

Pupil Testing Back to the Basics

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Overview

- Pupil anatomy and physiology
- Pupil testing
- Commonly encountered pupil disorders and how to detect them

Questions

- Will an afferent pupillary defect produce anisocoria (different pupil sizes)?
- If a pupil constricts well to near viewing but not to a light stimulus, what does that indicate?
- How can you tell if an anisocoria is physiologic or not?
- What does the 'A' in PERRLA stand for and when do we test for it?
- When is a third nerve palsy an emergency vs. an urgency?
- How do you test for an APD if one pupil is synched or fixed and dilated?
- What common glaucoma medication do I have in my office to help confirm a Horner's syndrome?

Why evaluate the pupils

One of the few *objective REFLEXES* that detect and quantify abnormalities of the...

Retina

Optic Nerve

Optic Chiasm

Optic Tract

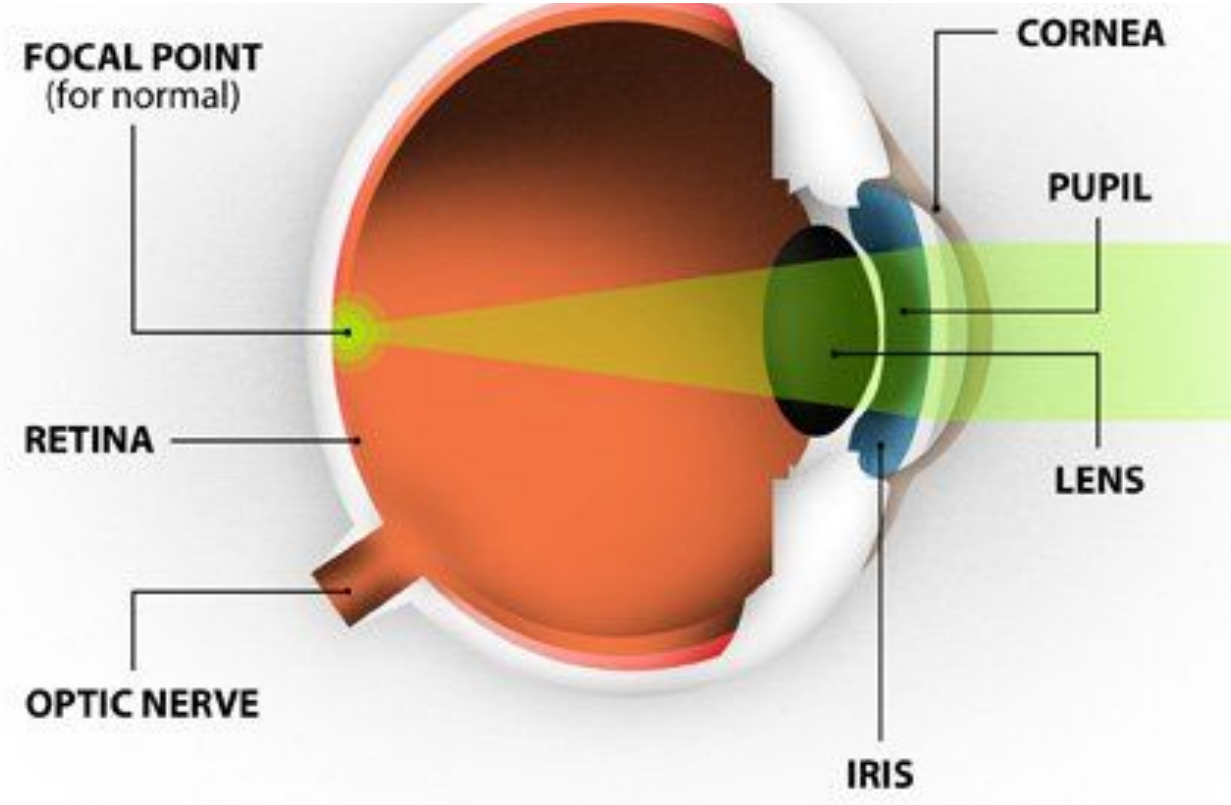
Midbrain

Peripheral Nerves

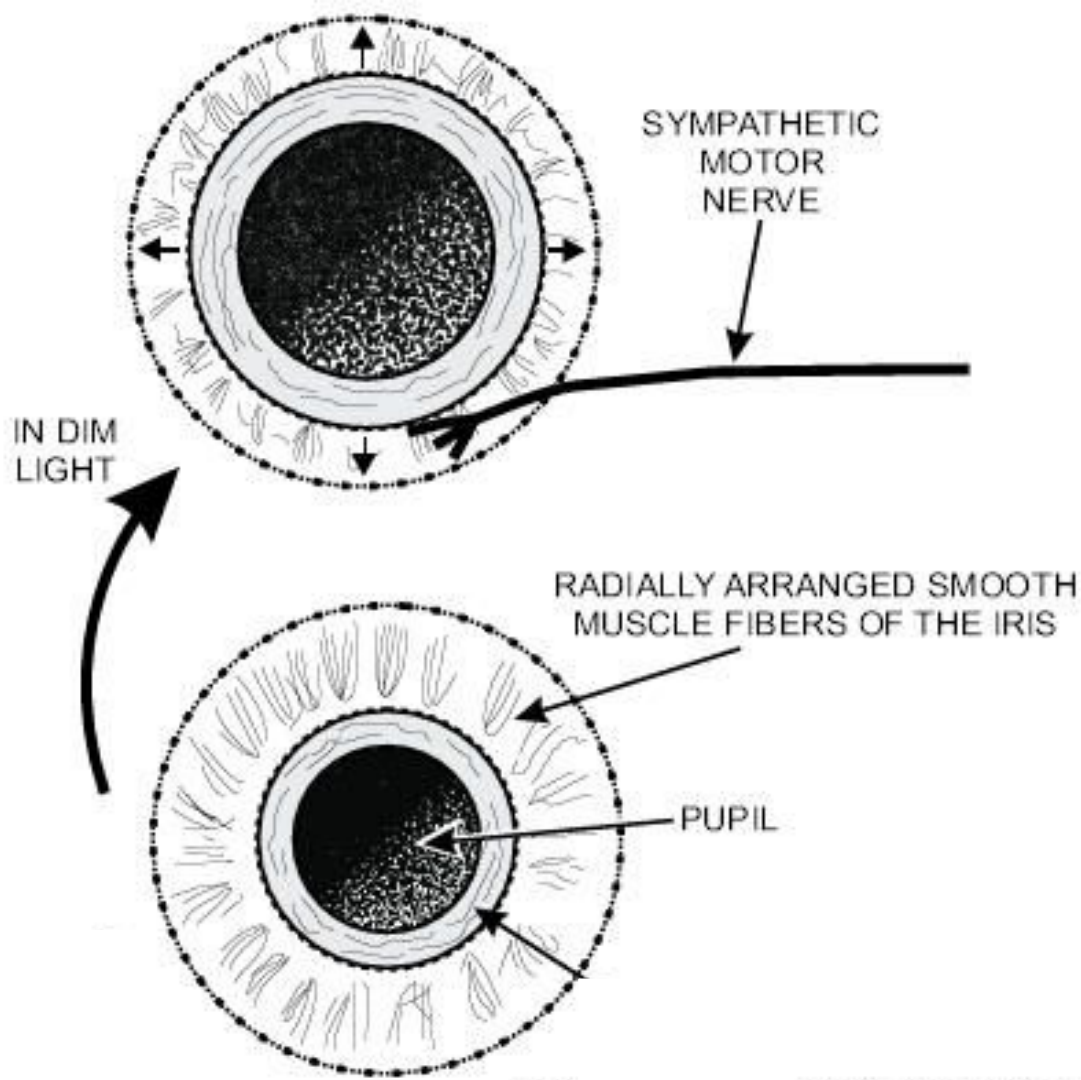
Why evaluate the pupils

- Pupil abnormalities can:
 - Reveal serious neuro-ophthalmic and retinal disease
 - Help aid in diagnosis and management of many conditions
 - Should be incorporated into every optometric examination

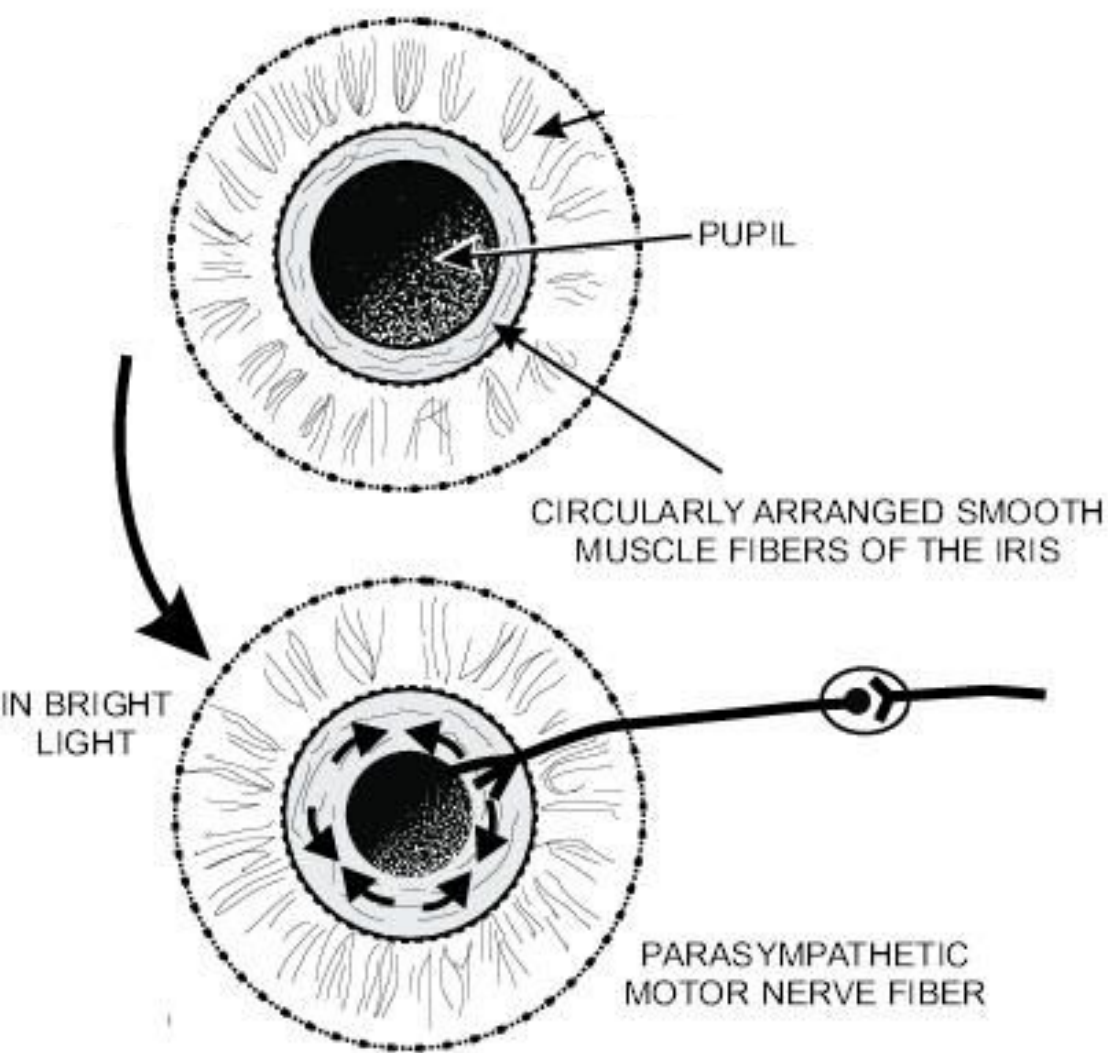
Eye and Pupil Anatomy



- Hole in center of iris
- *Involuntarily* controls how much light enters the eye



- Dim light → superior cervical ganglion stimulated → constriction of radial dilator pupillae muscles → pupil gets bigger



- Bright light → short ciliary nerve innervated → constriction of circular sphincter pupillae muscles → pupil gets smaller

Pupil Anatomy and Physiology

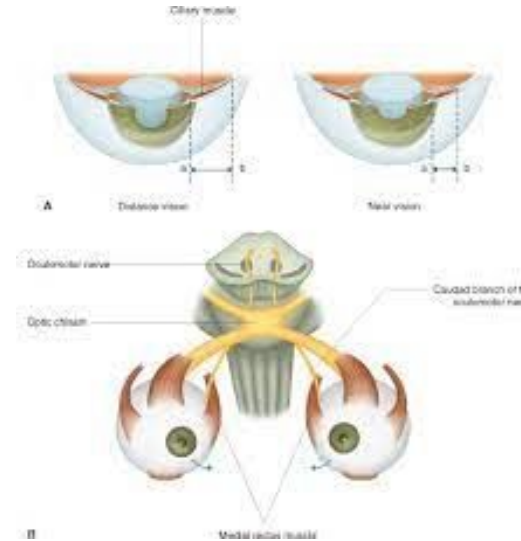
- Average pupil size in normal illumination ~3.5mm
 - Range 1.0 - 10.0 mm
 - <2mm considered miosis
 - >7mm considered mydriatic
 - Decrease with age due to senile miosis
 - Difference of 0.4mm or greater is clinically significant



Pupil Anatomy and Physiology

- In a normal pupil, amount of light entering the eye governs the size of the pupil

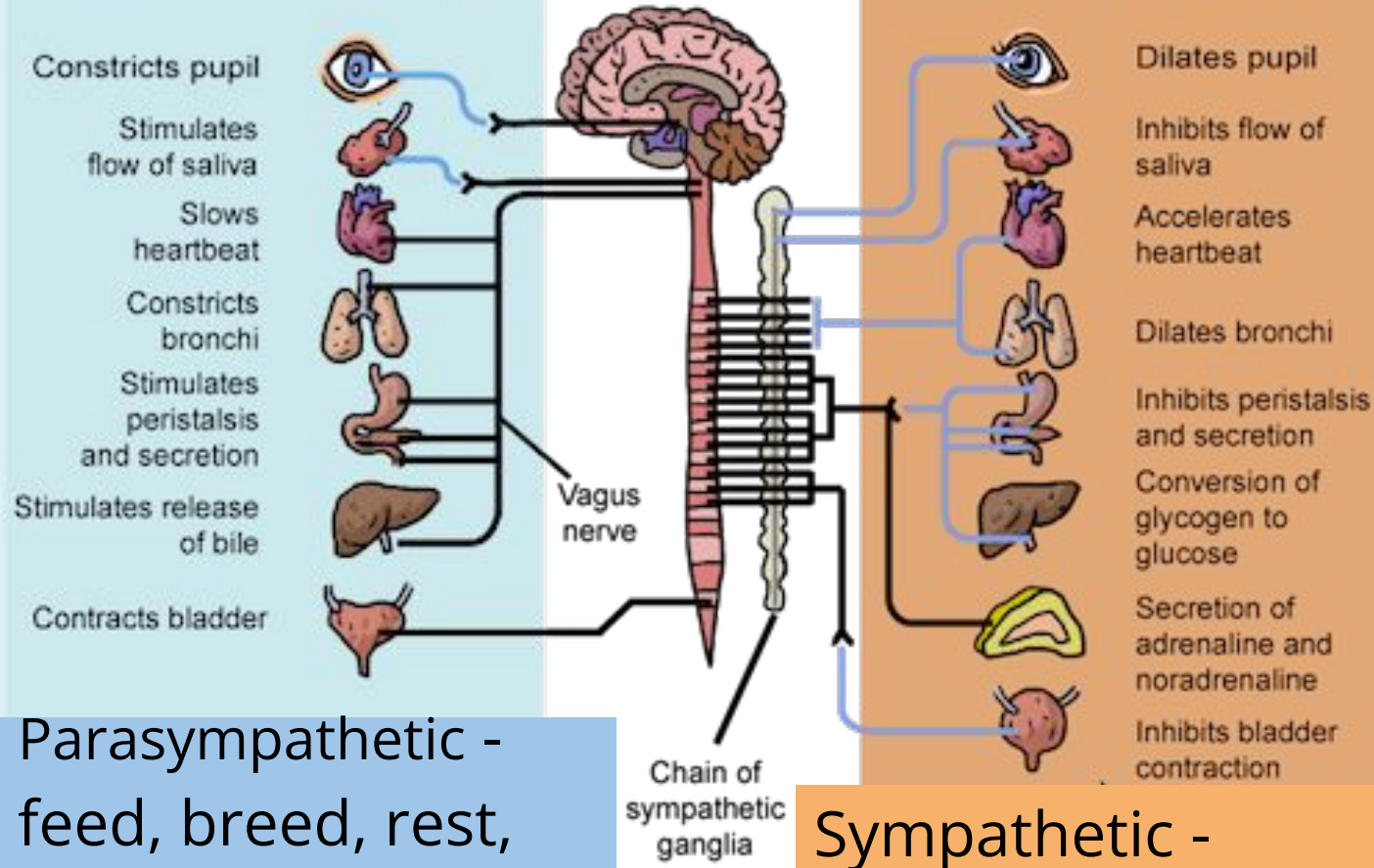
- Pupil size governed by
 - Amount of light entering the eye
 - Where patient is focusing
 - Mood
 - Drug use



Pupillary Function

Parasympathetic

Sympathetic



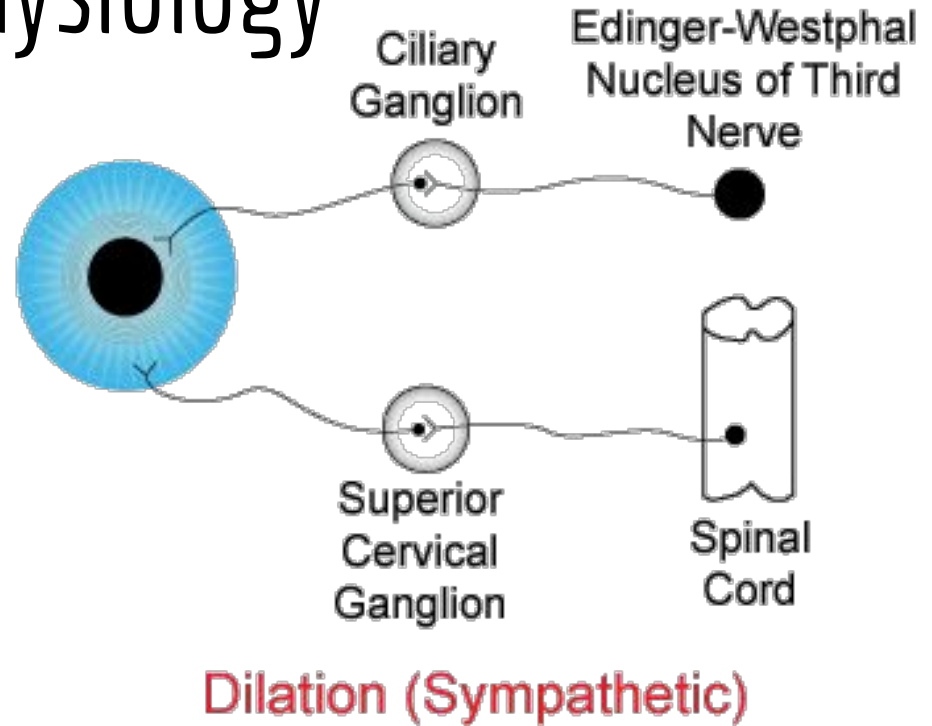
Autonomic
Nervous
System
(involuntary)

