DISCUSSION SESSION 3: GROSS ANATOMY

ONN BLOCK

Feb 12, 2024

Cranial Nerves
Orbit
Reflexes

Cranial Nerves - different types of neurons

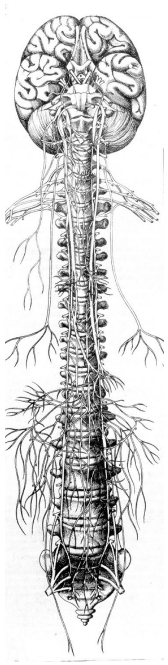
ARISE FROM,
PROJECT TO

CRANIAL NERVES

BRAIN (BRAIN-STEM)

SPINAL NERVES

SPINAL CORD



REFERENCE CHART - WAY TO REMEMBER TYPE OF NEURONS - USEFUL

VII. SUMMARY OF TYPES OF NEURONS IN CRANIAL NERVES (parenthesis - OLD 3 Letter system)

Nerve	SOMATIC MOTOR (GSE)	BRANCHIO-MOTOR (SVE)	VISCERAL MOTOR (GVE)	SOMATIC SENSORY (GSA)	VISCERAL SENSORY (GVA)	CHEMICAL SENSE (SVA)	SPECIAL SENSES (SSA)
III.	+		+				
IV.	+						
VI.	+						
XII.	+						
V.		+		+			
VII.		+	+	+	+	+	
IX.		+	+	+	+	+	
X.		+	+	+	+	+	
XI.		+					
I.						+	
II.							+
VIII.							+

NOTE: THREE LETTER SYSTEM - NO LONGER ON BOARD EXAMS BUT MAY BE REFERRED TO IN NEUROANATOMY - NO QUESTIONS IN GROSS ANATOMY

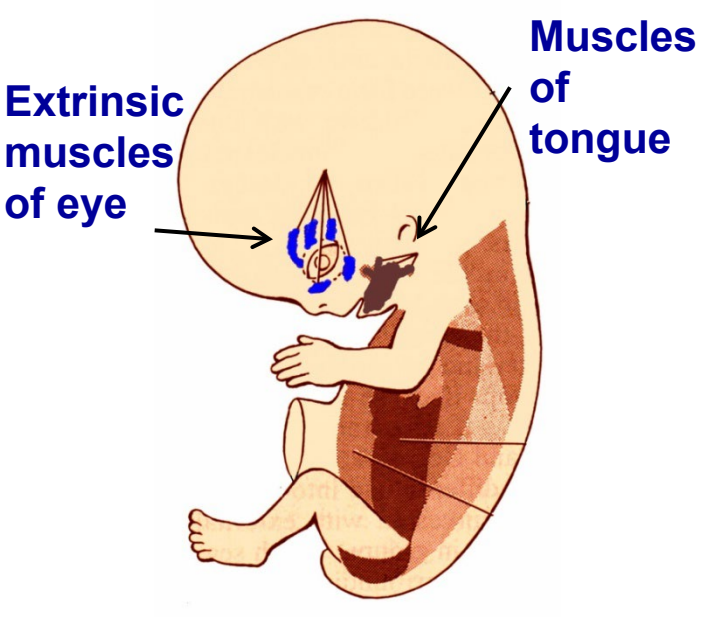
TYPES OF NEURONS

1. Somatic motor
2. Somatic sensory
3. Visceral motor
4. Visceral sensory
5. Special senses
6. Chemical senses
7. Branchiomotor

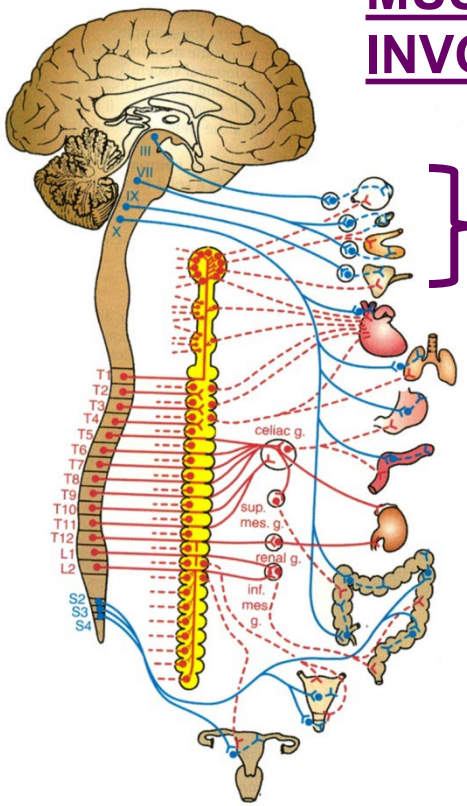
Important (Clinically) to Differentiate:
SOMATIC - def. generally refers to BODY; here refers to SOMITES that develop EMBRYOLOGICALLY
VISCERAL - def. refers to INTERNAL ORGANS (ex. GI tract, Circulatory system, Glands, etc.)

Cranial Nerves - Somatic Motor vs Visceral Motor

SOMATIC - SKELETAL MUSCLE - VOLUNTARY



VISCERAL - SMOOTH MUSCLE - INVOLUNTARY



IN HEAD: PARASYMPATHETICS COURSE IN CRANIAL NERVES

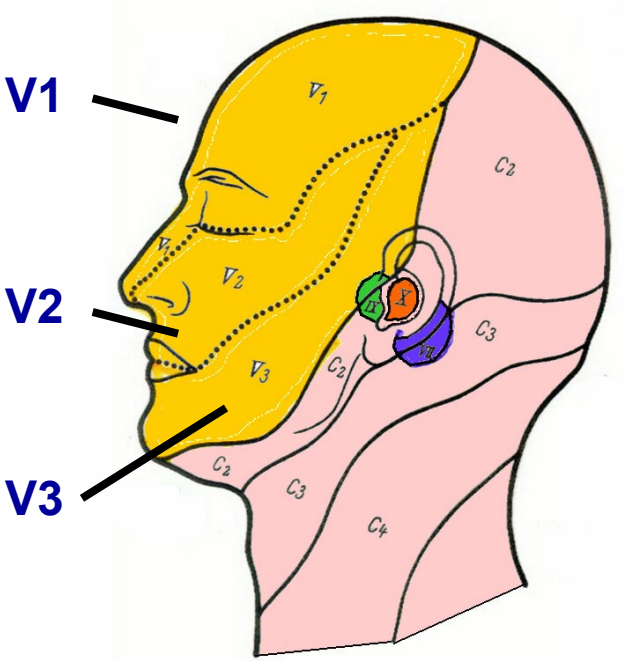
Somatic Motor - Motor neurons to skeletal muscles that are embryologically derived from Somites (other skeletal muscles derived from Branchial arches)

Visceral Motor - AUTONOMICS - Motor neurons to smooth muscles, glands, etc. ; also cardiac muscle

Cranial Nerves - Somatic Sensory (Precise Sensation) vs Visceral Sensory (Imprecise Sensation)

