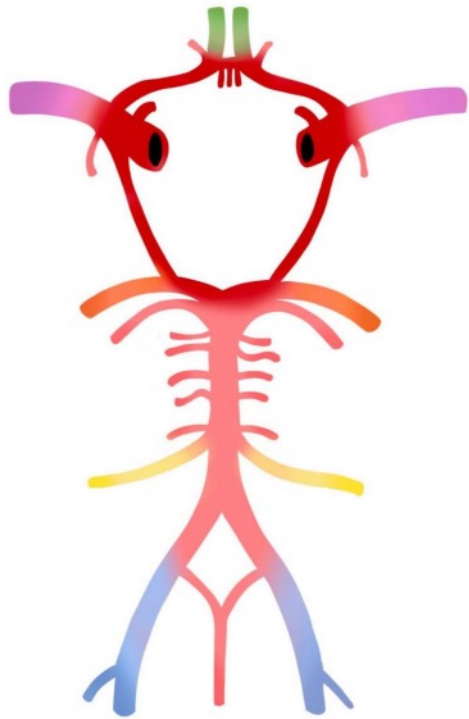


CRANIAL NERVES of the eyes

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April 2023

studyaid



Neuroanatomy

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Study smart with

Student Consult

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GRAY'S ANATOMY REVIEW

SECOND
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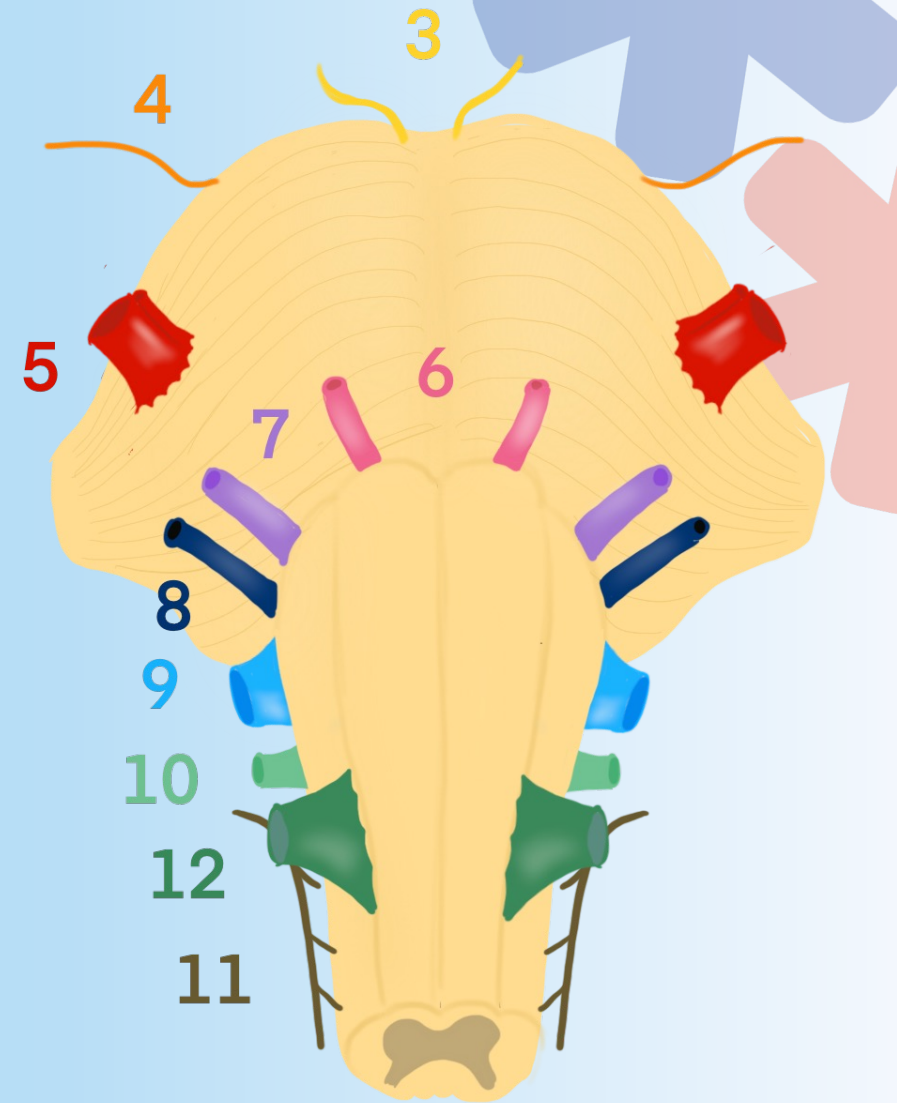
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ELSEVIER



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

Terms

- Special = special sensations
 - Smell (CN I)
 - Vision (CN II)
 - Hearing (CN VIII)
 - Balance (CN VIII)
 - Taste (CN VII, IX & X)
- General = Not special
- Visceral = Internal organs + reflexes
 - CN III, IX, X
- Somatic = skeletal muscle

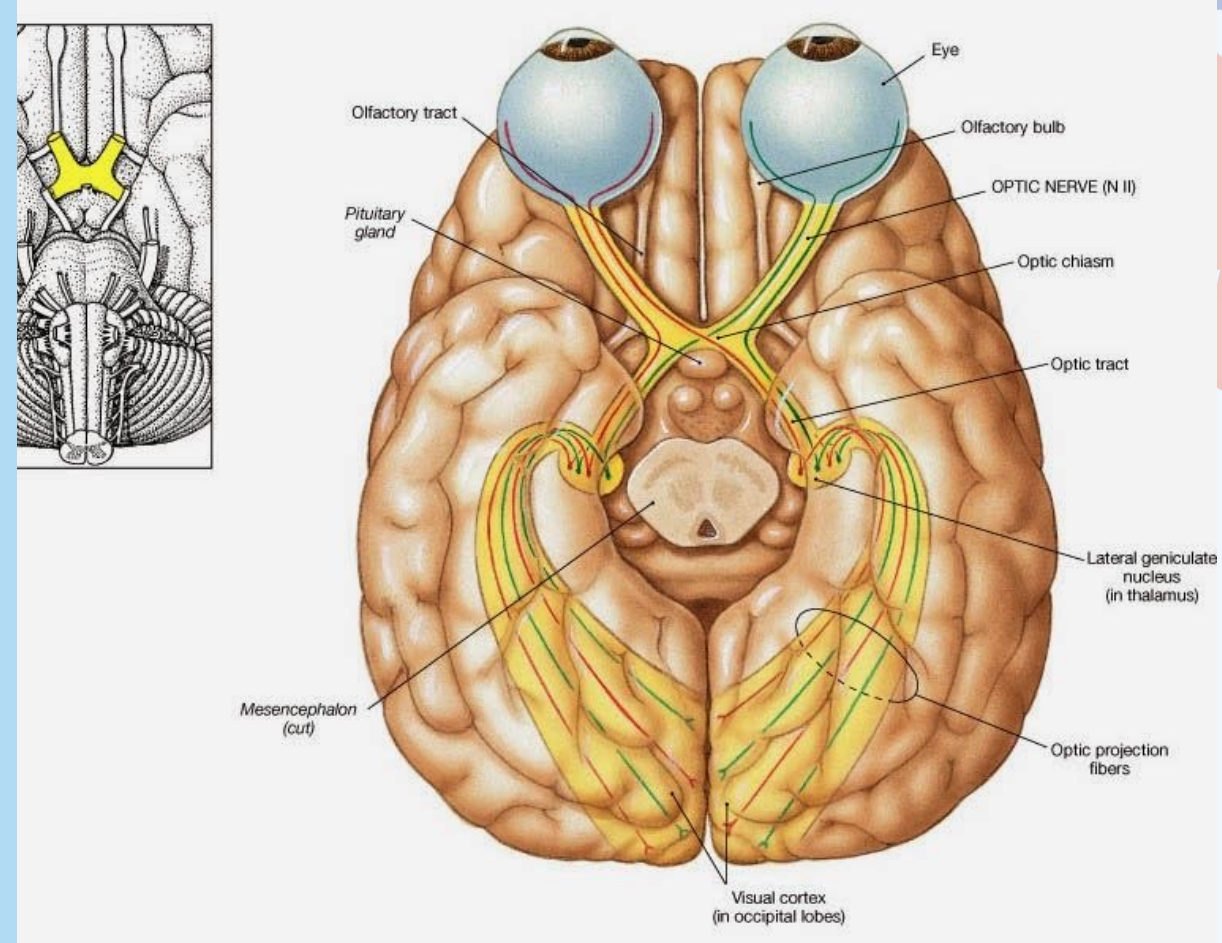
- **A**fferent - **A**bsorbs information = Sensory
 - From target
 - To brain
- **E**fferent - **E**xits CNS = Motor