Parasympathetic -
feed, breed, rest,
and digest

Sympathetic -
flight or fight

Pupil Anatomy and Physiology

- Pupil size is dependent on a balance between the sympathetic and parasympathetic innervation of the iris muscles



Parasympathetic Innervation

- Controlled by the parasympathetic system:
 - Pupil's response to light (miosis / light response)
 - Pupil's response to how close things are (near response)

a) Constriction pathway

1. Iris sphincter muscle

2. Short ciliary nerve

3. Ciliary ganglion

4. Optic nerves

5. Optic chiasm

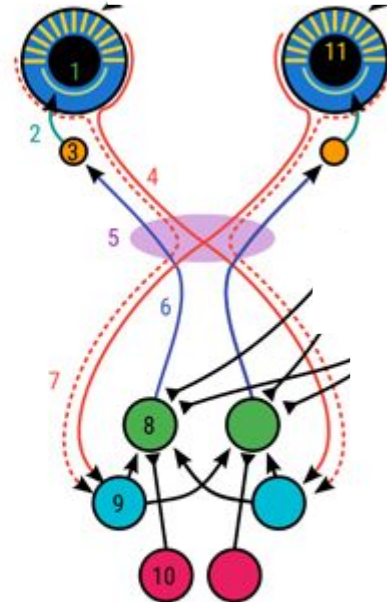
6. Oculomotor nerve

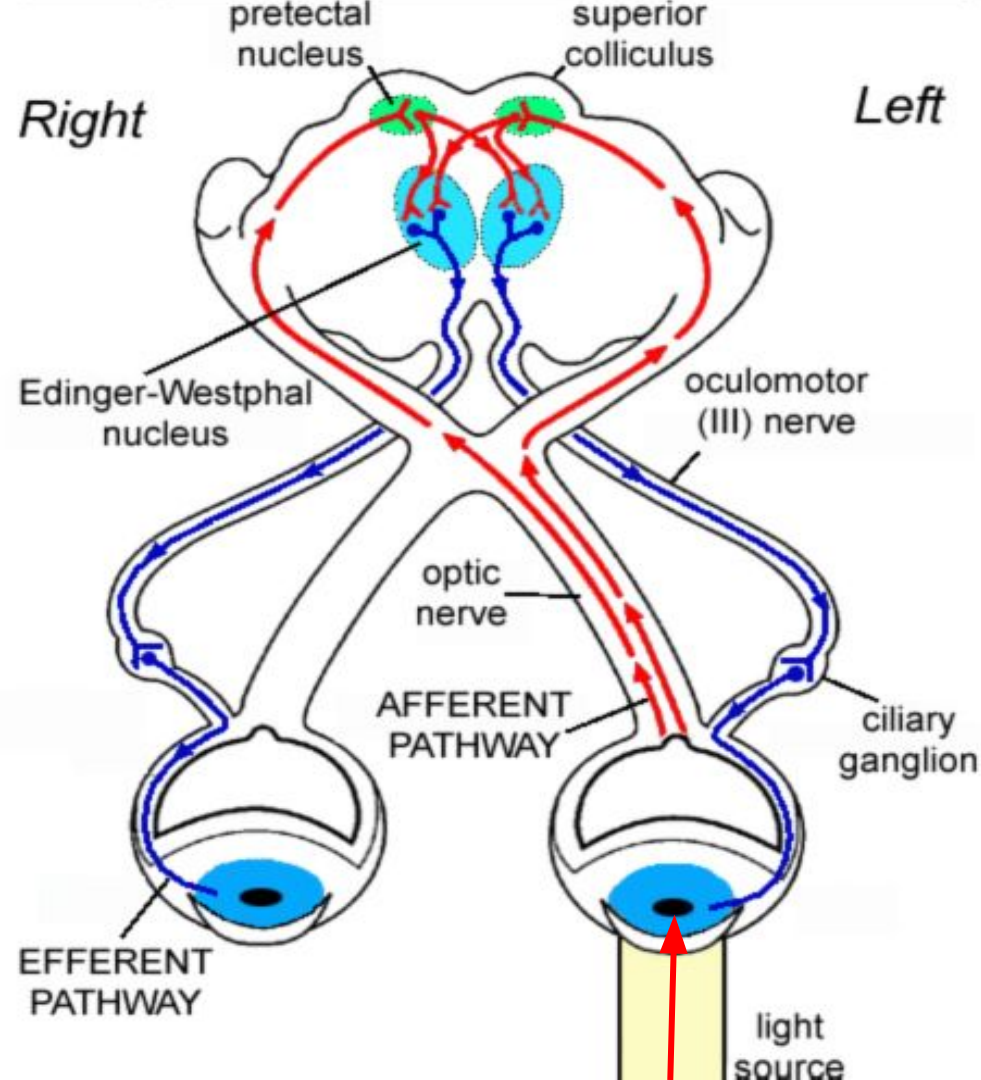
7. Optic tract

8. Edinger-Westphal nucleus (EWN)

9. Pretectal olivary nucleus (PON)

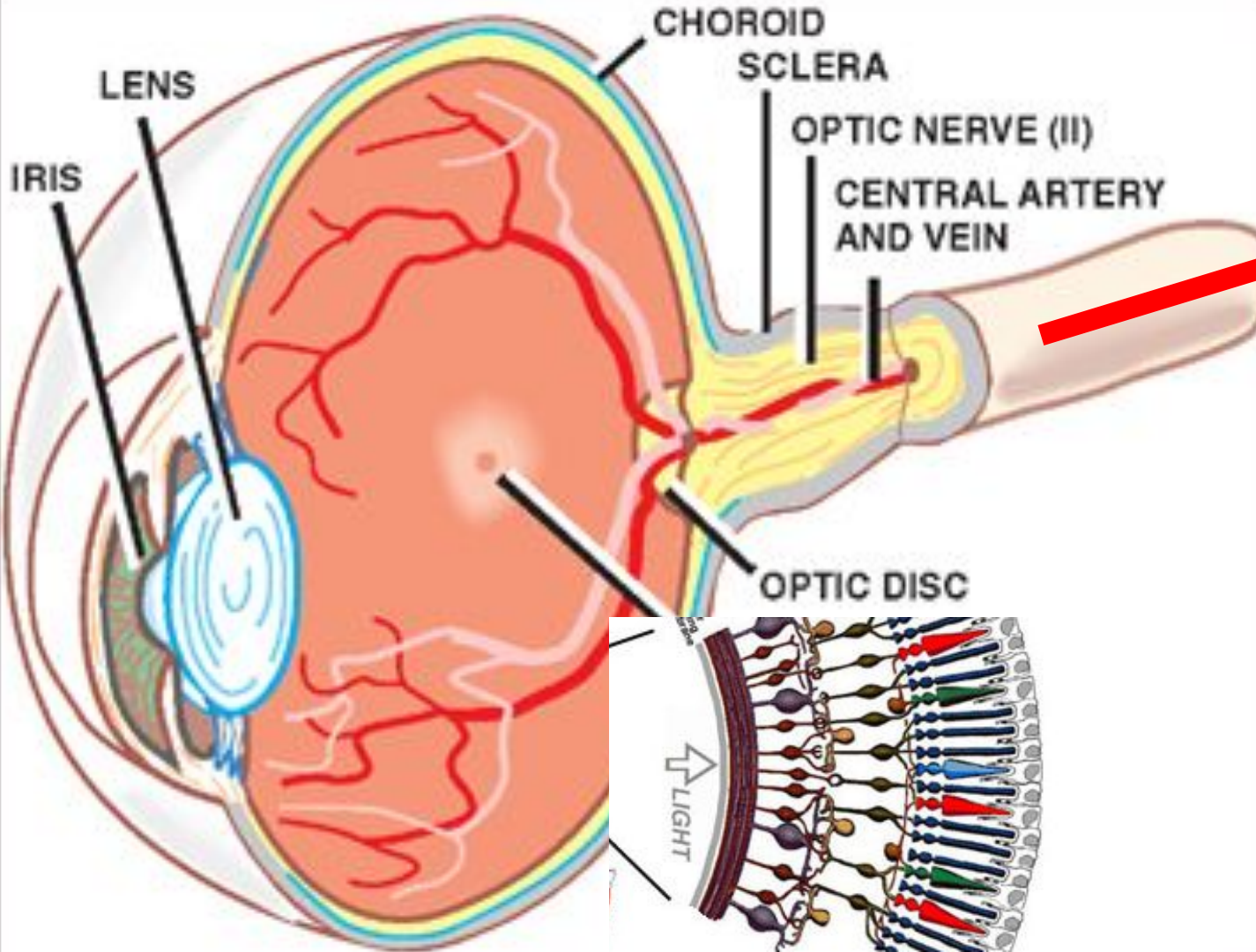
10. Superior colliculus (SC)





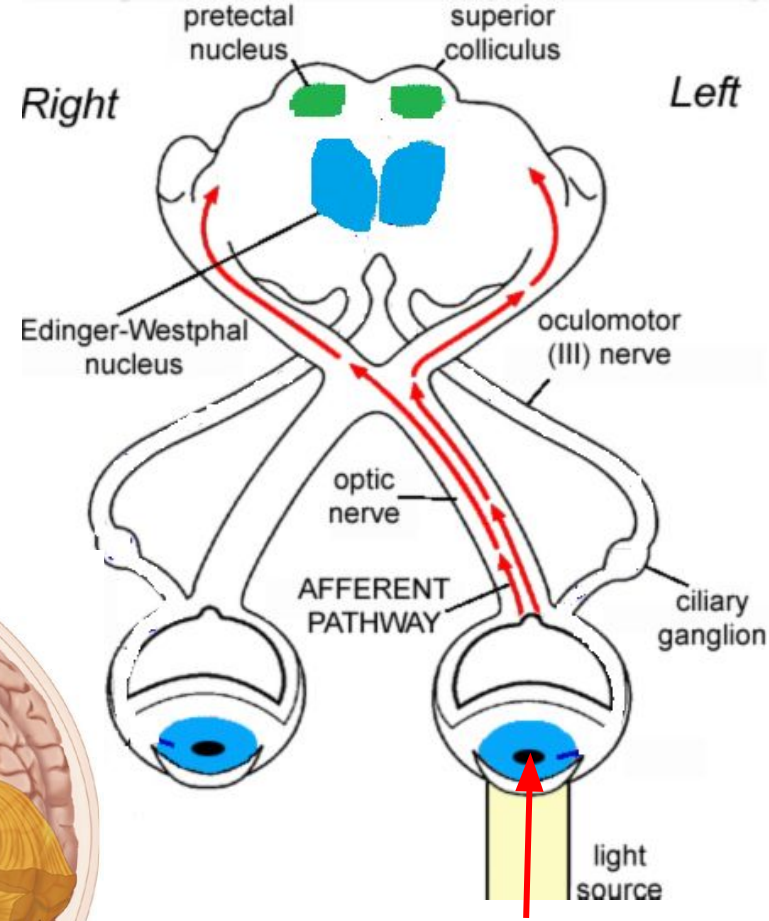
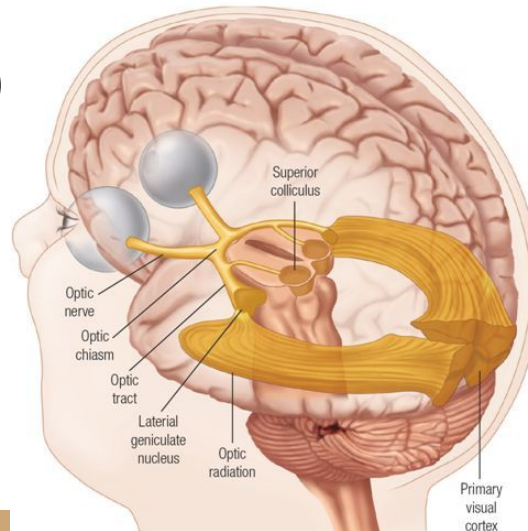
Parasympathetic Innervation

- Red = afferent (1)
 - From pupil to the brain
- Blue = efferent (2)
 - From brain to the pupil



Afferent Pupillary Pathway

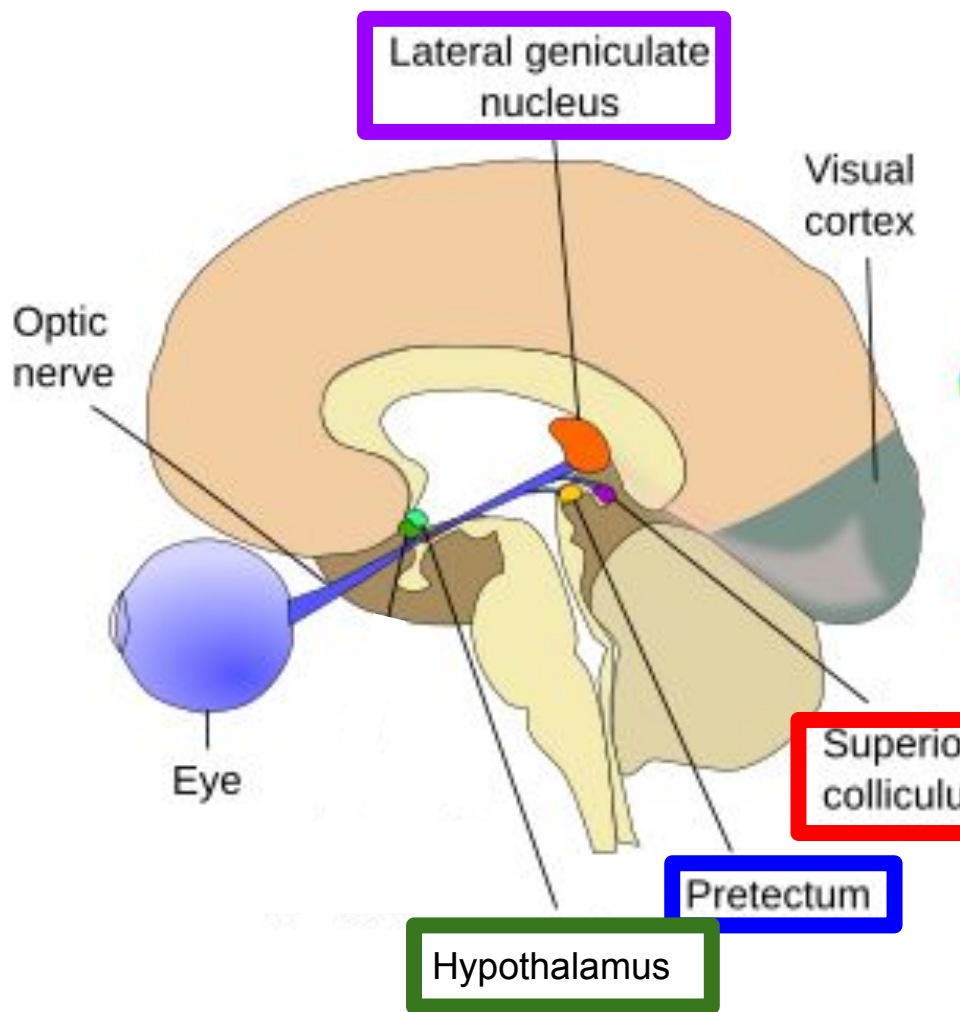
light impulse → retinal
photoreceptors → optic
nerve → **optic chiasm**
(bifurcation of fibers)
→ optic tract



Afferent Pupillary Path

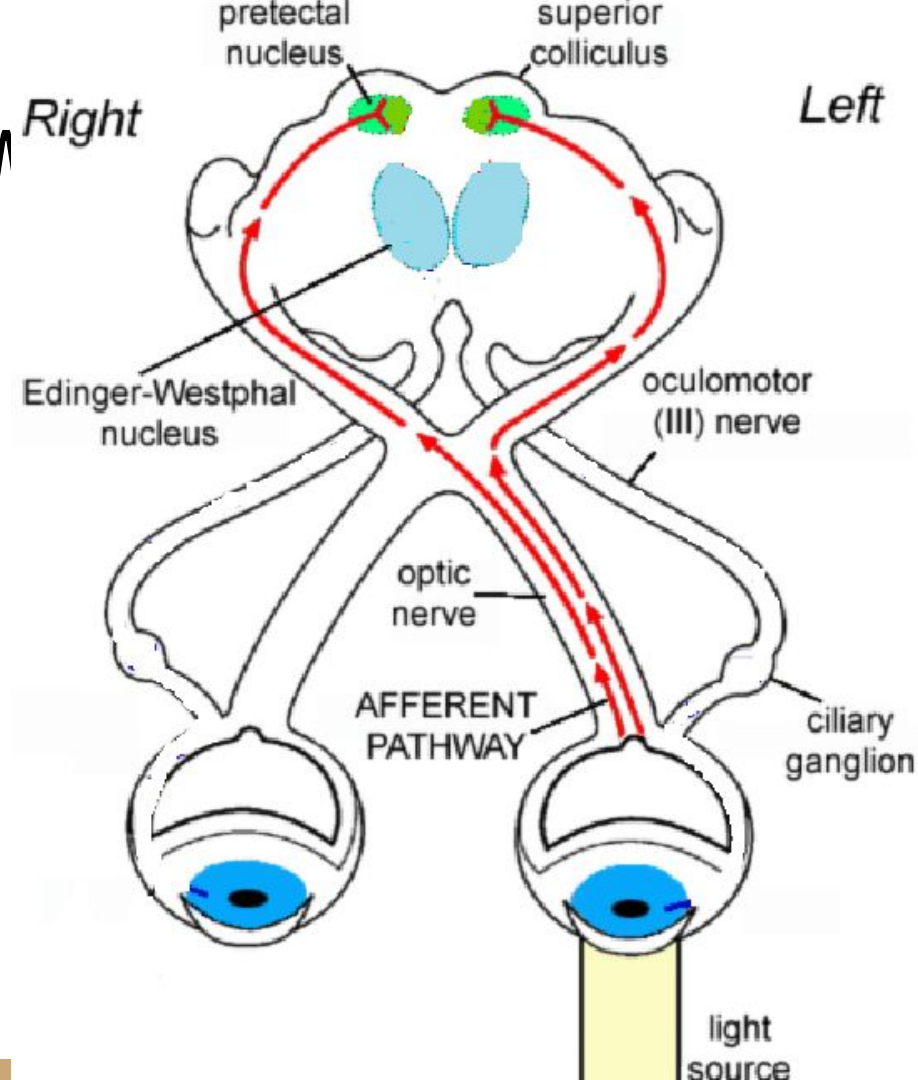
after optic tract, fibers break off to go to