Somatic - in head - sensory to skin, ORAL cavity, NASAL cavity, joints, muscle

MOSTLY TRIGEMINAL NERVE TO SKIN - PRECISE SENSATION - TWO POINT DISCRIMINATION



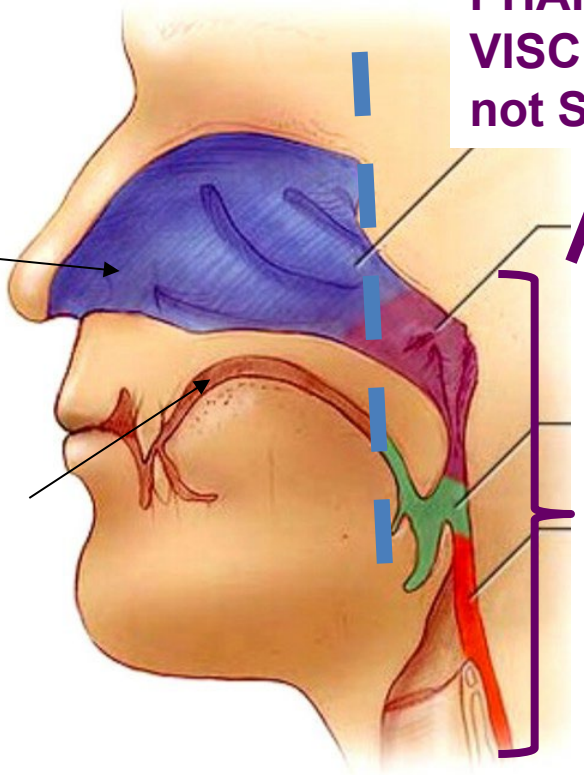
OUTER EAR - V, VII, IX, X

TRIGEMINAL NERVE ALSO - ORAL CAVITY, NASAL CAVITY

PHARYNX VISCERAL not Somatic

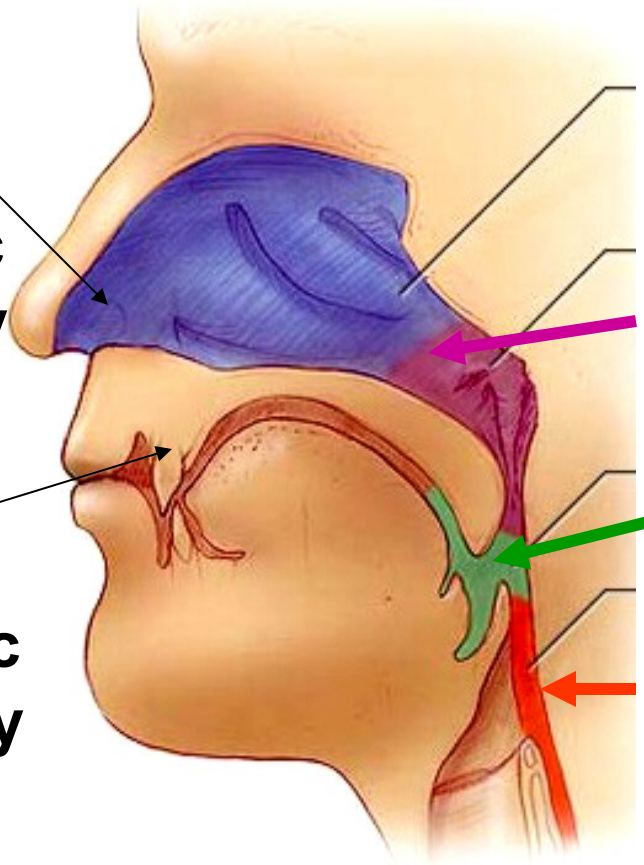
Nasal Cavity - Somatic Sensory

Oral Cavity Somatic Sensory



VISCERAL SENSORY

Sensory to Pharynx and derivatives



All Pharynx is
Visceral Sensory
In 3 Cranial Nerves

NASOPHARYNX - VII

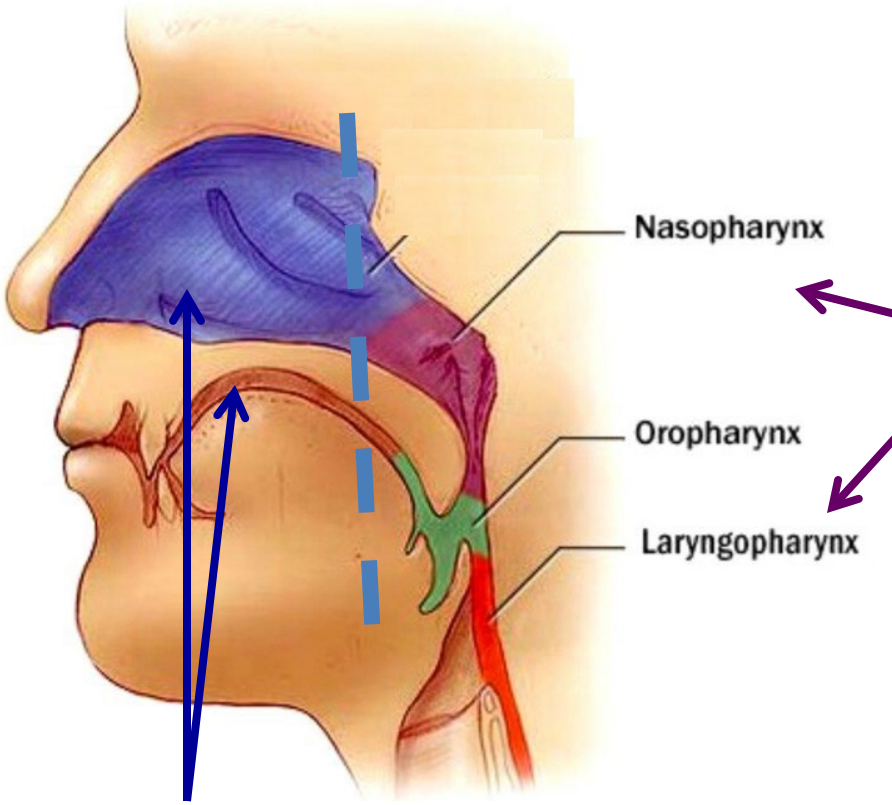
OROPHARYNX - IX

LARYNGOPHARYNX - X

PHARYNX IS UPPER PART OF GI TRACT = VISCERAL

Note: Authors disagree on innervation of nasopharynx

VISCERAL SENSORY - IMPRECISE - sensory to internal organs, GI and Cardiovascular



IN HEAD - VISCERAL SENSORY ALSO PHARYNX

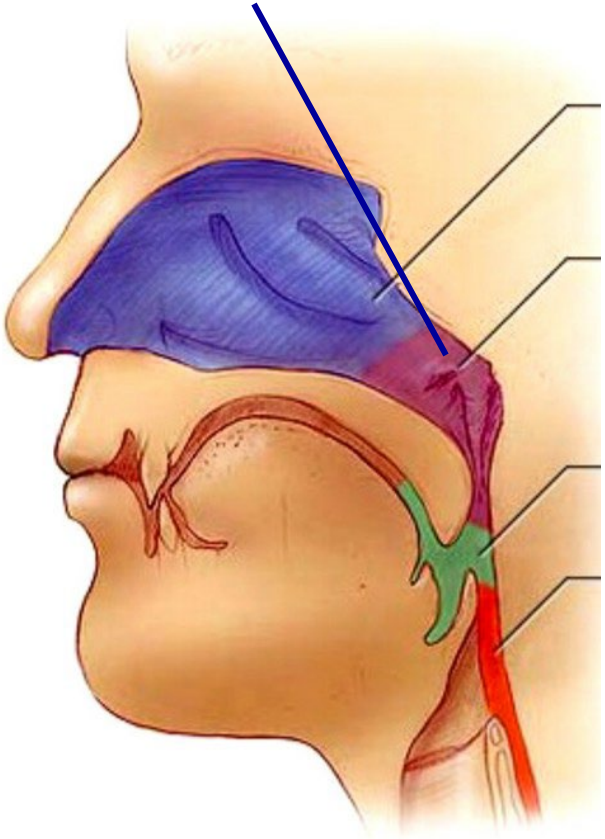
PHARYNX (OR POSTERIOR TONGUE IN OROPHARYNX) - TOUCH, PAIN NOT LOCALIZED, ELICITS 'GAG' REFLEX

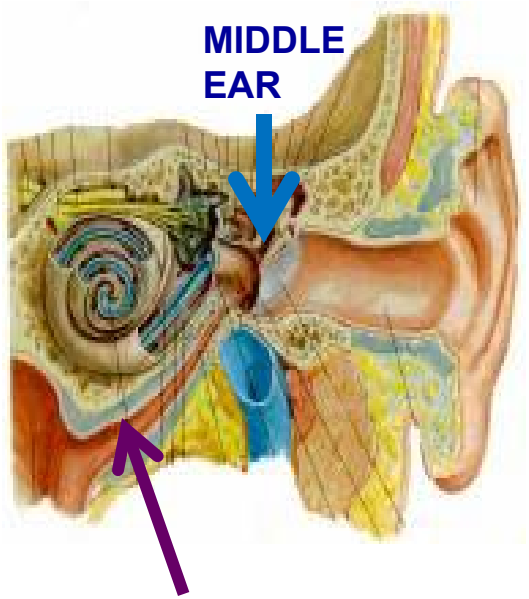
ORAL, NASAL CAVITIES (ANTERIOR TONGUE) - TOUCH, PAIN PRECISELY LOCALIZED

All Pharynx is Visceral Sensory In 3 Cranial Nerves - VII, IX, X

VISCERAL SENSORY - IMPRECISE - Also AUDITORY TUBE

OPENING OF AUDITORY TUBE IN NASOPHARYNX





AUDITORY TUBE IS AN EXTENSION OF NASOPHARYNX, LEADS TO MIDDLE EAR - INSIDE TYMPANIC MEMBRANE (EAR DRUM)

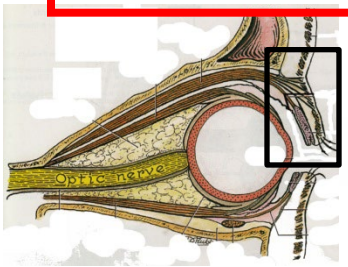
AUDITORY (EUSTACHIAN)TUBE - extension of ;Pharynx (Nasopharynx) lead to middle ear; Innervation Visceral Sensory (CN IX);
Children with middle ear infections (Otitis media) can't localize pain - 'Whole side of my head hurts)

CRANIAL NERVES - DAMAGE (discussed in reviews)

IDENTIFY CRANIAL NERVES ON VIEW INSIDE CRANIAL CAVITY

I. OLFACTORY - sense of smell - ANOSMIA
II. OPTIC - vision - BLIND IN ONE EYE, etc.
III. OCULOMOTOR - eye movement - LATERAL STRABISMUS (WALL-EYE), DILATED PUPIL, PTOSIS
IV. TROCHLEAR - eye movement - NO DOWN AND OUT, HEAD TILT TO OPPOSITE SIDE
V. TRIGEMINAL - touch, general sensation to skin, oral cavity, nasal cavity + more - SOMATIC
VI. ABDUCENS - eye movement - MEDIAL STRABISMUS (CROSS-EYED)
VII. FACIAL - muscles of facial expression + lots more - Bell's Palsy
VIII. VESTIBULO-COCHLEAR - hearing and balance - Loss hearing
IX. GLOSSOPHARYNGEAL - sensory to pharynx +more - Difficulty swallowing (dysphagia)
X. VAGUS - larynx, pharynx + rest of body
XI. ACCESSORY - sternocleidomastoid, trapezius
XII. HYPOGLOSSAL - muscles of tongue

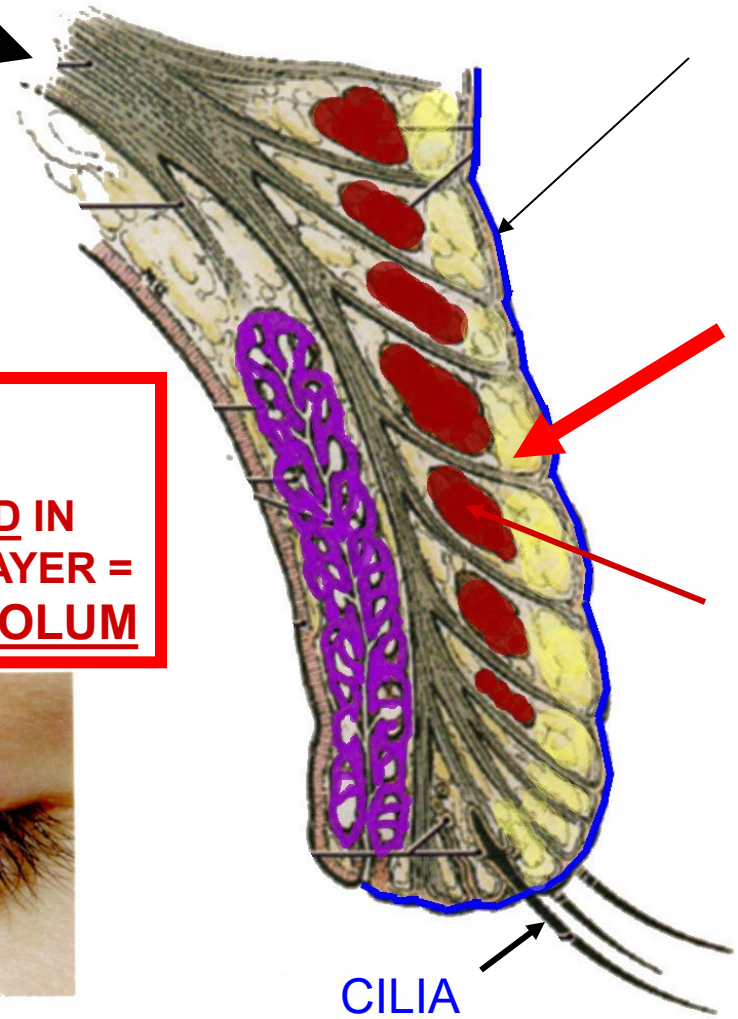
ORBIT



ORIENT - EYELID PARASAGITTAL SECTION

EYELIDS = PALPEBRAE - LAYERED

EYELIDS PROTECT EYE, MOVEABLE, KEEP CORNEA MOIST



1. SKIN - CONTAINS EYELASHES (CILIA) AND OPENINGS OF SEBACEOUS , SWEAT GLANDS;

2. SUBCUTANEOUS LAYER - CONNECTIVE TISSUE CONTAINS SEBACEOUS GLANDS; OBSTRUCTION = STYE OR HORDE'OLUM

3. ORBICULARIS OCULI (PALPEBRAL PART) - SKELETAL MUSCLE CLOSES EYE, INNERVATED BY VII - PARALYZE ORBICULARIS OCULI - CAN DAMAGE CORNEA

CLINICAL

OBSTRUCTION or INFECTION OF SEBACEOUS GLAND IN SUBCUTANEOUS LAYER = STYE OR HORDE'OLUM

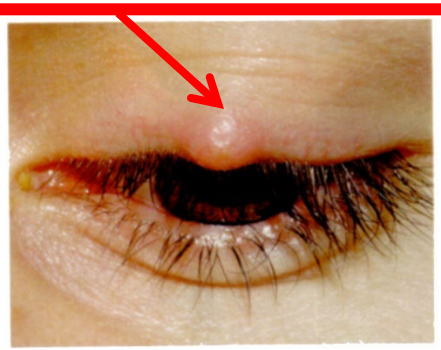


FIGURE 10-10
Acute hordeolum of upper eyelid.
From Palay, Krachmer, 1997.