CN II - Optic nerve

- **Sensory** - Special Somatic Afferent (SSA)
- Responsible for vision
- Exits the skull through the optic canal

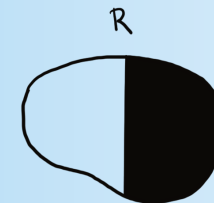
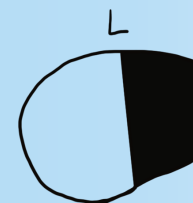
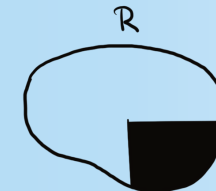
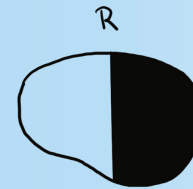
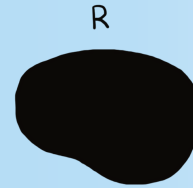
Lesion will cause

- Partial or complete loss of vision
 - The part of the visual field lost will correlate with the place of the lesion
- Lack of pupillary light reflex
- Decreased visual acuity



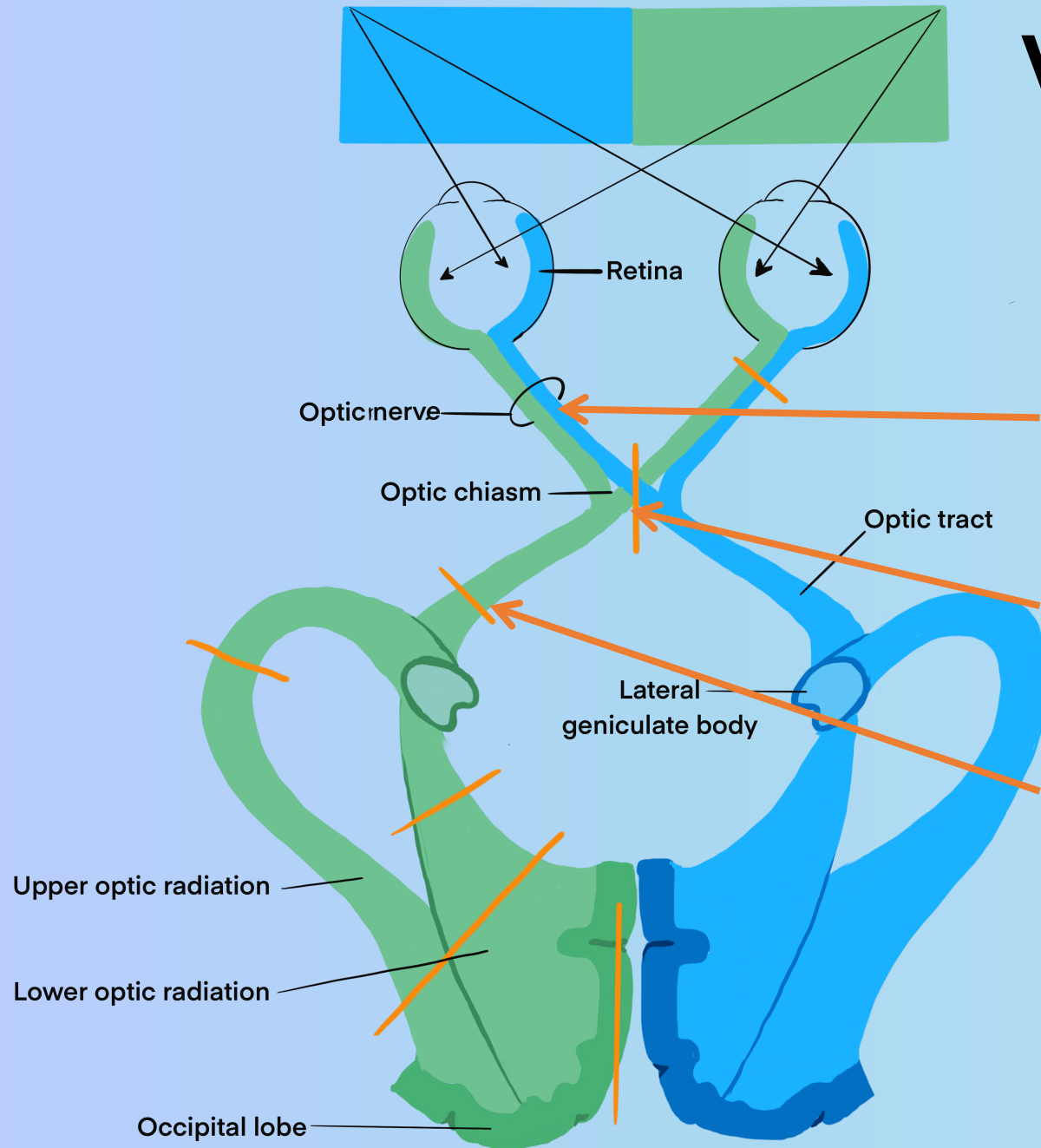
Terms for lack of vision

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

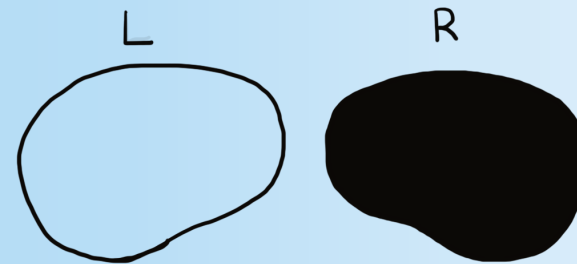
3. Optic tract

- Nasal fibers from **contralateral** eye
- Temporal fibers from **ipsilateral** eye

