

DISCUSSION SESSION 3: GROSS ANATOMY

NN BLOCK

Cranial Nerves

Orbit

Reflexes

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, no close eyes, no raise eyebrows**

VIII. VESTIBULO-COCHLEAR - hearing and balance - **Loss hearing**

IX. GLOSSOPHARYNGEAL - sensory to pharynx + more - **Difficulty swallowing (dysphagia)**

X. VAGUS - larynx, pharynx + rest of body; **voice**

XI. ACCESSORY - sternocleidomastoid, trapezius - rotate head

XII. HYPOGLOSSAL - muscles of tongue; **protrude**

Note: Oculomotor - both fibers to Skeletal muscles and Parasympathetics (smooth muscle)

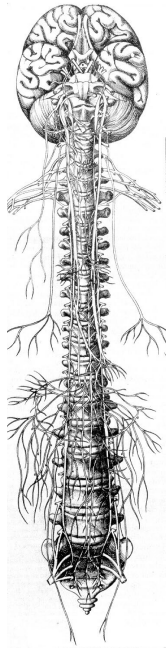
Cranial Nerves - different types of neurons

ARISE FROM,
PROJECT TO

REFERENCE CHART - WAY TO REMEMBER
TYPE OF NEURONS - USEFUL

CRANIAL
NERVES

SPINAL
NERVES



BRAIN
(BRAIN-
STEM)

SPINAL
CORD

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.							+

TYPES OF NEURONS

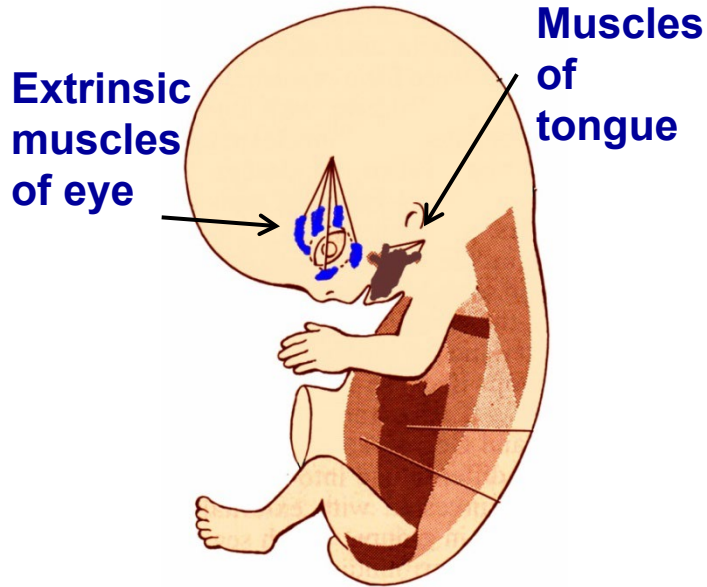
1. Somatic motor
2. Somatic sensory
3. Visceral motor
4. Visceral sensory
5. Special senses
6. Chemical senses
7. Branchiomotor

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

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.)

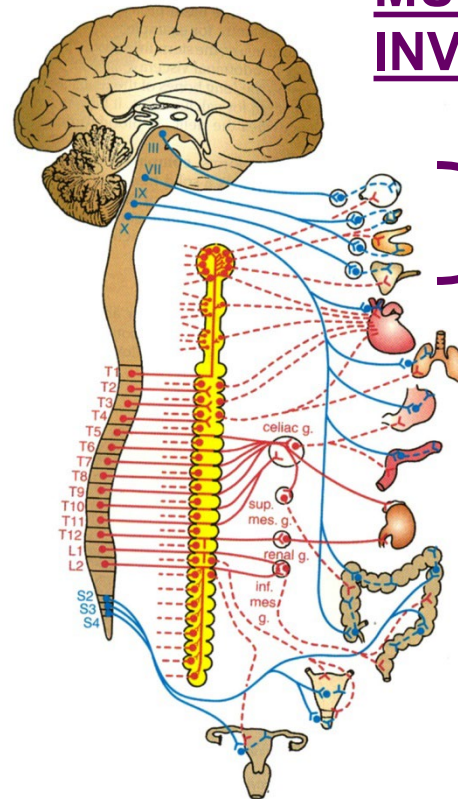
Cranial Nerves - Somatic Motor vs Visceral Motor

SOMATIC - SKELETAL
MUSCLE - VOLUNTARY



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

VISCERAL - SMOOTH
MUSCLE -
INVOLUNTARY

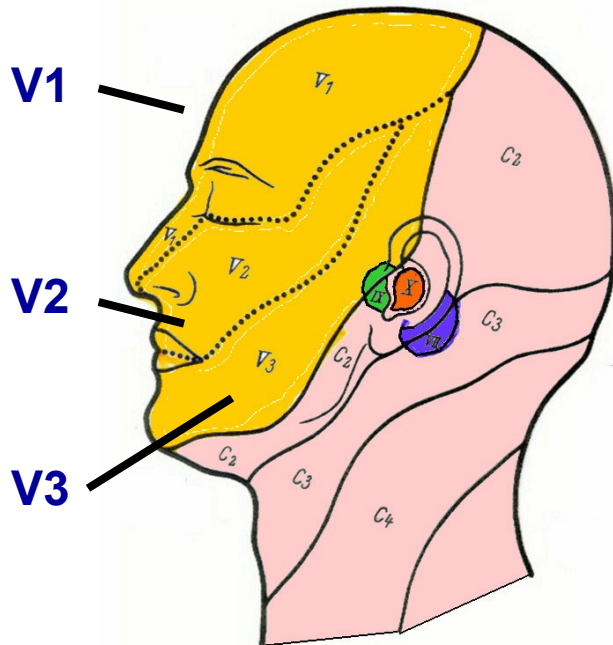


Visceral Motor - AUTONOMICS - Motor neurons to smooth muscles, glands, etc. ; also cardiac muscle