- Lateral geniculate nucleus (90%) → visual cortex
- Hypothalamus → circadian rhythm
- Superior colliculus → saccades
- Pretectum → pupil



Afferent Pupillary Pathway

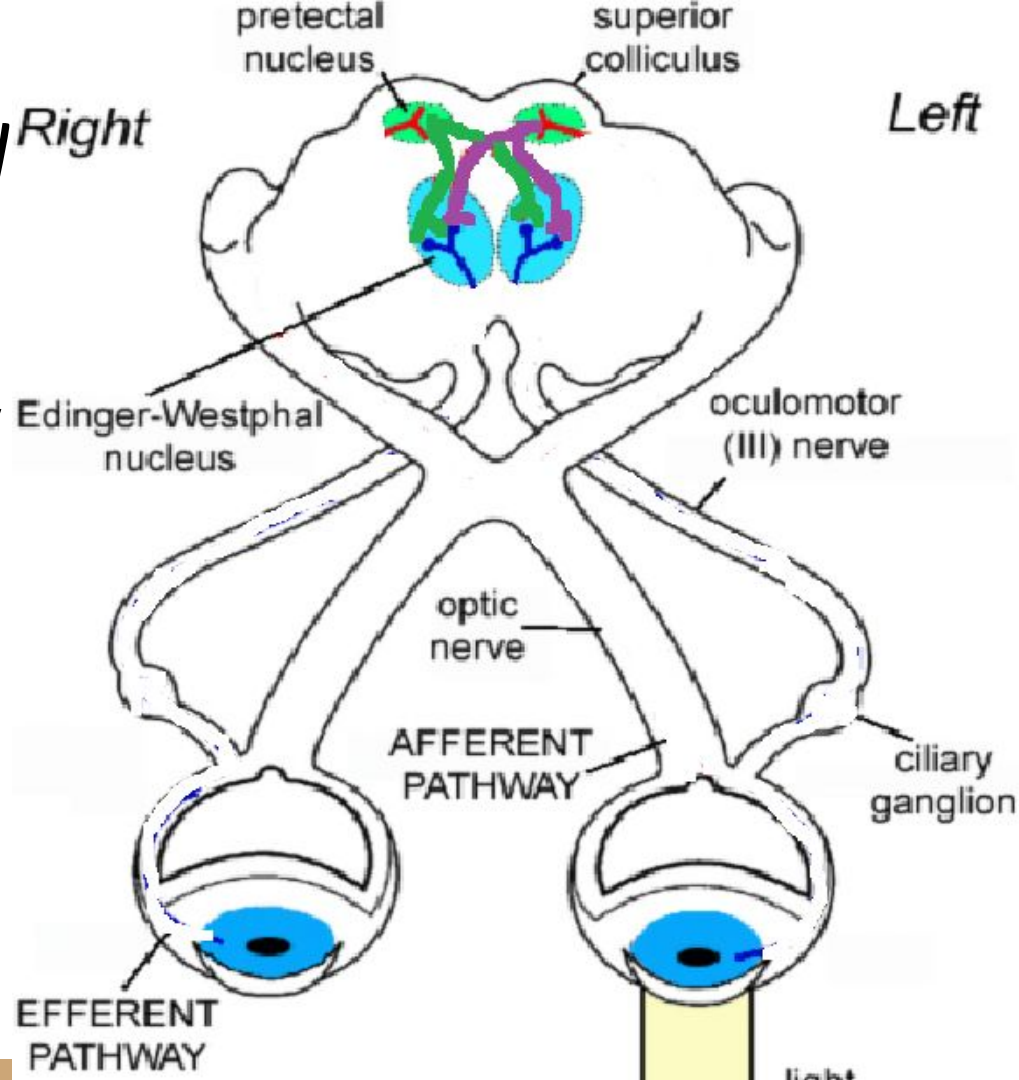
After optic tract, fibers break off to **bilaterally** stimulate the **pretectal nuclei** in the midbrain



Internuclear Pathway

Pretectal nuclei → **bifurcate**
→ Edinger-Westphal nuclei of
the oculomotor nerve (CN III)

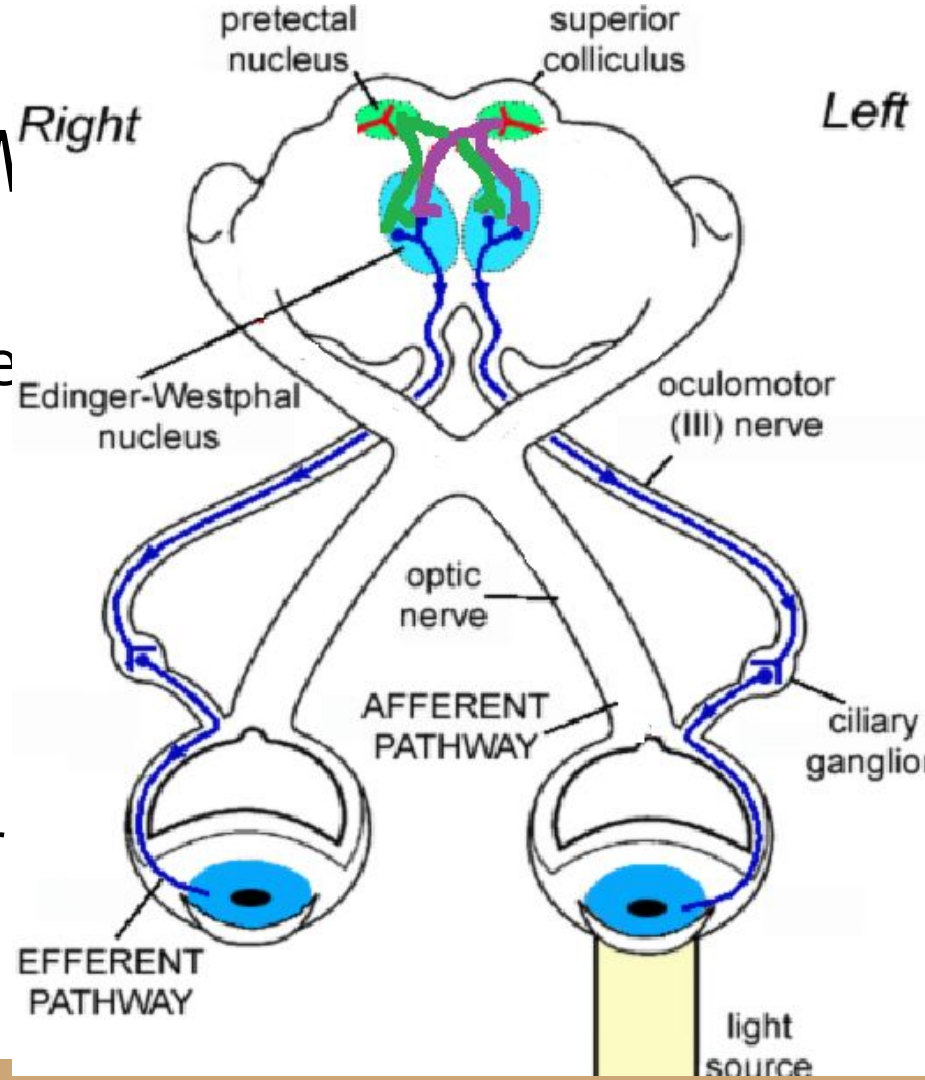
EW nucleus lies dorsal to main
oculomotor nucleus. Responsible
for *autonomic functions* of the
oculomotor nerve (pupillary
constriction and accommodation)



Efferent Pupillary Pathway

Edinger-Westphal nuclei of the oculomotor nerve (CN III) → travel back towards both orbits to both ciliary ganglion

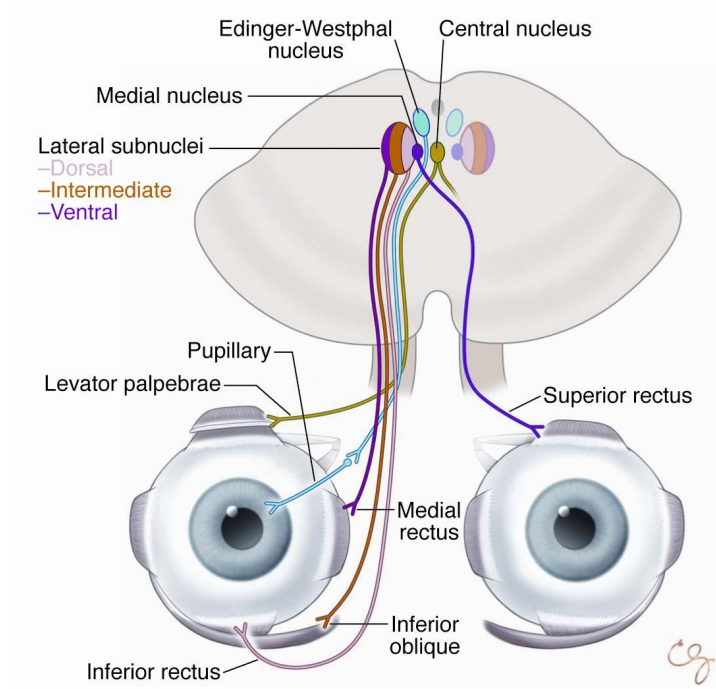
- 97% innervate ciliary body → accommodation
- 3% innervate iris sphincter → pupil constriction



Cranial Nerve 3 (Oculomotor Nerve)

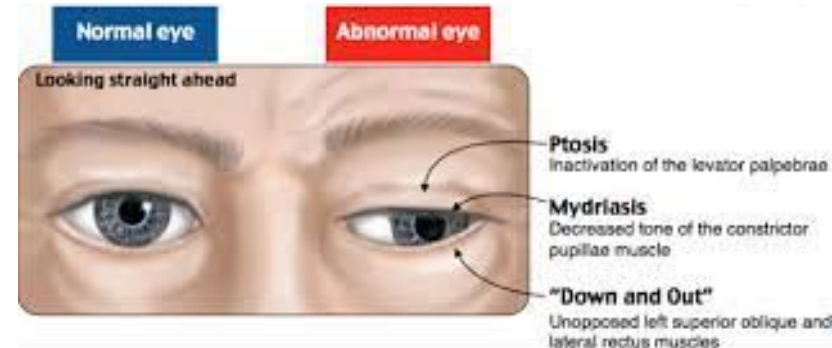
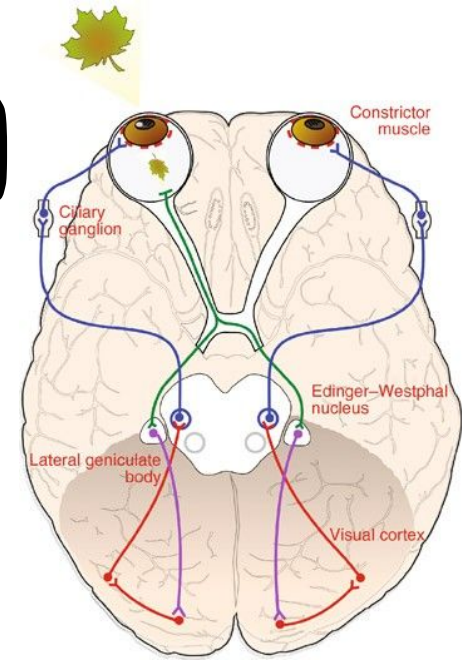
● Controls

- Eye movement (superior rectus, inferior rectus, medial rectus, inferior oblique)
- Levator palpebrae (upper eyelid control)
- Ciliary Ganglion (parasympathetics)
 - Accommodation
 - Pupil constriction

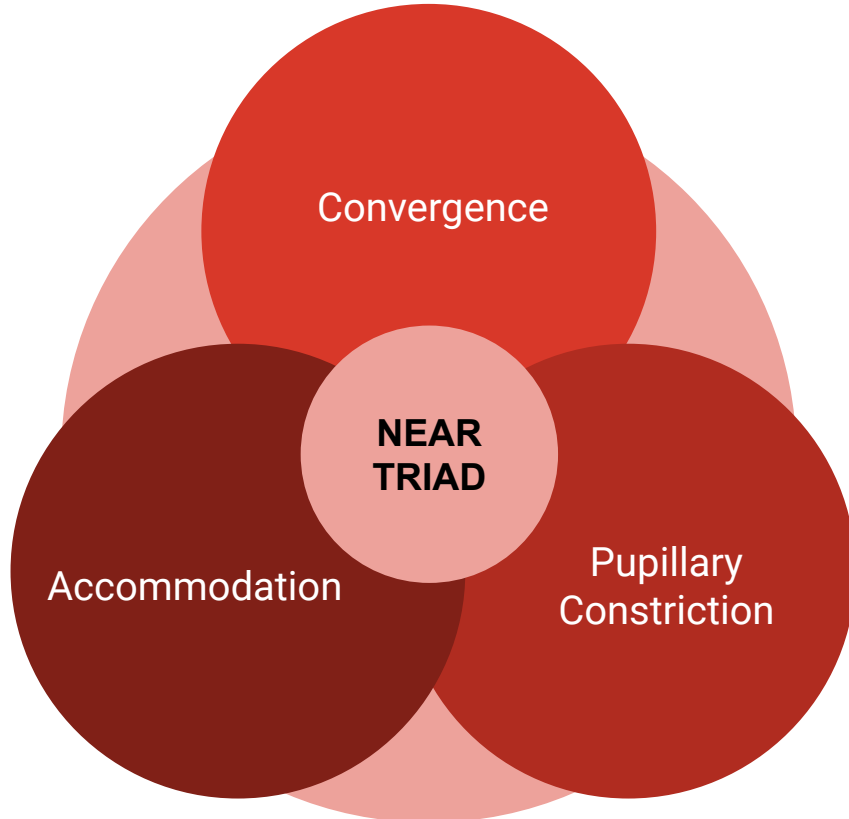


Cranial Nerve 3 (Oculomotor Nerve)

- Interruption of Oculomotor / Parasympathetic pathway will cause
 - Eye positioned down and out
 - Large ptosis
 - Lack of accommodation
 - Dilated pupil



Pupillary Reaction to Near Response



Near Triad →
Fixation at near
causes



Pupillary Reaction to Near Response

- How to test pupillary constriction to near → Slowly alternate fixation between distant and near target in dim illumination (3x)
- Only performed if there is a poor constriction of the pupils to light
 - If the direct pupillary light reaction is *normal*, the pupillary near response is *always intact*

Pupillary Reaction to Near Response

- If pupil fails to respond to light but normal at near → *afferent* pathway is interrupted but *efferent* pathway is intact (*light-near dissociation*)
 - Midbrain lesions, amaurotic pupil (ON disease), aberrant regeneration from a previous NON-ISCHEMIC 3rd nerve palsy

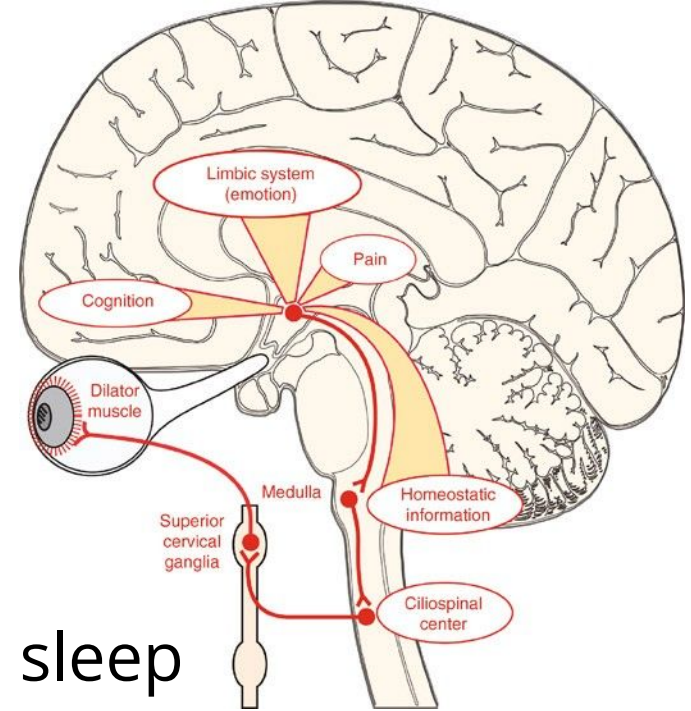


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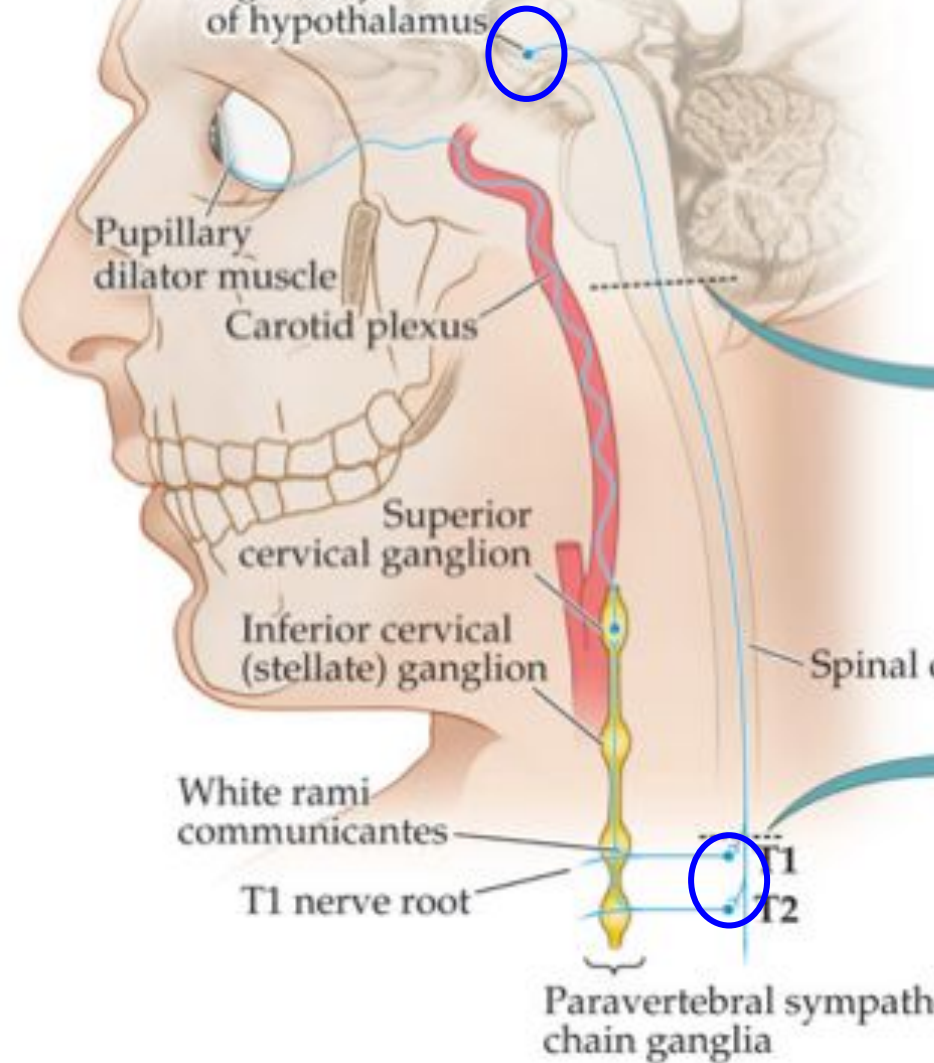
Sympathetic Innervation

