopia

- Loss of vision on the same eye as the damaged nerve



Caused by

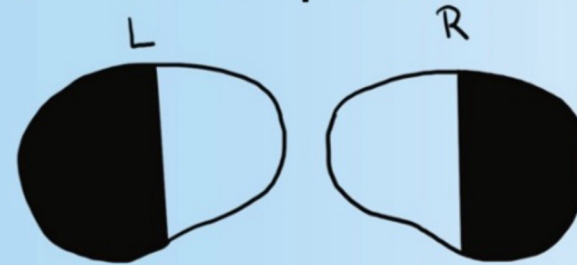
- Most common cause is glaucoma
- Trauma
- Tumors



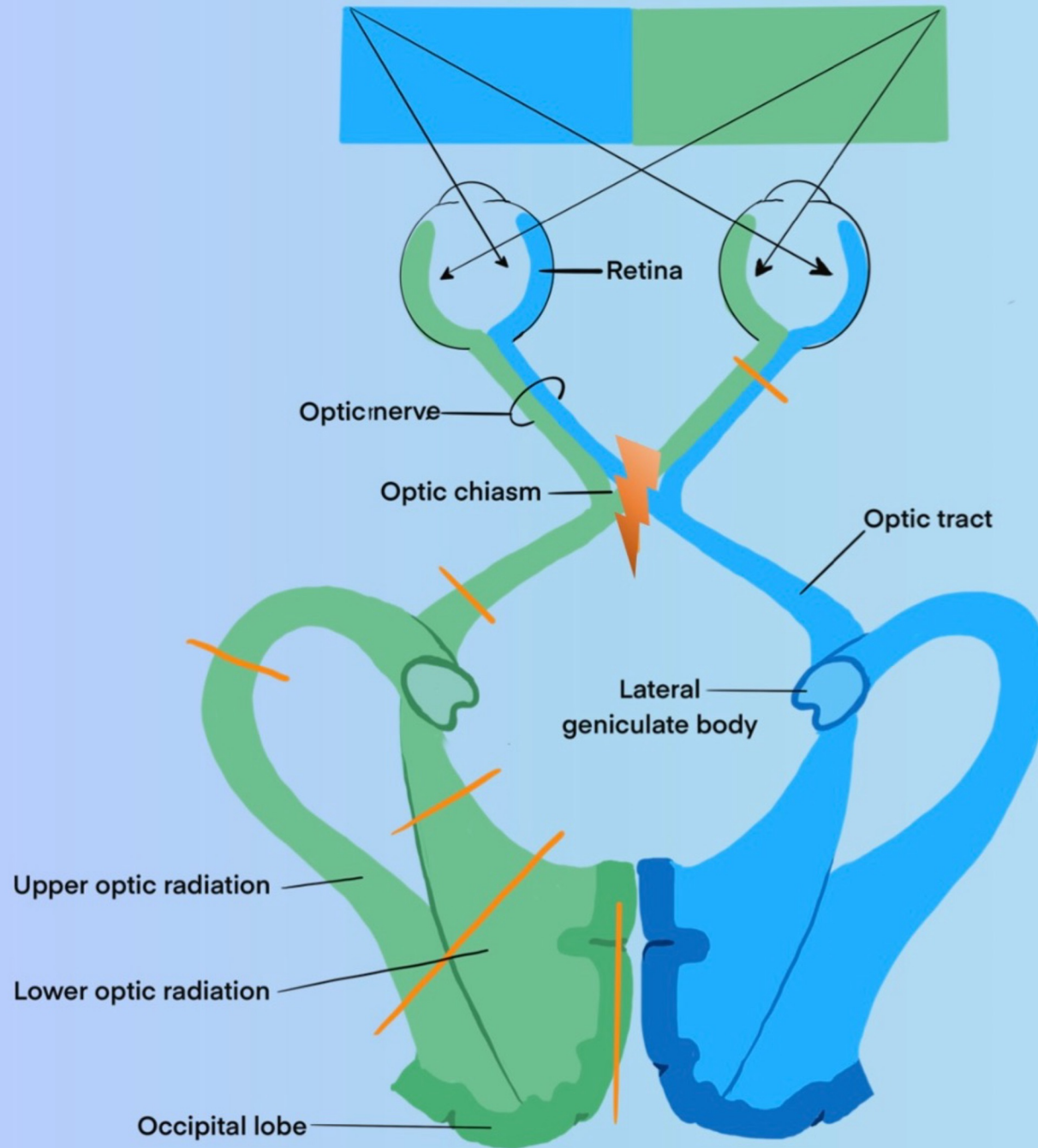
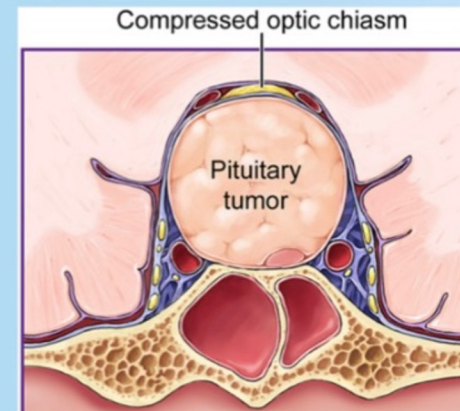
Optic chiasm lesion

Bitemporal hemianopia (tunnel vision)