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

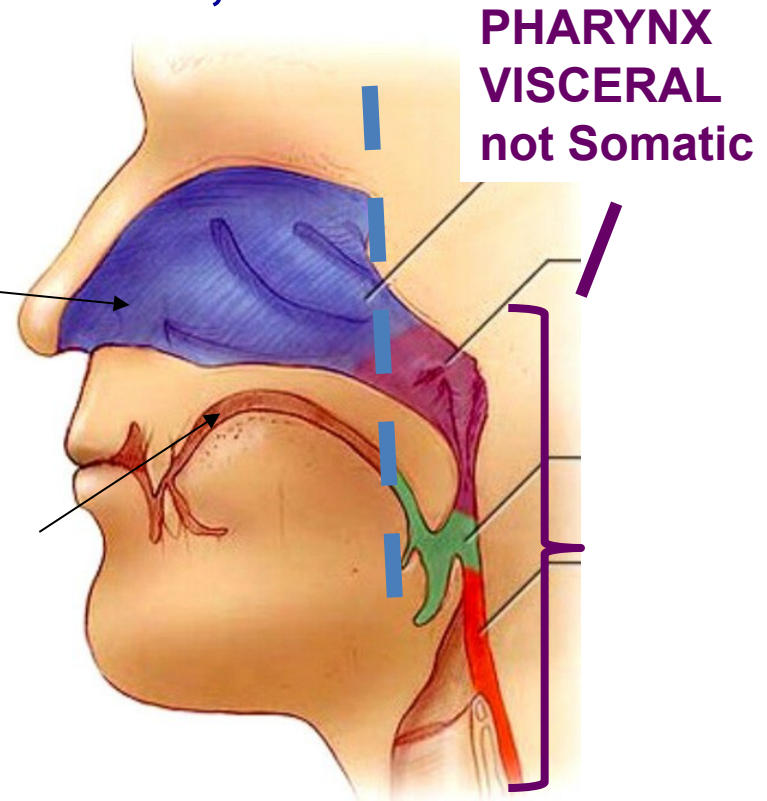


OUTER EAR - V, VII, IX, X

TRIGEMINAL NERVE ALSO - ORAL CAVITY, NASAL CAVITY

Nasal Cavity - Somatic Sensory

Oral Cavity Somatic Sensory



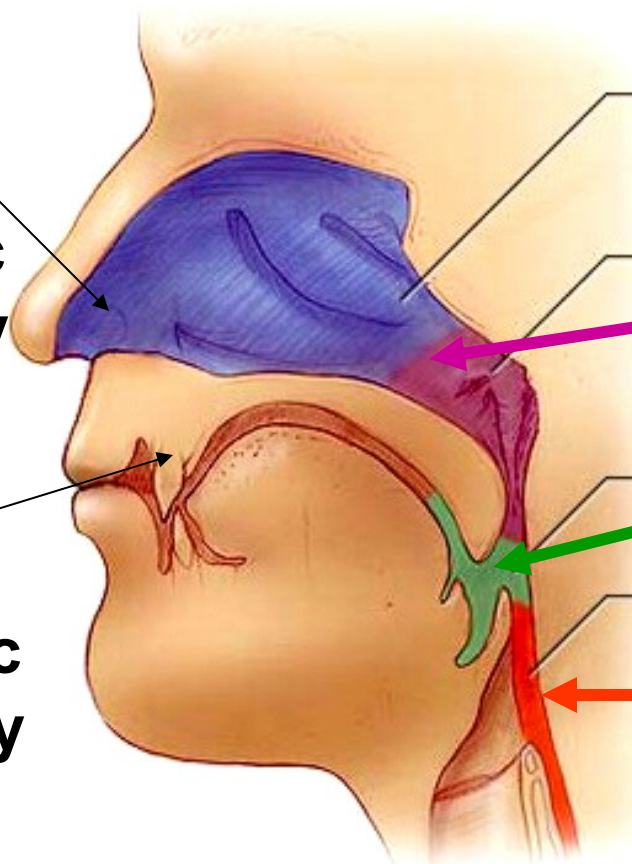
PHARYNX VISCERAL not Somatic

VISCERAL SENSORY

Sensory to Pharynx and derivatives

Nasal
Cavity
Somatic
Sensory

Oral
Cavity
Somatic
Sensory



All Pharynx is
Visceral Sensory
In 3 Cranial Nerves

NASOPHARYNX - VII

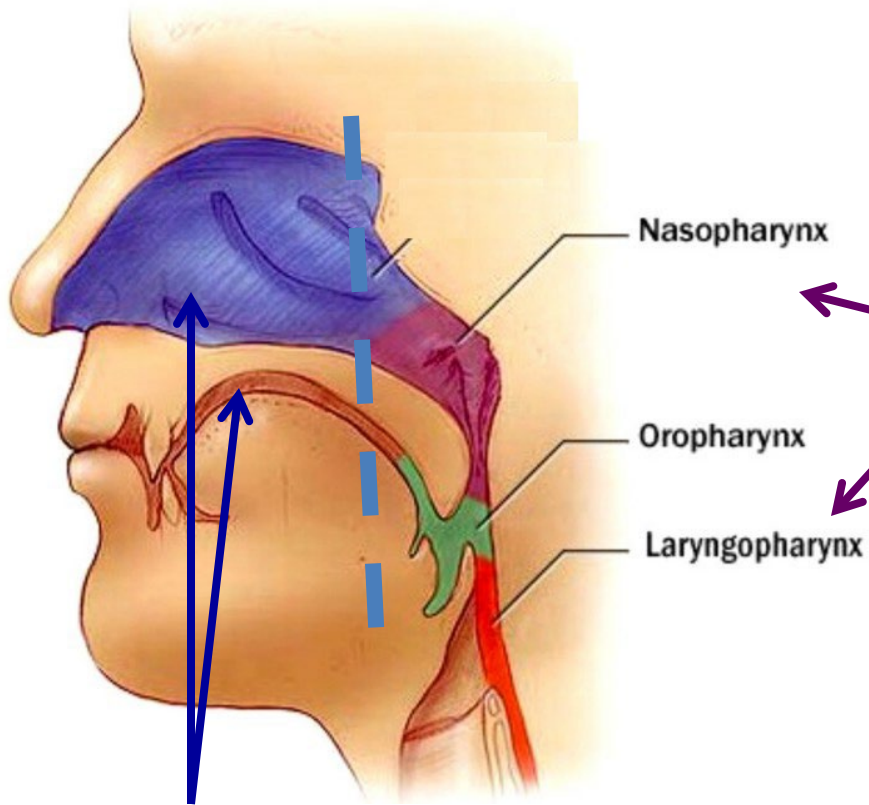
OROPHARYNX - IX

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



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

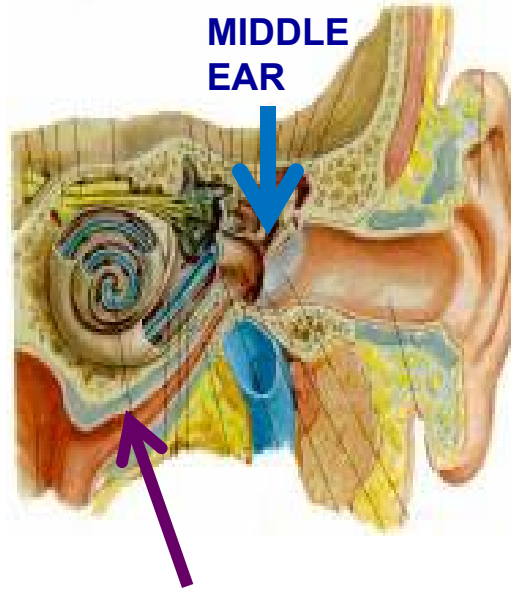
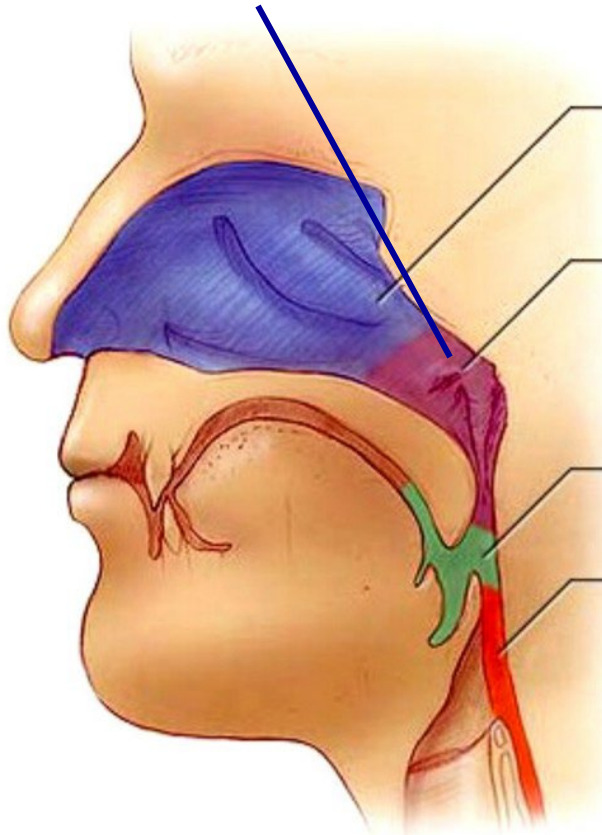
**IN HEAD - VISCERAL
SENSORY ALSO PHARYNX**

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

**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)

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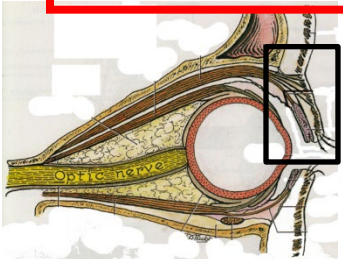
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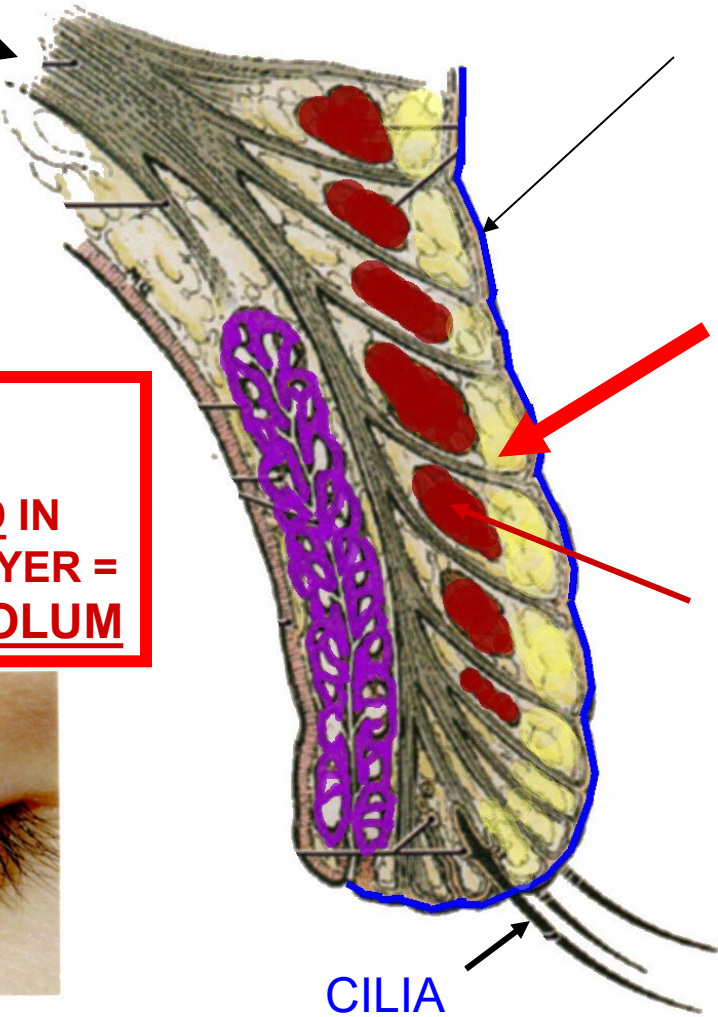
ORBIT