- **EFFERENT ONLY** system
 - Modulates pupil dilation via constriction of radial dilator muscles of iris
 - Less during drowsiness and sleep
 - During sleep pupils are partially constricted but still reactive to light
 - More during intense concentration, fright, and arousal



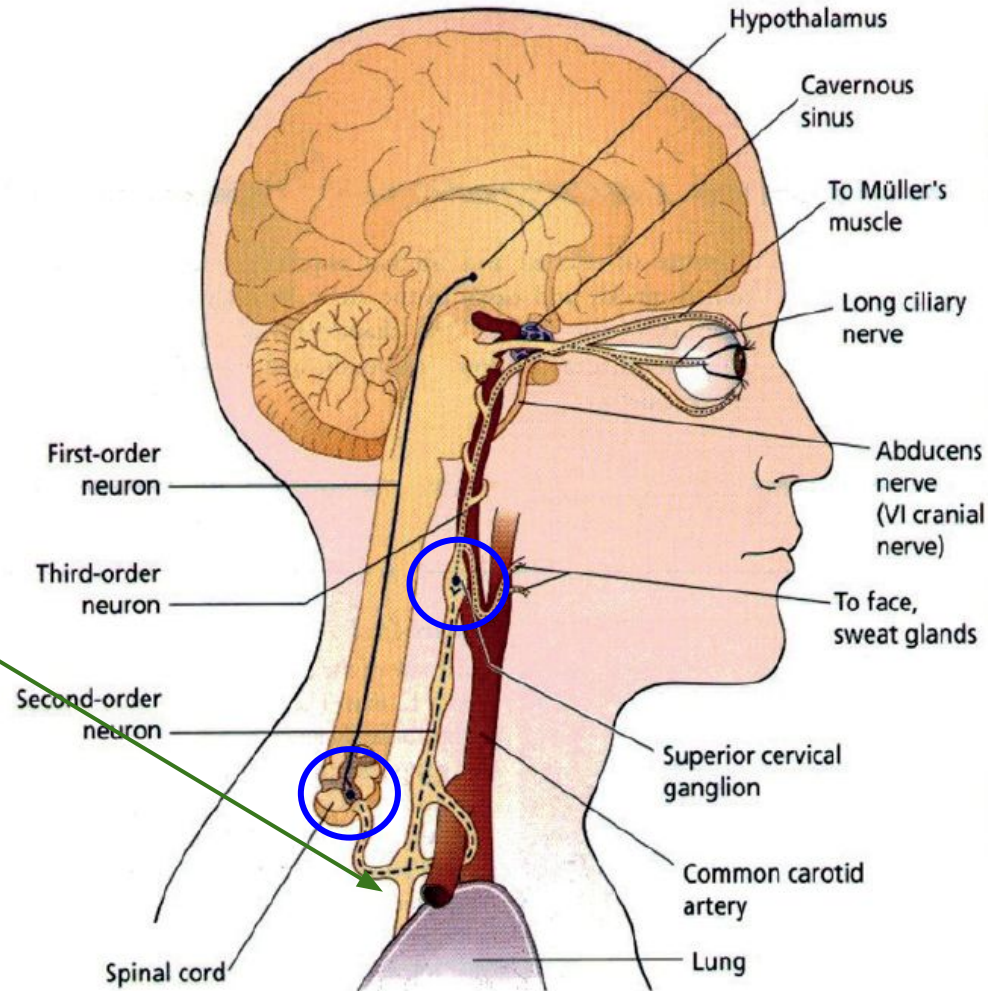
Sympathetic Innervation

- **Hypothalamus** 1st order neuron → descends through brainstem on each side (**no bifurcation**) → 1st synapse at **ciliospinal center** at C8 - T1 level

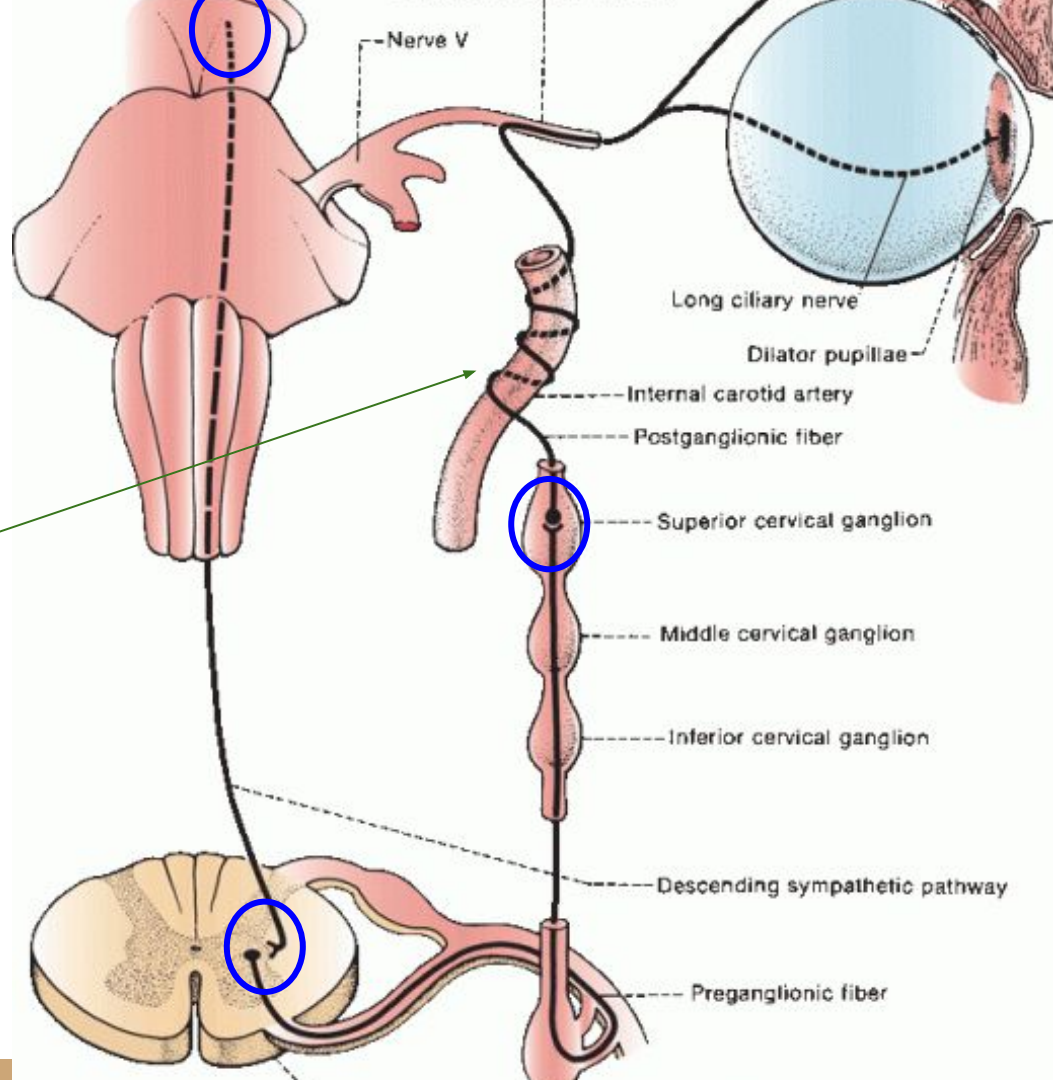


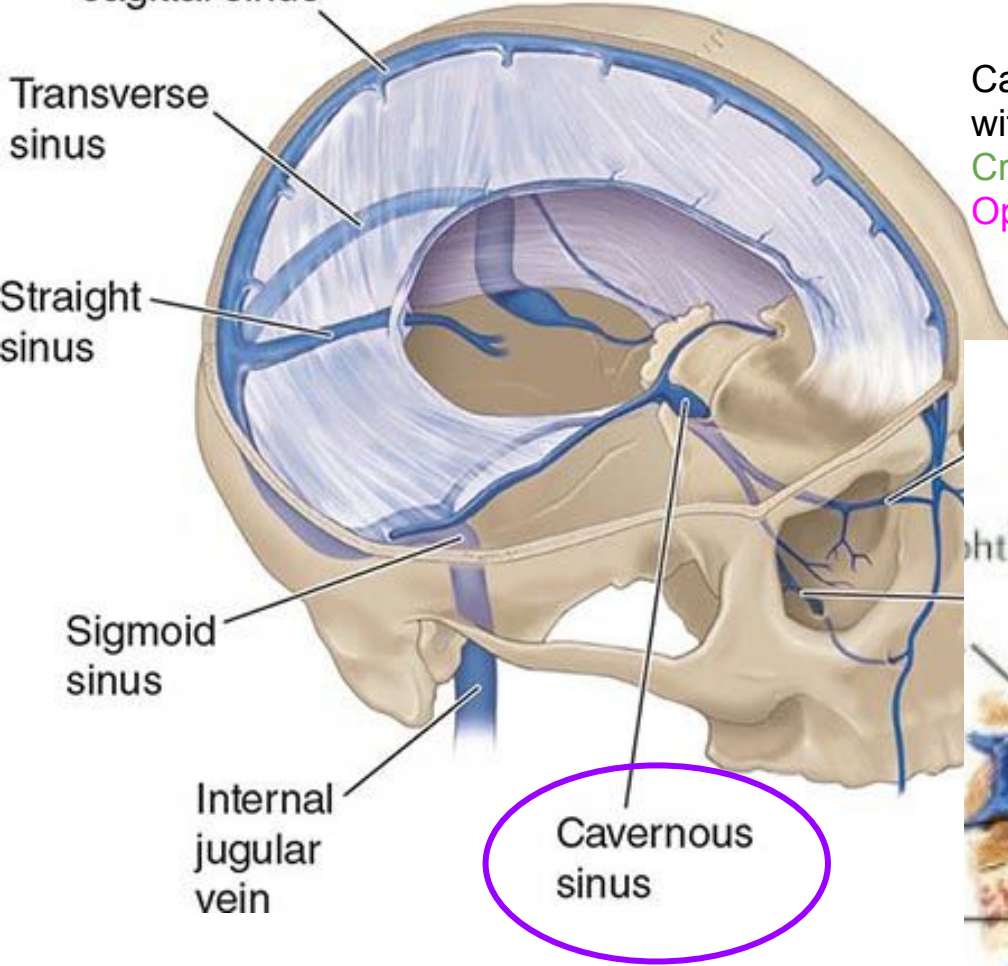
Sympathetic Innervation

- 2nd order neuron exit spinal cord → pass over apices of the lungs → synapse at superior cervical ganglion at level of the jaw



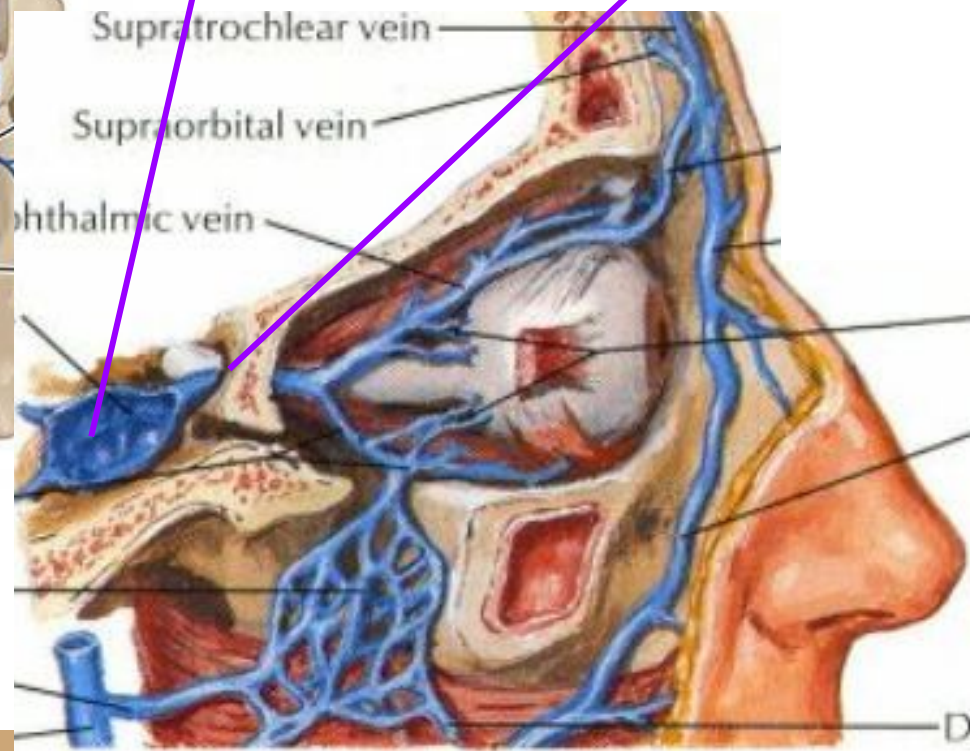
- synapse at superior cervical ganglion → 3rd order neuron form a **plexus around internal carotid artery** → run along the internal carotid artery into the cavernous sinus



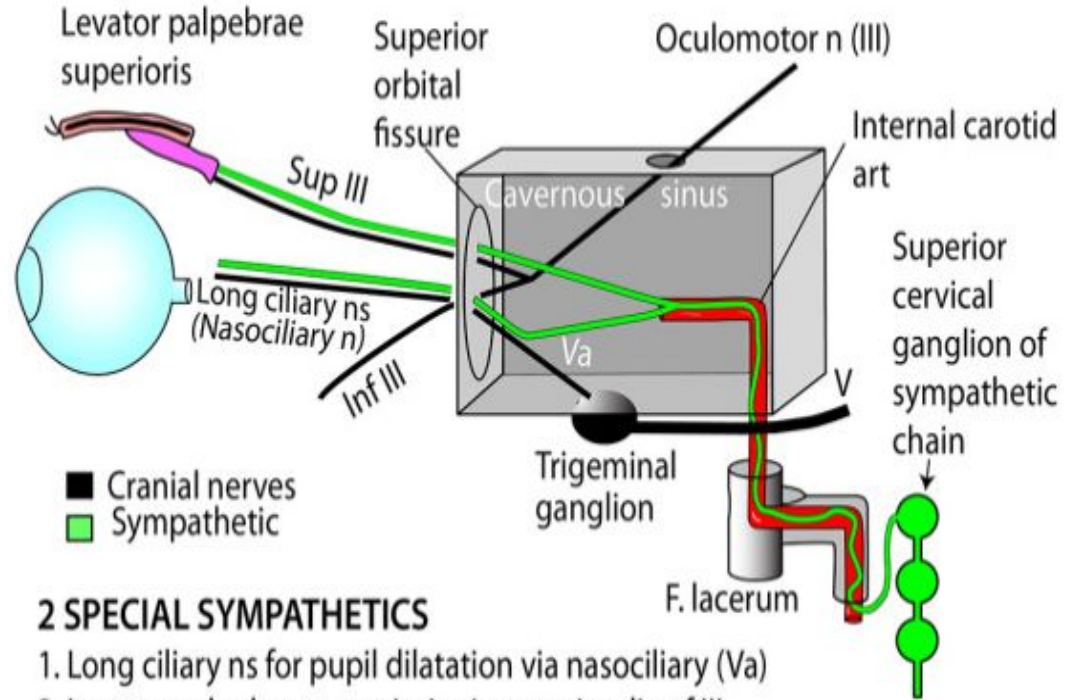


Cavernous Venous Sinus (meet with Ophthalmic division of 5th Cranial Nerve (V1) and Ophthalmic artery)

Superior Orbital Fissure



- Neurons traveling with **ophthalmic artery** → Mueller's muscle (eyelid control)
- Neurons traveling with **1st branch of C.N. 5** → through long ciliary ganglion → iris dilator (mydriasis)
- Neurons traveling to **sweat glands of face**