Optic nerve lesion

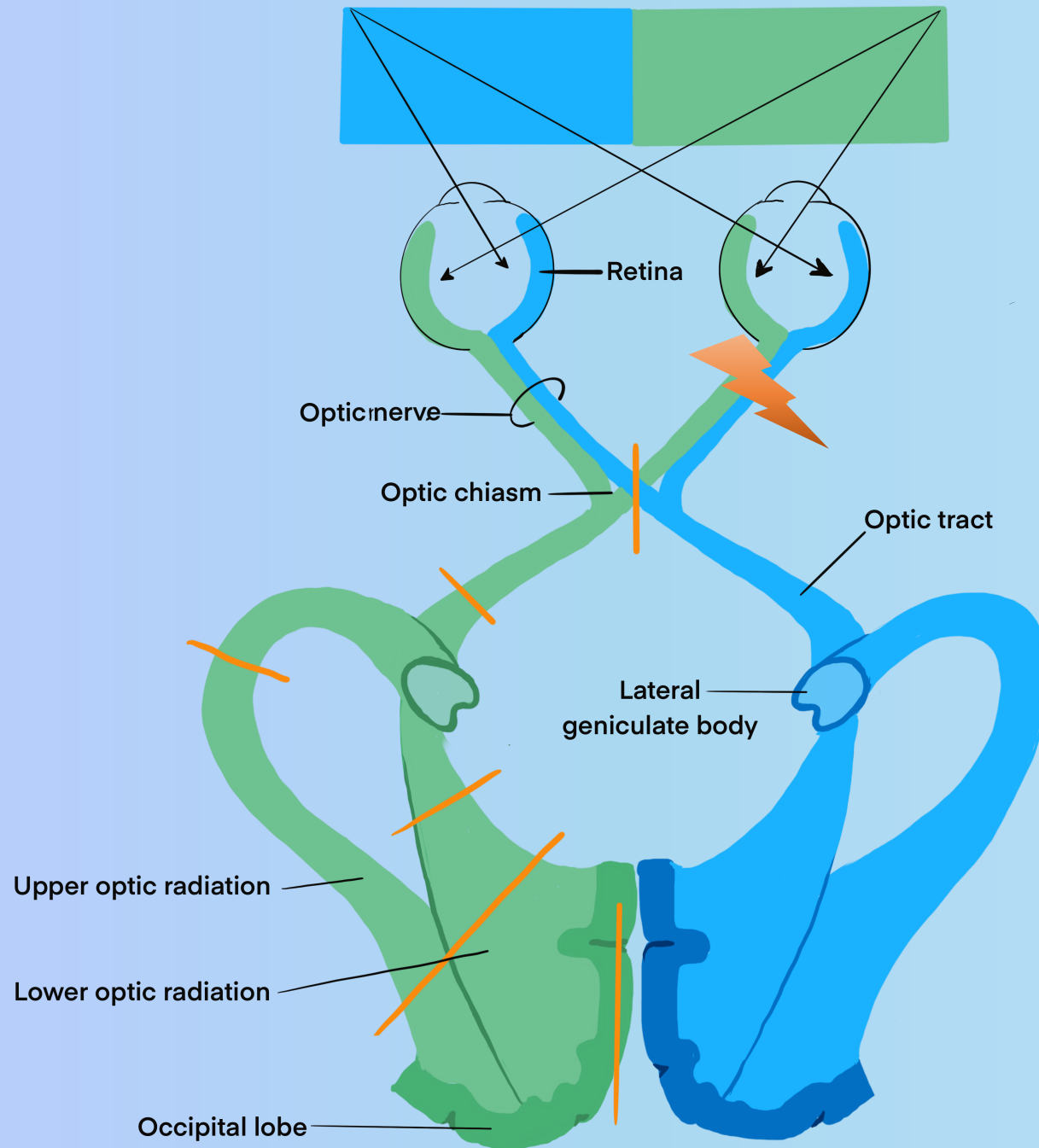
Ipsilateral monocular anopia

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



Caused by

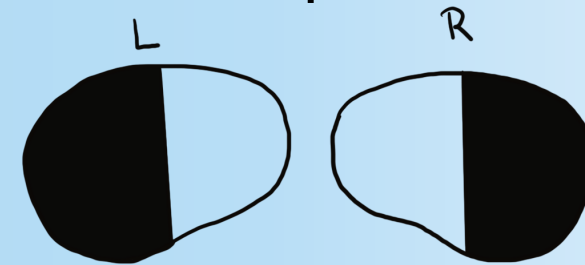
- Most common cause is glaucoma
- Trauma
- Tumors



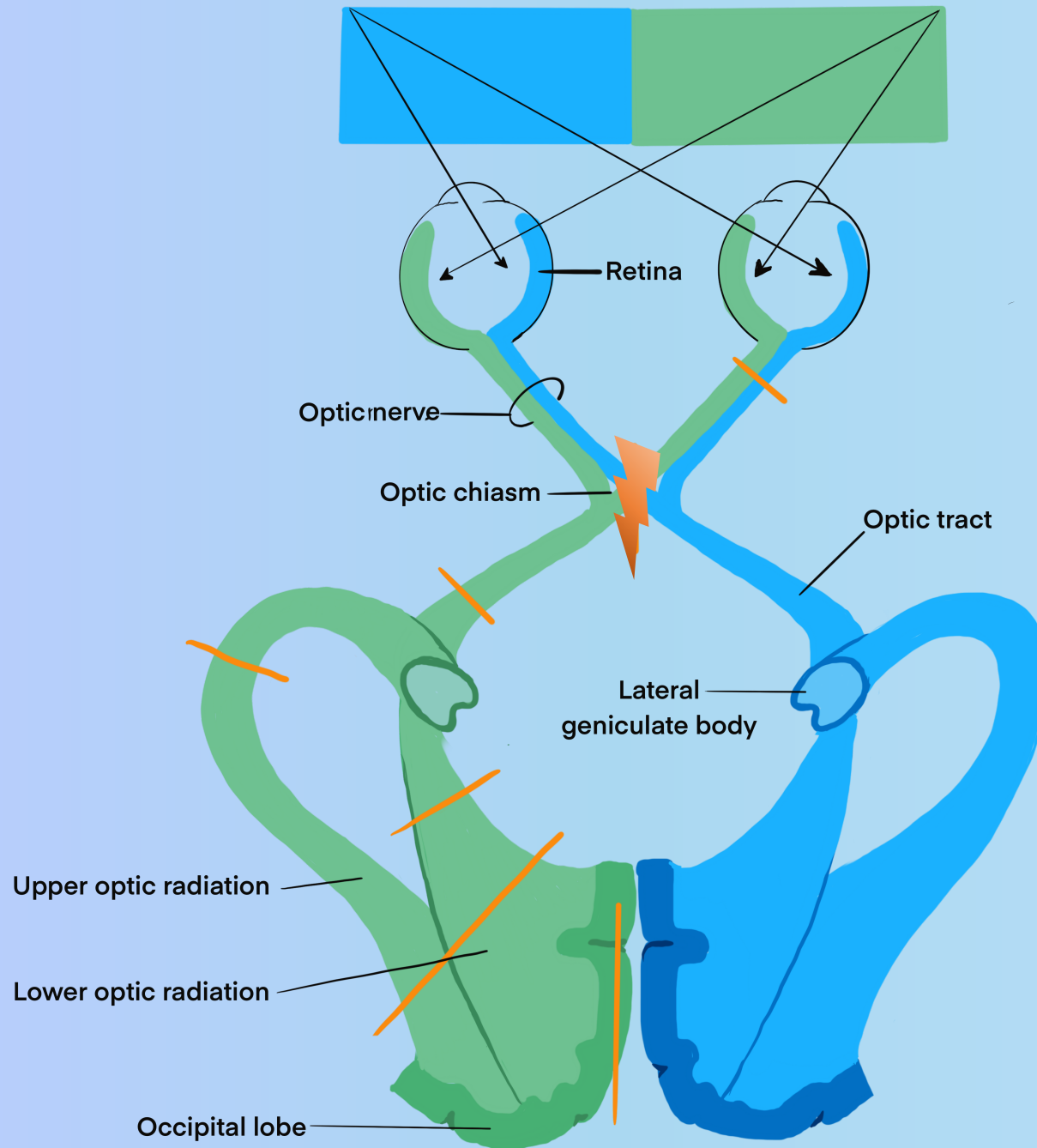
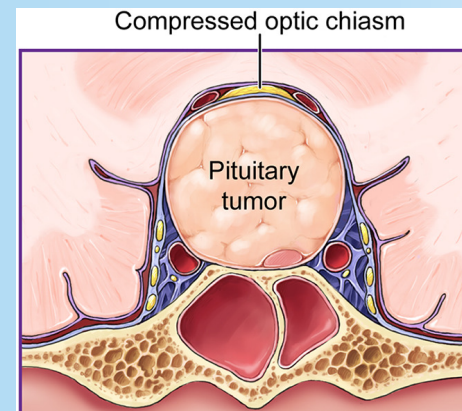
Optic chiasm lesion