EYELIDS = PALPEBRAE - LAYERED

EYELIDS PROTECT EYE, MOVEABLE, KEEP CORNEA MOIST



ORIENT - EYELID
PARASAGITTAL
SECTION



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

CILIA

CLINICAL

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



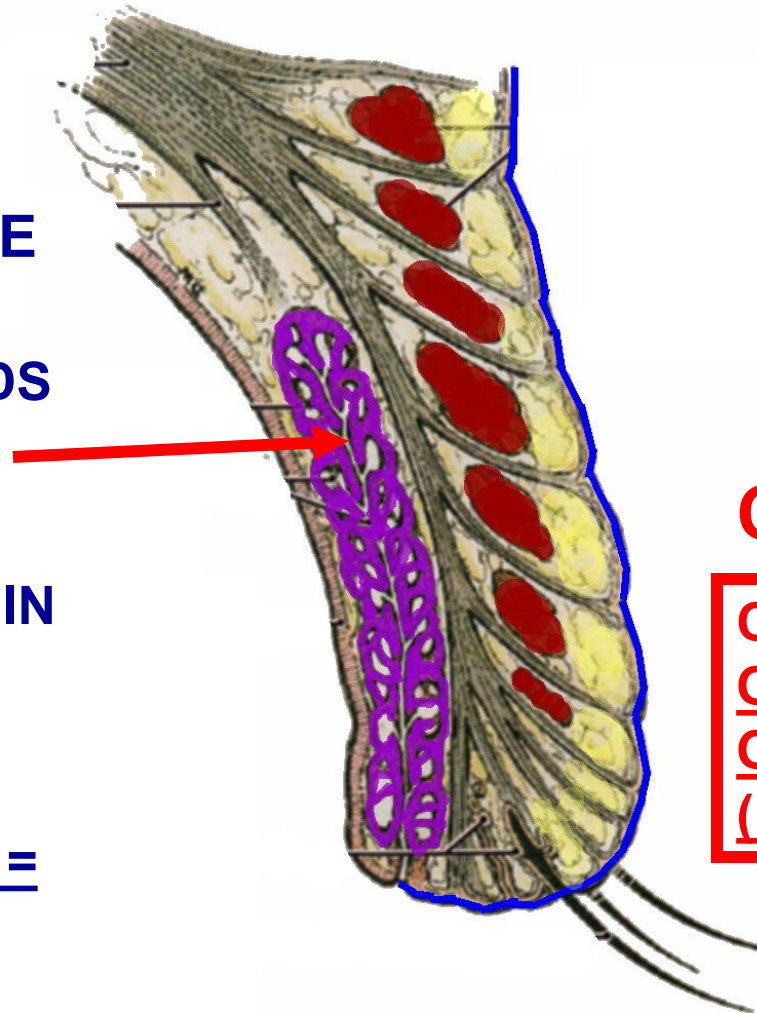
FIGURE 10-10
Acute hordeolum of upper eyelid.
From Palay, Krachmer, 1997.

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



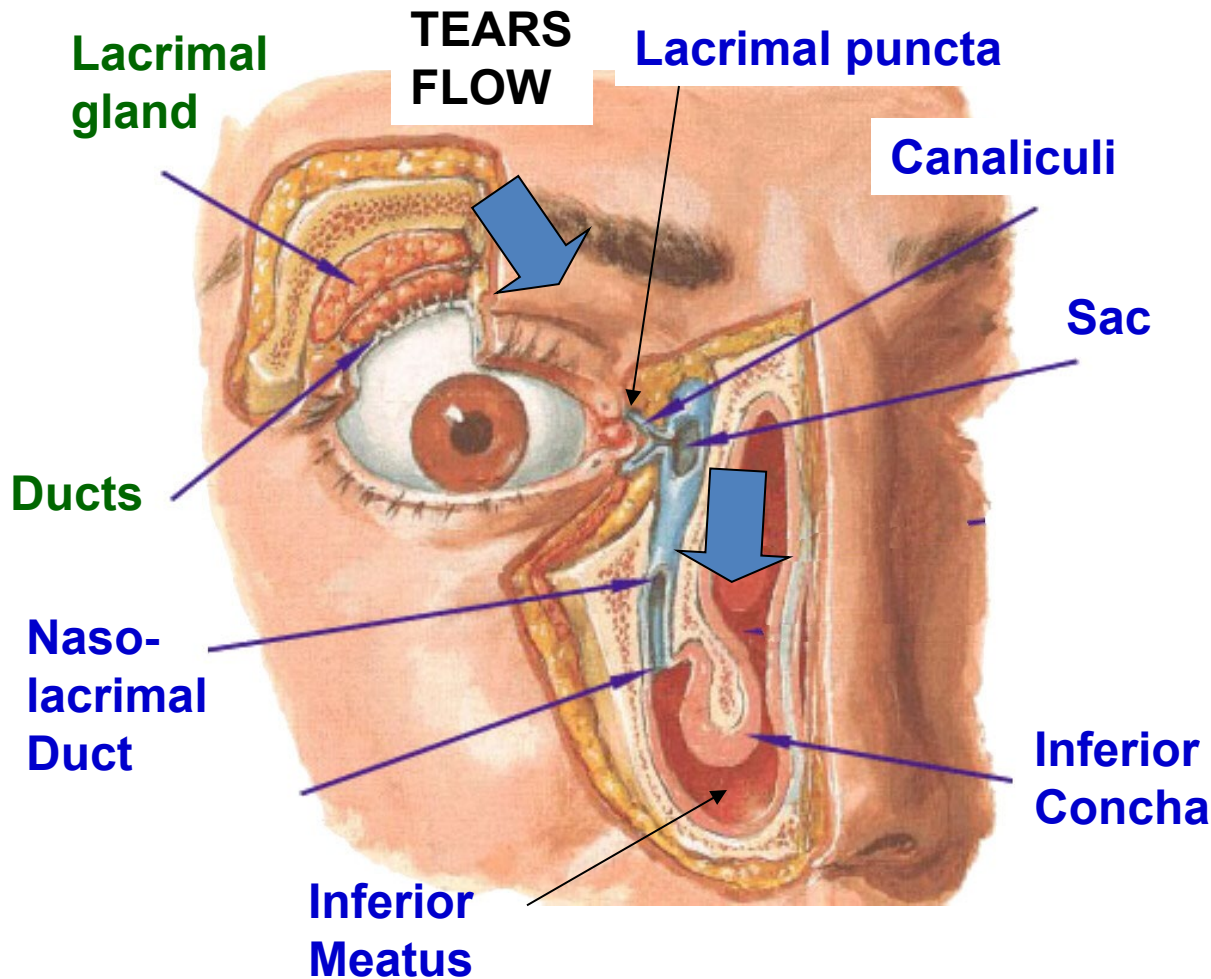
CHALAZION



CLINICAL

**CHALAZION:
OBSTRUCTION
OF TARSAL
(MEIBOMIAN) GLAND**

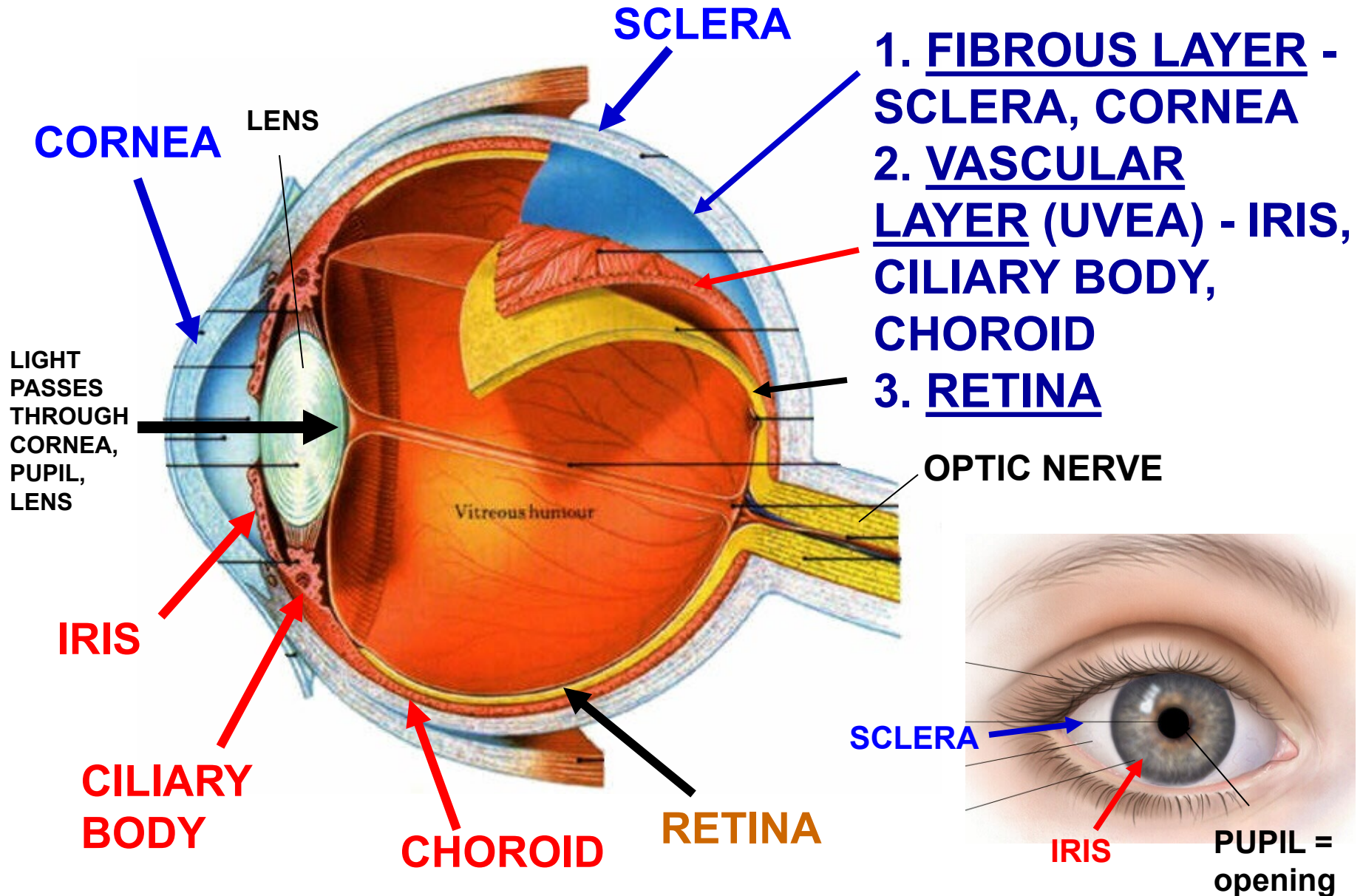
LACRIMAL GLAND



- 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 INFERIOR MEATUS OF NASAL CAVITY