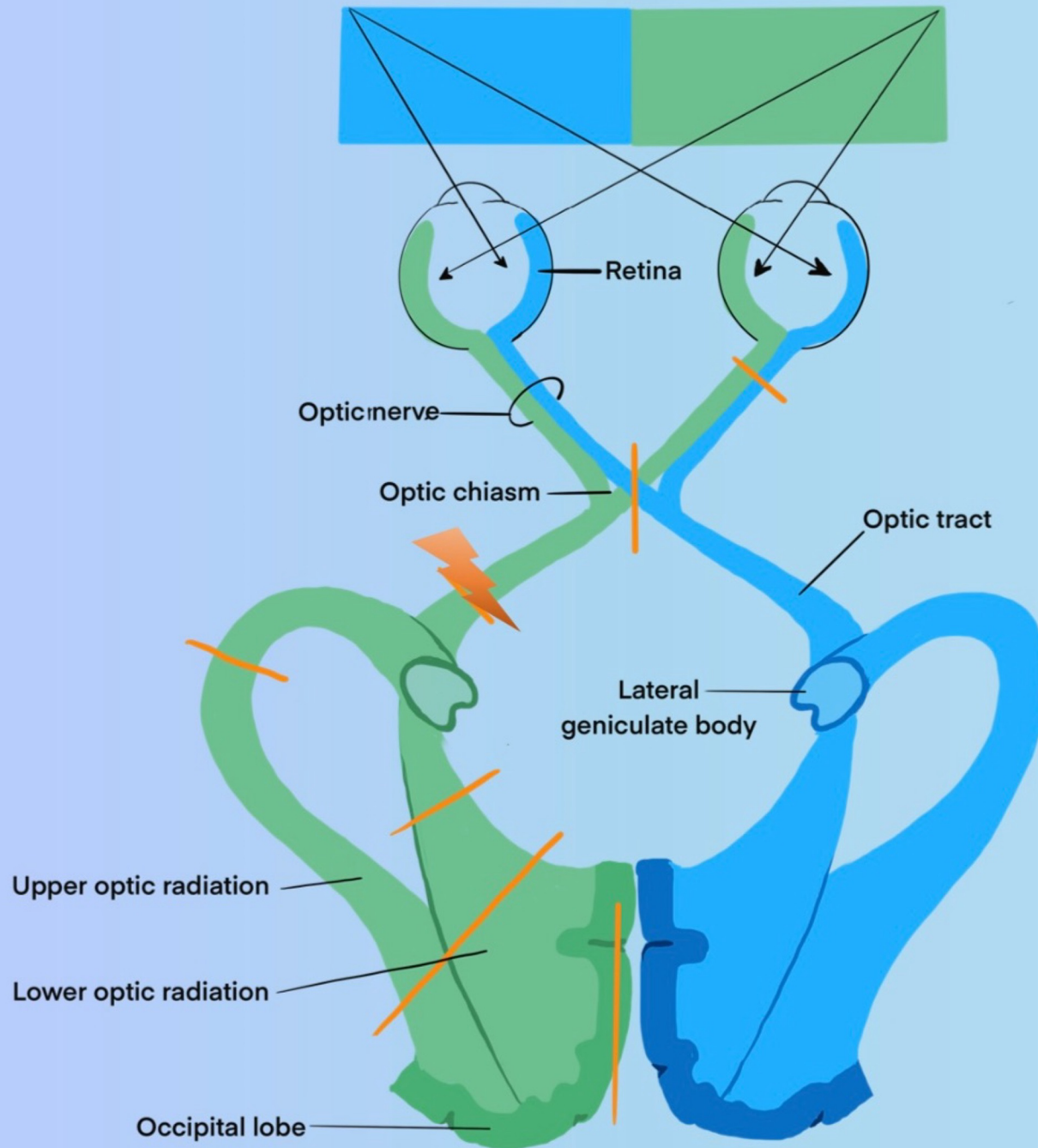
- Only nasal fibers
- Loss of temporal visual fields



MCC is pituitary tumor

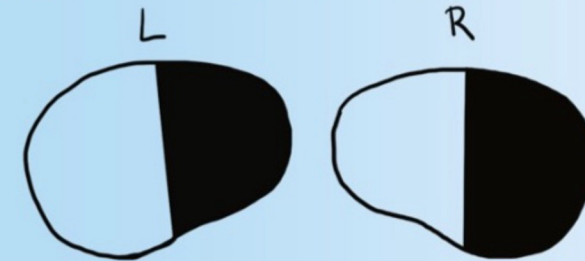


Optic tract lesion



Right/left homonymous hemianopia

- Loss of vision from 1 visual field
 - Left tract = right visual field (illustrated)
 - Right tract = left visual field