2 SPECIAL SYMPATHETICS

1. Long ciliary ns for pupil dilatation via nasociliary (Va)
2. Levator palpebrae superioris via superior div of III

Sympathetic Innervation

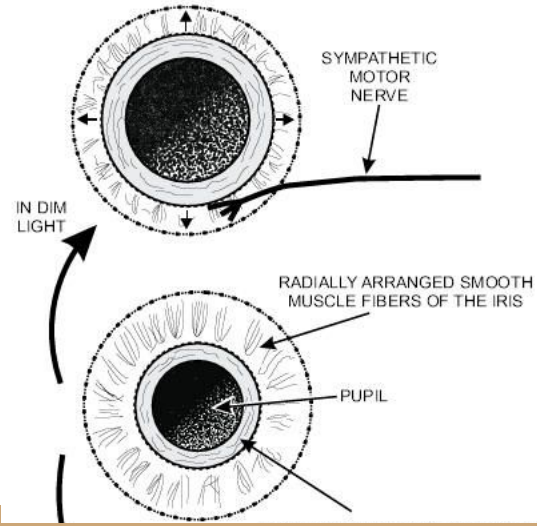
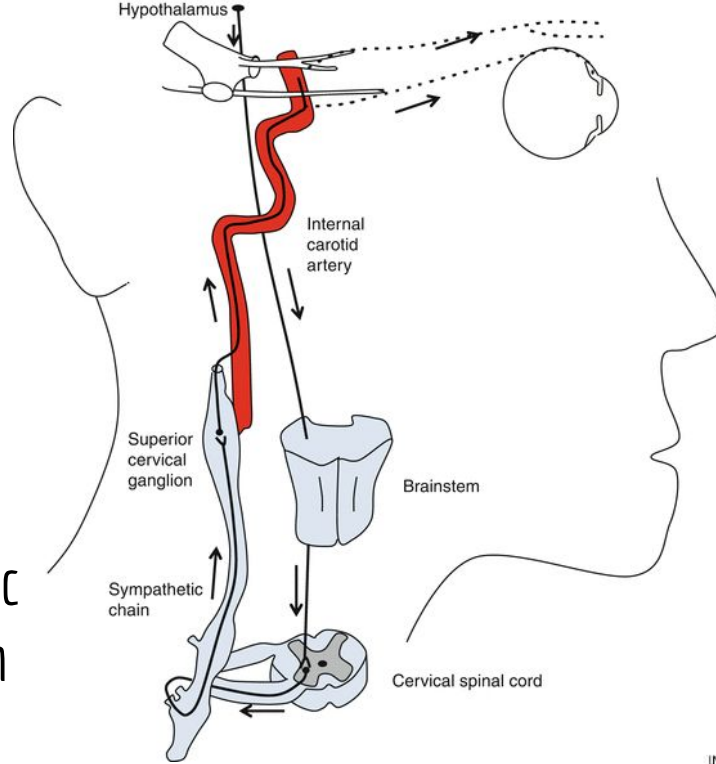
- Pupil dilation
- Eyelid elevation
- Facial sweating

*Interruption of ocular sympathetic pathway at **any level** will result in unilateral*

Miosis

Ptosis (mild-moderate)

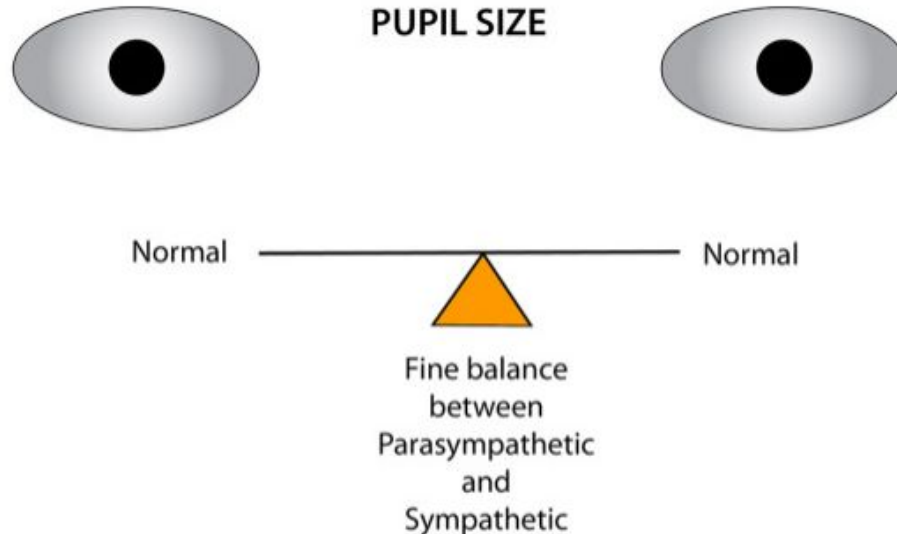
Facial anhidrosis



Pupillary Testing

Pupil Testing

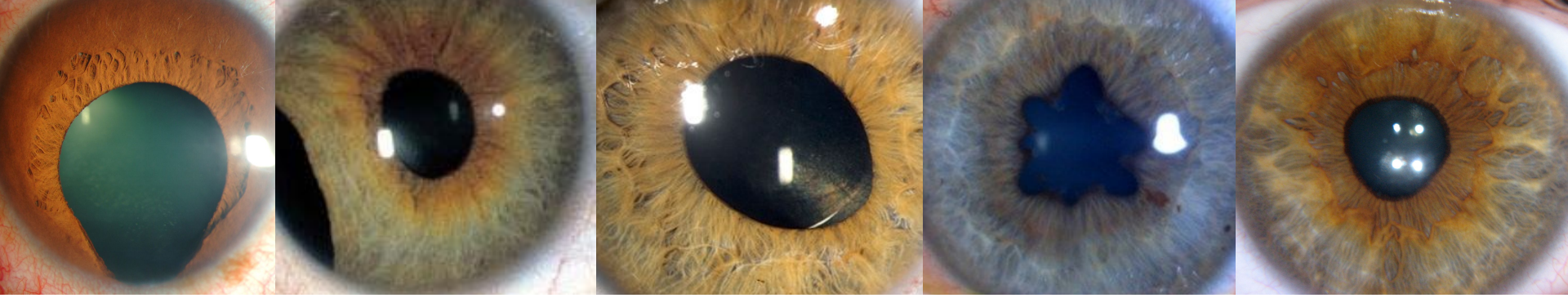
Can objectively measure integrity of **afferent** and **efferent** pupillary pathways



Pupil Testing



- Purpose is to evaluate pupil:
 - Symmetrical Size (bright and dim)
 - Symmetrical Shape (round)
 - Similar Location (central)
 - Strength of *direct* pupillary light response compared to strength of *consensual* pupillary light response



- Pupils should be round
 - Non-round pupillary shape can be due to

Surgery

Iris atrophy from age

Trauma

Ischemia

Congenital

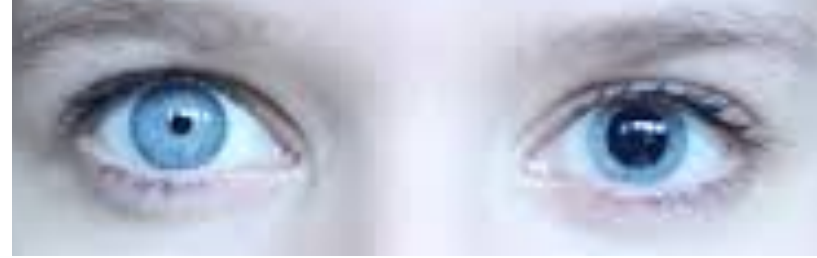
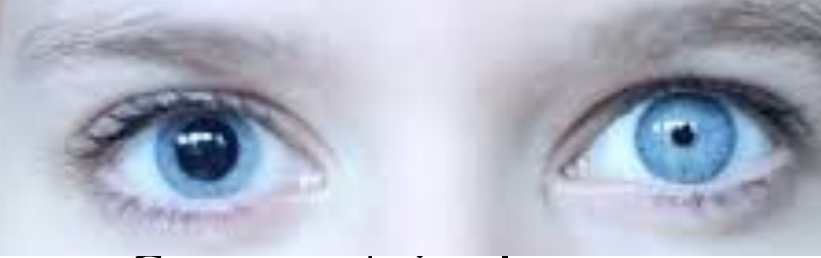
Inflammation

Posterior synechiae



Pupil Testing

- Pupils should be
 - Symmetrical in Size
 - Anisocoria - unequal size between pupils
 - Physiologic anisocoria
 - 20% of people, benign
 - Difference in pupil diameter *less than* 1.0mm
 - Difference is **same** in dark and bright illumination



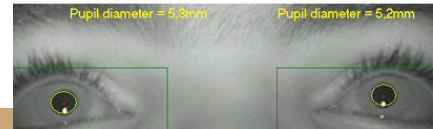
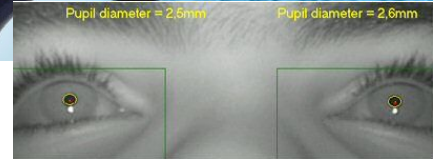
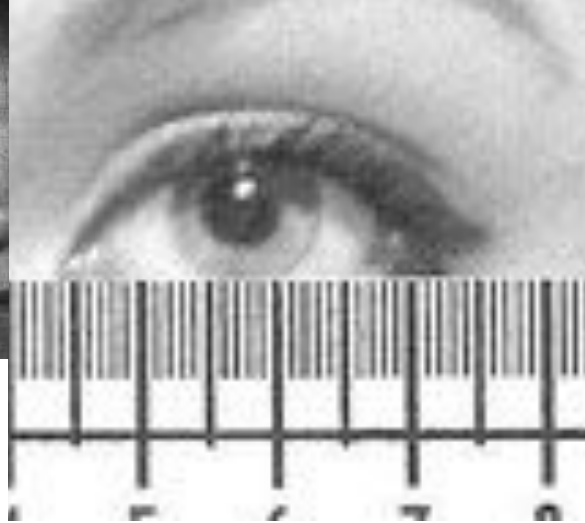
- Symmetrical
 - Pupillary inequality (**anisocoria**) usually results from an **iris innervation (efferent)** problem
 - But can also be due to trauma, inflammation, synechia
 - Must check iris sphincter and iris dilator muscles - can do in *slit lamp*
 - An **AFFERENT** defect will **NOT PRODUCE ANISOCORIA** due to 2 bifurcations in the pathway

Pupil Testing

- Comprehensive and detailed **case history** is key to reach appropriate diagnosis
 - Recent contact with medications or agents that can affect pupil size
 - History of trauma
 - History of surgery
 - Ocular history of inflammation
 - Use old photos to evaluate possible onset and duration

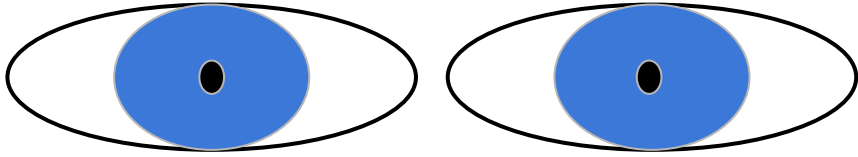
Pupil Testing

- Measure using a mm ruler
 - Some new auto refractors
 - Pupillometer
- Keep **below visual axis** to avoid accommodation and miosis
- Can use O-scope to simultaneously observe red reflexes → easier to evaluate symmetry of pupil size

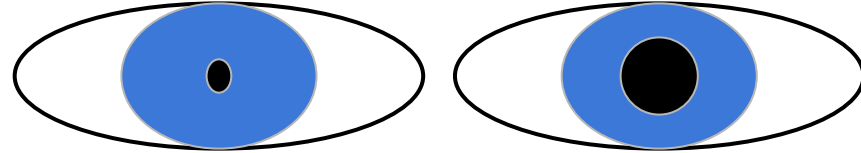


Anisocoria worse in dim light

Bright

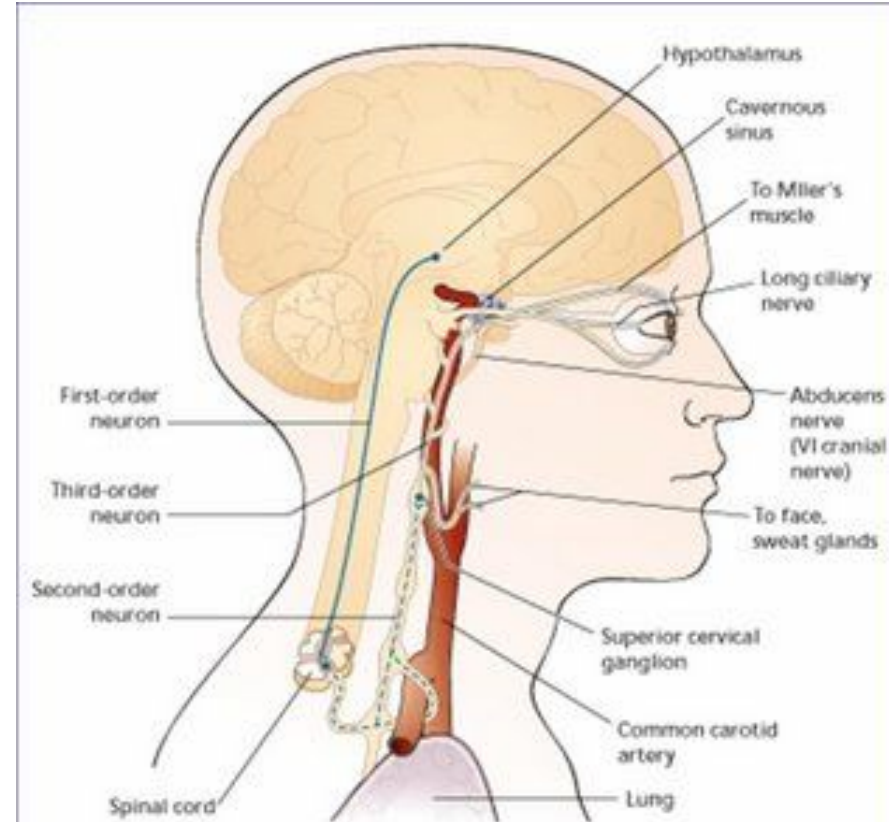


Dim



Anisocoria Testing - too small

- *Small Pupil* is the problem
 - Anisocoria greater in the dark (unable to dilate in the dark)
 - Impairment of oculo-sympathetic system



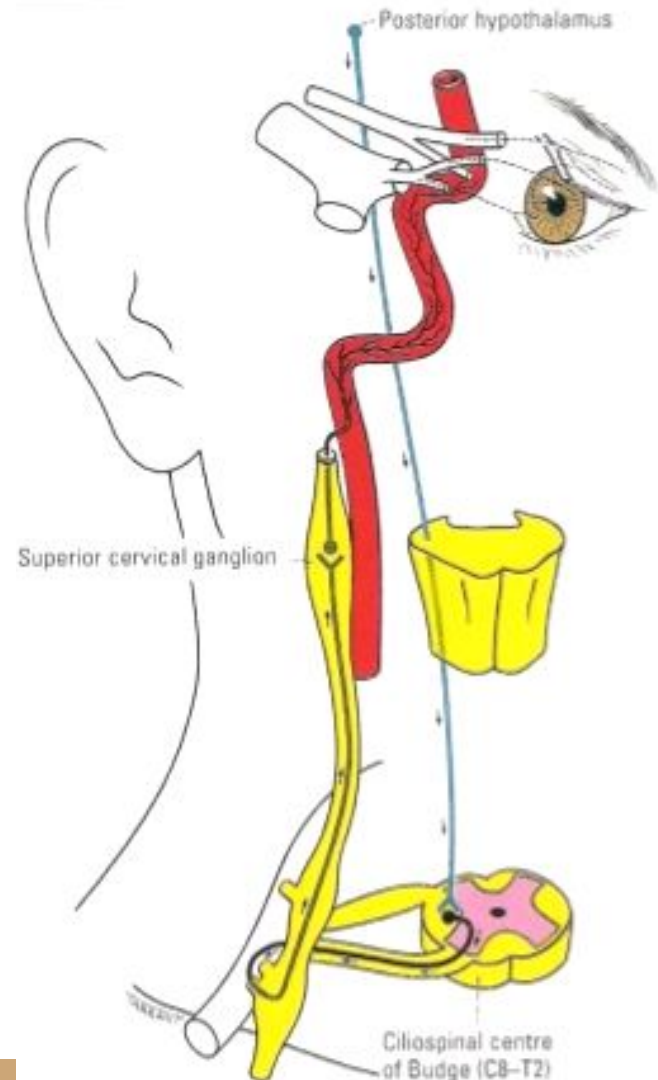
Anisocoria Testing - too small

- *Small Pupil* is the problem

Pharmacologic

Horner's syndrome

Argyll-Robertson



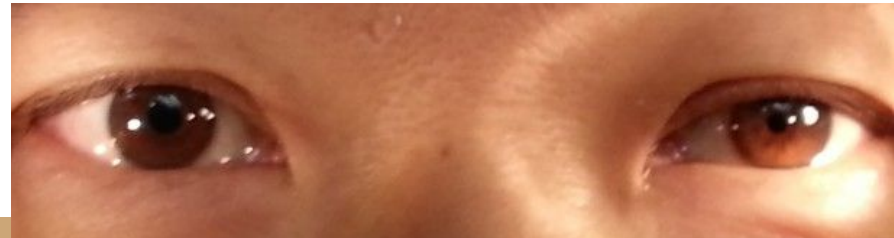
Anisocoria Testing - too small

- Pharmacologic constriction
 - Morphine, Heroin, Codeine, Oxycodone
 - usually bilateral
 - Cholinergic agonist / Anticholinesterase
 - Antipsychotics, antidepressants, MAOI
 - Clonidine and tetrahydrozoline (for HTN)
 - Pilocarpine, flea/tick control products
 - Spray or patch



Anisocoria Testing - too small

- Horner's Syndrome / Oculo-sympathetic paresis
 - Interruption along oculo-sympathetic pathway anywhere between hypothalamus (origin) and iris dilator (destination)
 - Classic triad - Ipsilateral
 - Unilateral ptosis
 - Miosis
 - Facial anhidrosis



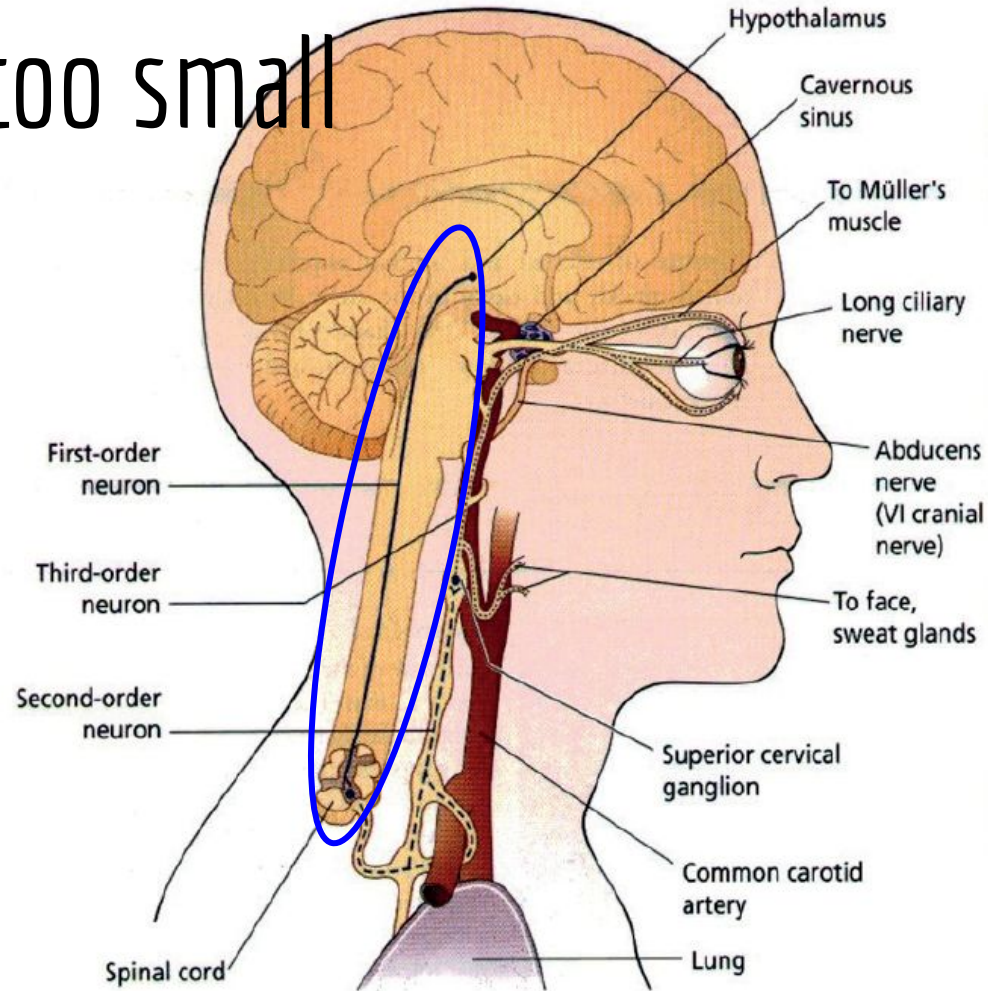
Anisocoria Testing - too small

- Horner's Syndrome / Oculo-sympathetic paresis
 - 33% are idiopathic
 - 4 - 13% are congenital
 - Iris heterochromia - lighter iris = affected eye
 - Rarely can have Horner's *without* heterochromia