LACRIMAL GLAND IS INNERVATED BY VII - FACIAL NERVE;
BLOCK VII - DECREASE TEARS; PRESSURE/IRRITATION VII - EXCESSIVE TEARS;
'Crocodile tears - Lacrimation while eating (salivation) - VII innervates salivary glands

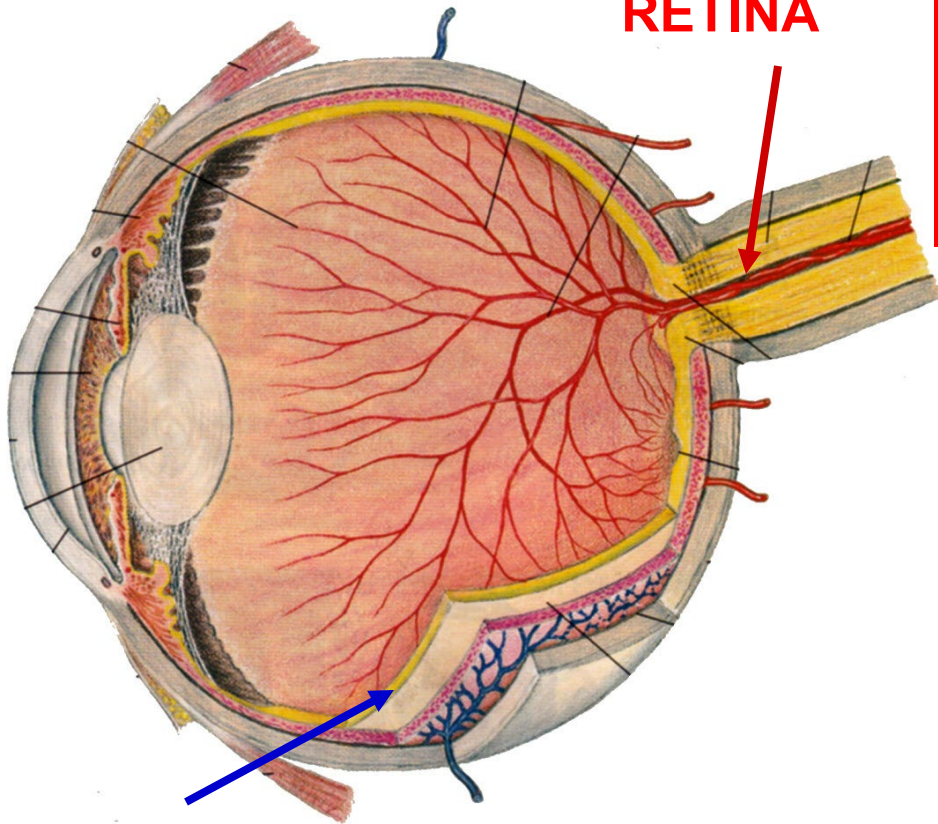
STRUCTURE OF EYE - 3 LAYERS



ARTERIAL SUPPLY – CENTRAL ARTERY OF RETINA

CENTRAL ARTERY OF RETINA

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

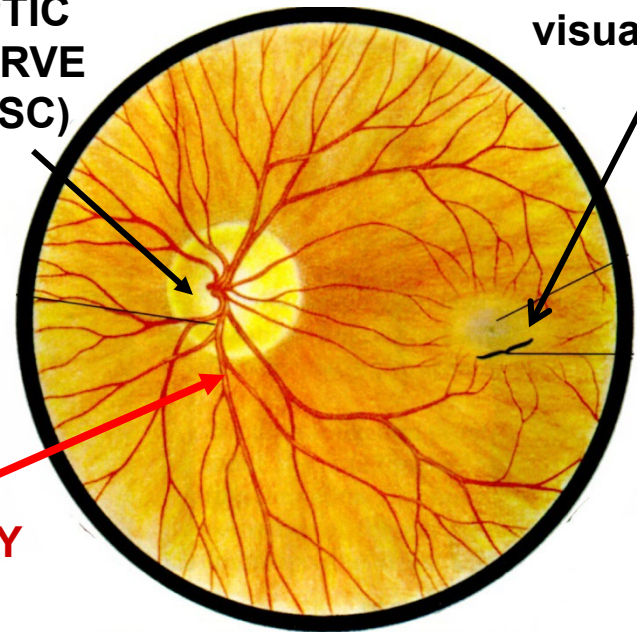


RETINA

BRANCHES OF CENTRAL ARTERY AND VEIN OF RETINA

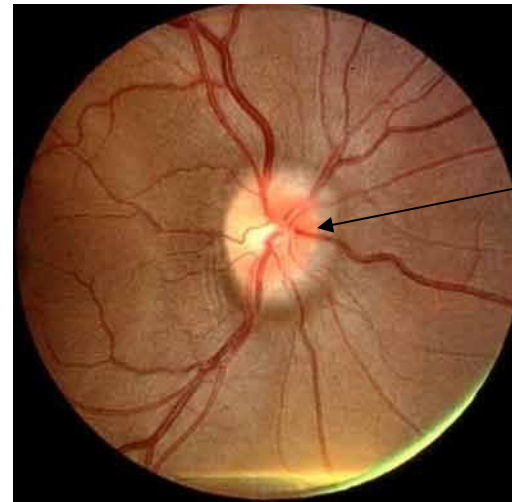
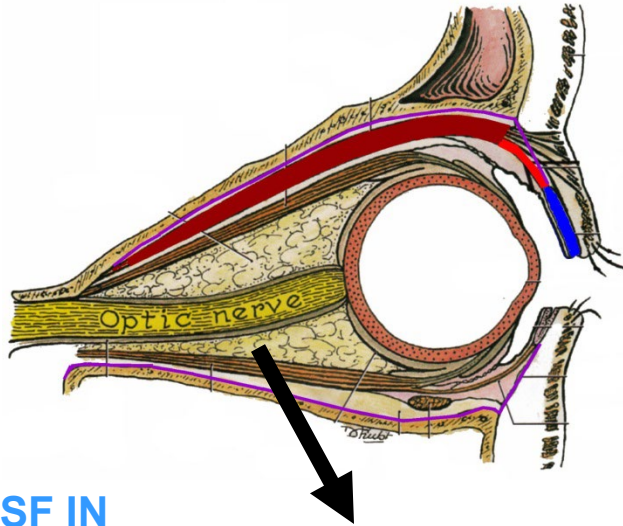
OPTIC NERVE (DISC)