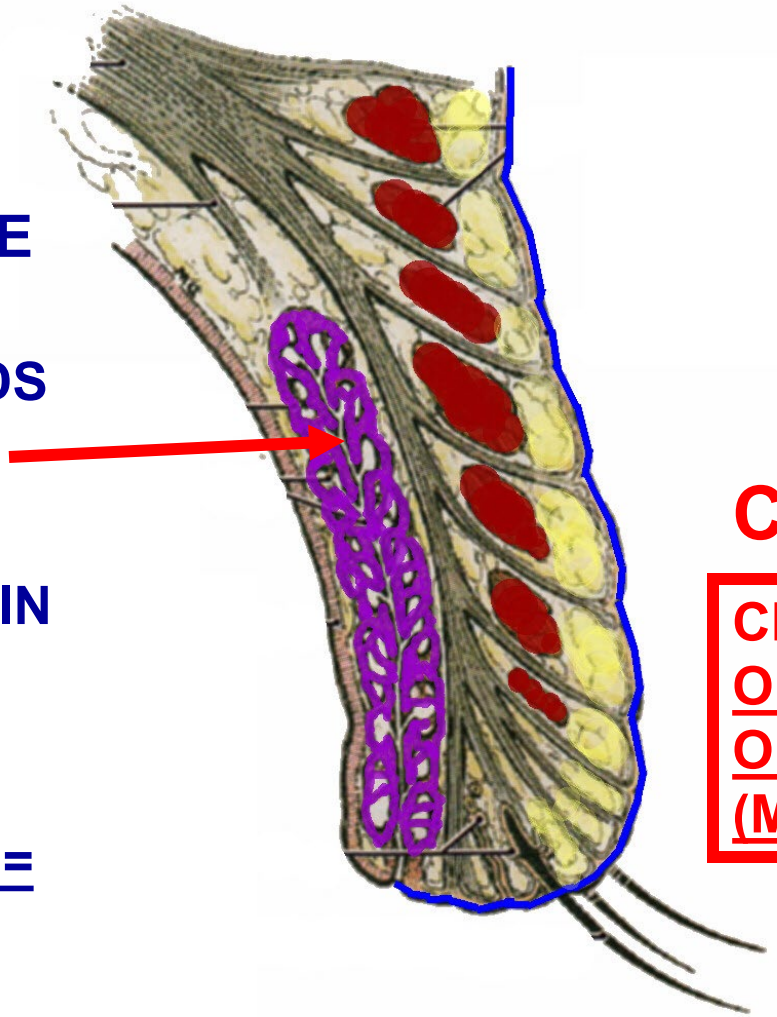
EYELIDS - LAYERS

TARSAL PLATE - FIBROUS CT 'SKELETON' OF EYELID, DEEP TO ORBITAL SEPTUM

TARSAL PLATE

- CONTAINS TARSAL GLANDS (Meibomian glands)

- KEEP TEARS IN EYE, PREVENT EVAPORATION OF TEARS - OBSTRUCTION = CHALAZION

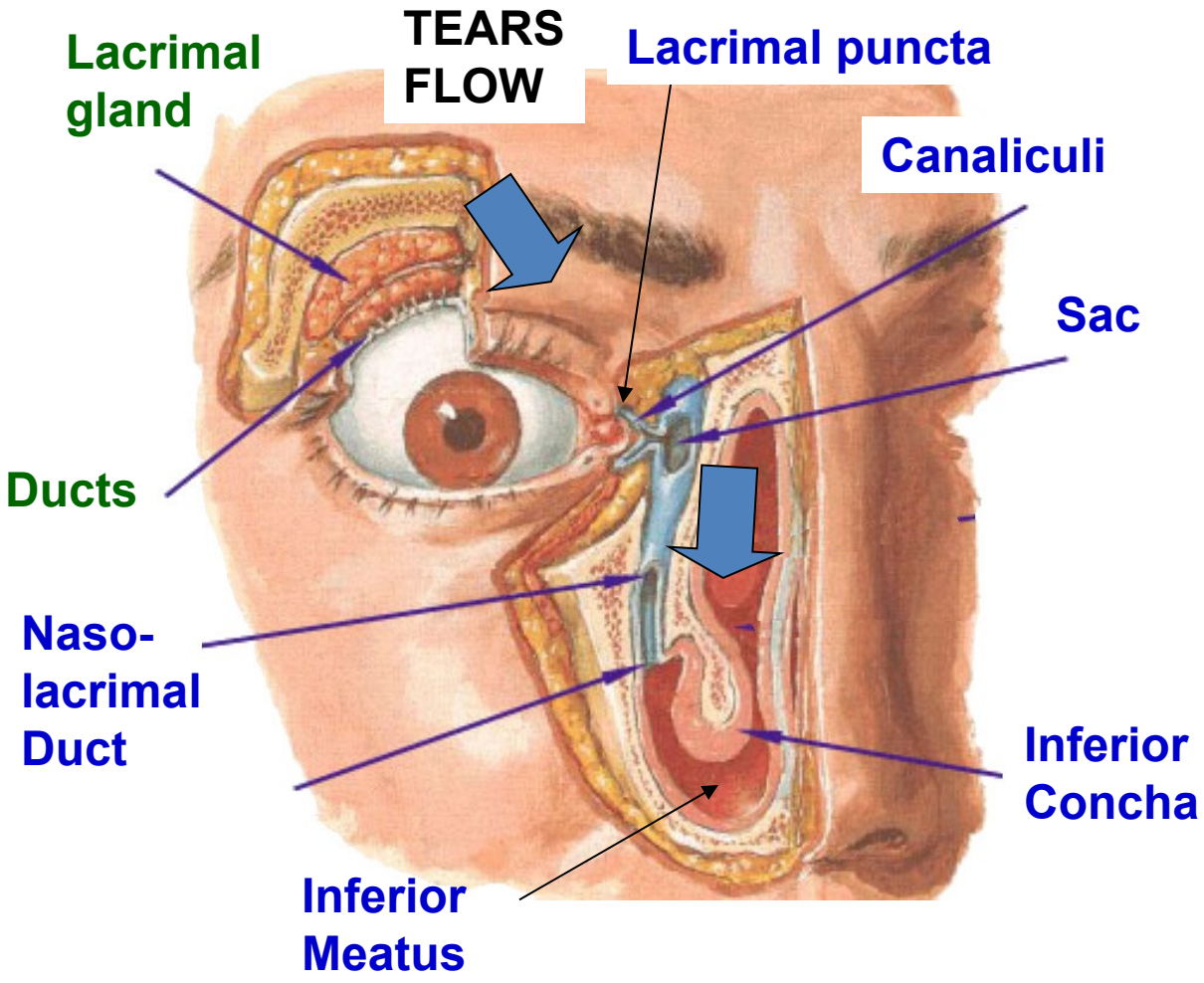


CHALAZION

CLINICAL

CHALAZION: OBSTRUCTION OF TARSAL (MEIBOMIAN) GLAND

LACRIMAL GLAND



- TEARS FLOW ACROSS EYE TO LACRIMAL PUNCTA ON MEDIAL END OF EYELIDS (eyelids meet at MEDIAL CANTHUS);

- TEARS THEN PASS THROUGH LACRIMAL CANALICULI TO LACRIMAL SAC;

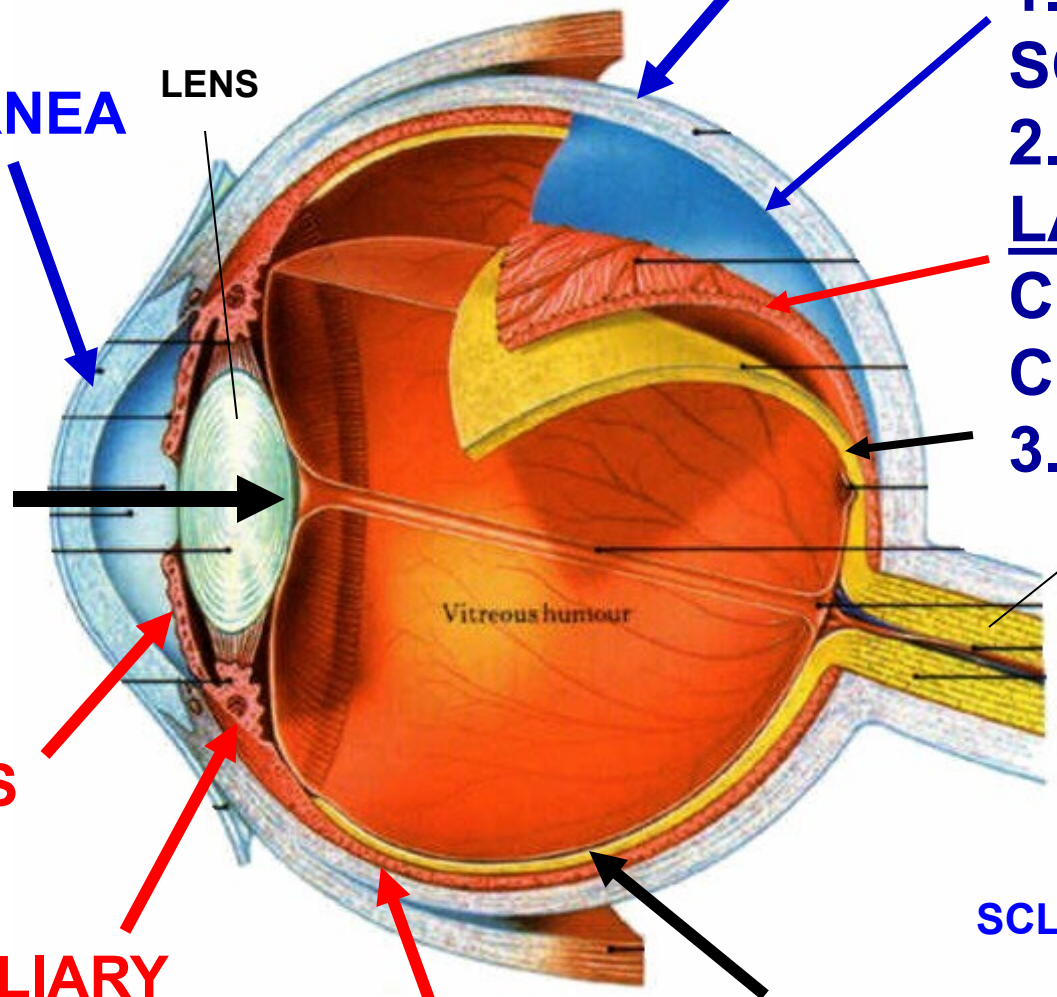
- SAC CONNECTS TO NASOLACRIMAL DUCT WHICH DRAINS TO <u>INFERIOR MEATUS</u> OF NASAL CAVITY

LACRIMAL GLAND IS INNERVATED BY VII - <u>FACIAL NERVE</u>;

BLOCK VII - DECREASE TEARS; PRESSURE/IRRITATION VII - EXCESSIVE TEARS;

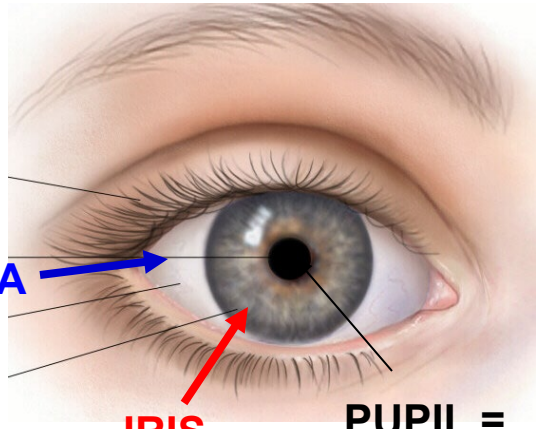
'Crocodile tears - Lacrimation while eating (salivation) - VII innervates salivary glands

STRUCTURE OF EYE - 3 LAYERS



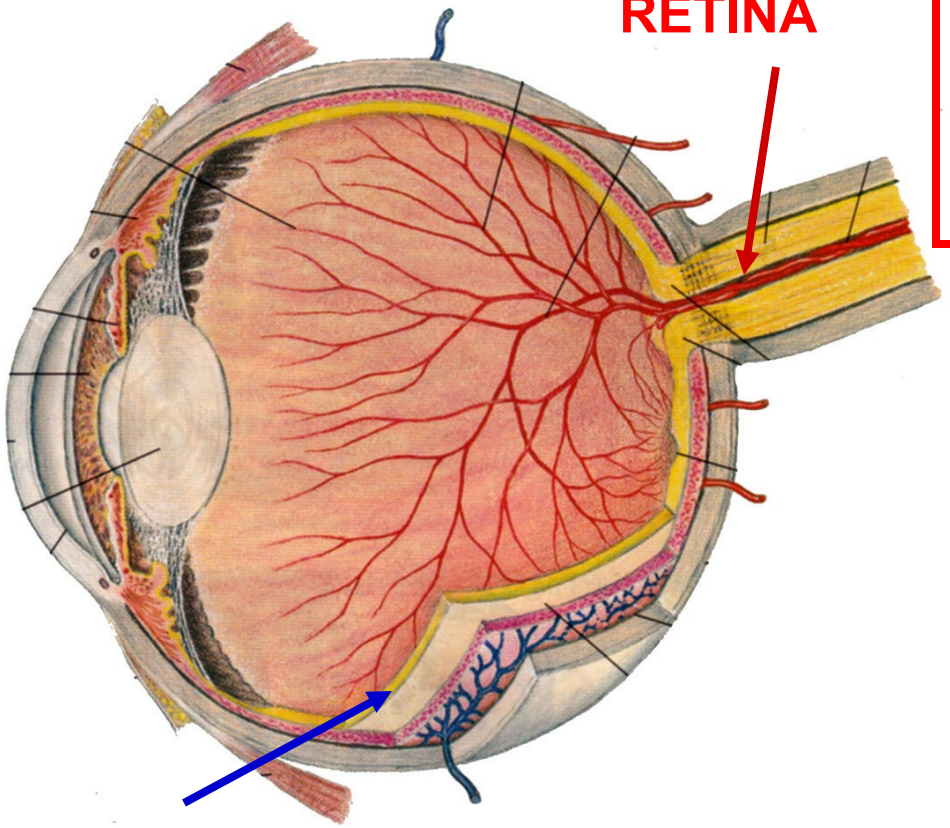
1. FIBROUS LAYER - SCLERA, CORNEA
2. VASCULAR LAYER (UVEA) - IRIS, CILIARY BODY, CHOROID
3. RETINA