Bitemporal hemianopia (tunnel vision)

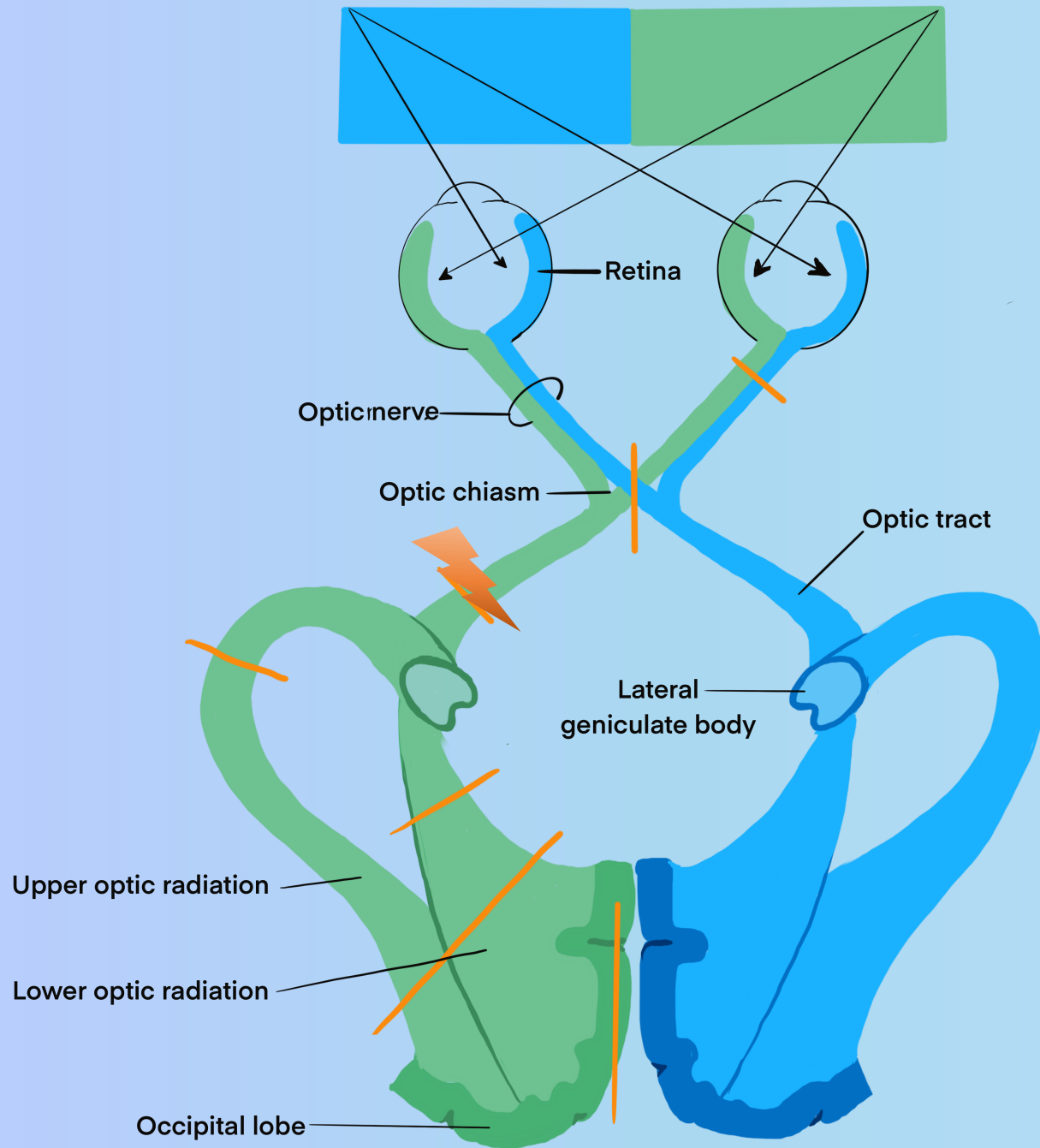
- Only nasal fibers
- Loss of temporal visual fields



MCC is pituitary tumor

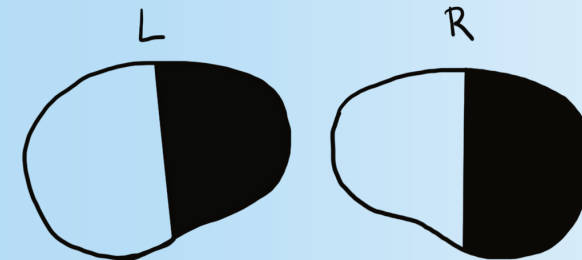


Optic tract lesion



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

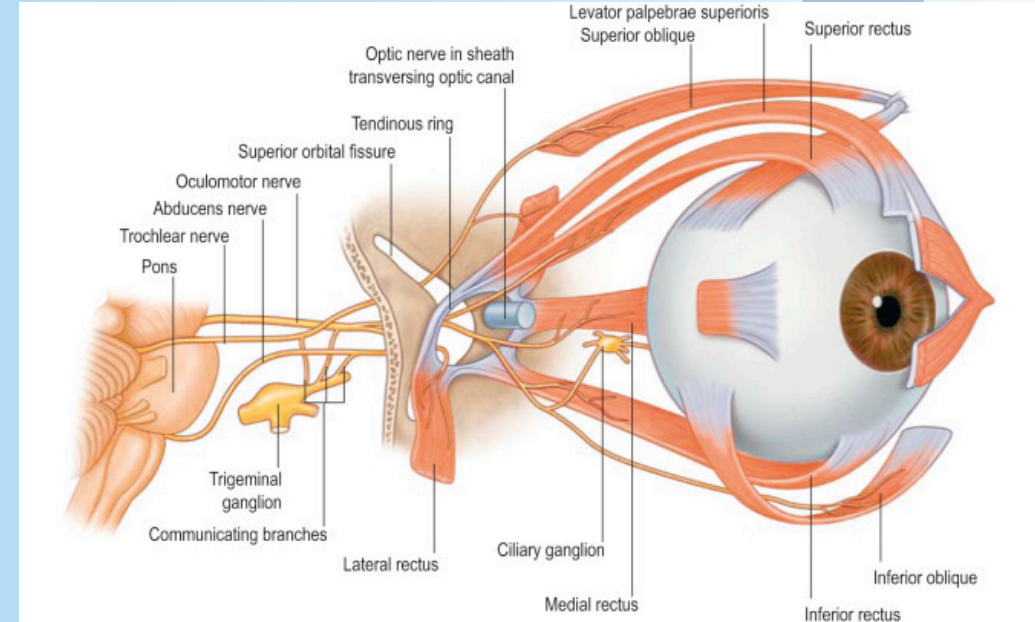
CN III - Oculomotor

Motor fibers - General somatic efferent (GSE)