MACULA = visual acuity



OPHTHALMOSCOPE VIEW

DIAGNOSE CHANGES IN CSF IN OPHTHALMOSCOPE VIEW

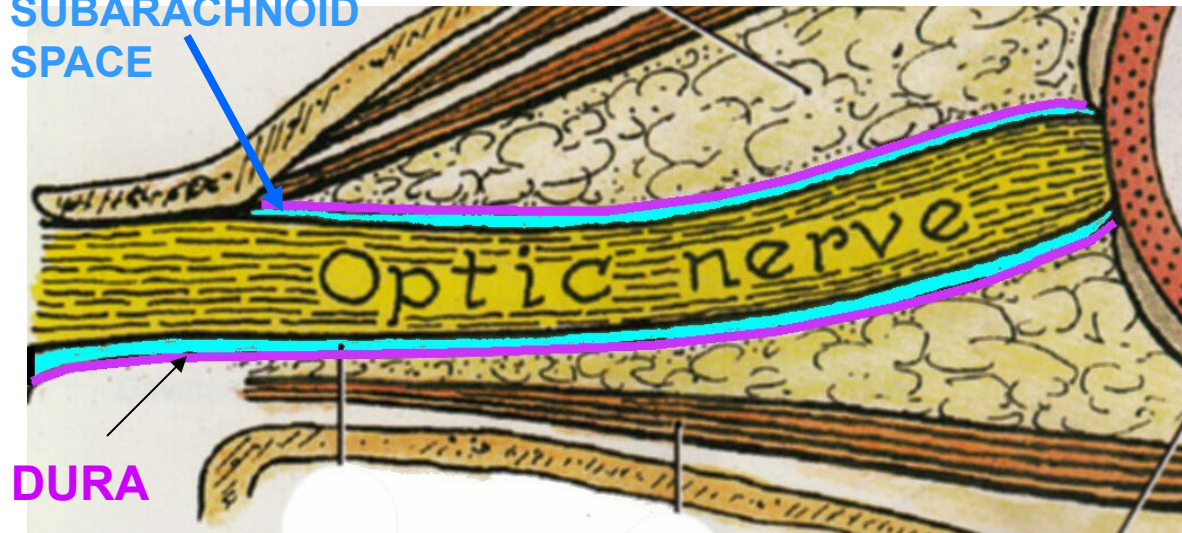


HYDROCEPHALUS

PAPILLEDEMA

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

CSF IN SUBARACHNOID SPACE



DURA

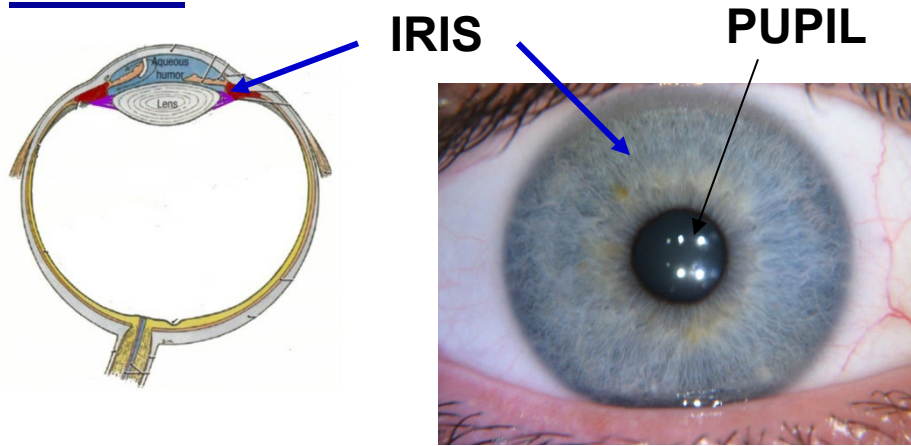
CLINICAL

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



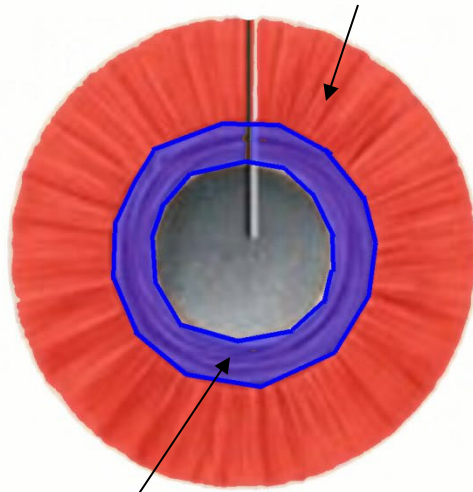
IRIS - PIGMENTED, CONTRACTILE LAYER WITH SMOOTH MUSCLES SURROUNDING PUPIL

NORMAL

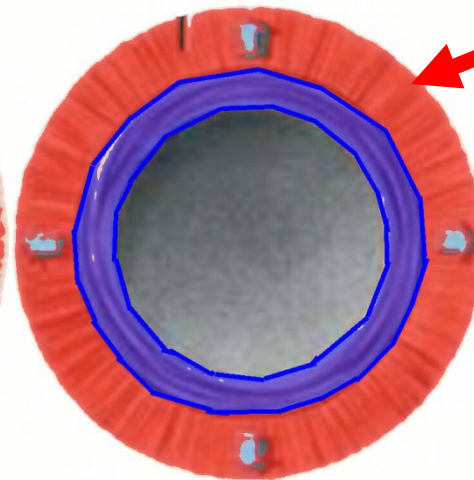
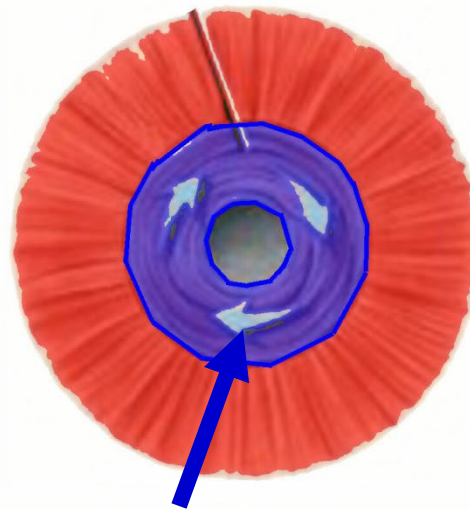
DILATOR