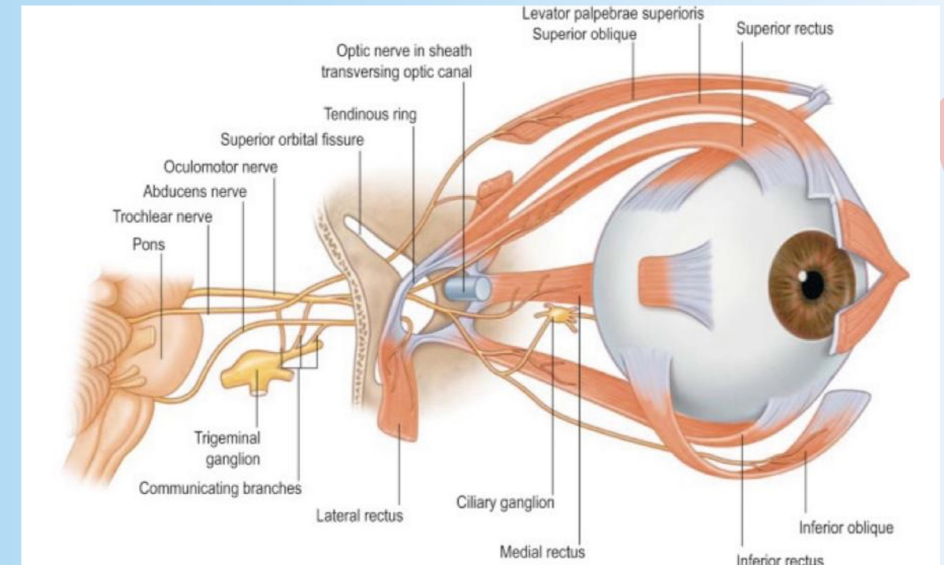


Caused by

- Subcortical lesions
 - Stroke
 - Tumors
 - Infections
 - Congenital

CN III - Oculomotor nerve

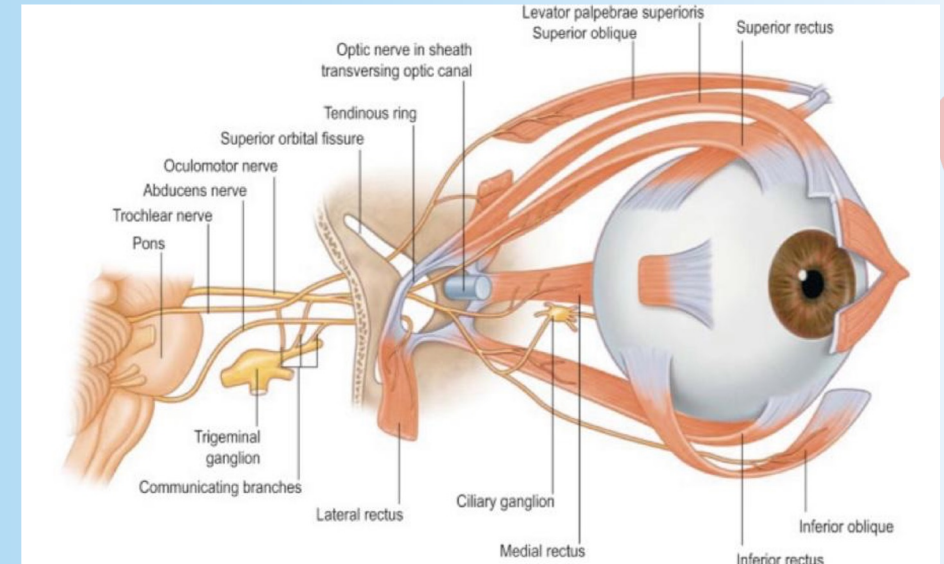
- Motor - General Somatic Efferent
- Innervates 4/6 extraocular muscles
 - Superior rectus
 - Inferior rectus
 - Medial rectus
 - Inferior oblique
- Levator palpebra
- Responsible for opening the eye