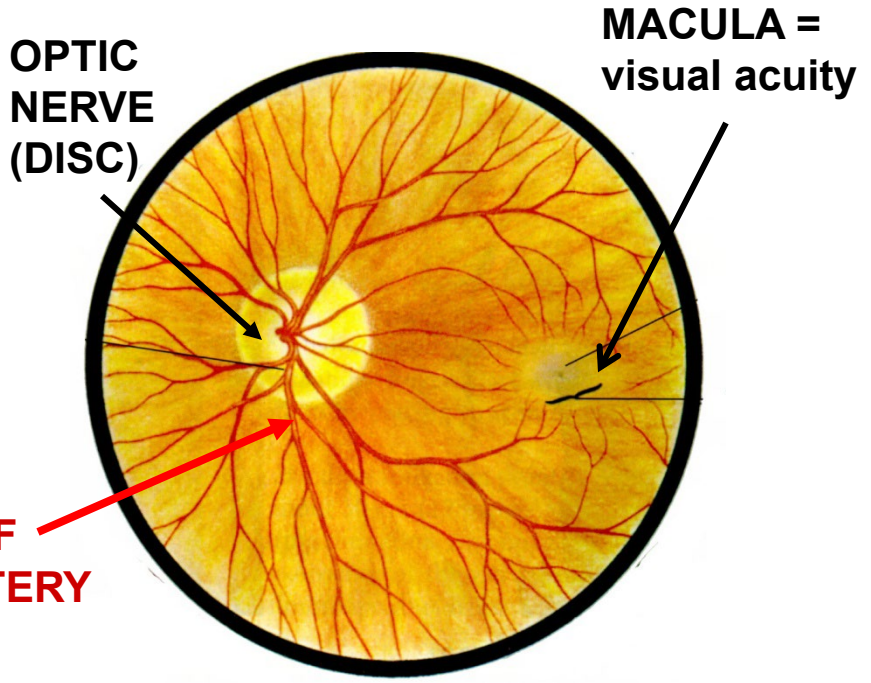
OPTIC NERVE



ARTERIAL SUPPLY – CENTRAL ARTERY OF RETINA

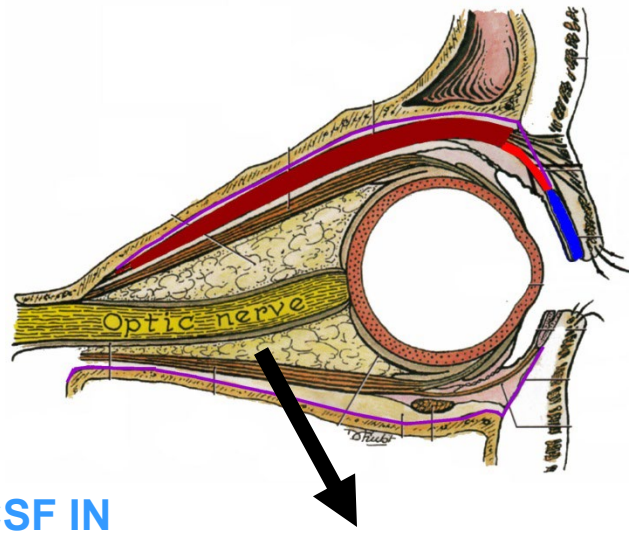
RETINA CONTAINS RODS AND CONES (PHOTOSENSITIVE)
CENTRAL ARTERY OF RETINA- BRANCH OF OPHTHALMIC ART.
NO (OR LIMITED) ANASTOMOSES; OCCLUSION RESULTS IN BLINDNESS (EXCEPT WHEN SUPPLY FROM CILIO-RETINAL ARTERIES)



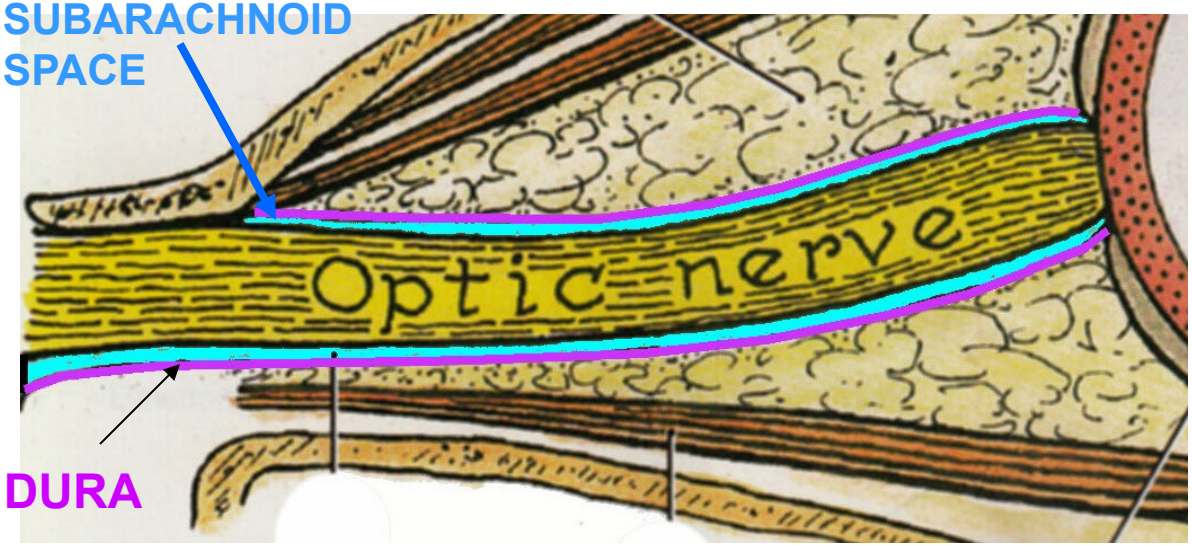


OPHTHALMOSCOPE VIEW

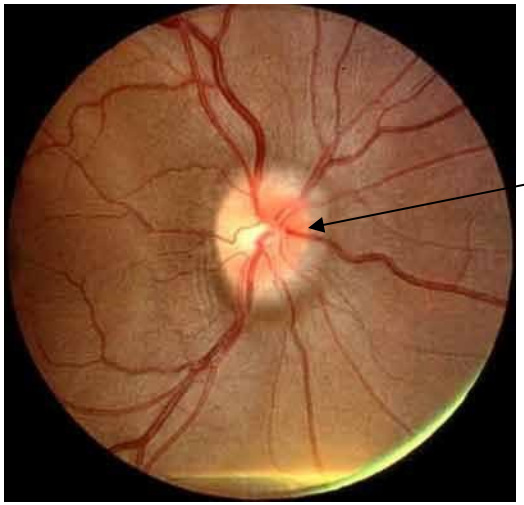
DIAGNOSE CHANGES IN CSF IN OPHTHALMOSCOPE VIEW



CSF IN SUBARACHNOID SPACE



DURA



HYDROCEPHALUS

PAPILLEDEMA
- engorgement of retinal veins (correspond to branches of central artery)