BRIGHT LIGHT - PUPIL CONSTRICTED

DIM LIGHT - PUPIL DILATED



CONSTRUCTOR

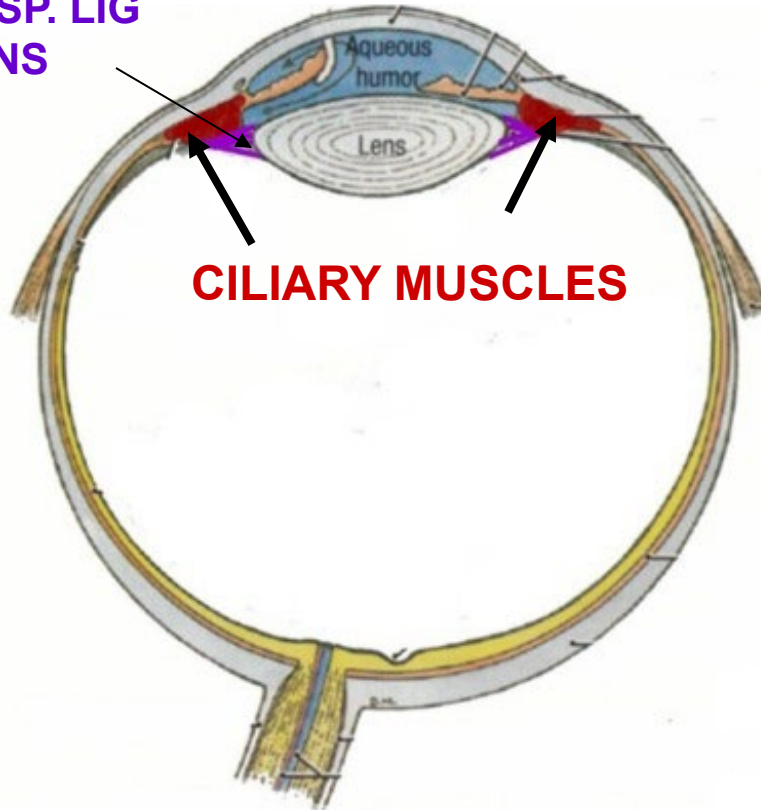


DILATOR PUPIL- RADIAL SMOOTH MUSCLE; SYMPATHETICS

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

EYE- STRUCTURE OF EYEBALL- VASCULAR LAYER

SUSP. LIG
LENS

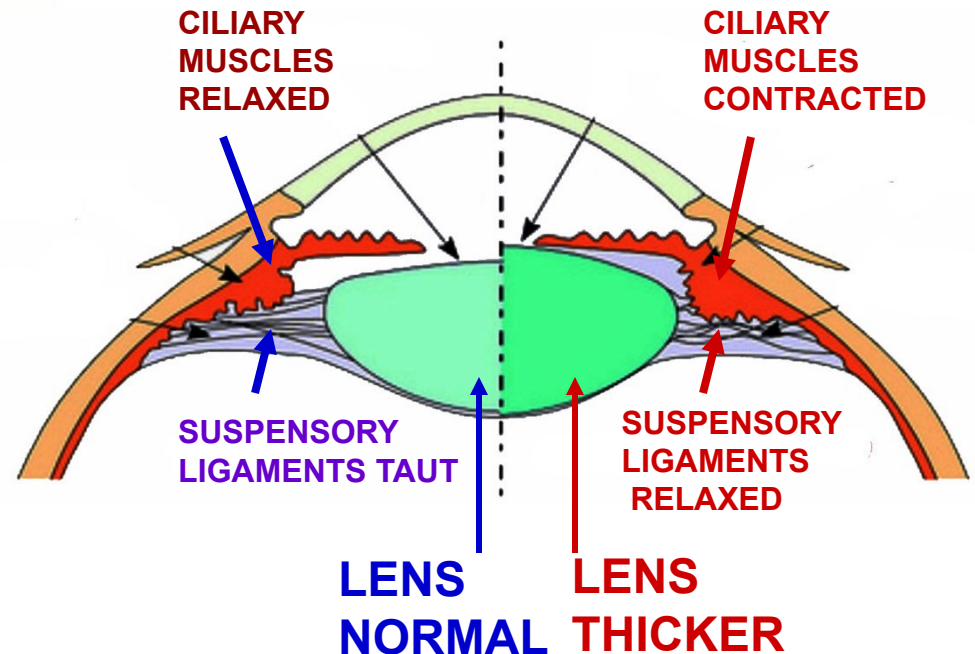


CILIARY MUSCLES

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

**NORMAL
VISION**

**NEAR
VISION**



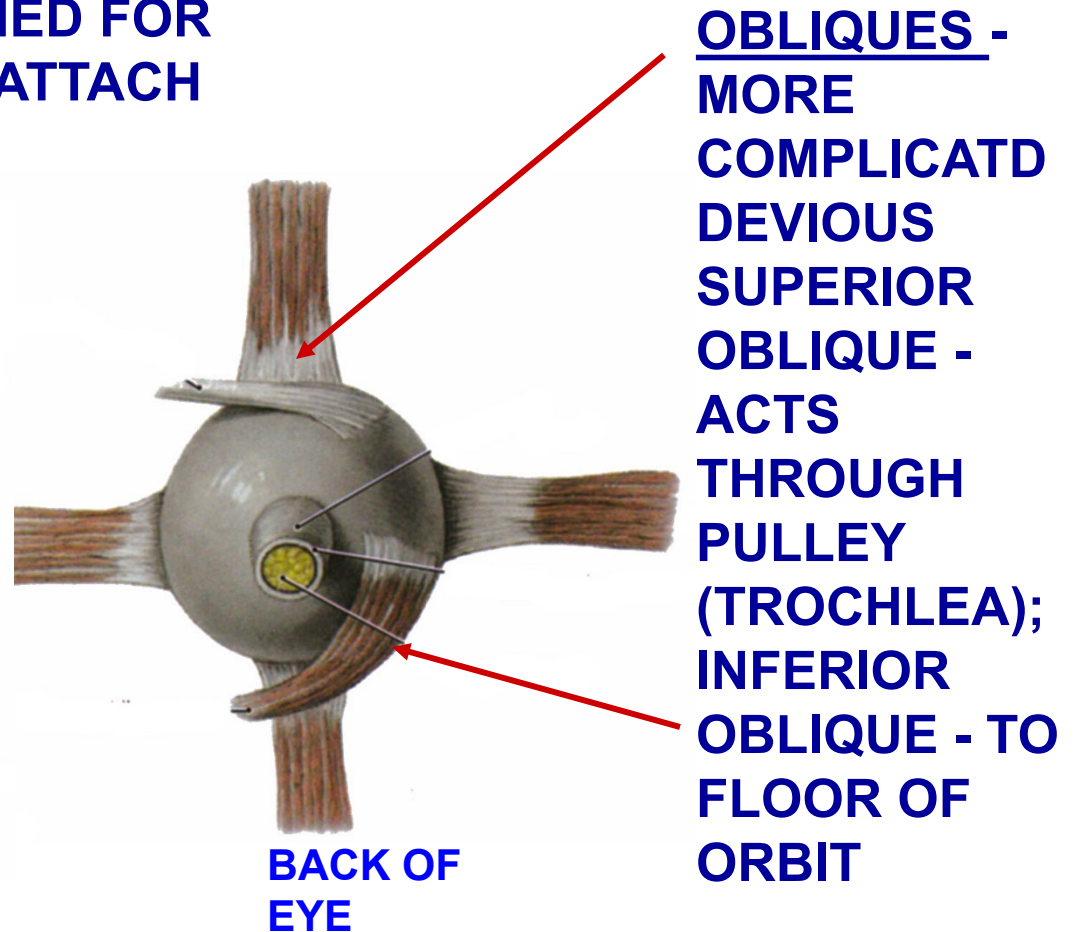
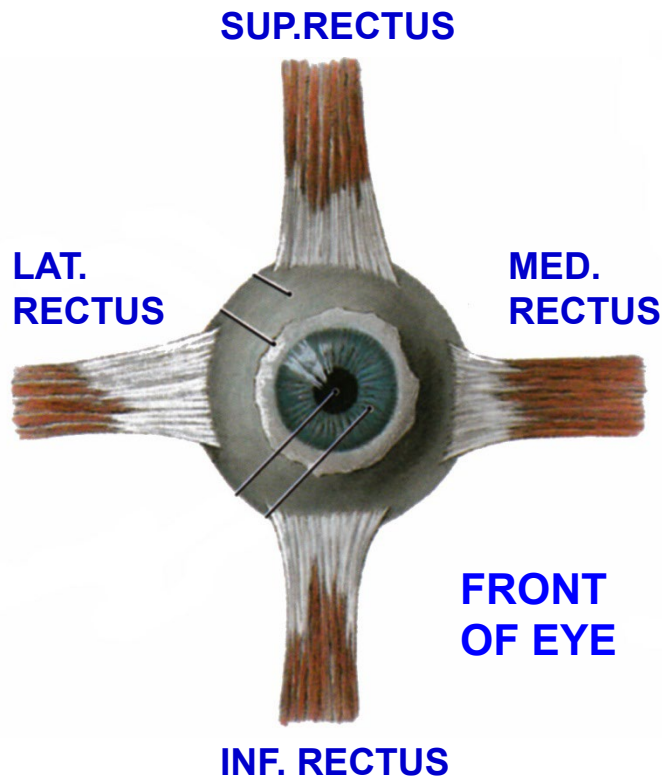
**ACCOMMODATION -
THICKEN LENS FOR NEAR
VISION (VIEWING OBJECTS
CLOSE UP)
PARASYMPATHETIC
CONTROL- III (Short ciliary
nerves)**

CILIARY MUSCLES CONTRACT - LENS THICKER

ORBIT - EXTRAOCULAR MUSCLES

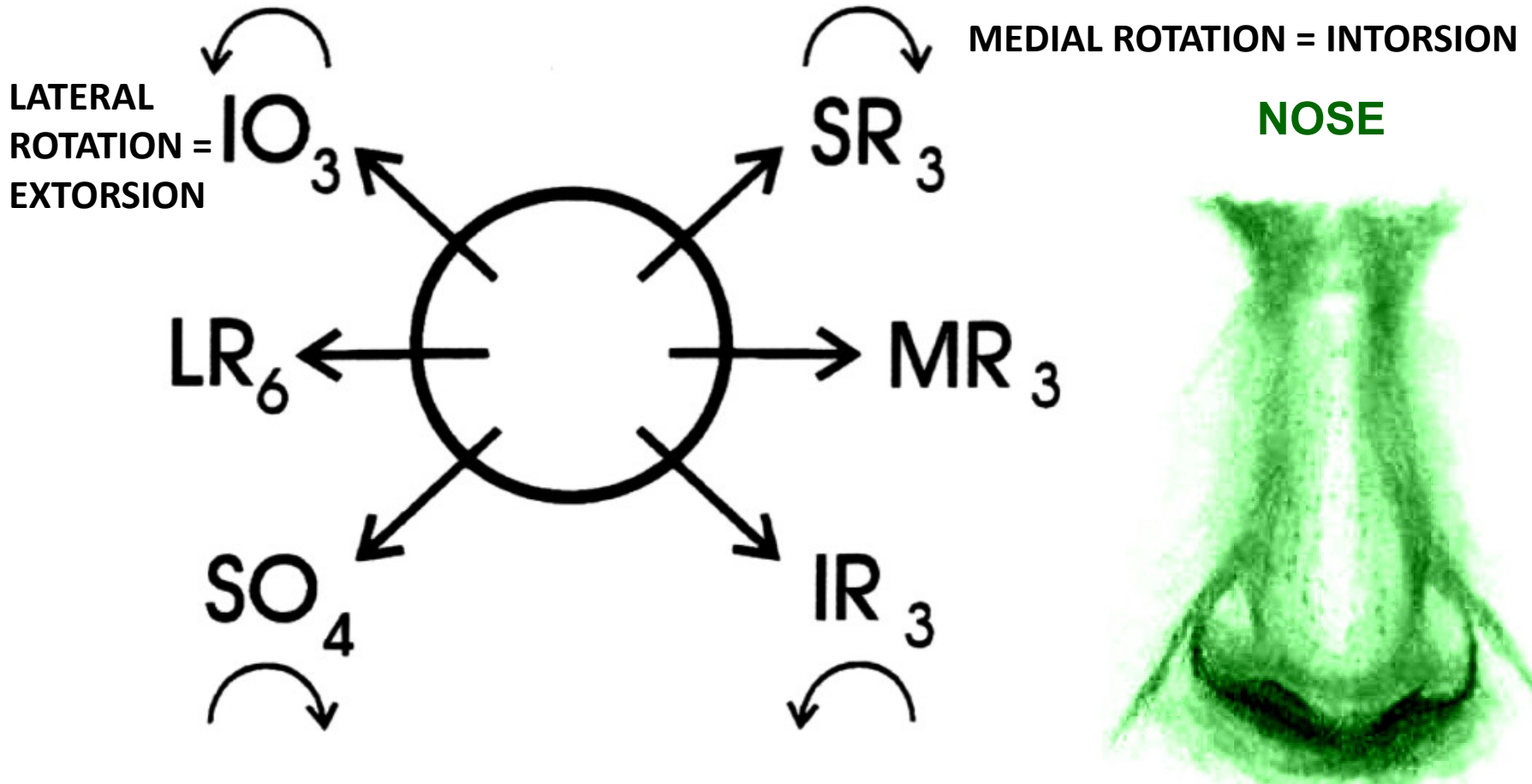
VOLUNTARY SKELETAL MUSCLES WHICH MOVE EYEBALL

RECTI = STRAIGHT, NAMED FOR SIDES ON WHICH THEY ATTACH

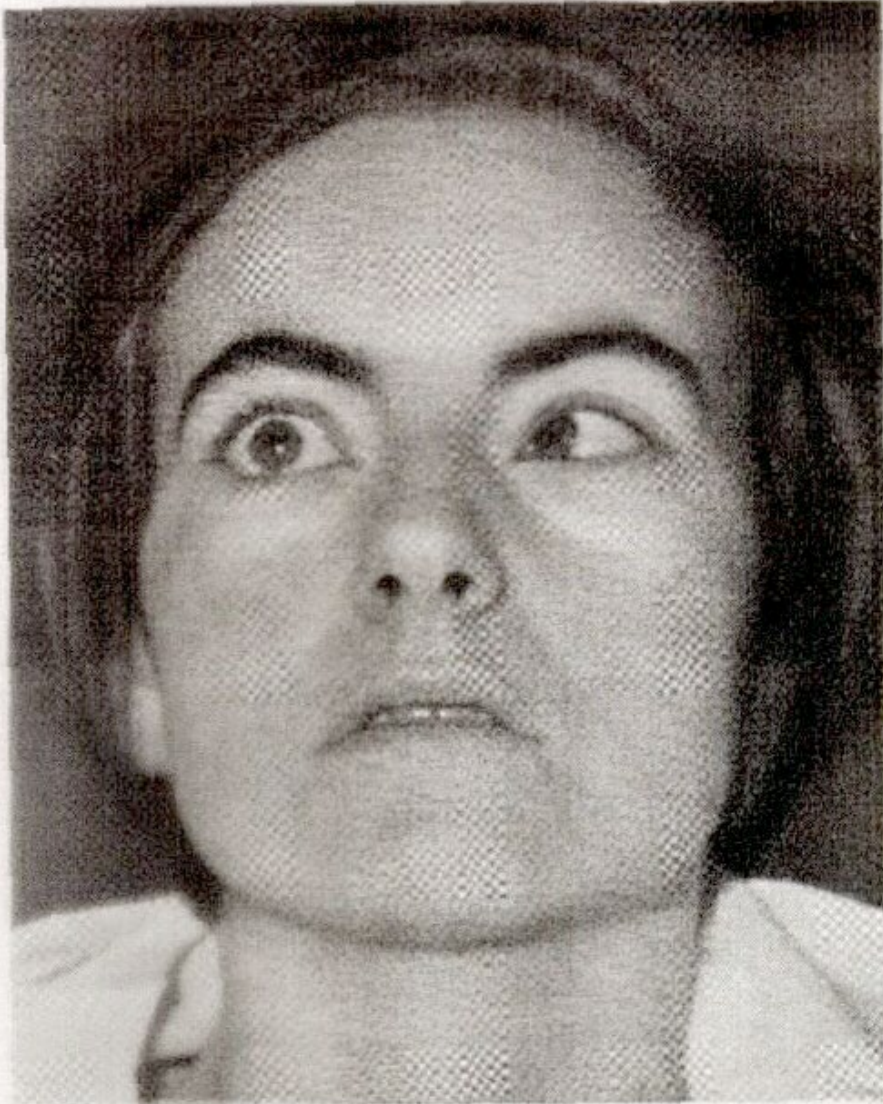


OBLIQUES - MORE COMPLICATED DEVIUS SUPERIOR OBLIQUE - ACTS THROUGH PULLEY (TROCHLEA); INFERIOR OBLIQUE - TO FLOOR OF ORBIT