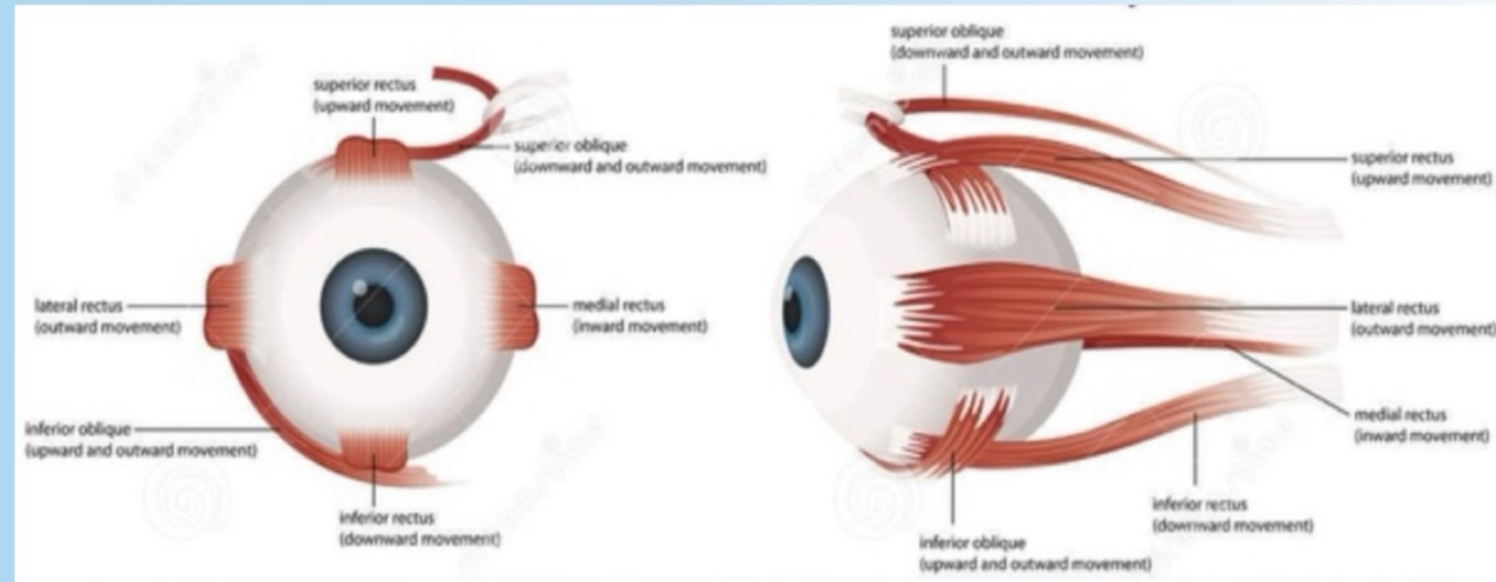
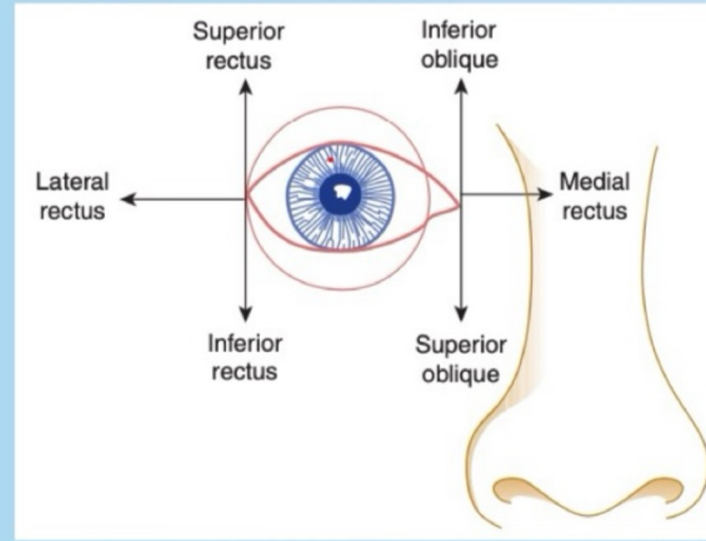
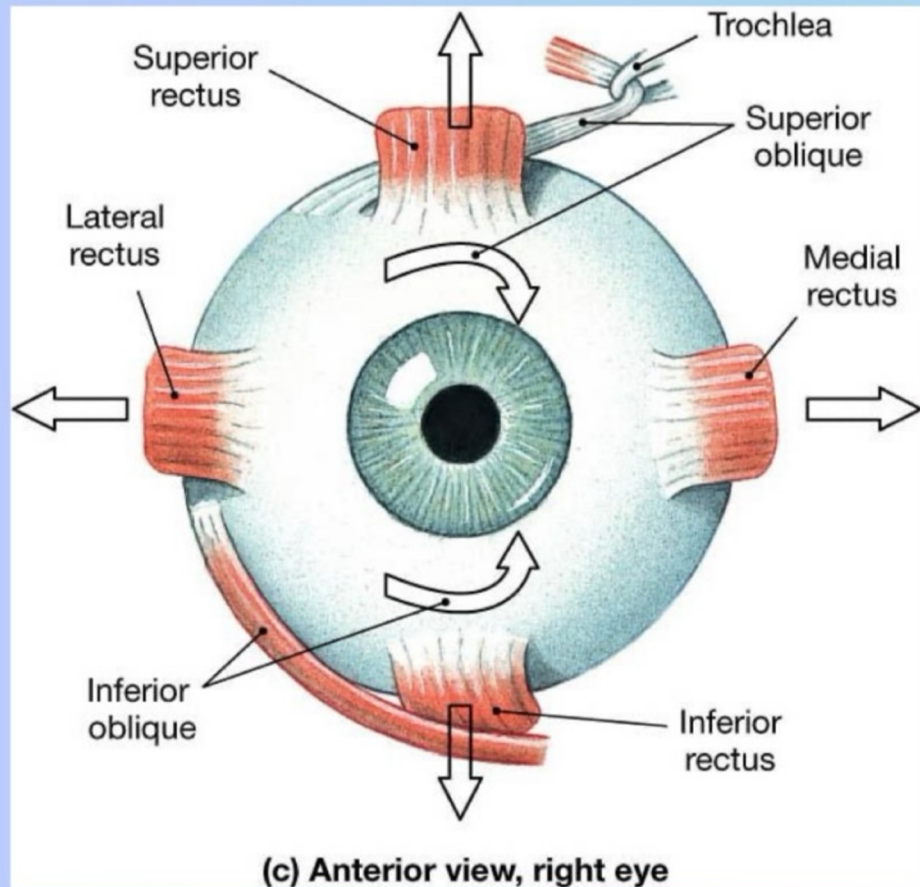
CN III - Oculomotor nerve

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- Parasympathetic fibers (1973) - General Visceral Efferent
 - Innervates pupillary sphincter
 - Innervates ciliary muscles