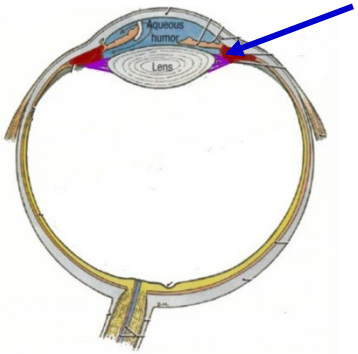
CLINICAL

DURA AND SUBARACHNOID SPACE (CSF) EXTEND AROUND OPTIC NERVE; INCREASE IN CSF (PRESSURE) CAN AFFECT VISION

PAPILLEDEMA = swelling of optic disc

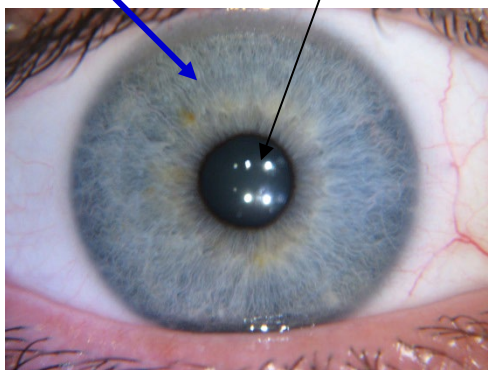
Clinical - slow onset; headaches

EYE - STRUCTURE OF EYEBALL- SMOOTH MUSCLES IN VASCULAR LAYER



IRIS

PUPIL



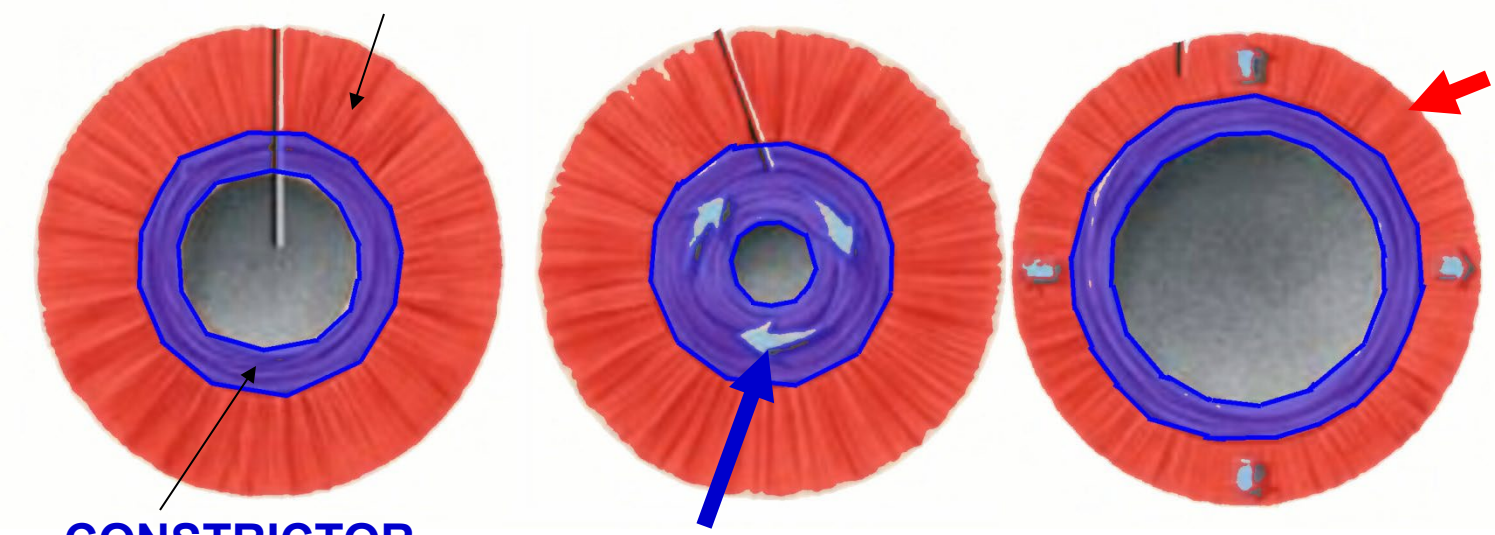
IRIS - PIGMENTED, CONTRACTILE LAYER WITH SMOOTH MUSCLES SURROUNDING PUPIL

NORMAL

DILATOR

BRIGHT LIGHT - PUPIL CONSTRICTED

DIM LIGHT - PUPIL DILATED

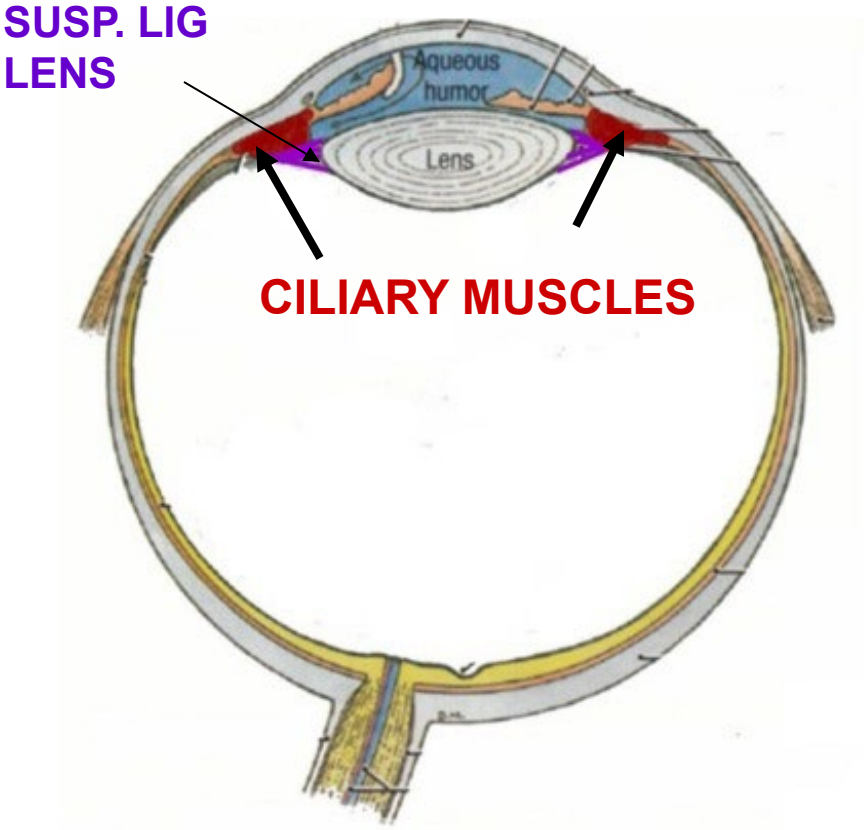


CONSTRICTOR

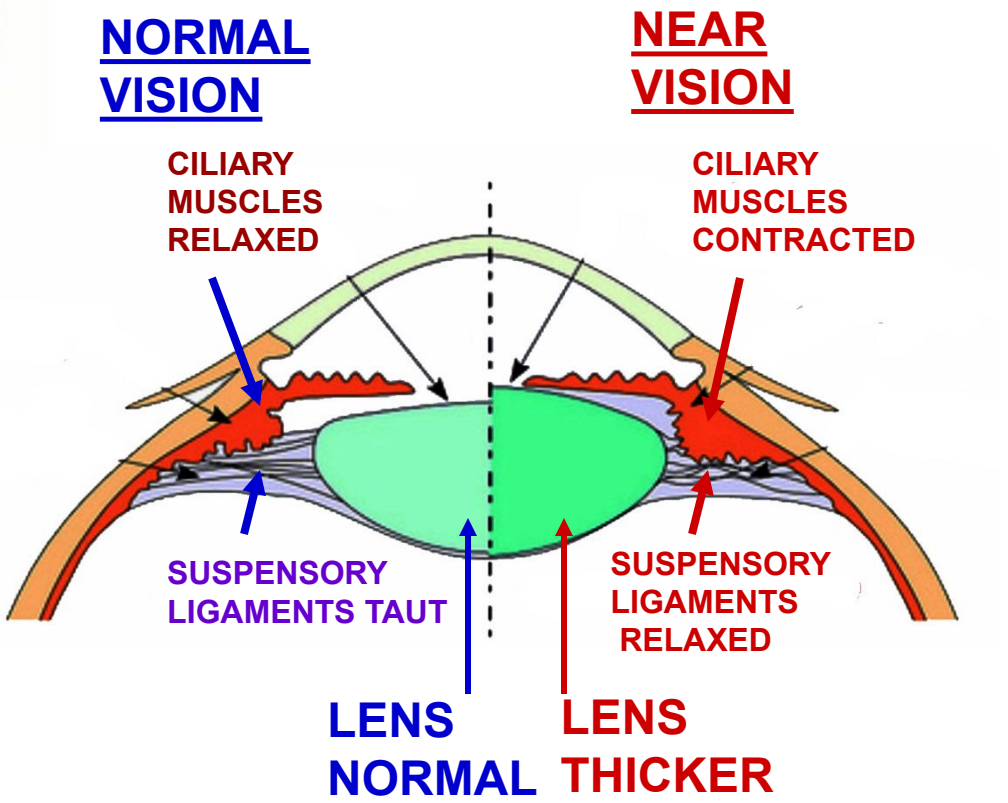
DILATOR PUPIL- RADIAL SMOOTH MUSCLE; SYMPA-THETICS

CONSTRICTOR PUPIL- CIRCULAR SMOOTH MUSCLE; PARASYMPATHETICS (CN III)

EYE- STRUCTURE OF EYEBALL- VASCULAR LAYER



CILIARY BODY- CILIARY MUSCLES- SMOOTH MUSCLES AT ATTACHMENTS OF SUSPENSORY LIGAMENTS OF LENS CONTROL THICKNESS OF LENS



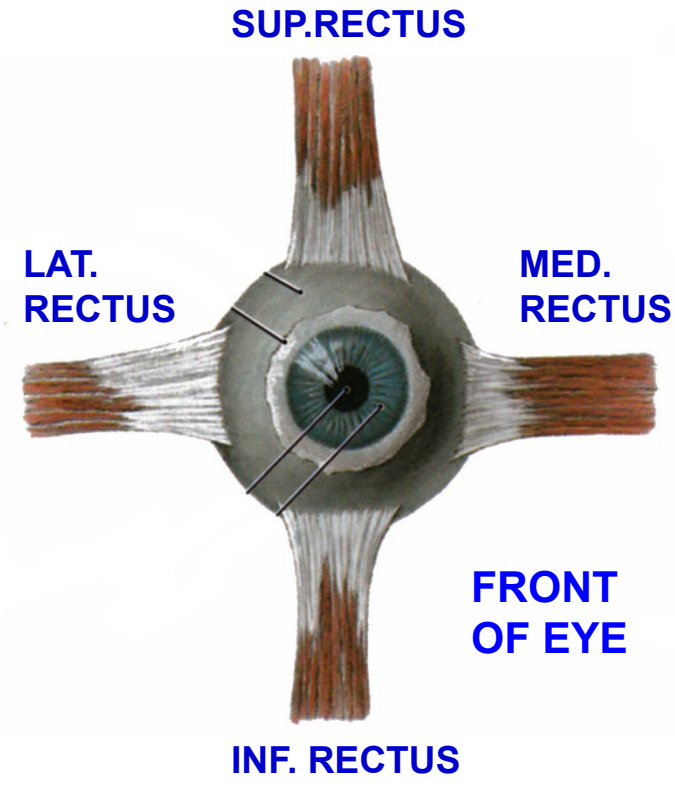
ACCOMMODATION - THICKEN LENS FOR NEAR VISION (VIEWING OBJECTS CLOSE UP)
PARASYMPATHETIC CONTROL- III (Short ciliary nerves)

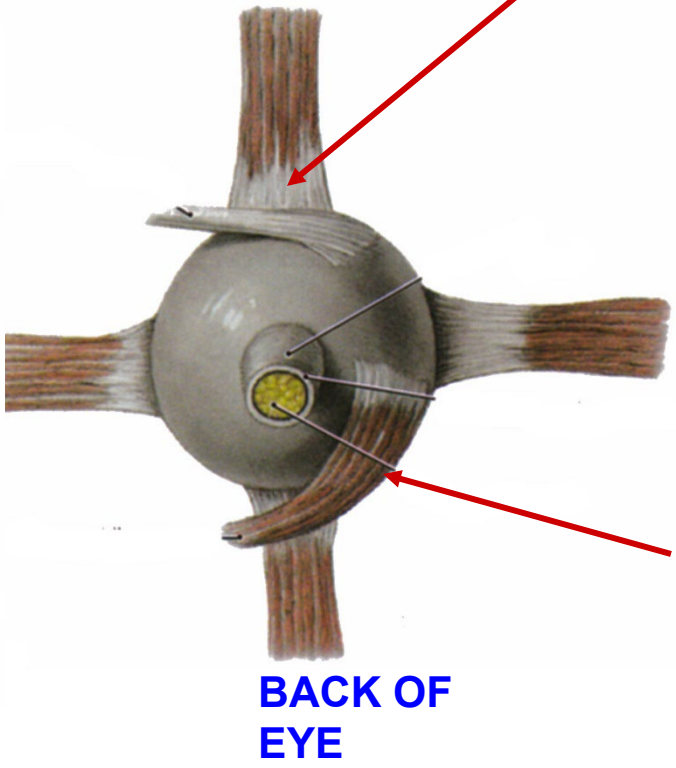
CILIARY MUSCLES CONTRACT - LENS THICKER

ORBIT - EXTRAOCULAR MUSCLES

VOLUNTARY SKELETAL MUSCLES WHICH MOVE EYEBAL

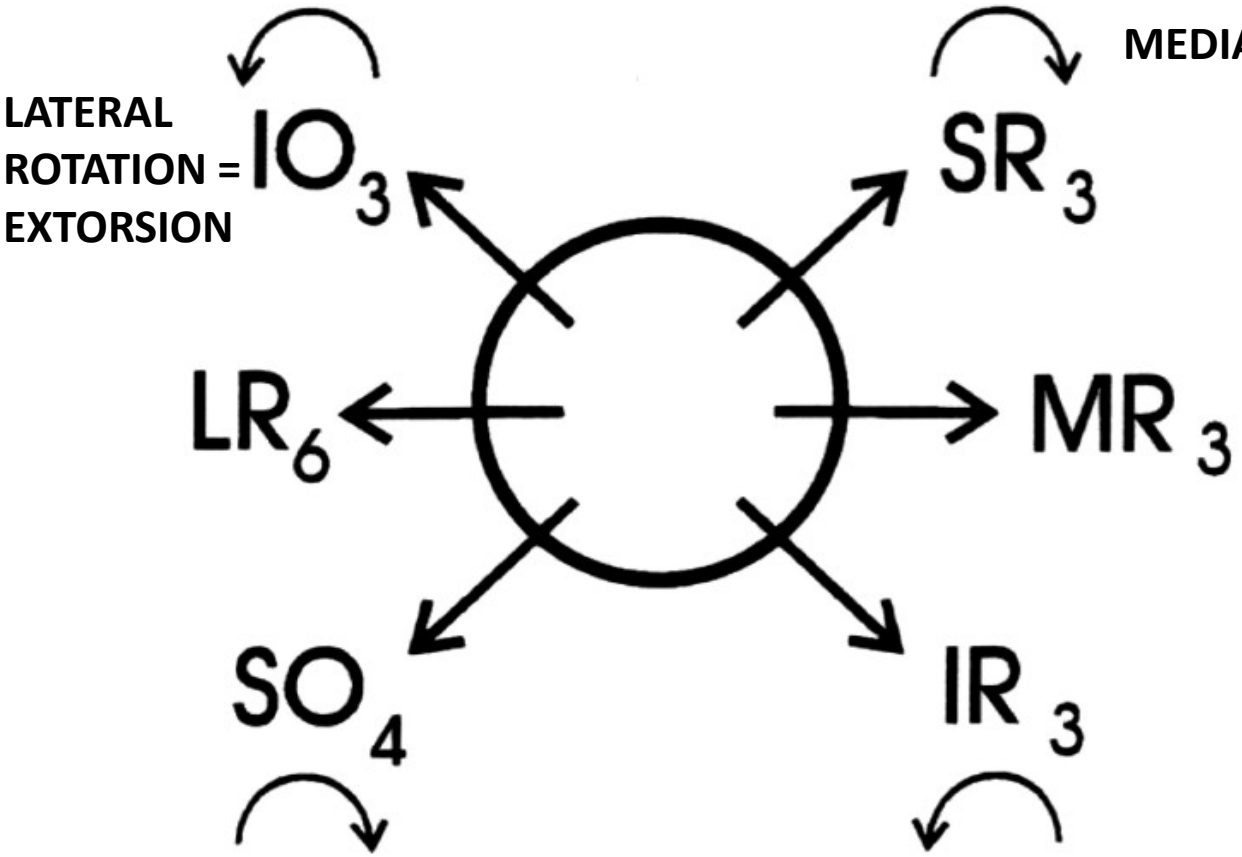
RECTI = STRAIGHT, NAMED FOR SIDES ON WHICH THEY ATTACH





OBLIQUES - MORE COMPLICATD DEVIOUS SUPERIOR OBLIQUE - ACTS THROUGH PULLEY (TROCHLEA); INFERIOR OBLIQUE - TO FLOOR OF ORBIT