- Innervates all extraocular muscles except for **SO₄LR₆**
 - SO₄ = Superior oblique, controlled by CN 4
 - LR₆ = Lateral rectus, controlled by CN 6
- Levator palpebrae
 - Responsible for opening the eye

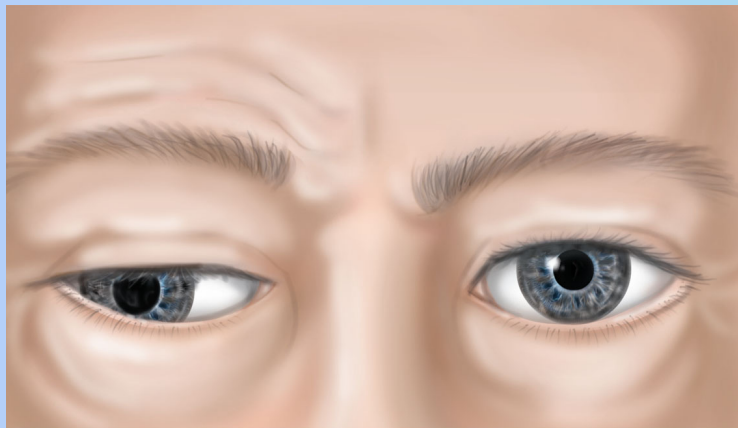
Parasympathetic fibers (1973) - General visceral efferent (GVE)

- Innervates sphincter pupillae - responsible for constriction of the pupil
- Innervates ciliary muscles - responsible for accommodation



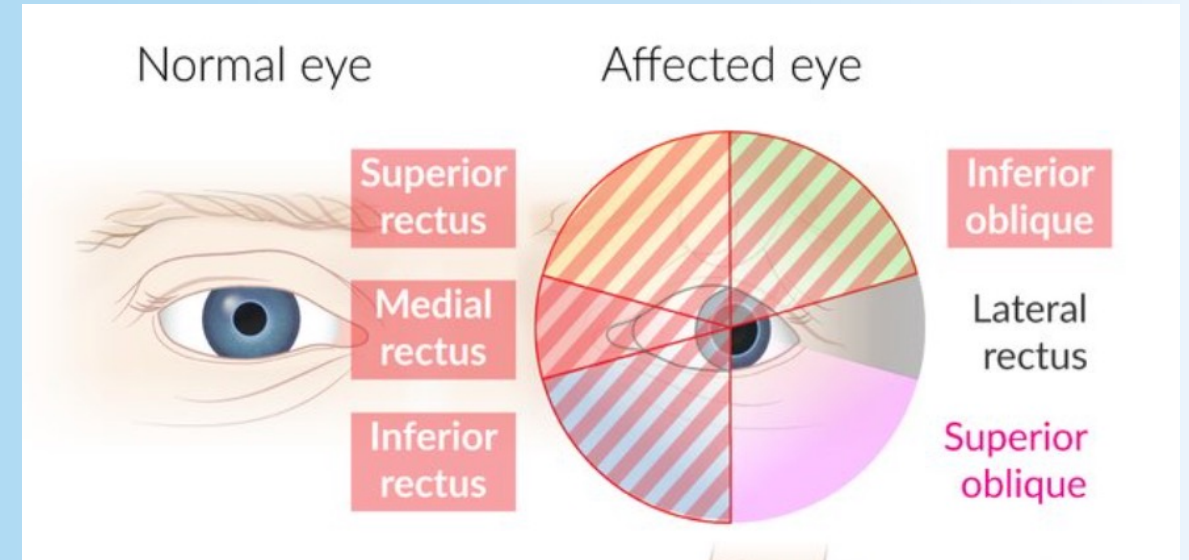
Lesion of the oculomotor nerve

- 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

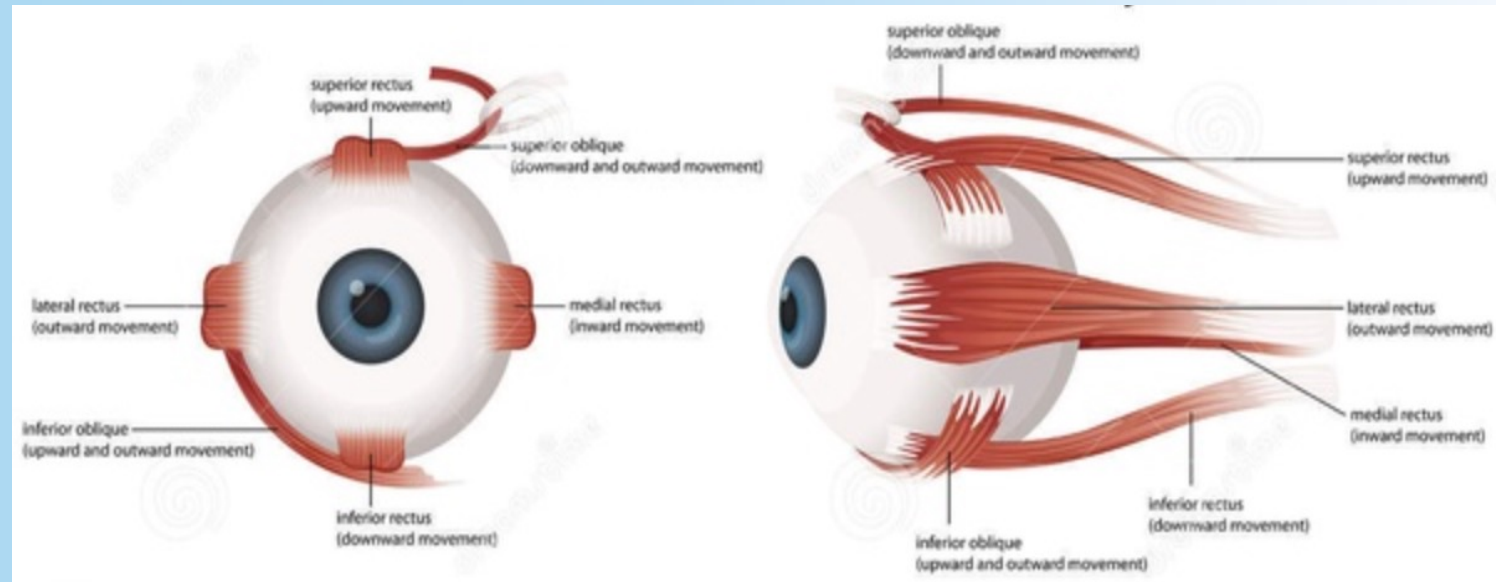
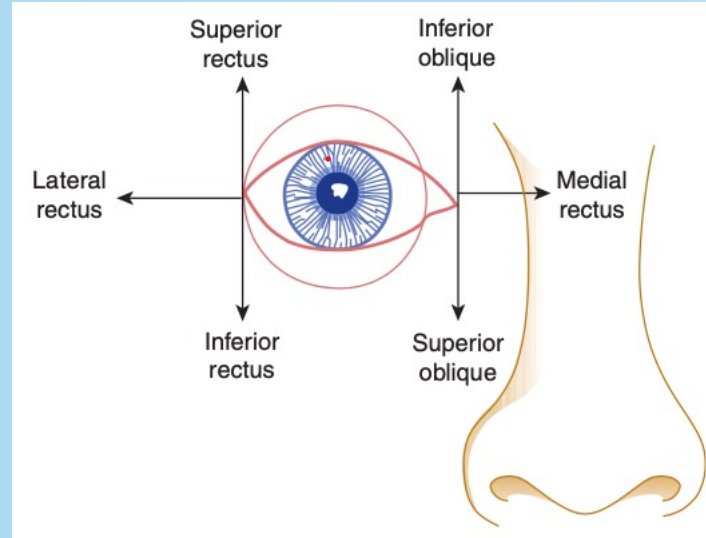
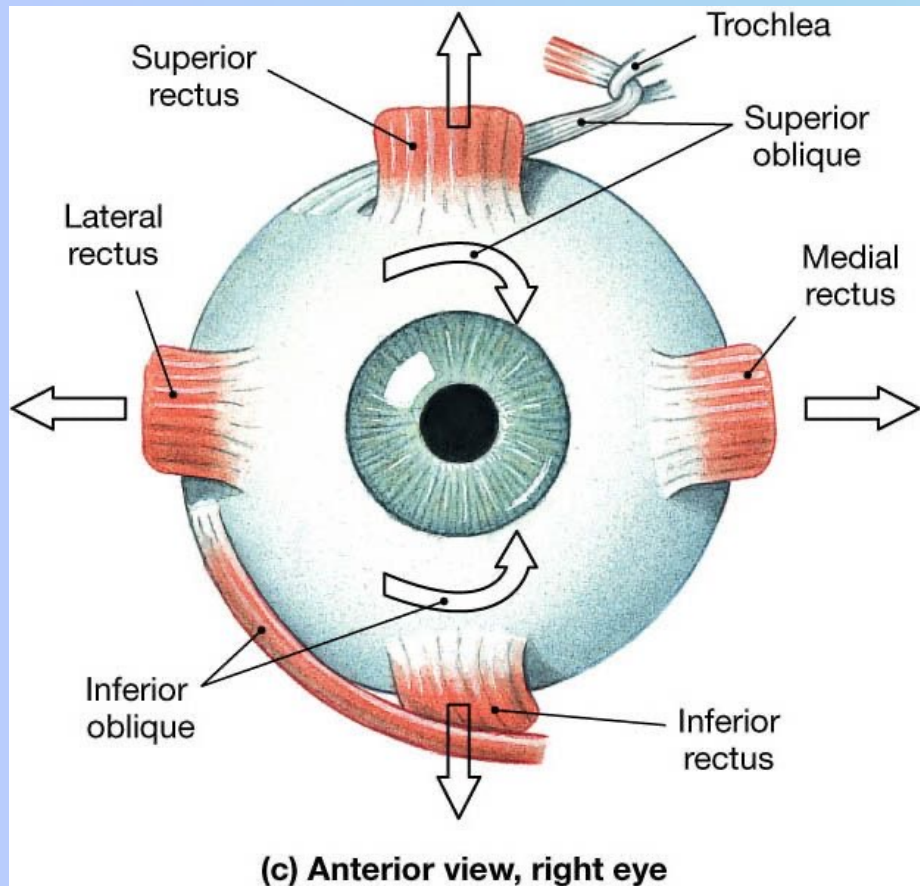