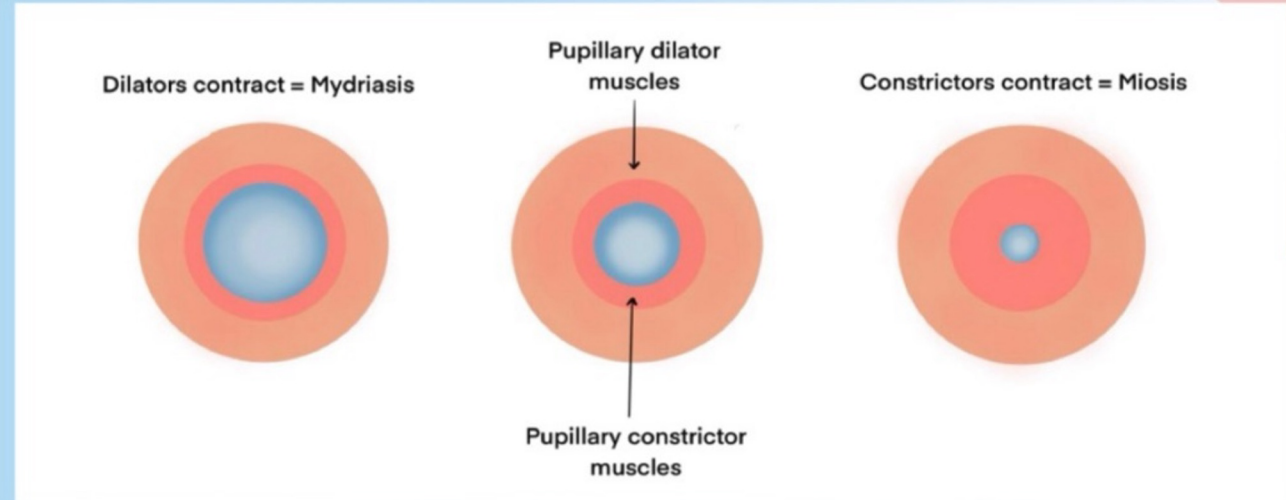


Eye movements



Pupillary constriction and dilatation

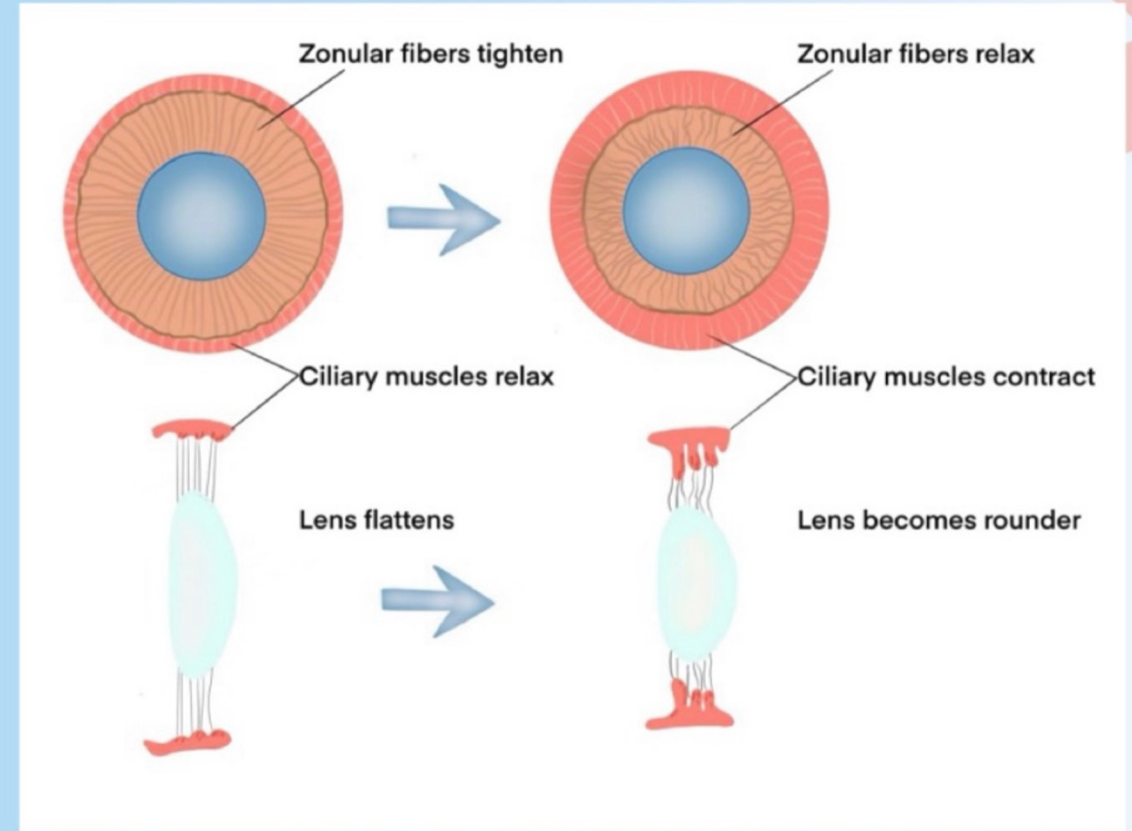
- Parasympathetic stimuli (CN III) cause constriction of the pupil through stimuli of the sphincter pupillae
- Sympathetic stimuli (cervical sympathetic ganglia) causes dilatation (mydriasis) through the dilator pupillae.



Accommodation

Adjustment or adaption of the lens to focus on a near object.

- **Relaxation** of ciliary muscles → tension of zonular fibers → stretched lens
- **Constriction** of ciliary muscles → relaxation of zonular fibers → bulged lens



Pupillary light reflex

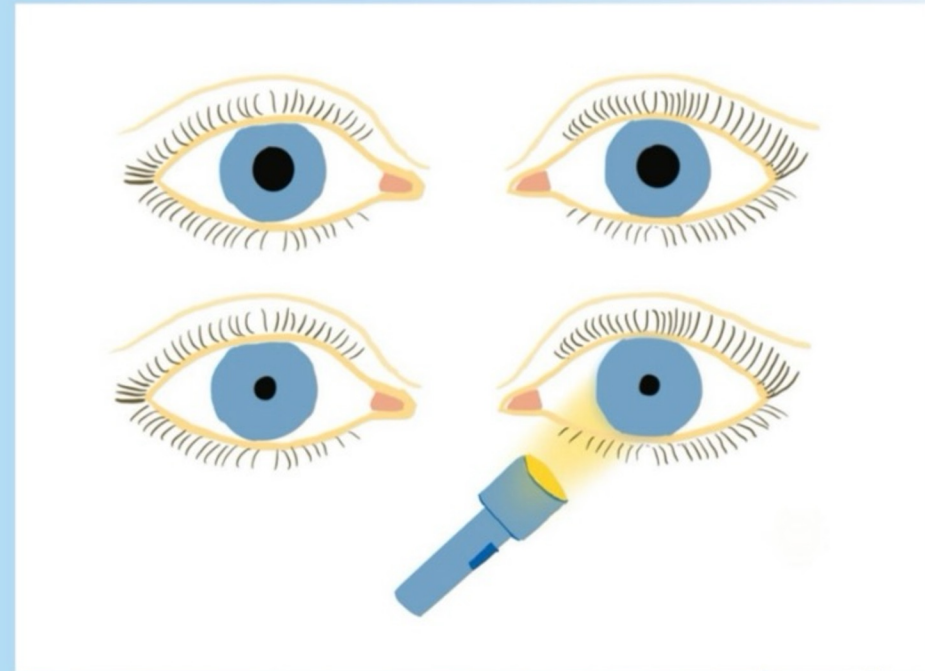
Pupillary light reflex is constriction of the pupil in response to light stimulation.