EYE MOVEMENTS DIAGRAM



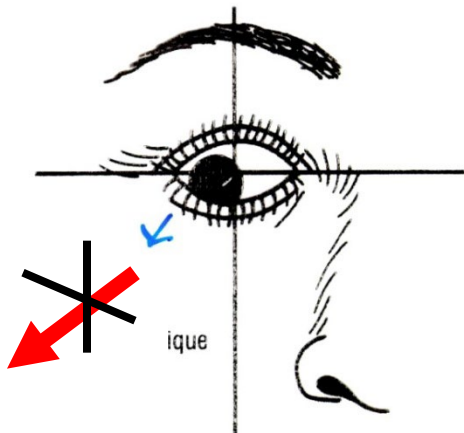
- 1- Resting position of eye depends upon tonic activities in muscles.
- 2- Damage to any one muscle does not entirely eliminate abduction, adduction, elevation or depression; only get weakness.



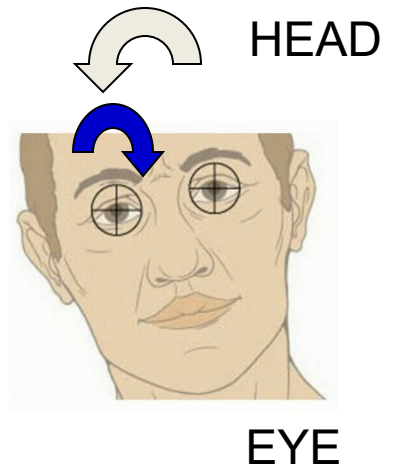
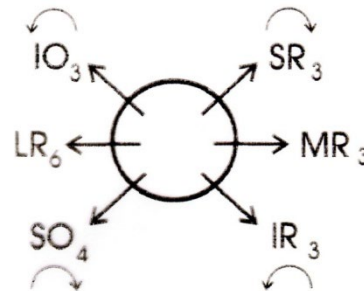
ABDUCENS (VI) NERVE DAMAGE

**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



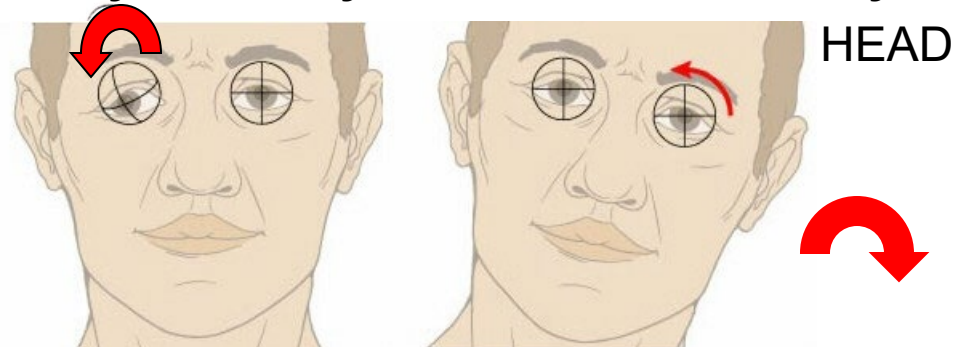
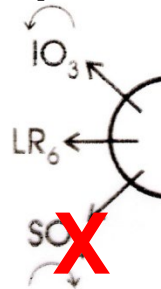
NORMAL



**PATIENT
CANNOT LOOK
DOWN AND OUT**

**Symptoms - Difficulty
walking down stairs;
HEAD TILTED**

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



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

OCULOMOTOR (III) NERVE DAMAGE



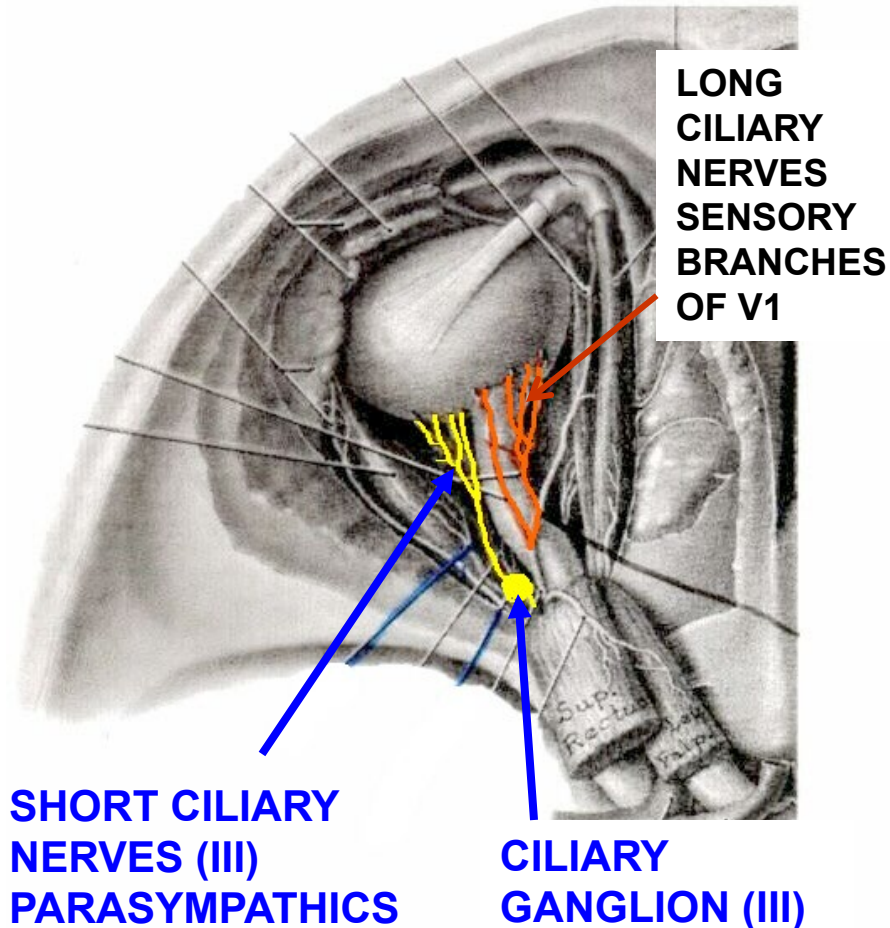
AT REST

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 (CONTRACTOR)
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 SPINAL AND CRANIAL NERVES

**SENSORY
STIMULUS**



**MOTOR
RESPONSE**

Definition of a Reflex - stereotyped motor response to a specific sensory stimulus

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	<u>Hyporeflexia</u> - 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**