Caused by

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



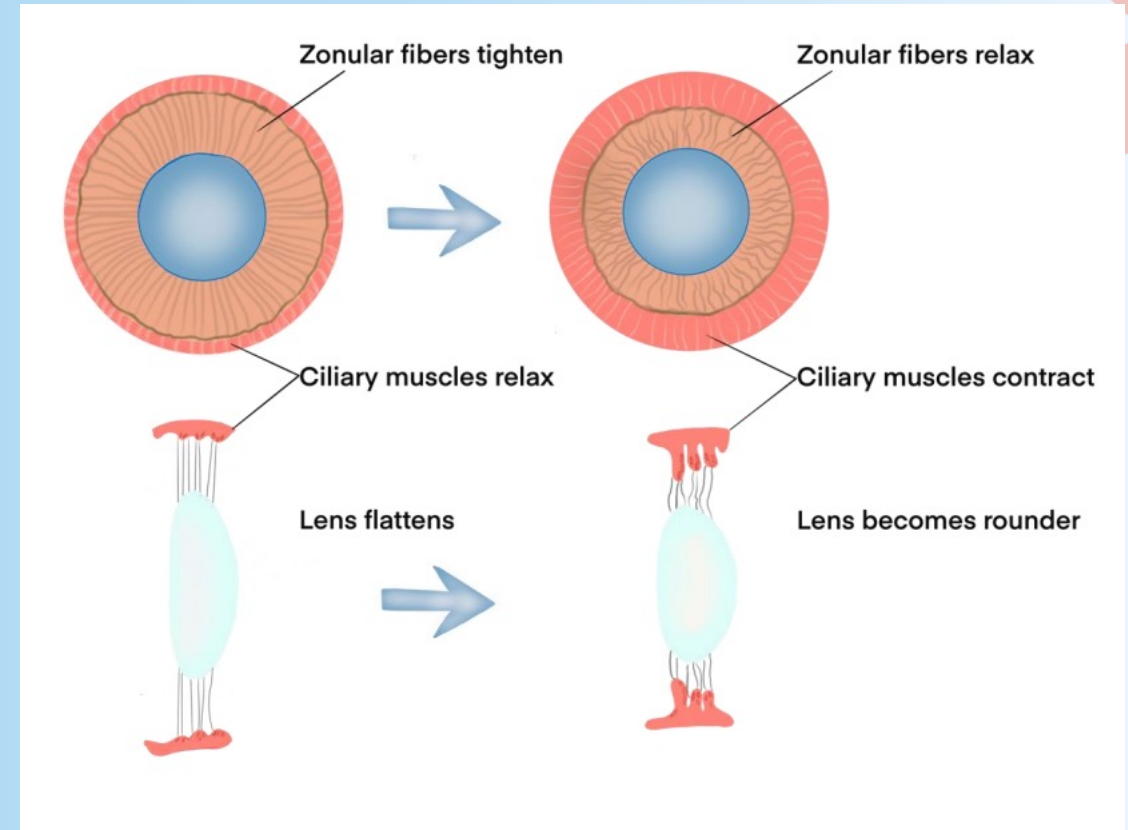
Eye movements



Accommodation

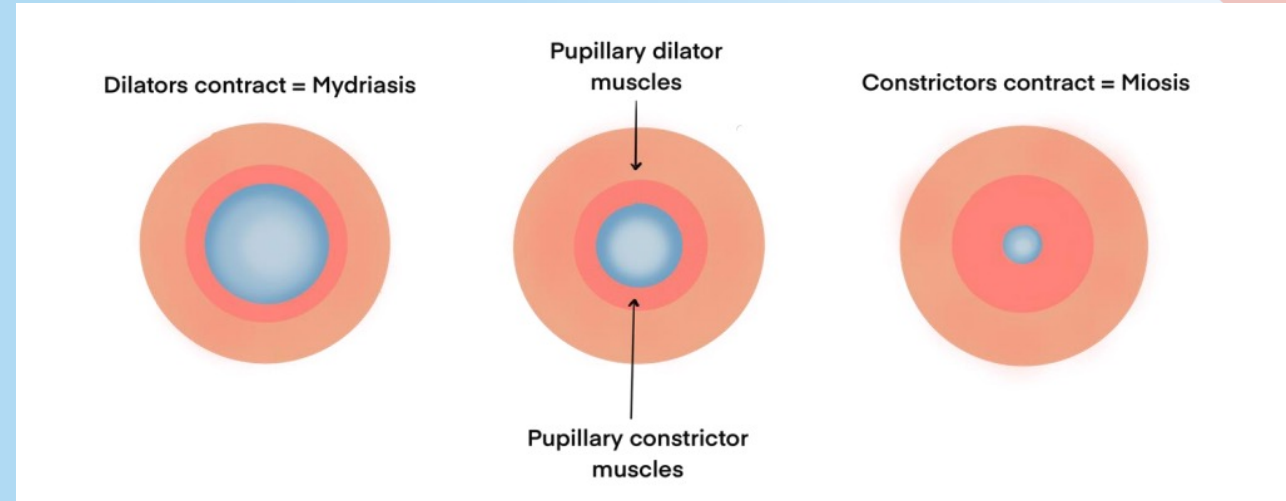
Adjustment or adaption of the lens to focus on a near object.