Efferent limb: Oculomotor nerve

Afferent limb: Optic nerve

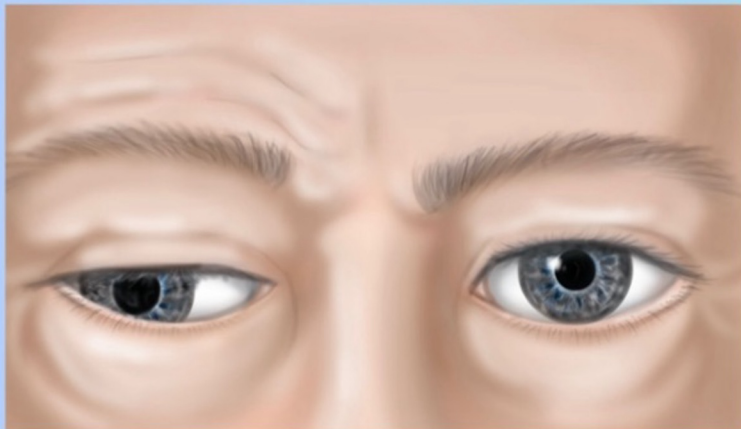
Parasympathetic stimuli from the EW nucleus through the short ciliary nerves cause constriction of the pupil (**miosis**) in both eyes.

- Stimulated pupil contracts = direct reflex
- Contralateral pupil contracts = Consensual reflex



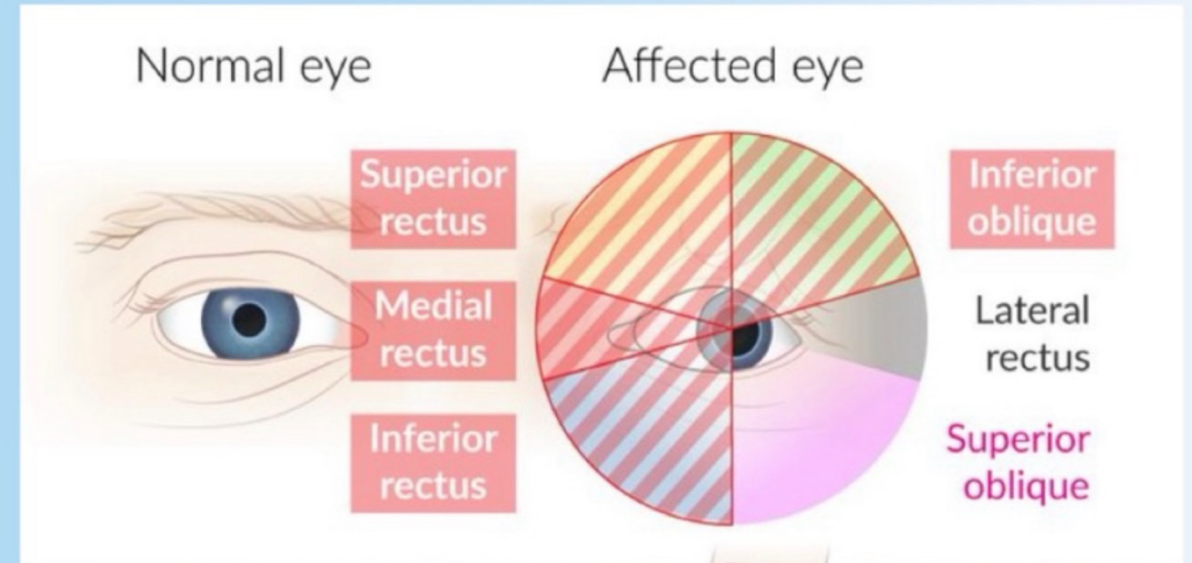
Lesion of the oculomotor nerve

- Ptosis
 - Drooping of the upper eyelid due to paralysis of levator palpebrae
- Eye looks down and out
 - Unopposed action of Lateral rectus and Superior oblique
- Diplopia
- Cycloplegia (Mydriasis + loss of accommodation)
 - Loss of PS innervation causes fixed and dilated pupil and paralysis of accommodation



Caused by

- Aneurysms of internal carotid or posterior communicating arteries
- Subdural or epidural hematomas