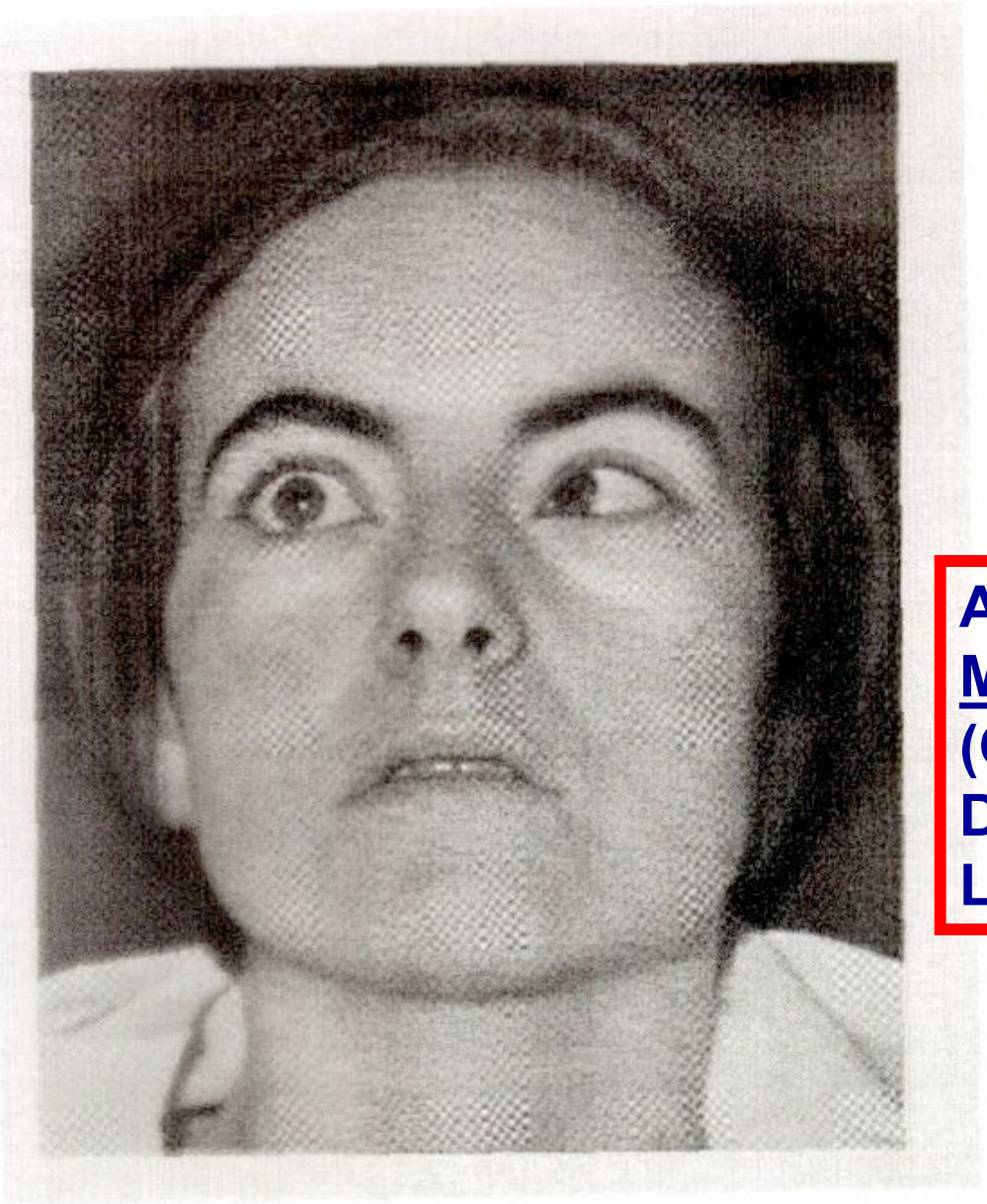
EYE MOVEMENTS DIAGRAM



NOSE

1- Resting position of eye depends upon tonic activities in muscles.

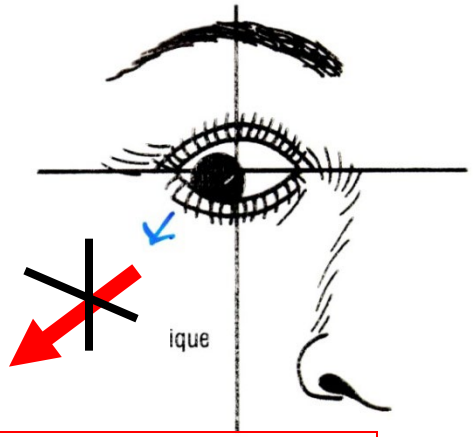
2- Damage to any one muscle does not entirely eliminate abduction, adduction, elevation or depression; only get weakness.



ABDUCENS (VI) NERVE DAMAGE

ABDUCENS (VI): AT REST
MEDIAL STRABISMUS
(CROSS-EYED) DUE TO DAMAGE/PARALYZE LATERAL RECTUS

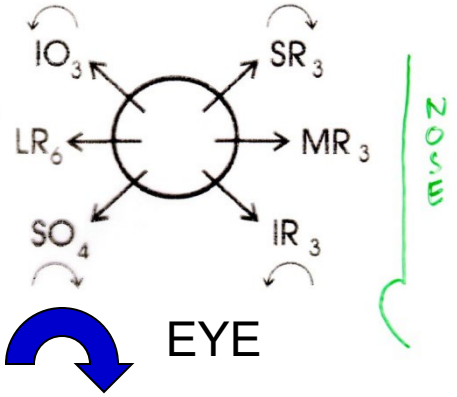
TROCHLEAR (IV) NERVE DAMAGE: INABILITY TO TURN EYE DOWN AND OUT; ALSO HEAD TILT

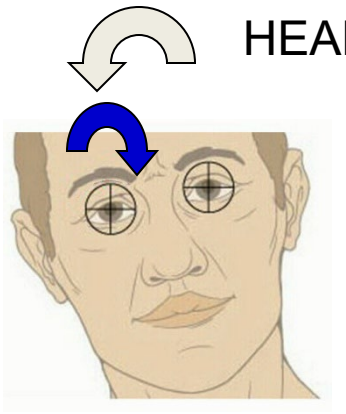


PATIENT CANNOT LOOK DOWN AND OUT

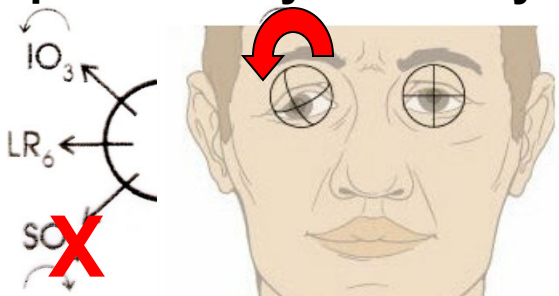
Symptoms - Difficulty walking down stairs; HEAD TILTED

NORMAL





NORMAL Rotation - occurs when tilt head; rotate ipsilateral eye medially when tilt head laterally



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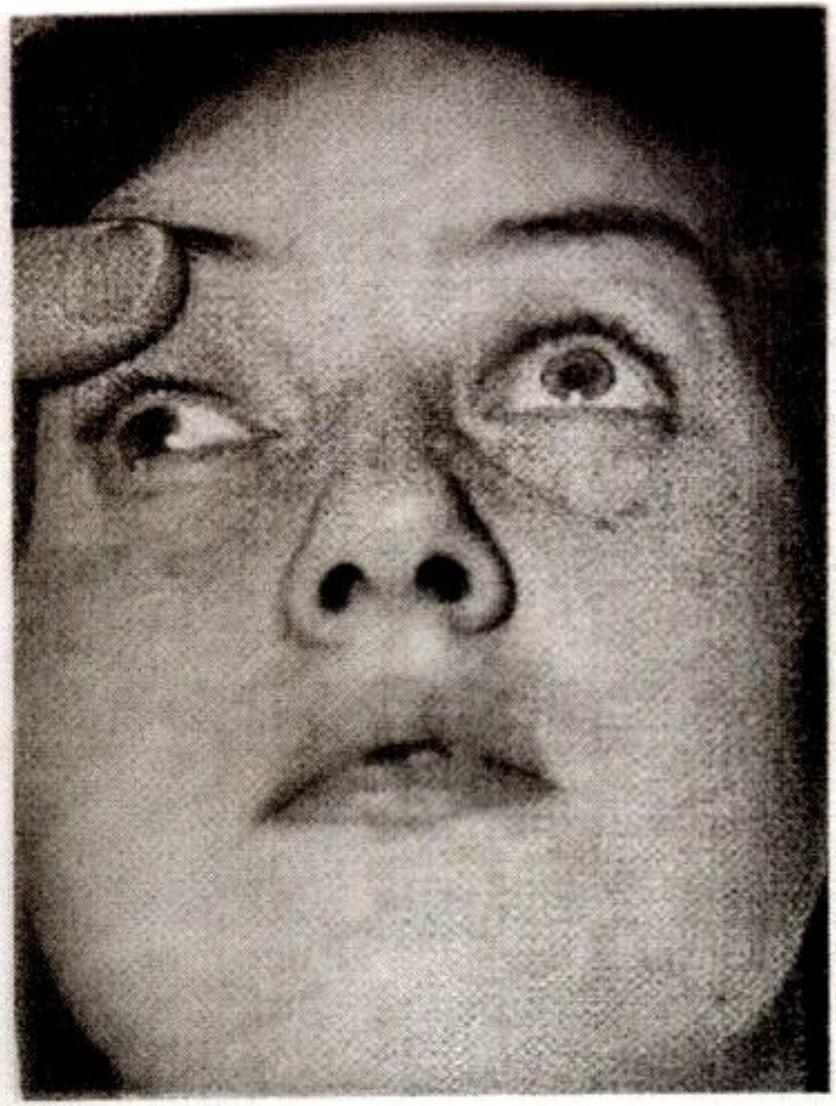
AFTER IV DAMAGE - eye rotated laterally; PATIENT TILTS HEAD TO OPPOSITE SIDE so both eyes rotated