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



Pupillary 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.



Pupillary light reflex

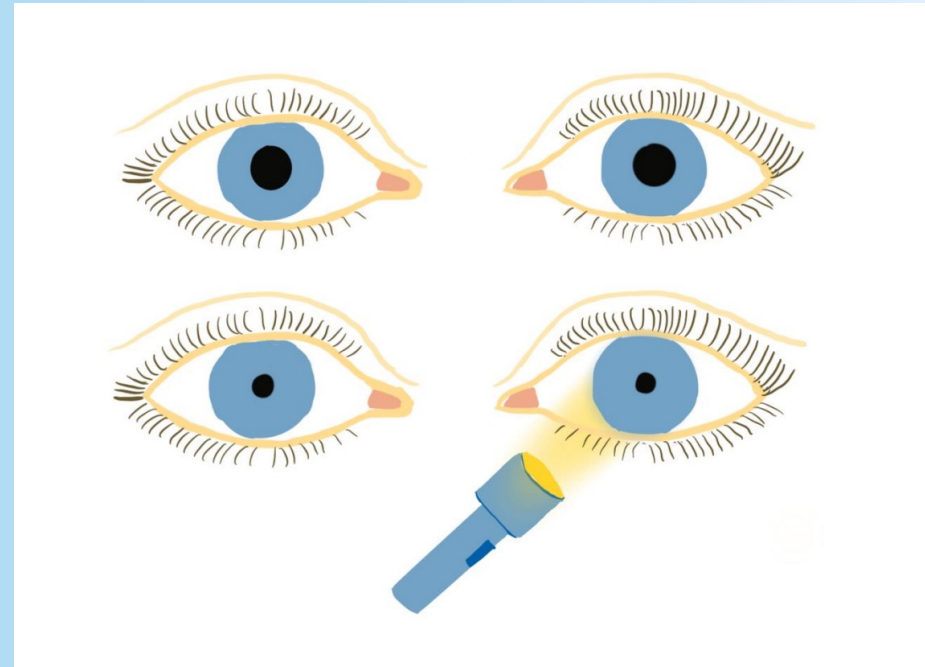
Pupillary light reflex is constriction of the pupil in response to light stimulation.