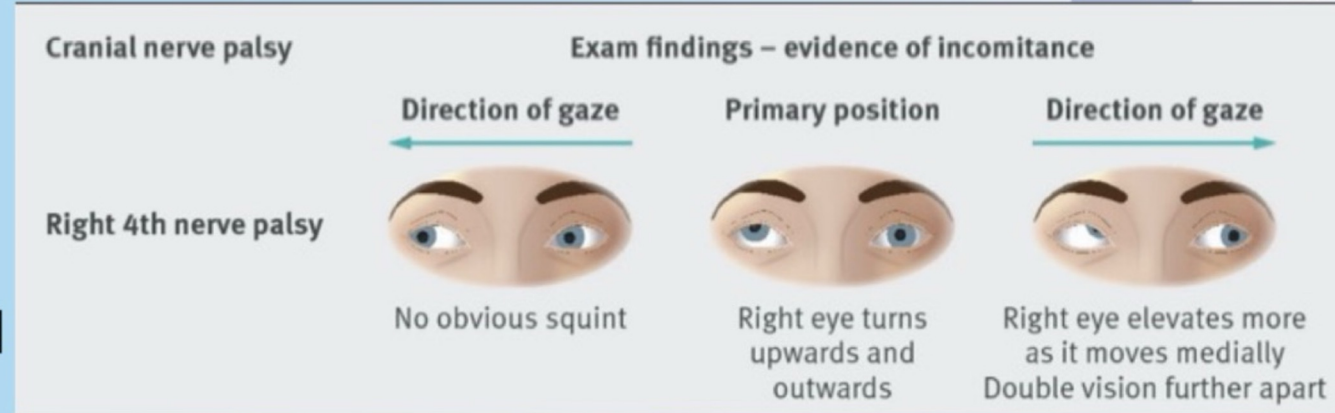
CN IV - Trochlear

- **M**otor - General somatic efferent (GSE)
- Innervates **Superior Oblique muscle**
- Responsible for internal (medial) rotation, depression (look down) and abduction of the eyeball

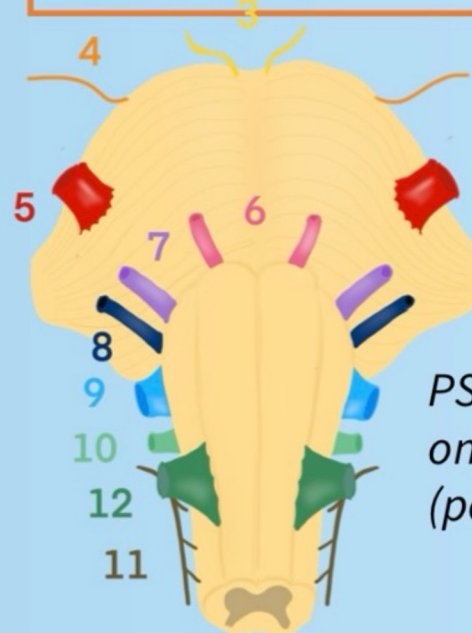
Lesion

- Diplopia when looking down - i.e. when the pt is walking down the stairs
- Pt. typically has a slight head tilt to the opposite side of the lesion

Causes include major head trauma



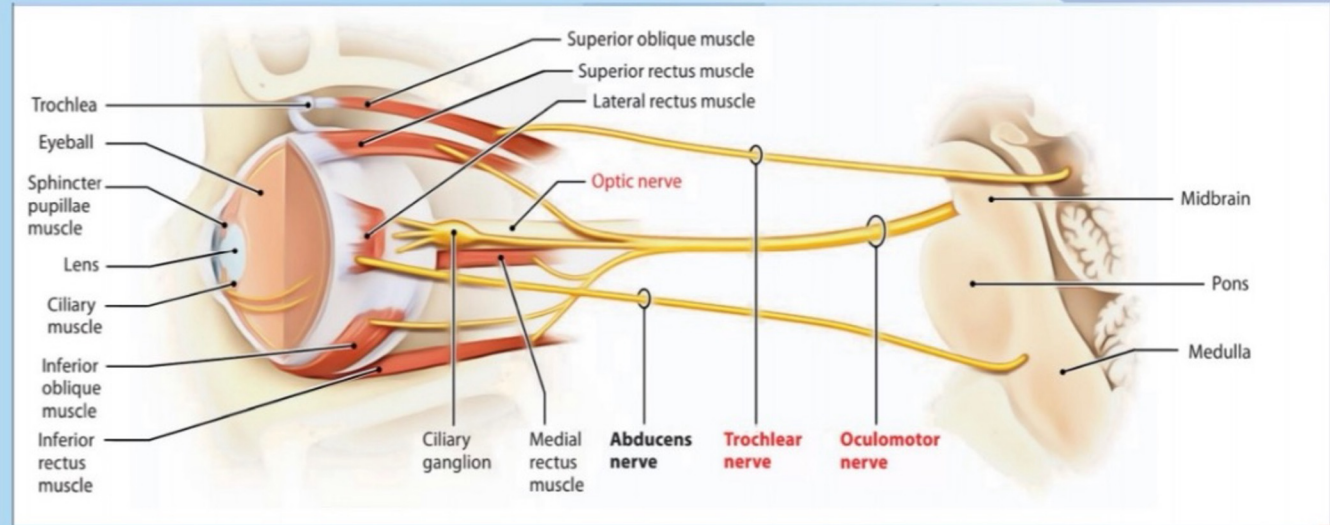
With a lesion of cranial nerve four, you cannot look at the floor.



PS: Remember that trochlear is the only CN exiting from the dorsal (posterior) side of the brainstem

CN VI - Abducent

- **M**otor - General somatic efferent (GSE)
- Innervates lateral rectus (LR₆)
 - Meaning it moves the eye laterally



Lesion causes:

- Inability to move the eyeball laterally (abduct)
 - Causes medial deviation of the affected eye due to unopposed action of the medial rectus
- Diplopia - at its worst when looking towards the side of the paralyzed muscle.