OCULOMOTOR (III) NERVE DAMAGE



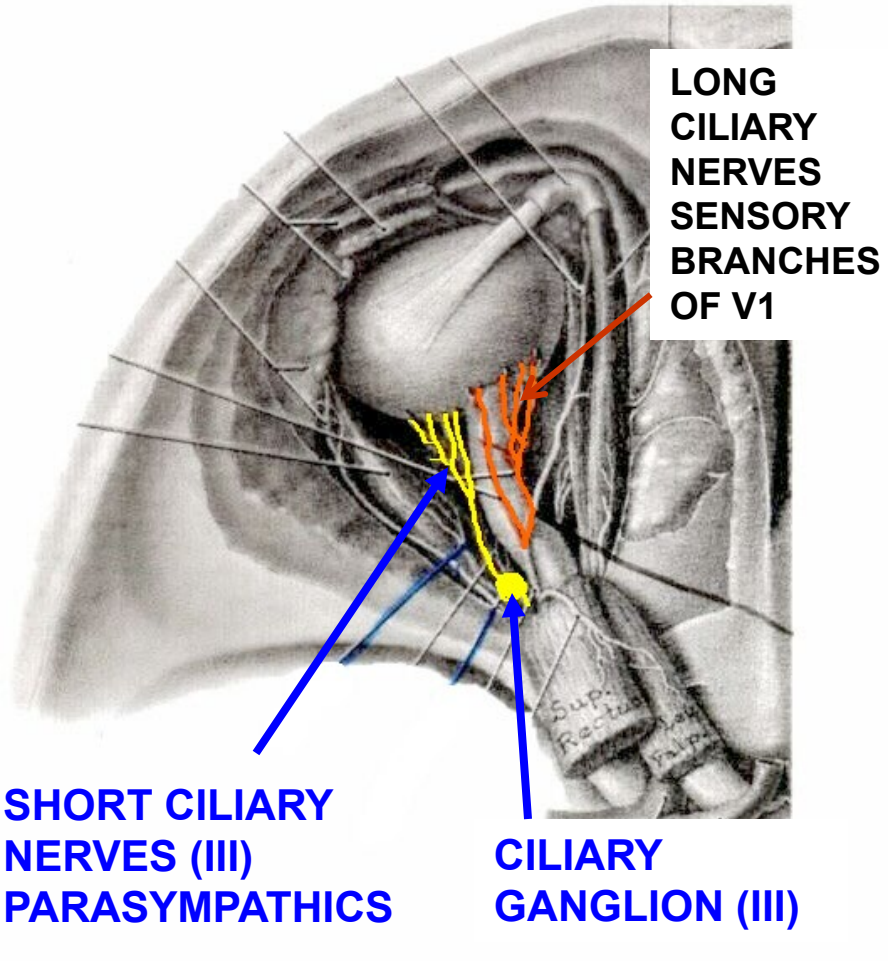
AT REST

1) LATERAL STRABISMUS (WALL-EYED) DUE TO PARALYZE MEDIAL RECTUS

2) PTOSIS - DROOPING EYELID PARALYZE LEV. PALPEBRAE SUPERIORIS

3) DILATED PUPIL - (MYDRIASIS) PARALYZE PUPILLARY CONSTRICTOR

CILIARY GANGLION - PARASYMPATHETIC



CILIARY GANGLION- PARASYMPATHETICS OF OCULOMOTOR N (III); TRAVEL IN **SHORT CILIARY NERVES -** (FOUND LATERAL AND DORSAL TO OPTIC NERVE)

INNERVATE: 1) CILIARY MUSCLES 2) SPHINCTER (CONSTRICTOR) PUPILLAE

NOTE: LONG CILIARY NERVES BRANCHES OF V1 (OPHTHALMIC) - SENSORY TO CORNEA - (FOUND MEDIAL AND DORSAL TO OPTIC NERVE)

DAMAGE SHORT CILIARY NERVES (ONLY) - MAIN SYMPTOM: PUPIL IS DILATED = MYDRIASIS

REFLEXES OF CRANIAL NERVES

REFLEXES OF CRANIAL NERVES

REFLEX	STIMULUS	SENSORY	RESPONSE	CLINICAL
Pupillary Light Reflex (II to III)	Test: Shine light in eye	Light detected by Optic Nerve	Excite Constrictor of pupil of eye (III Short Ciliary nerves (Ciliary Ganglion, parasympathetic)	Extensively used to check CN II; Absence of Pupillary Light Reflex can indicate catastrophe (brain herniation)
Corneal Reflex (V to VII)	Touch cornea of eye with cotton	Touch detected by Long Ciliary nerves (V1), Somatic sensory	Close eye (VII to Orbicularis Oculi muscle) Branchiomotor	Absence of Corneal Reflex; Test for damage to V1 sensory, VII motor
Gag Reflex (IX to X)	Test: Touch posterior tongue, oropharynx;	Excites Visceral Sensory endings in Glossopharyngeal N. (IX)	Excite muscles of pharynx, palate; Vagus N. (X), Branchiomotor	Other symptoms of Vagus damage (X); Patient Say's Ahh: soft palate not elevated on ipsilateral side (paralyze Levator Palati); uvula deviated away from side of lesion
Jaw Jerk Reflex Stretch (Deep Tendon) Reflex (V to V)	Test: tap down on mandible; Stretch muscles of mastication (ex. Masseter)	Excites Muscle Spindle sensory neurons in Trigeminal nerve (V)	Contract muscles that elevate mandible Motor - V3	Hyporeflexia - indicates Trigeminal nerve damage

PUPILLARY LIGHT REFLEX - II TO III

AFFERENT ARM OF REFLEX

SENSORY STIMULUS

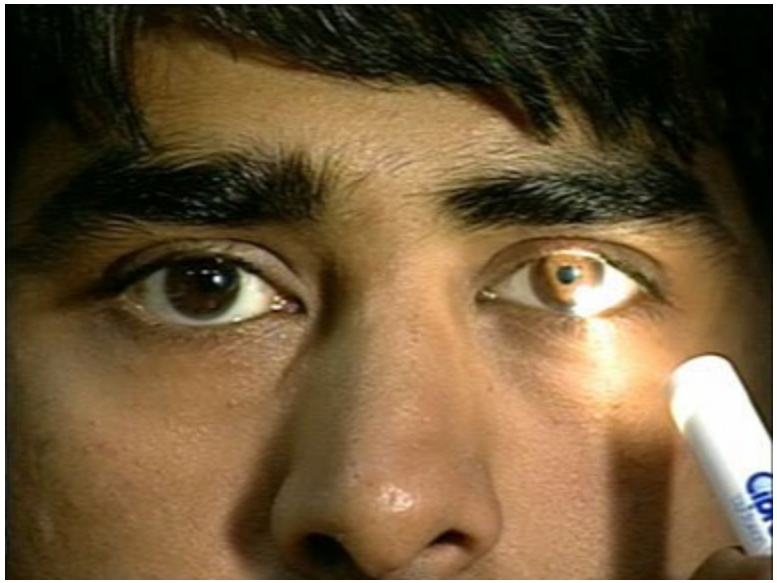
LIGHT IN EYE

EFFERENT ARM OF REFLEX

MOTOR RESPONSE

CONSTRICT PUPIL

**

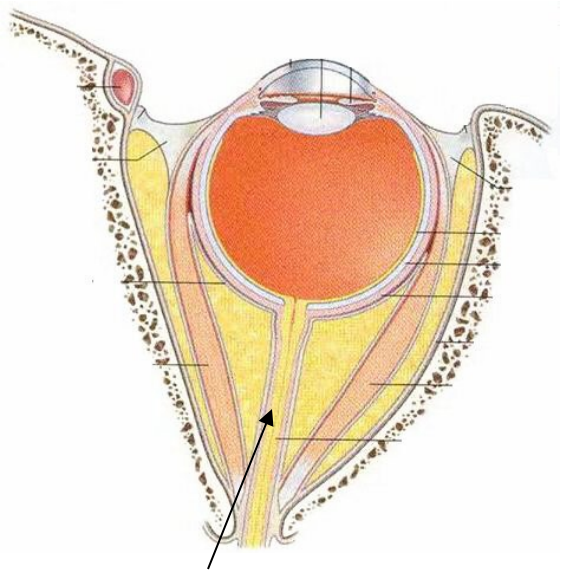


REFLEX IS CONSENSUAL – LIGHT IN ONE EYE CAUSES PUPILLARY CONSTRICTION IN BOTH EYES

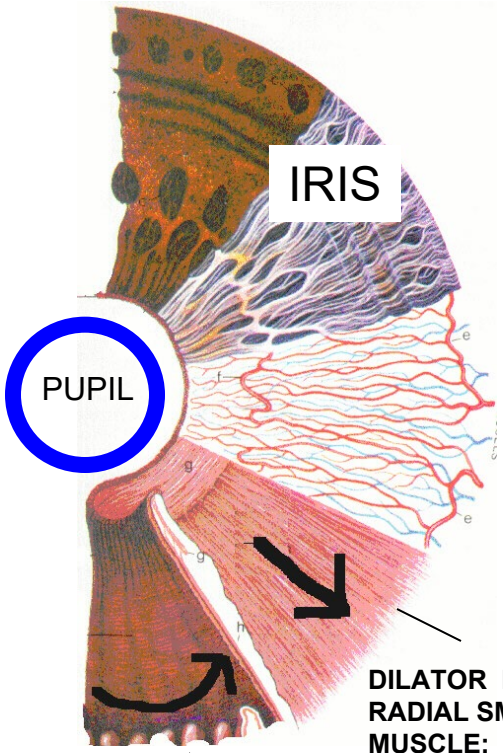
PUPILLARY LIGHT REFLEX

CN II - OPTIC NERVE - DETECTS LIGHT

CN III - OCULOMOTOR - parasympathetics from Ciliary Ganglion in Short Ciliary nerves