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



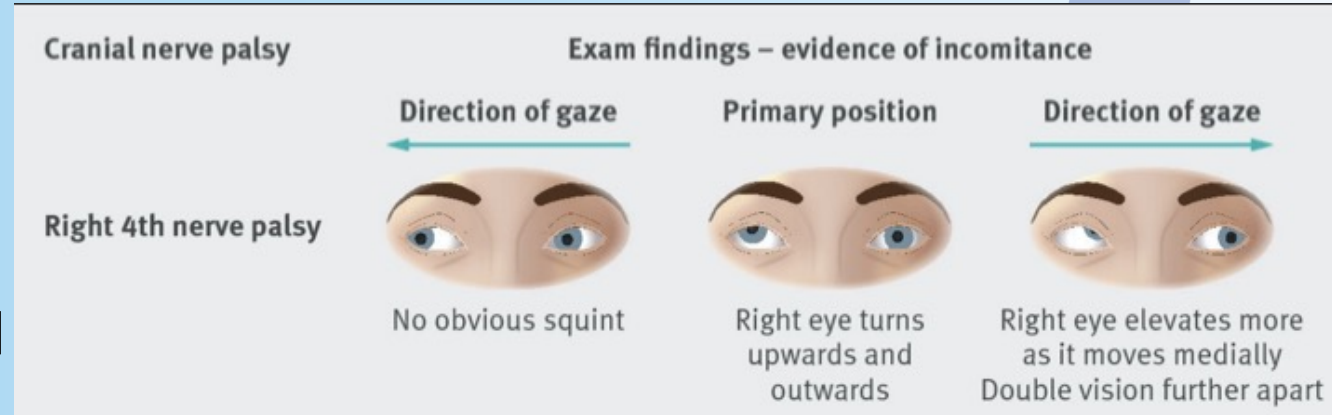
CN IV - Trochlear

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

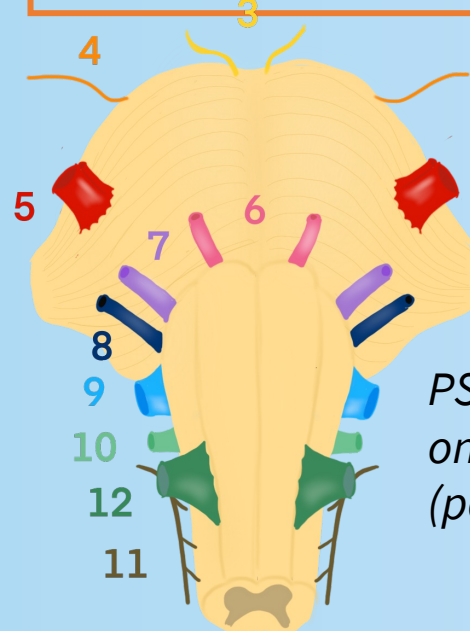
Lesion

- 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

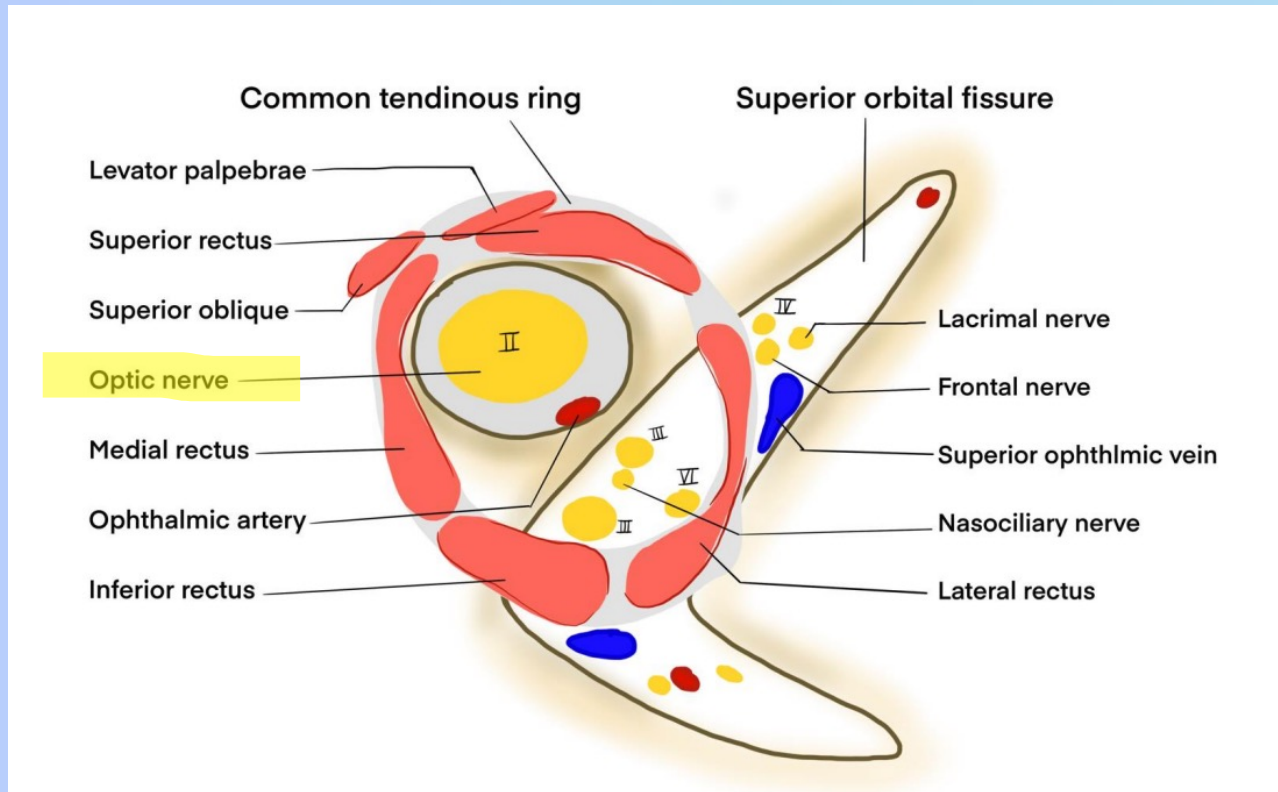


With a lesion of cranial nerve four, you cannot look at the floor.



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

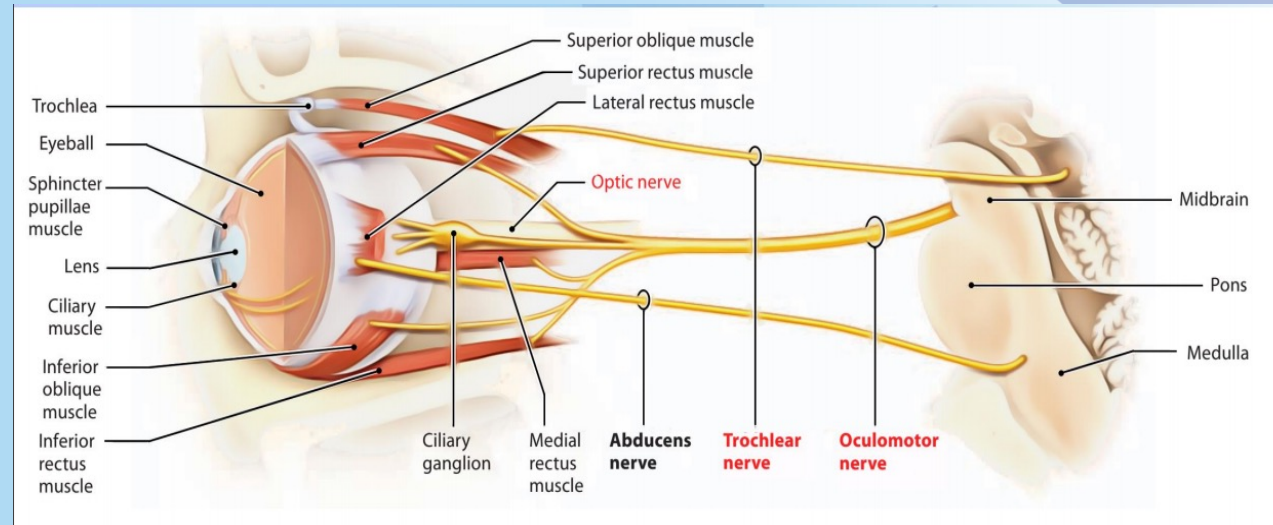
Common tendinous ring



- NB! Trochlear nerve is the only one of the nerves going to the muscles of the eye that does not pass through the common tendinous ring.
- Lacrimal, Frontal and nasociliary nerves are all branches of V1.

CN VI - Abducent

- **Motor** - 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

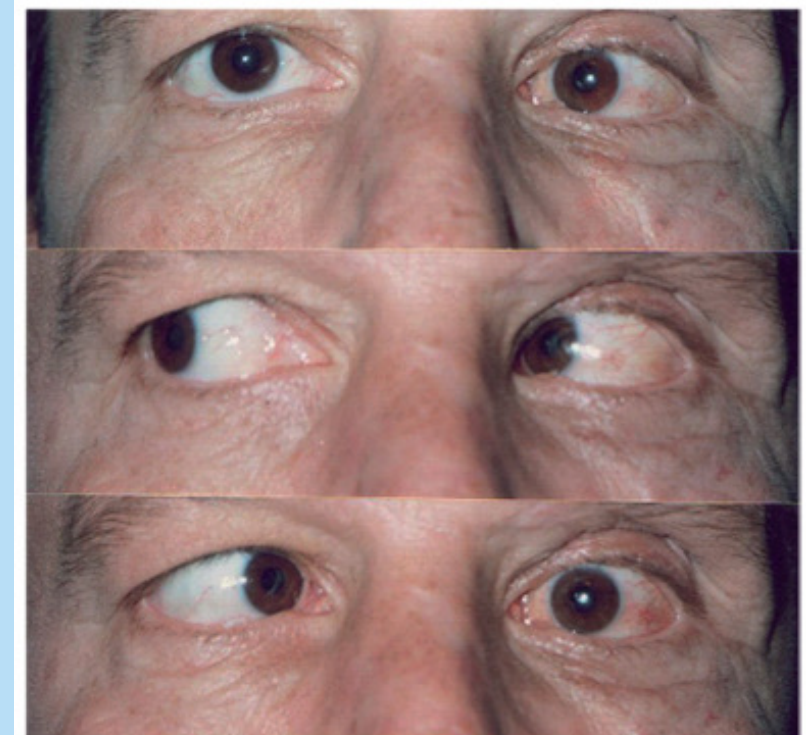
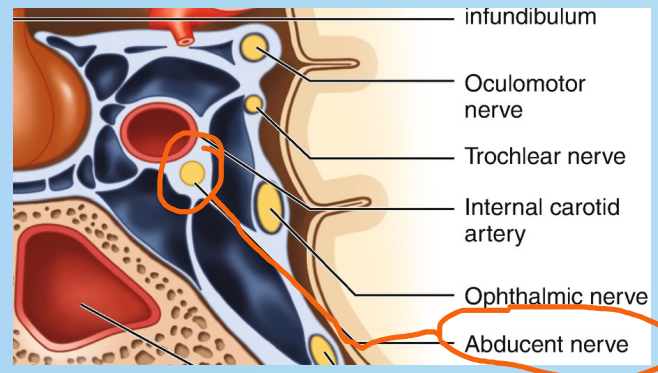


Figure 1: Left VI nerve (abducens) paresis or paralysis. Left esotropia with major limitation of abduction, increasing on left gaze

Reflexes

Reflex	Afferent limb	Efferent limb
Corneal reflex	V1 - Nasociliary branch	Facial nerve ¹ – CN VII
Pupillary light reflex	Optic nerve – CN II	Oculomotor ² – CN III
Accommodation	Optic nerve – CN II	Oculomotor ² – CN III
Lacrimation	Ophthalmic division – CN V1	Facial nerve ¹ – CN VII
Jaw jerk	Mandibular division – CN V3 (Sensory)	Manidbular division – CN V3- (Motor)
Gag reflex	Glossopharyngeal – CN IX	Vagus – CN X
Cough reflex	Vagus – CN X	Vagus – CN X
Sneeze reflex	Maxillary division – CN V2	Vagus – CN X

¹ Orbicularis oculi, innervated by temporal branch of VII, closes the eye

² Parasympathetic fibers from Edinger-Westphal nucleus of CN III