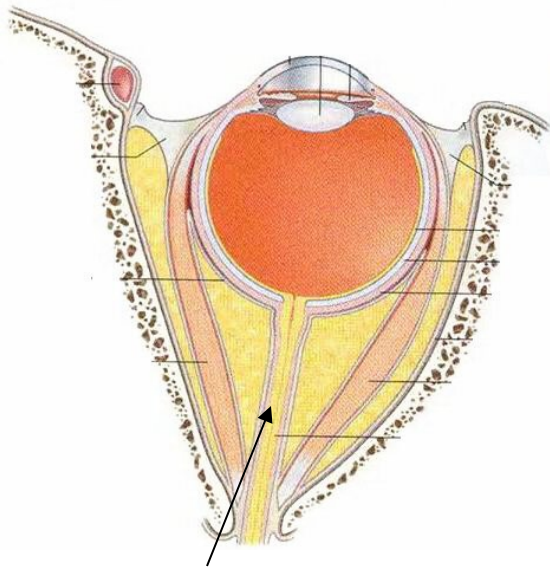
**CONSTRICT
PUPIL**



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

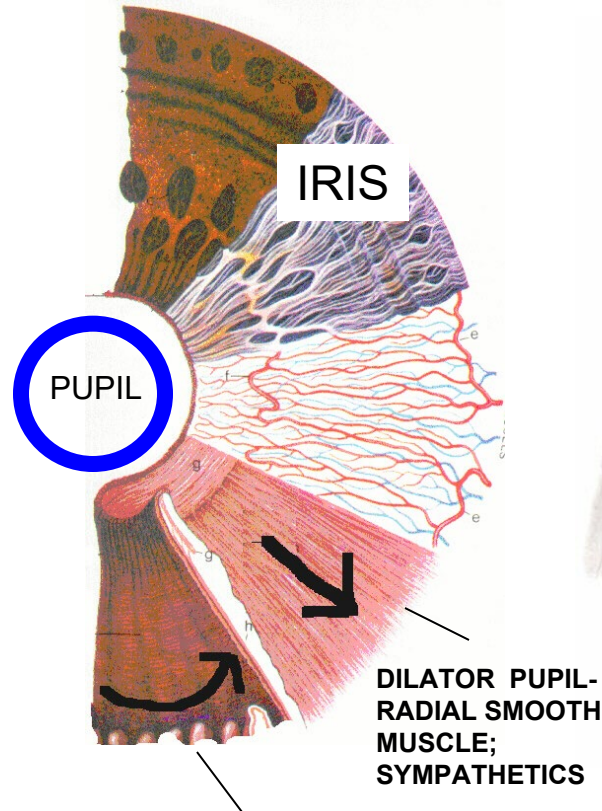
PUPILLARY LIGHT REFLEX

**CN II - OPTIC NERVE -
DETECTS LIGHT**

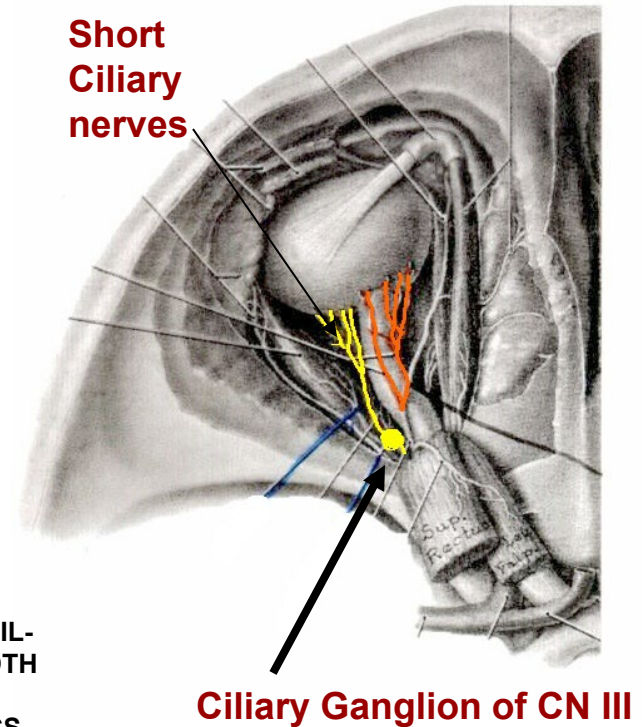


**OPTIC NERVE -
CN II VISION**

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



**CONTRACTOR PUPIL-
CIRCULAR SMOOTH MUSCLE;
PARASYMPATHETICS - 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**

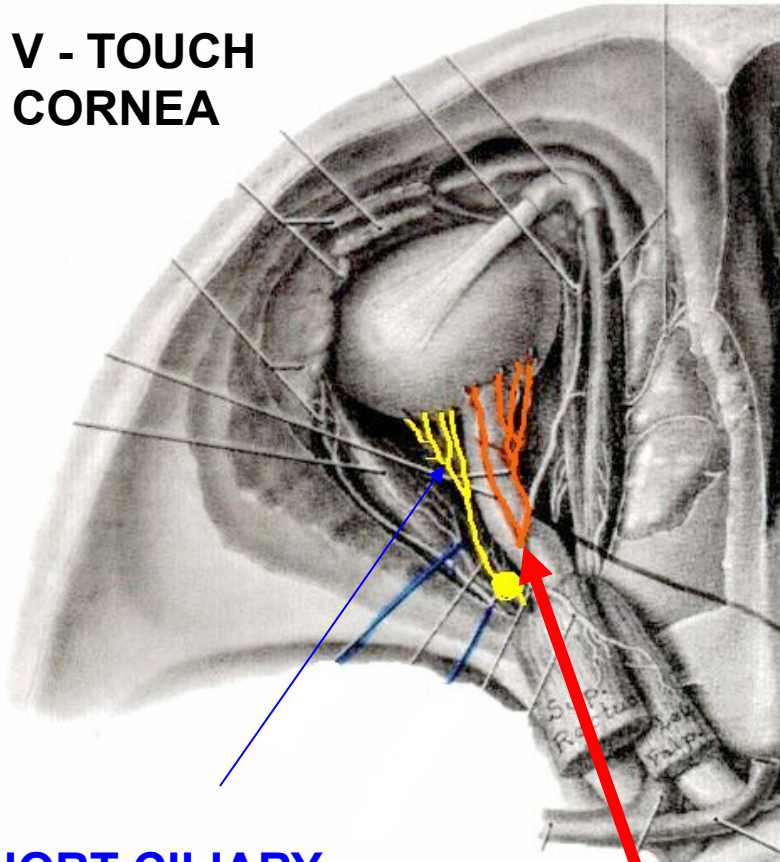
**FACIAL -
VII - MOTOR TO
ORBICULARIS
OCULI
(Branchiomotor)**



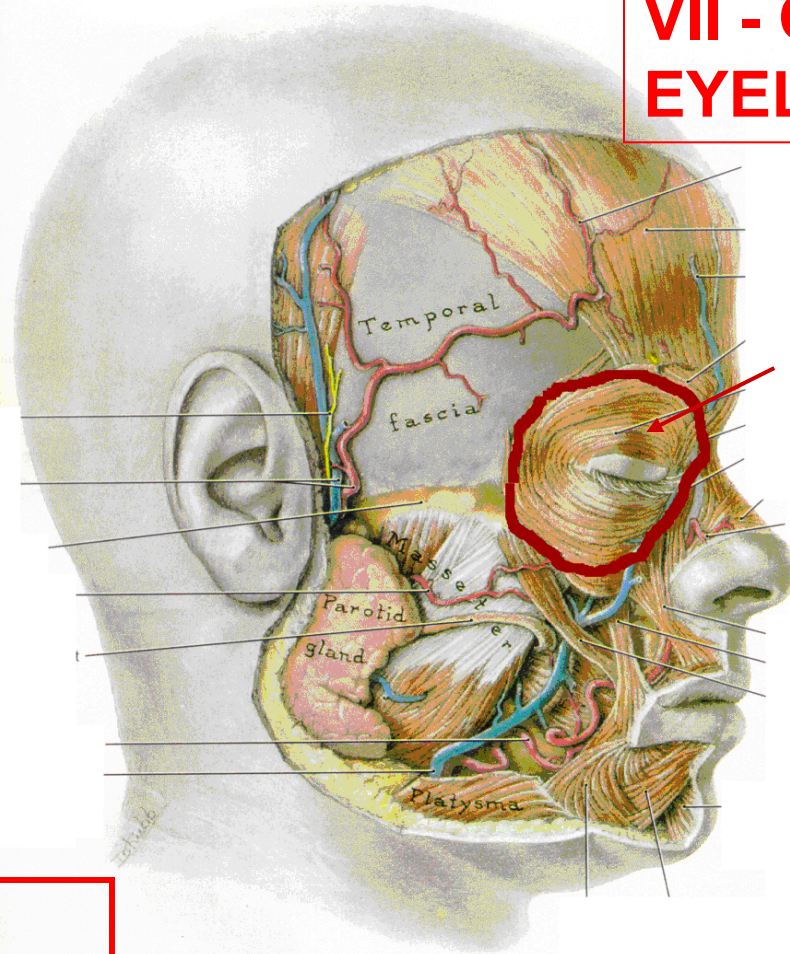
CORNEAL REFLEX - V to VII



V - TOUCH
CORNEA



VII - CLOSE
EYELID



ORBICULARIS
OCULI
M.

SHORT CILIARY
NERVES (III),
CILIARY GANGLION
PARASYMPATHETIC

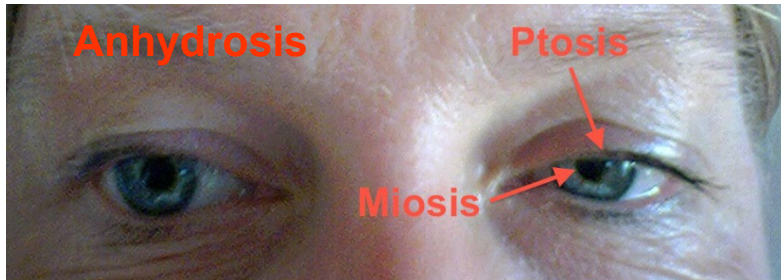
LONG CILIARY
NERVES (V1) -
SOMATIC
SENSORY TO
CORNEA

- 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 -

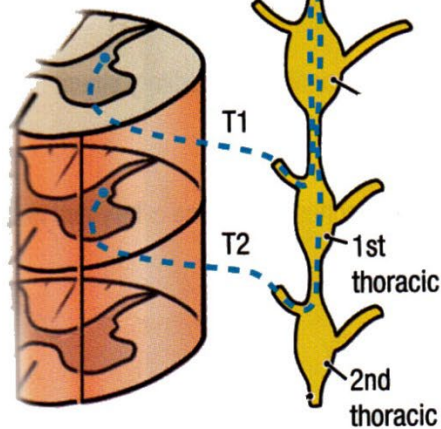
SYMPTOMS -

- 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**

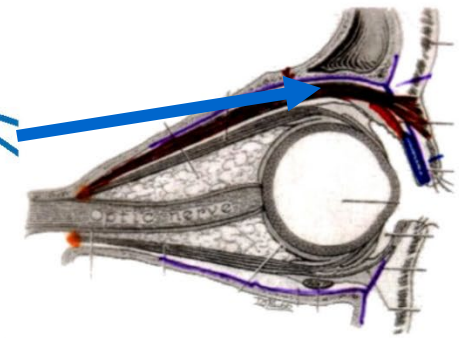
1) **OUT T1,
T2**



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

4) **PARALYZE
SMOOTH
MUSCLE OF
LEVATOR
PALPEBRAE
SUPERIORIS**

**PTOSIS =
EYELID DROOP**



HYPOTHALAMUS

DIENCEPHALON

MIDBRAIN

POIS

MEDULLA

SPINAL CORD

T 1

L 2

White rami

LESIONS CAN OCCUR IN MANY PLACES IN PATHWAY

HYPOTHALAMO-SPINAL TRACT

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