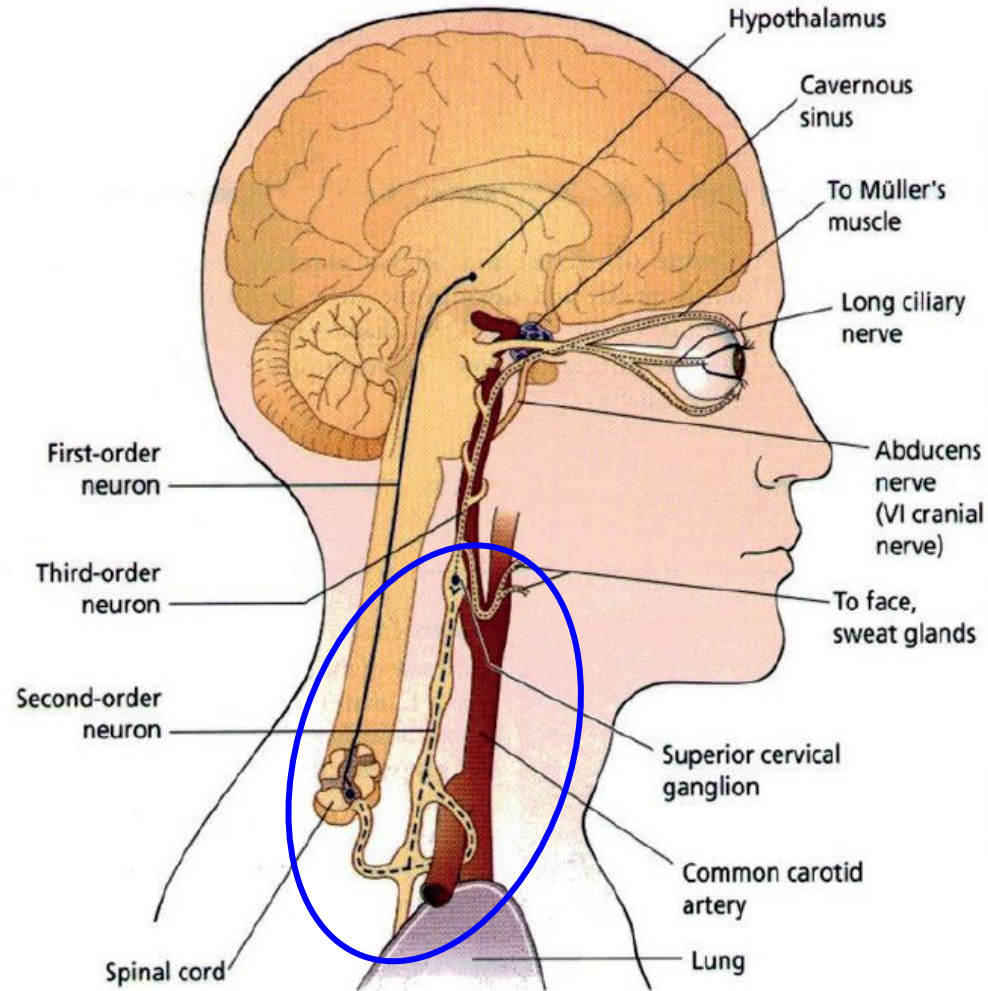
Anisocoria Testing - too small

- Horner's Syndrome / Oculo-sympathetic paresis
 - Acquired causes - **central** (1st order)
 - Stroke
 - Trauma to neck
 - Surgery
 - Aortic or carotid artery dissection
 - Otitis media



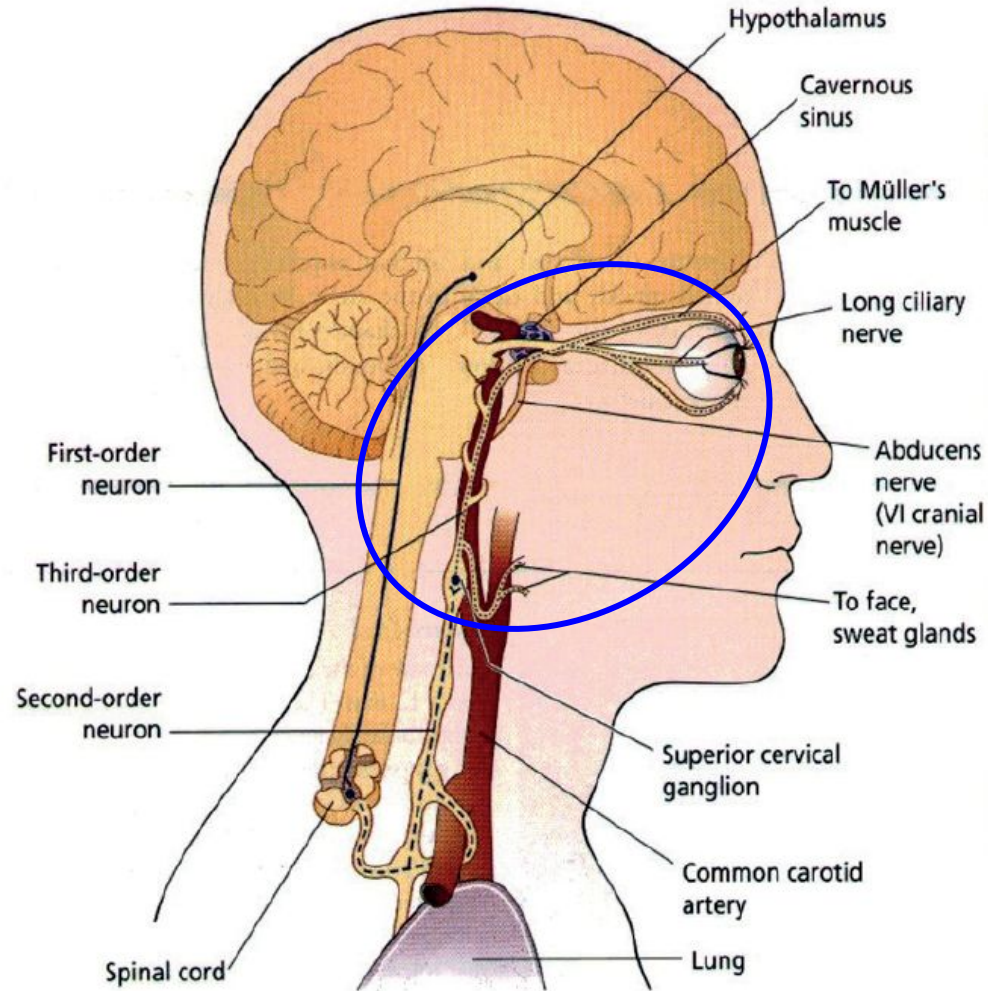
Anisocoria Testing -

- Horner's Syndrome / Oculo-sympathetic paresis
- Acquired causes -
 - **preganglionic** (2nd order)
 - Pancoast tumor
 - Tuberculosis
 - Neck trauma or surgery
 - Thyroid surgery/neoplasm



Anisocoria Testing -

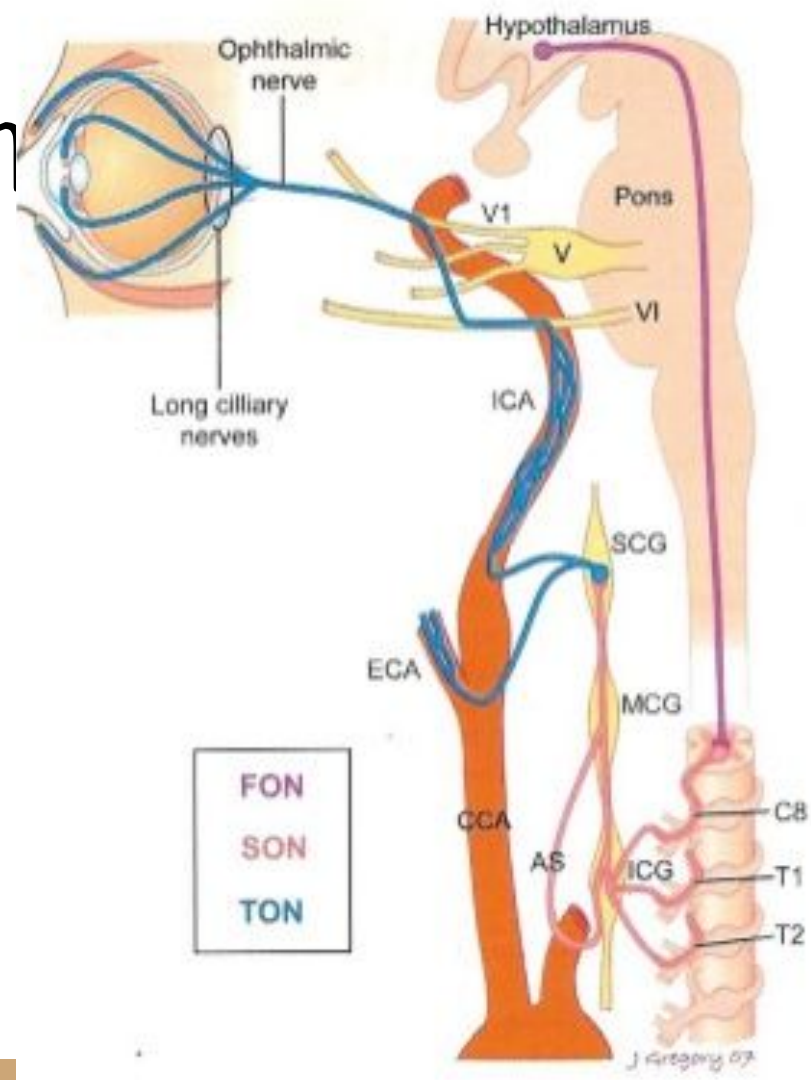
- Horner's Syndrome / Oculo-sympathetic paresis
- Acquired causes
 - **postganglionic** (3rd order)
 - Trauma /surgery
 - Raeder's syndrome
 - painful cluster migraine
 - Giant cell arteritis
 - Cavernous sinus/superior orbital fissure lesion
 - Nasopharyngeal carcinoma



Anisocoria Testing - too sn

- Horner's Syndrome / Oculo-sympathetic paresis

Detailed **history** and diagnostic **imaging** can help with differential diagnosis



Aniso



- Horner's Syndrome / Oculo-sympathetic paresis
 - Evaluation
 - Look for 'dilation lag' - Horner's pupil will be *delayed in its dilation* in dim illumination
 - Anisocoria *most evident* 4-5 seconds after turn off lights and will equalize 10-15 seconds after

Anisocoria Testing - too small

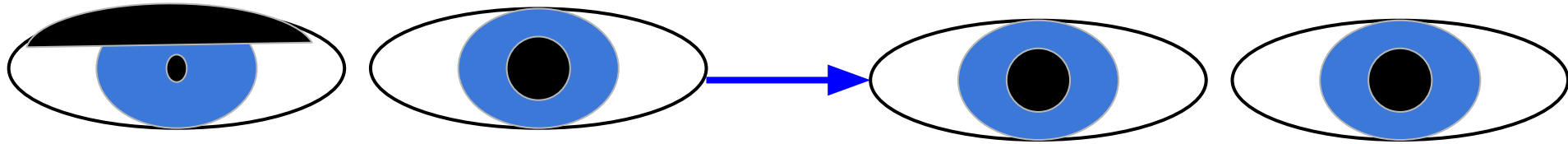
- Horner's Syndrome / Oculo-sympathetic paresis
 - In most instances, *imaging takes precedence* over localization via drops especially if have
 - Diplopia
 - Cranial nerve palsy
 - Numbness
 - Headache
 - Pain

Anisocoria Testing - too small

- Horner's Syndrome / Oculo-sympathetic paresis
 - Pharmacologic testing can help localize lesion and aid in differential diagnosis
 - apraclonidine / lopidine (Alcon)
 - Alpha-adrenergic receptor agonist
 - One drop of 0.5% or 1% **will dilate a Horner's pupil** with no/minimal effect on normal pupil
 - Must have 1.0mm or more dilation after 30-45 minutes



apraclonidine / lolidine OU to **CONFIRM HORNER'S**



0.5% or 1% lolidine will
have no effect on normal pupil
dilate a Horner's pupil by at least 1.0mm in 30-40 min

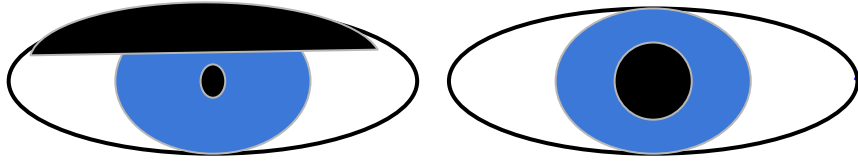
Anisocoria Testing - too small

- Allow 48 hours for lopedine to dissipate
 - Two drops of 1% hydroxyamphetamine (Paredrine) Akorn - difficult to obtain
 - Will dilate first or second order neuron lesion and normal pupils only
 - Release stored norepinephrine from postganglionic axon terminals into neuromuscular junction at iris dilator
 - Can not differentiate between first or second order lesions

Anisocoria Testing - too small

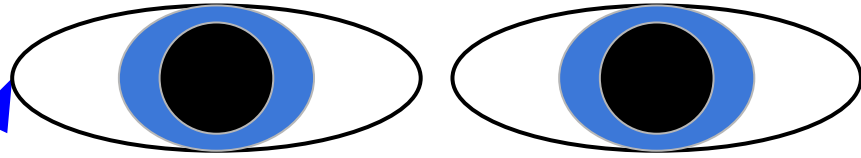
- Horner's Syndrome / Oculo-sympathetic paresis
 - Paredrine fails to dilate Horner's pupil caused by postganglionic (3rd order) lesion so anisocoria increases (normal pupil dilates)
 - Hydroxyamphetamine causes release of norepinephrine only if postganglionic nerve endings are intact
 - If there is a lesion to the 3rd order neuron, there are no surviving nerve endings to release norepinephrine and the pupil will not dilate

Right Horner's

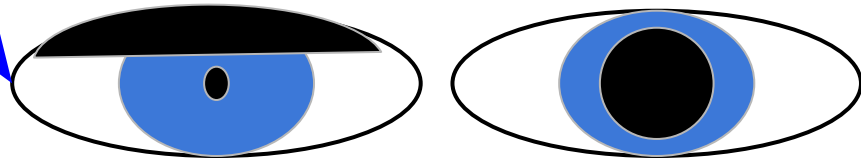


Hydroxyamphetamine OU

Horner's due to first or
second order neuron
lesions



Horner's due to 3rd order



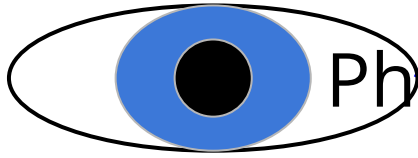
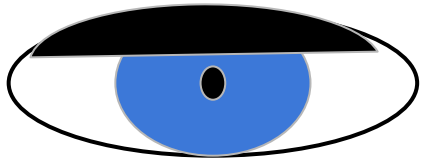
Anisocoria Testing - too small

- Horner's Syndrome / Oculo-sympathetic paresis
 - Must localize lesion
 - Phenylephrine 1%
 - Will dilate a postganglionic Horner's syndrome (due to denervation super-sensitivity)
 - Takes time to develop so acute / new onset cases may not respond properly

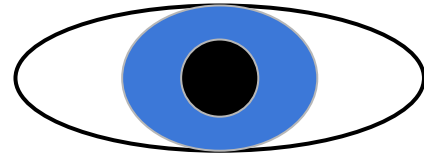
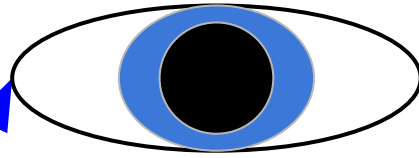
Anisocoria Testing - too small

- Horner's Syndrome / Oculo-sympathetic paresis
 - Must localize lesion
 - Phenylephrine 1%
 - Will not dilate central or preganglionic Horner's
 - Has a no to mild/slight effect on normal pupil

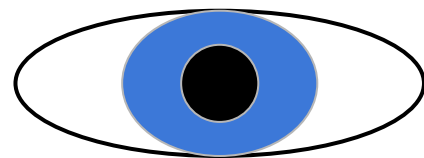
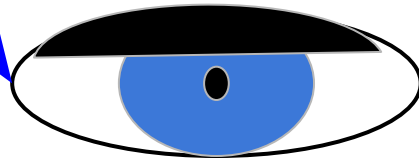
Right Horner's



Phenylephrine 1%



Horner's due to
postganglionic (3rd
order) lesion



Horner's due to 1st or 2nd

Localizing Horner's Syndrome

Is it a Horner's? 0.5-1% apraclonidine will dilate Horner's (but not a normal pupil) by >1mm after 30-40min	1% hydroxyamphetamine	1% phenylephrine (longstanding Horner's only)
Central (1st order)	Dilation of Horner's pupil Dilation of normal pupil	No dilation of Horner's pupil Minimal dilation of normal pupil
Preganglionic (2nd order)	Dilation of Horner's pupil Dilation of normal pupil	No dilation of Horner's pupil Minimal dilation of normal pupil
Postganglionic (3rd order)	No dilation of Horner's pupil Dilation of normal pupil	Dilation of Horner's pupil Minimal dilation of normal pupil