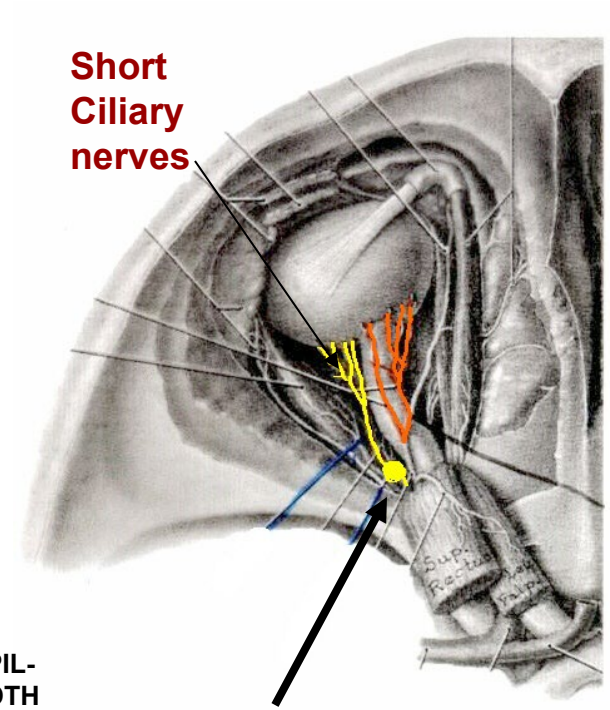


OPTIC NERVE - CN II VISION



DILATOR PUPIL- RADIAL SMOOTH MUSCLE; SYMPATHETICS

CONSTRICTOR PUPIL- CIRCULAR SMOOTH MUSCLE; PARASYMPATHETICS - CN III



Ciliary Ganglion of CN III

CORNEAL REFLEX - V TO VII

AFFERENT ARM OF REFLEX

SENSORY STIMULUS

TOUCH CORNEA

TRIGEMINAL - V1 - LONG CILIARY NERVES TO CORNEA

EFFERENT ARM OF REFLEX

MOTOR RESPONSE

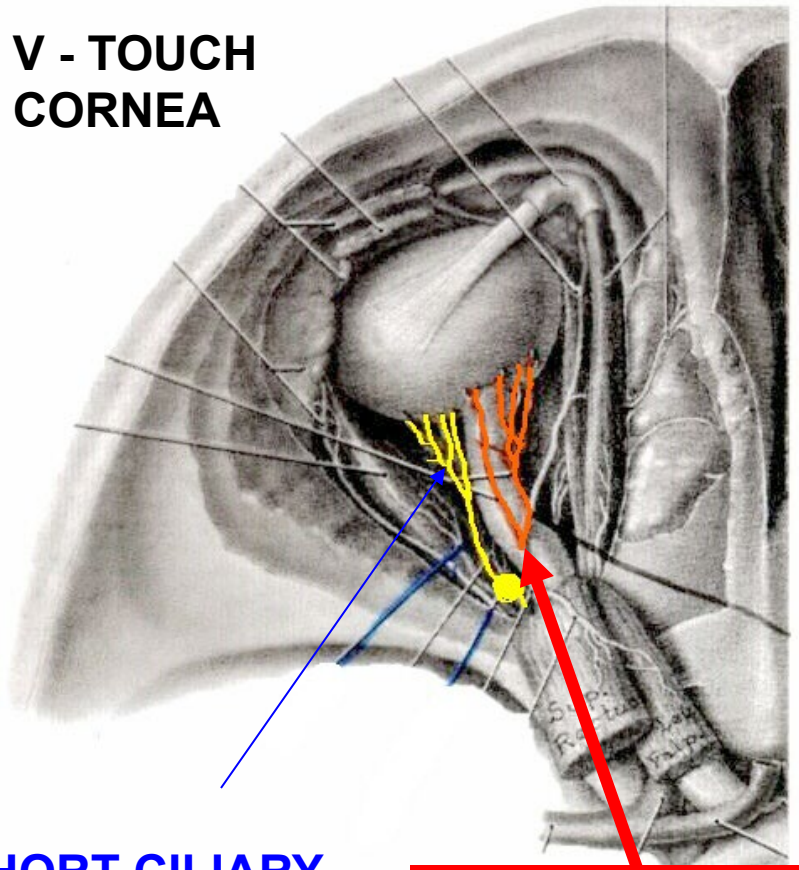
CLOSE EYELID

FACIAL - VII - MOTOR TO ORBICULARIS OCULI (Branchiomotor)

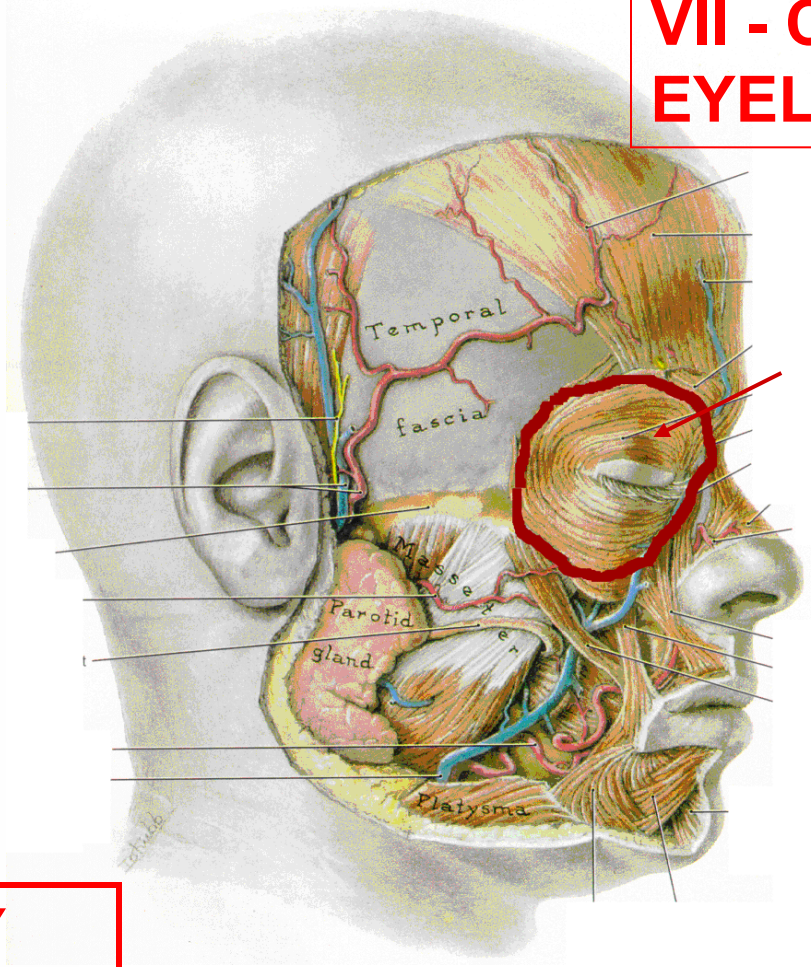
CORNEAL REFLEX - V to VII

**

V - TOUCH CORNEA



VII - CLOSE EYELID



ORBICU-LARIS OCULI M.

SHORT CILIARY NERVES (III),

CILIARY GANGLION

PARASYMPATHETIC

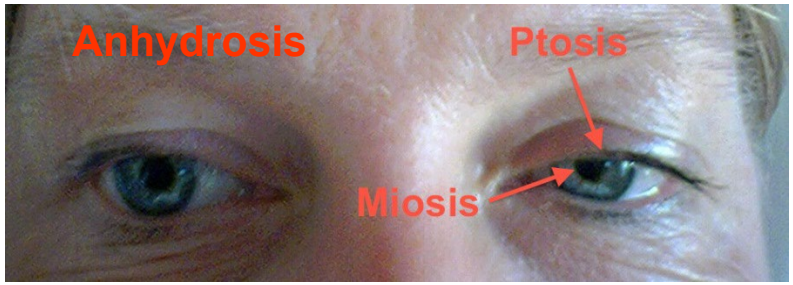
LONG CILIARY NERVES (V1) - SOMATIC SENSORY TO CORNEA

- Palpebral part - Close eyelids
- Orbital part - Buries eyelids, Ex. sandstorm
BRANCHIOMOTOR - VII

LESIONS OF SYMPATHETICS PRODUCE SYMPTOMS IN EYE: HORNER'S SYNDROME

Sympathetics in Eye Innervate
-Pupillary Dilator, part of Levator Palpebrae Superioris

HORNER'S SYNDROME



CLINICAL

CAN DAMAGE SYMPATHETIC CHAIN IN NECK; SHOW SYMPTOMS IN EYE AND FACE

HORNER'S SYNDROME - damage to Sympathetic pathways: symptoms involve structures of eye and head -

SYMPTOMS -

1) MIOSIS - pupillary constriction;
PARALYSIS OF PUPILLARY DILATOR MUSCLE

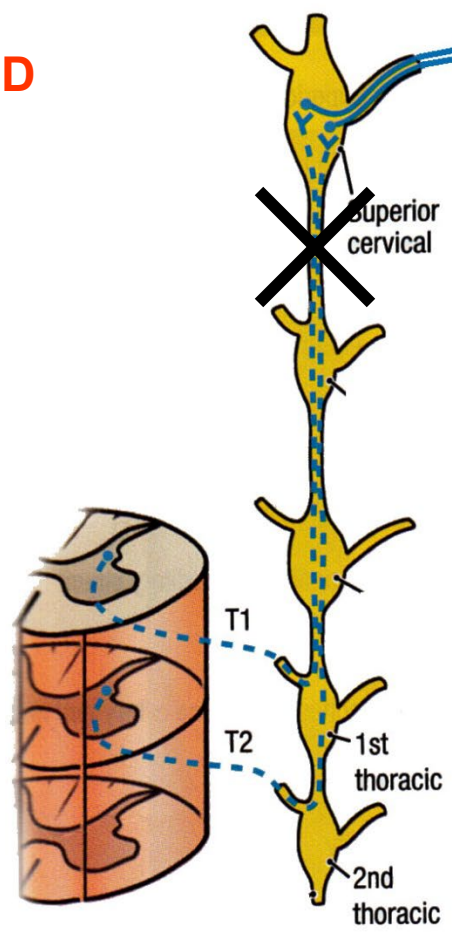
2) PTOSIS - drooping eyelid;
PARALYSIS OF SMOOTH MUSCLE PART OF LEVATOR PALPEBRAE SUPERIORIS

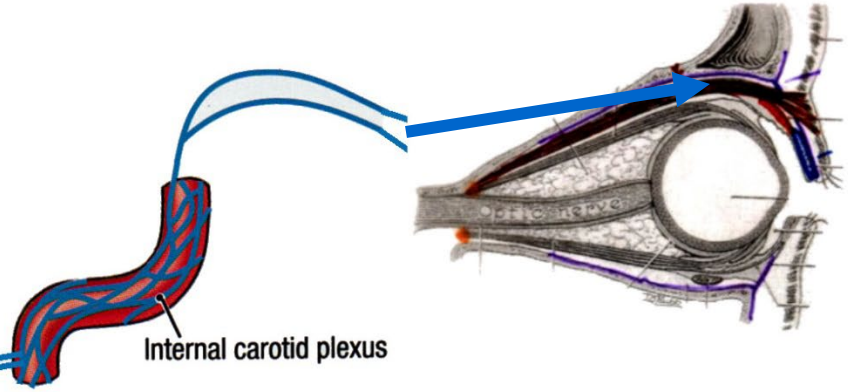
3) ANHYDROSIS - lack of sweating;
LOSS OF INNERVATION OF SWEAT GLANDS

PTOSIS - DAMAGE PATHWAY OF SYMPATHETICS TO EYE

2) PRE-GANGLIONIC AXONS ASCEND CHAIN AND SYNAPSE IN SUPERIOR CERVICAL GANGLION

1) OUT T1, T2





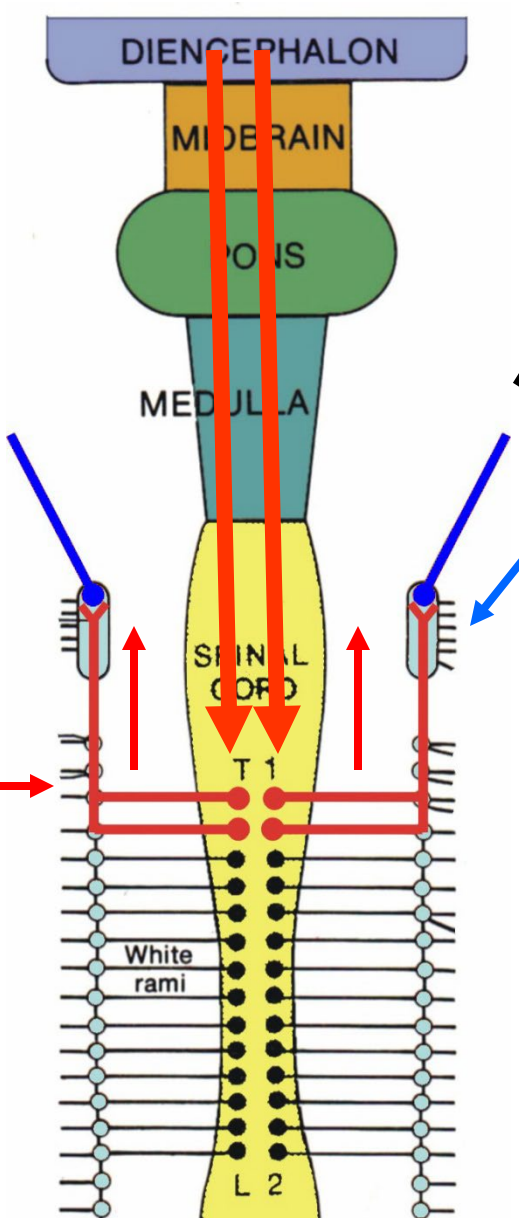
3) POST-GANGLIONIC FIBERS JOIN PLEXUS ON INTERNAL CAROTID ARTERY

4) PARALYZE SMOOTH MUSCLE OF LEVATOR PALPEBRAE SUPERIORIS

PTOSIS = EYELID DROOP

HYPOTHALAMUS

HYPOTHALAMO-SPINAL TRACT



LESIONS CAN OCCUR IN MANY PLACES IN PATHWAY

to Target Organ

2) Neuron 2 (Postganglionic neuron) In Superior Cervical Ganglia

PATHWAY TO HEAD -

1) Neuron 1 (Preganglionic neuron) in spinal cord at T1, T2