Causes include

- Brain tumor
- Thrombosis of the cavernous sinus

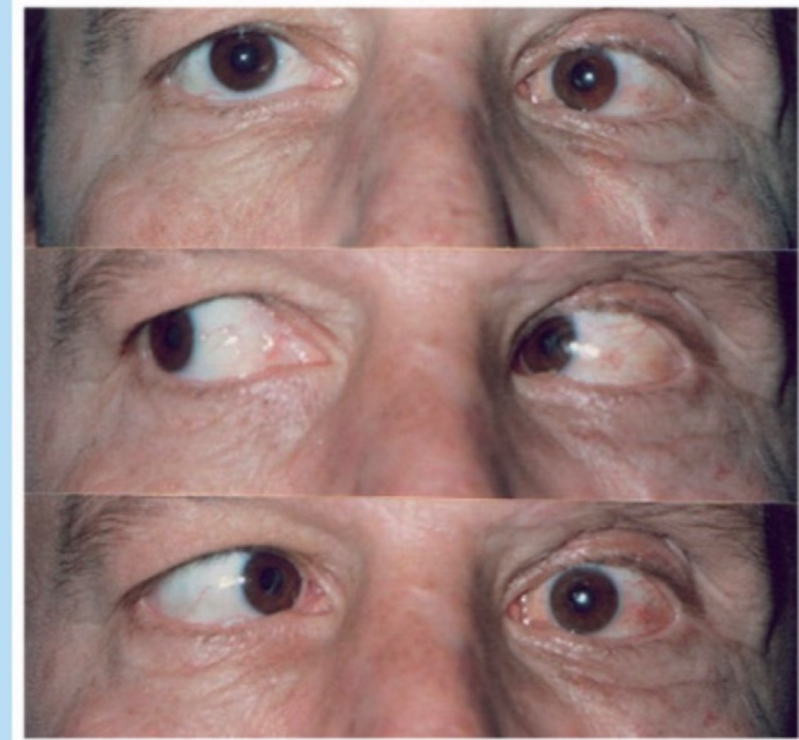
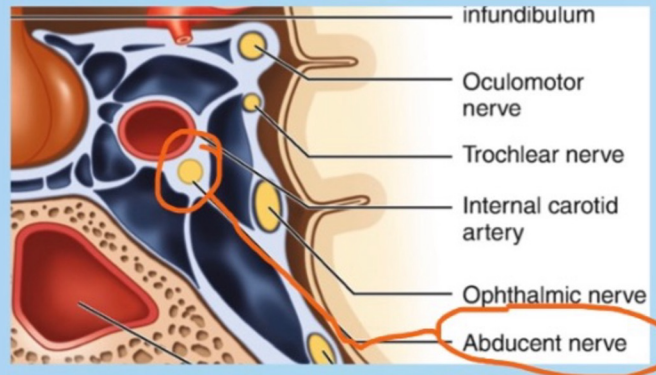


Figure 1: Left VI nerve (abducens) paresis or paralysis. Left esotropia with major limitation of abduction, increasing on left gaze



Cranial nerve mnemonics



Terminology



Optic nerve



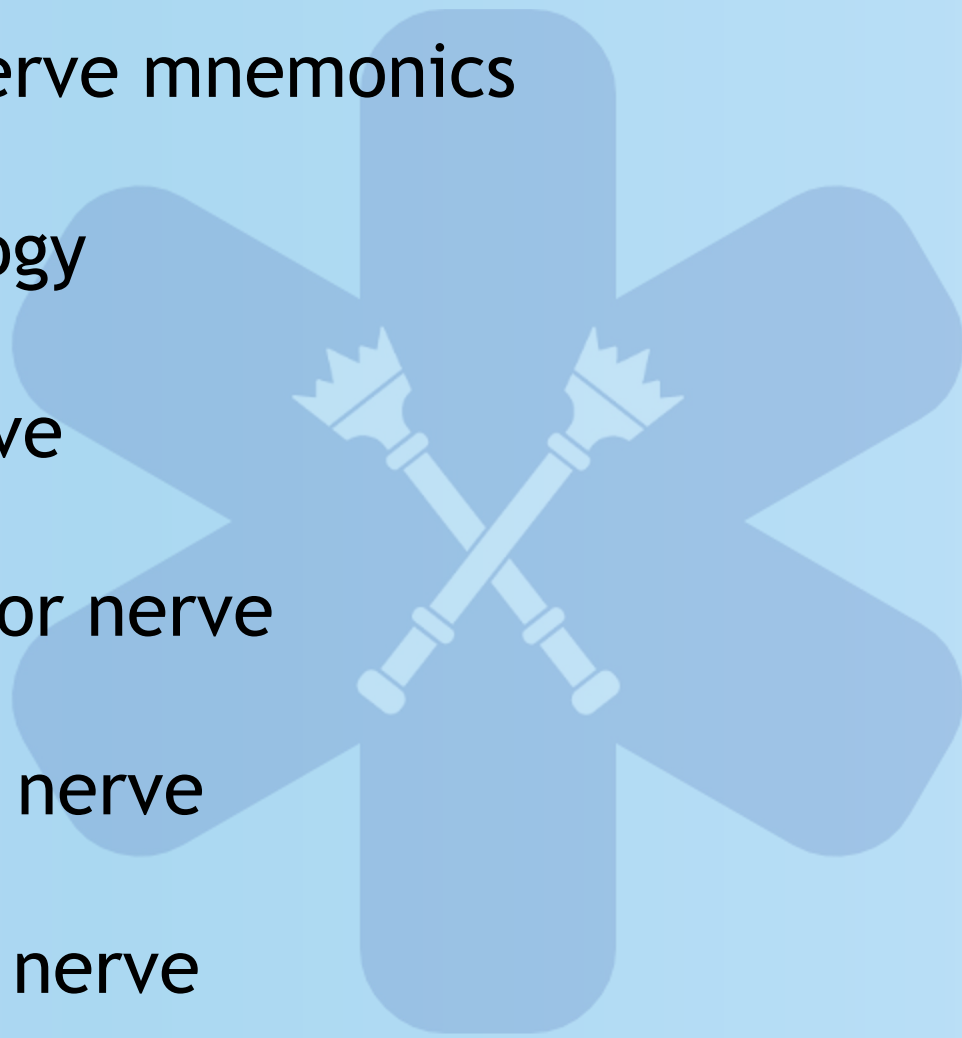
Oculomotor nerve



Trochlear nerve



Abducens nerve



QUESTIONS?