Anisocoria Testing - too small

- Horner's Syndrome / Oculo-sympathetic paresis
 - No treatment for Horner's itself
 - Resolution is often possible if/when underlying cause is cured
 - Few weeks to few months
 - Can use 2.5% phenylephrine in affected eye to cosmetically resolve anisocoria

FALCON
PHARMACEUTICALS

Phenylephrine
Hydrochloride
Ophthalmic
Solution

2.5%

5 mL STERILE

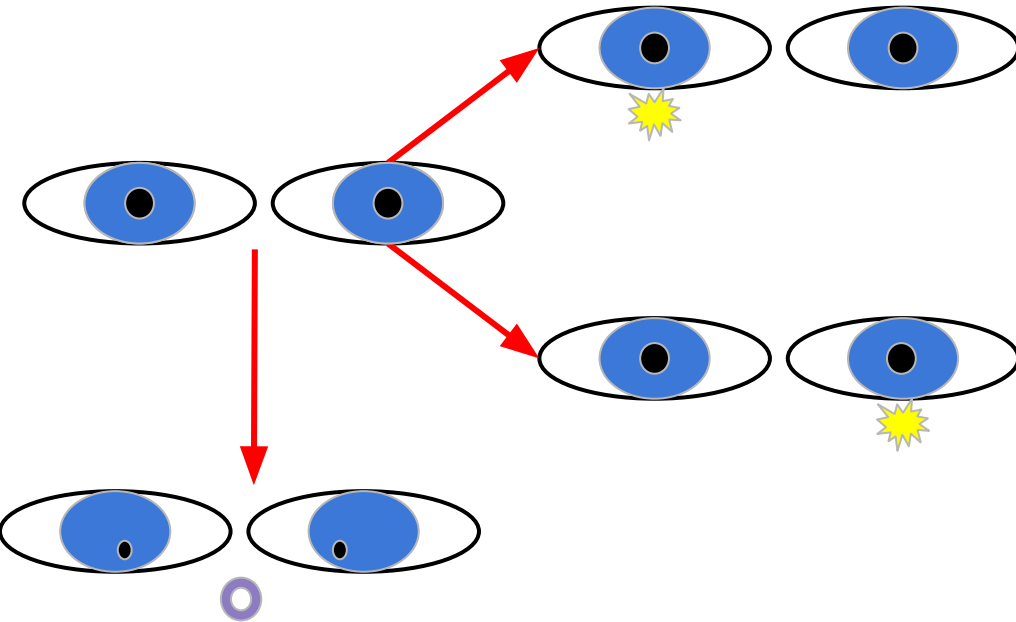
AFFILIATE OF
ALCON
LABORATORIES, INC.



Anisocoria Testing - too small

- Argyll-Robertson Pupils
 - Asymmetrically, bilateral small and irregular pupils that
 - Respond poorly to light
 - Respond poorly to dilation
 - Light-Near Dissociation → pupil constriction to near response *markedly better* than to light response

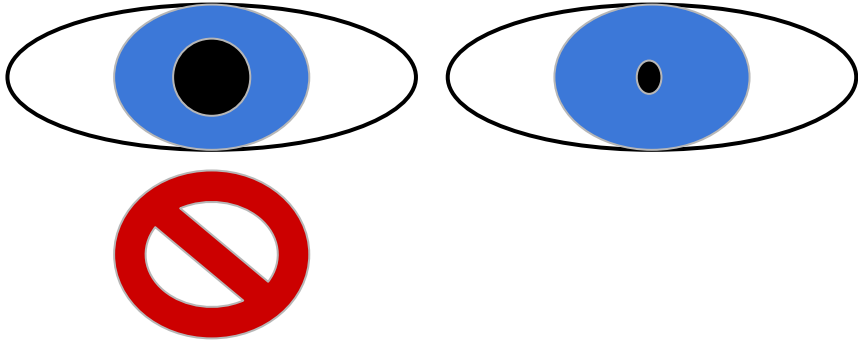
Argyll-Robertson Pupils



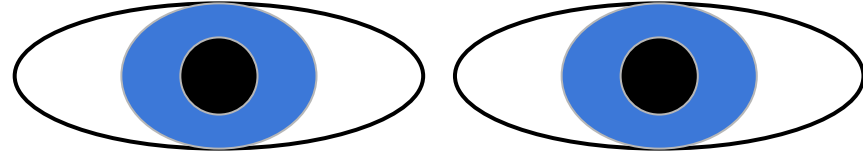
- Due to lesion in the Edinger-Westphal nucleus
- Associated with chronic syphilis, MS, DM, Wernicke's encephalopathy
 - Bloodwork indicated
 - CBC
 - Metabolic Panel
 - FTA-Abs, RPR/VDRL
 - Imaging

Anisocoria worse in bright light

Bright



Dim



Pupil Testing



- Anisocoria - worse in **bright light**
 - Larger pupil is not constricting properly
 - Parasympathetic problem
 - Pharmacologic dilation
 - Trauma
 - Adie's tonic pupil
 - Cranial nerve III palsy

Anisocoria Testing - too big

- Pharmacologic Dilation - bi or unilateral
 - Anticholinergics
 - Scopolamine - motion sickness patches
 - Permethrin - insecticide
 - Plants
 - Angel's trumpet, jimson weed, belladonna
 - OTC products
 - Phenylephrine - antihistamines, 'get the red out' drops, anti-itch creams, nose spray



Anisocoria Testing - too big

- Pharmacologic Dilation
 - Recreational drugs
 - Alcohol
 - Stimulants - cocaine, crack, methamphetamines
 - Ecstasy, LSD, Acid, Hallucinogens
 - Marijuana, inhaled propellants



Anisocoria Testing - too big

- Pharmacologic Dilation
 - Fixed or sluggish and dilated
 - Will **not constrict** to 1% pilocarpine



Anisocoria Testing - too big

- Trauma
 - Trauma / surgery to circular iris sphincter at edge of pupil
 - Can be full or sectoral



Anisocoria Testing

- Adie's Tonic Pupils

- Lesion to ciliary ganglion or short posterior ciliary nerve which innervate iris constrictor
- Most common cause is ***postviral denervation*** of pupil sphincter

Orbital trauma

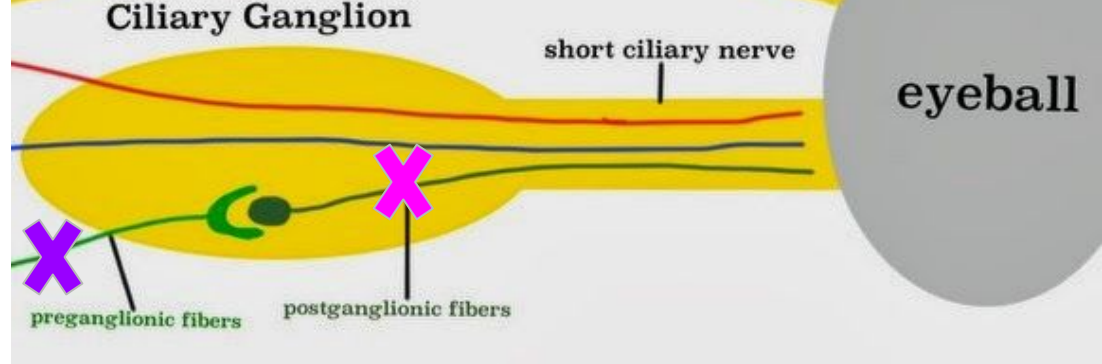
Diabetes

Syphilis

Virus

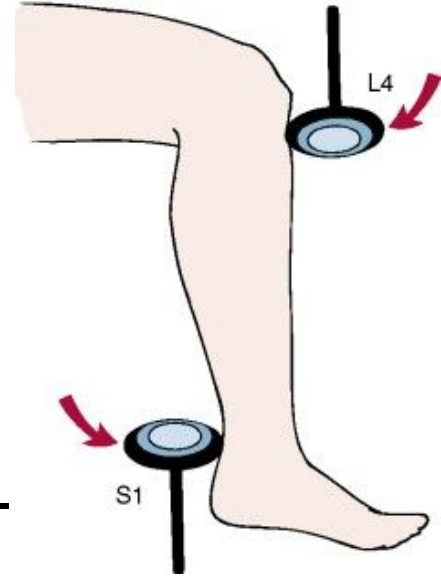
Giant cell arteritis

Varicella-Zoster



Anisocoria Testing - too big

- Tonic Pupils
 - Adie's tonic pupil
 - Idiopathic tonic pupil found in 20-40yo females
 - Markedly diminished or absent deep tendon reflexes in knee and ankle frequently found



Anisocoria Te

- Tonic Pupils
 - Unilateral
 - Can become bilateral at rate of 4% / year
 - Anisocoria diminishes with time as larger tonic pupil becomes more miotic with age
 - Long standing Adie's pupil will be miotic and remain constricted



Anisocoria Testing - too big

- Characteristic findings
 - Sluggish, segmental pupillary sphincter palsies
 - Light-near dissociation
 - Better (but still poor) pupil constriction to near with slow redilation
 - Vs. Argyle-Robertson where the constriction to near is quick and normal
 - Denervation hypersensitivity - *supersensitive* constriction to diluted pilocarpine (0.125%)



A: poor response to light
B: better response to near but not brisk
C: sluggish redilation at far gaze

Anisocoria Testing - too big

- Tonic Pupils
 - No treatment available
 - Mild miotics may help for symptomatic glare
 - Brimonidine
 - Low-dose pilocarpine
 - Bifocal for accommodation
 - Cosmetic CL for aniso



Anisocoria Testing - toc

- Cranial Nerve III Palsy

- CN III palsy signs

- Moderate-Large ptosis

- levator palpebra

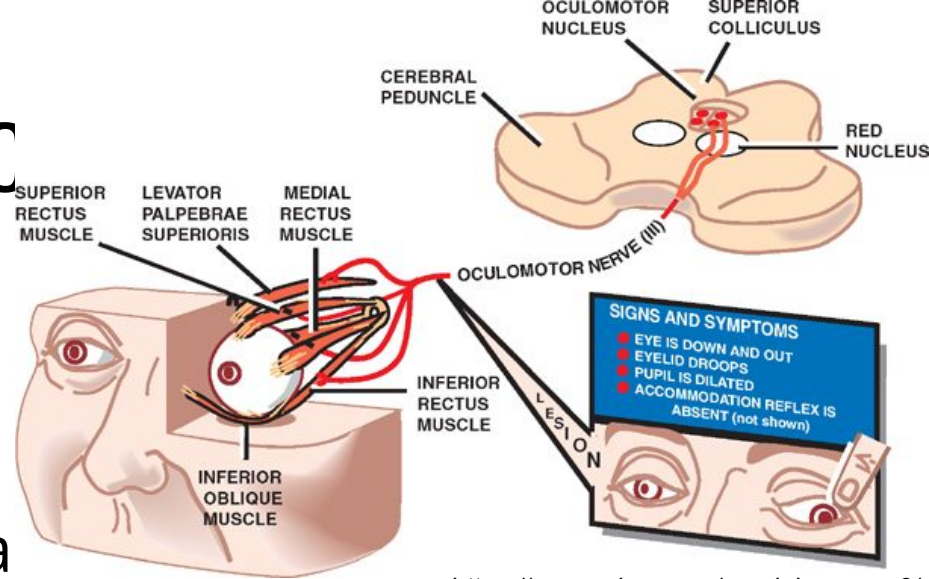
- Exotropia and hypotropia (down and out)

- Medial, superior, inferior recti, inferior oblique

- Eye does not adduct on EOM testing

- Pupil dilation (sometimes)

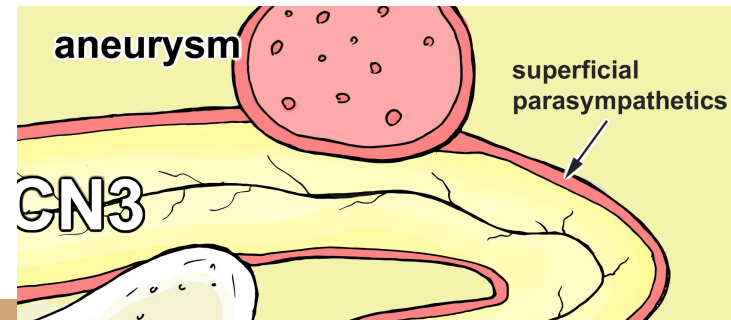
- Unilateral accommodative dysfunction



<https://neupsykey.com/cranial-nerves-3/>

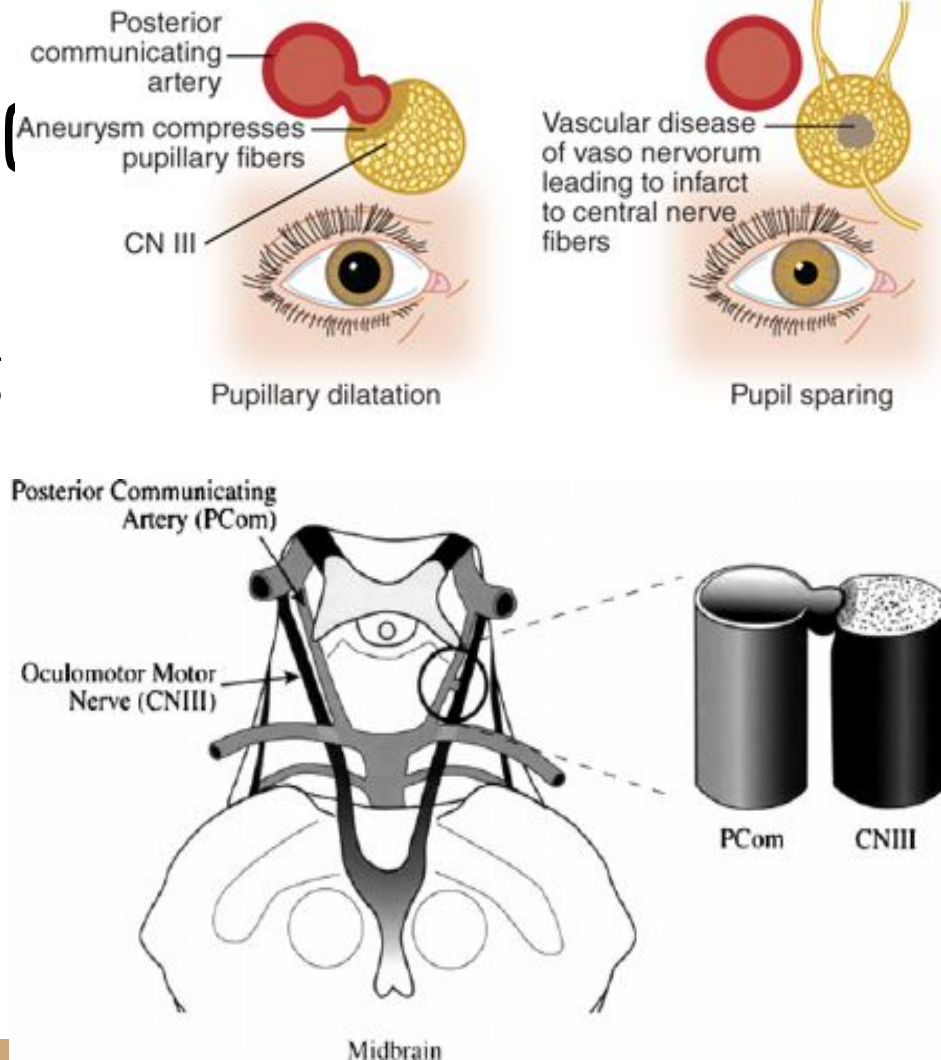
Anisocoria Testing - too big

- Cranial Nerve III Palsy
 - Pupillary fibers are close to surface of CN III → susceptible to compression via mass or aneurysm at or close to CN III
 - Inability for pupil to constrict
 - Poor accommodation

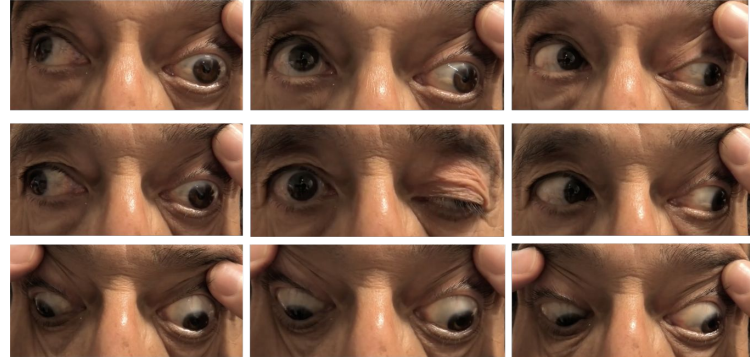


Anisocoria Testing - to

- Cranial Nerve III Palsy
 - Posterior communicating artery aneurysm presents with a CN III palsy 30-60% of the time
 - Other causes:
 - Ischemia
 - Tumor
 - Trauma



Anisocoria Testing - too big



- Cranial Nerve III Palsy

- A **COMPLETE** CN III palsy with **no pupil involvement** and **no other neurologic symptoms** is likely ischemic in nature (DM, HTN, HCL, Smoking, Age, GCA)
 - Pupil-sparing may become pupil-involving over time
 - 14% of CN III palsies due to aneurysm may not have pupil involvement in early stages → monitor daily for pupil involvement the first week
 - Follow very closely with neurologist

Anisocoria Testing - too

- Cranial Nerve III Palsy
 - a. Complete CN III palsy ***with pupil involvement***
 - b. **Incomplete** CN III palsy (some EOMs still functioning)
 - c. CN III palsy with **other neurological signs** or complications like headache or neck stiffness
 - IMMEDIATE ER / Neuro consult with neuroimaging and angiography



Defects of Pupillary Light Response

Pupil Testing

- Remove glasses
- Fixate on a *non-accommodative* distance target
- Perform in bright then dim room (visualize pupils)
- Stand off to the side



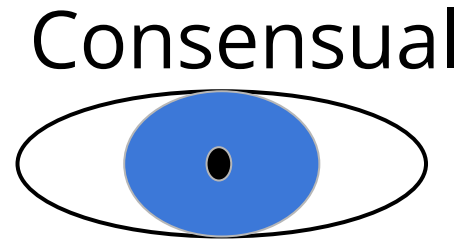
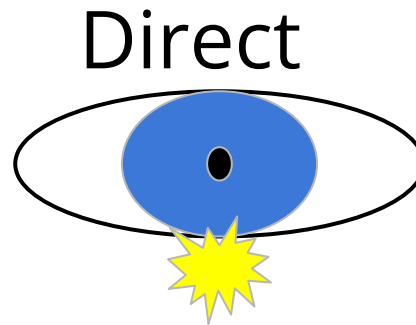
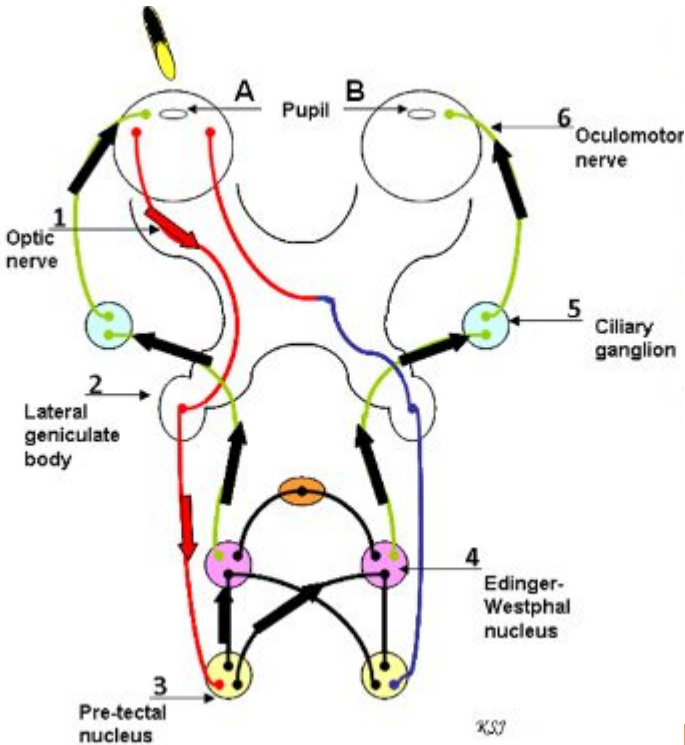
Pupillary Light Response



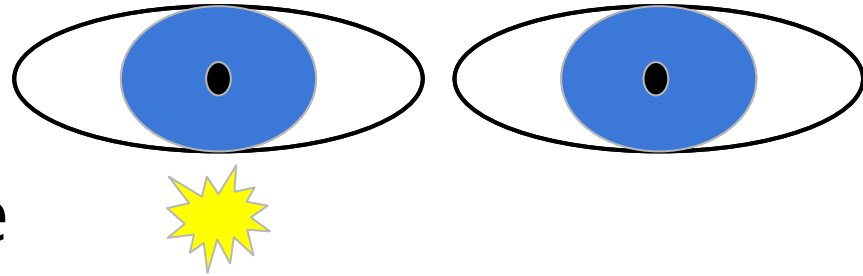
- Observe pupils before introducing light to look for anisocoria
- Dim room, patient fixates at distance with glasses off
- Use transilluminator or light from BIO ~1 inch away
- Point light directly into eye - Stray light can cause non-tested pupil to constrict
- Quickly move light to left eye in a “U” motion
 - Avoid stimulating accommodation
- Hold light for 2-4 seconds
 - Observe both tested and non-tested pupil response
- Repeat 3 - 4 times
- Magnitude and duration must be constant

Swinging Flashlight / Marcus Gunn Test

Direct → Consensual → Swinging Flashlight



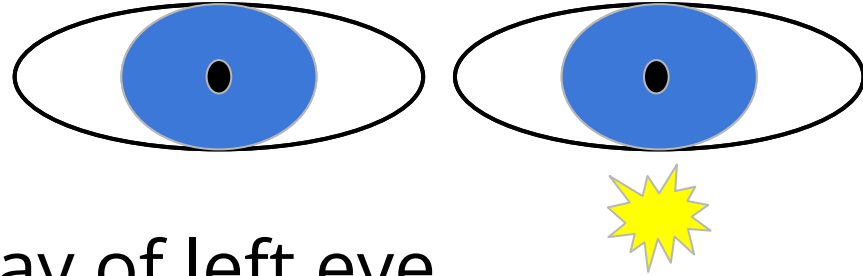
Pupillary Light Response



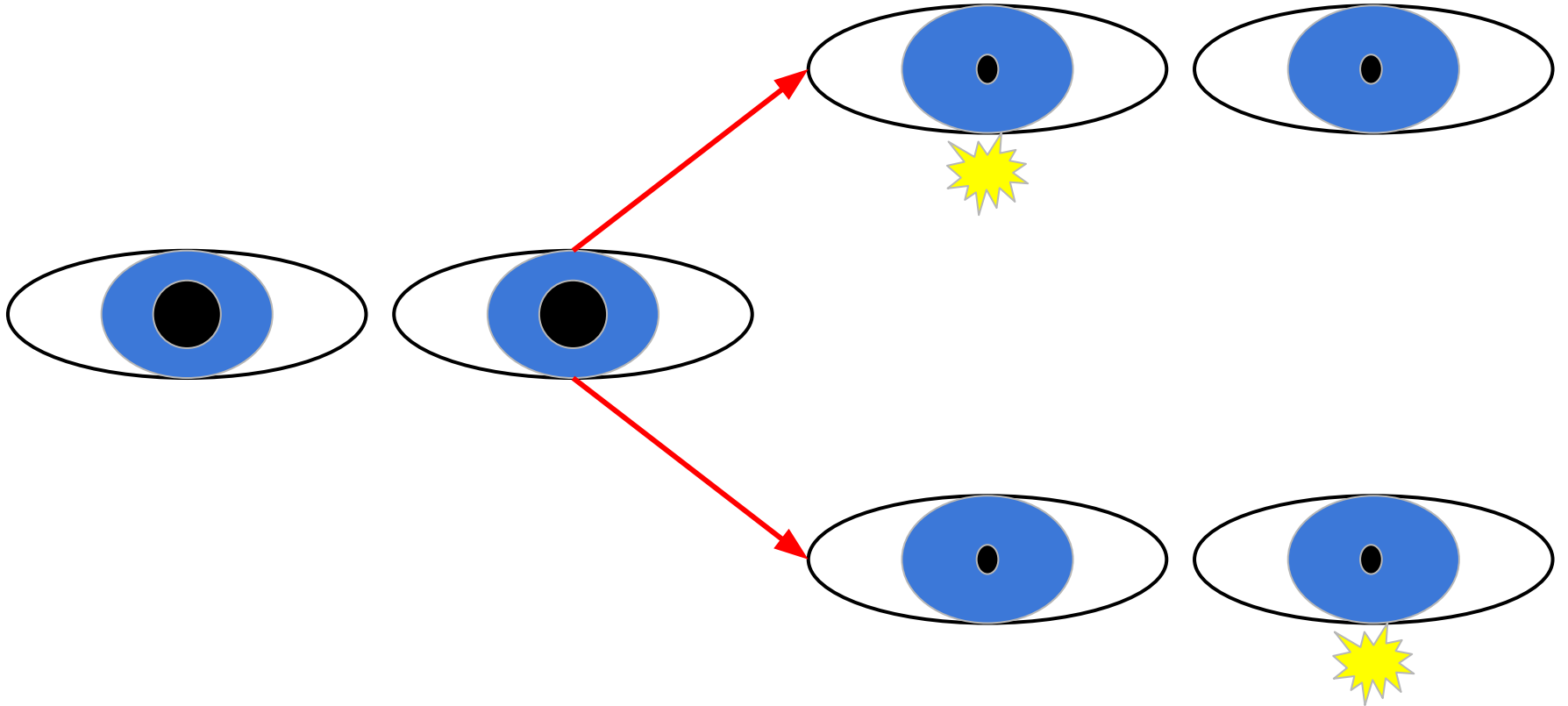
- Light pointed into right eye
- Measuring **afferent** pathway of right eye
 - Observe *direct* response of right eye
 - Observe *consensual* response of left eye
 - Constriction amount (quantity), rapidity (quality), and time to release should be the same in both eyes

Pupillary Light Response

- Light pointed into left eye
- Measuring **afferent** pathway of left eye
 - Observe *direct* response of left eye
 - Observe *consensual* response of right eye
 - Similar quantity, quality, and release



Normal pupil response



Swinging Flashlight / Marcus Gunn Test

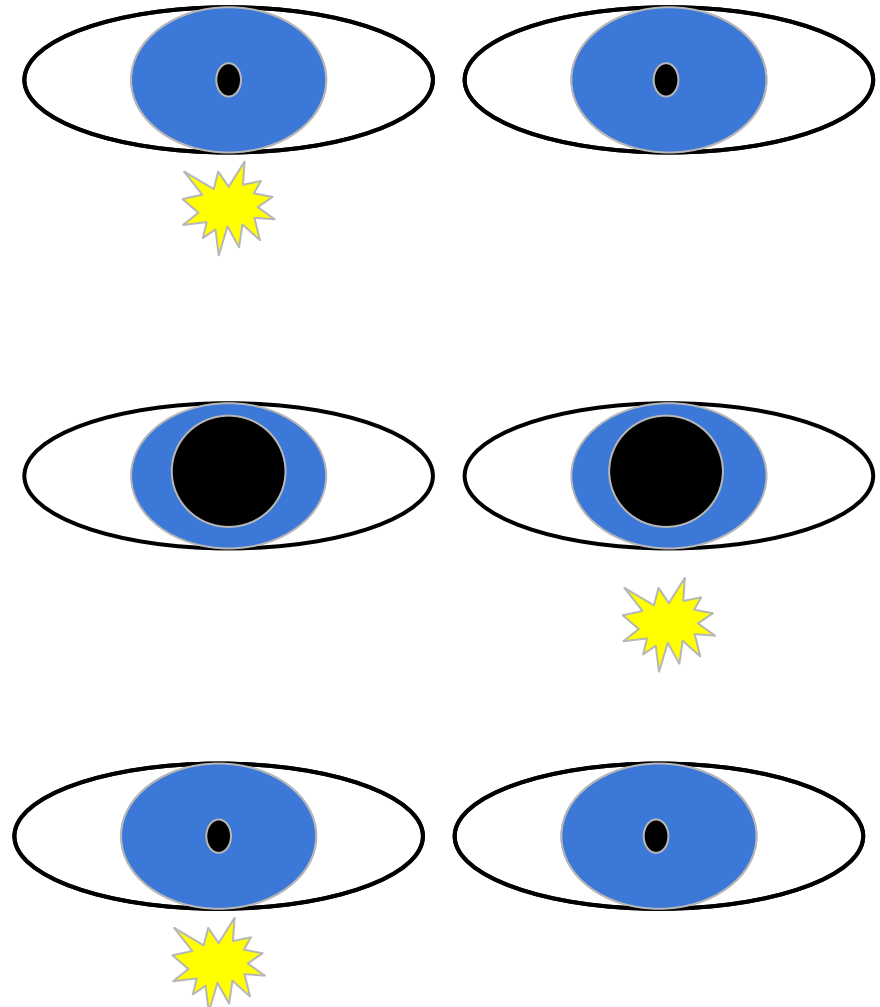
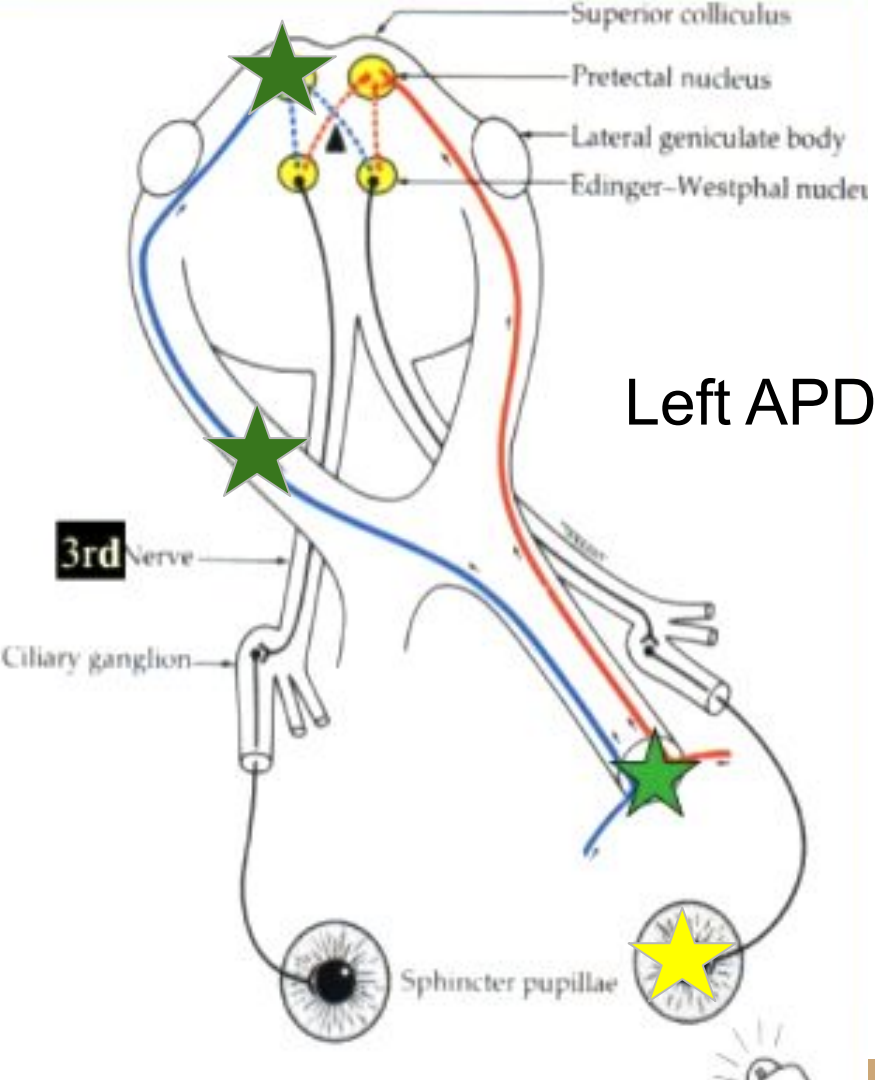
- RAPD alone does **not cause** anisocoria
 - Due to consensual response pupils will look the same size
 - **Anisocoria** is due to an efferent, traumatic, mechanical, or pharmacological etiology

Swinging Flashlight / Marcus Gunn Test

- **Afferent** Pupillary Light Reflex-Optic Nerve and Tract
 - Strength of *direct* pupillary light response compared to strength of *consensual* pupillary light response in the **SAME EYE** - a RELATIVE comparison
 - Relative **Afferent** Pupillary Defect (RAPD)
 - Damage **at or before the Pretectum / Midbrain**

Swinging Flashlight / Marcus Gunn Test

- Relative **Afferent** Pupillary Defect
 - *Consensual* response of an eye is **greater** than *direct* response of the **same eye**
 - Unilateral or asymmetric damage to anterior visual pathway (afferent) on that side



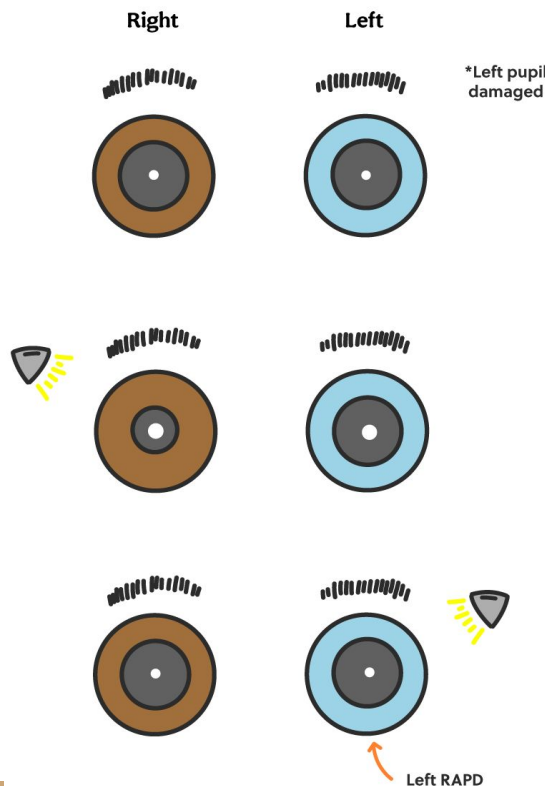
Swinging Flashlight / Marcus Gunn Test

- Consensual Response / Reverse APD Test
 - Only one functioning pupil or one visible pupil needed to test for RAPD in **either** eye
 - Surgical / traumatic / pharmacologic pupil
 - Obscured view of pupil
 - Anisocoria

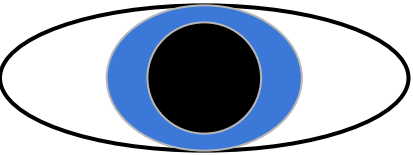
Swinging Flashlight / Marcus Gunn Test

Reverse RAPD Testing

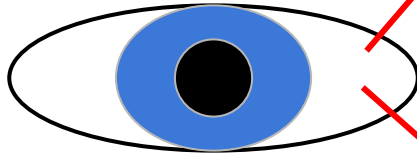
- Consensual Response / Reverse APD Test
 - Perform as usual but observe ONLY the VISIBLE / REACTIVE pupil
 - Compare *that* eye's direct response to *that* eye's consensual response
 - If working pupil constricts more with direct illumination than with consensual, RAPD is present in the *opposite*, unreactive or unobservable eye



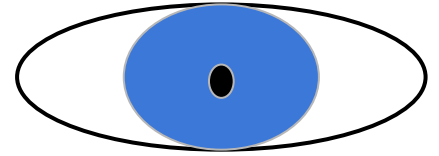
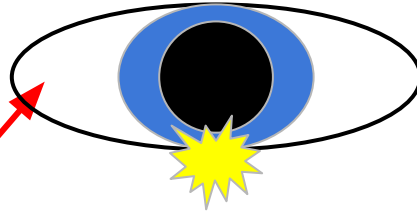
Pupil with no APD/MG
(fixed due to medication
or synechia)



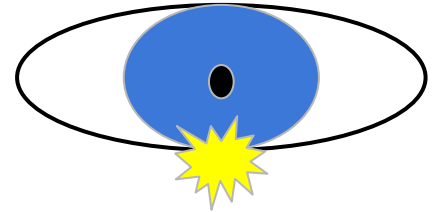
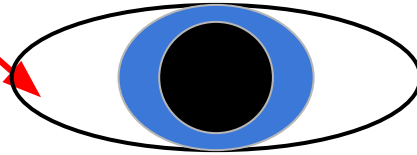
Fixed pupil



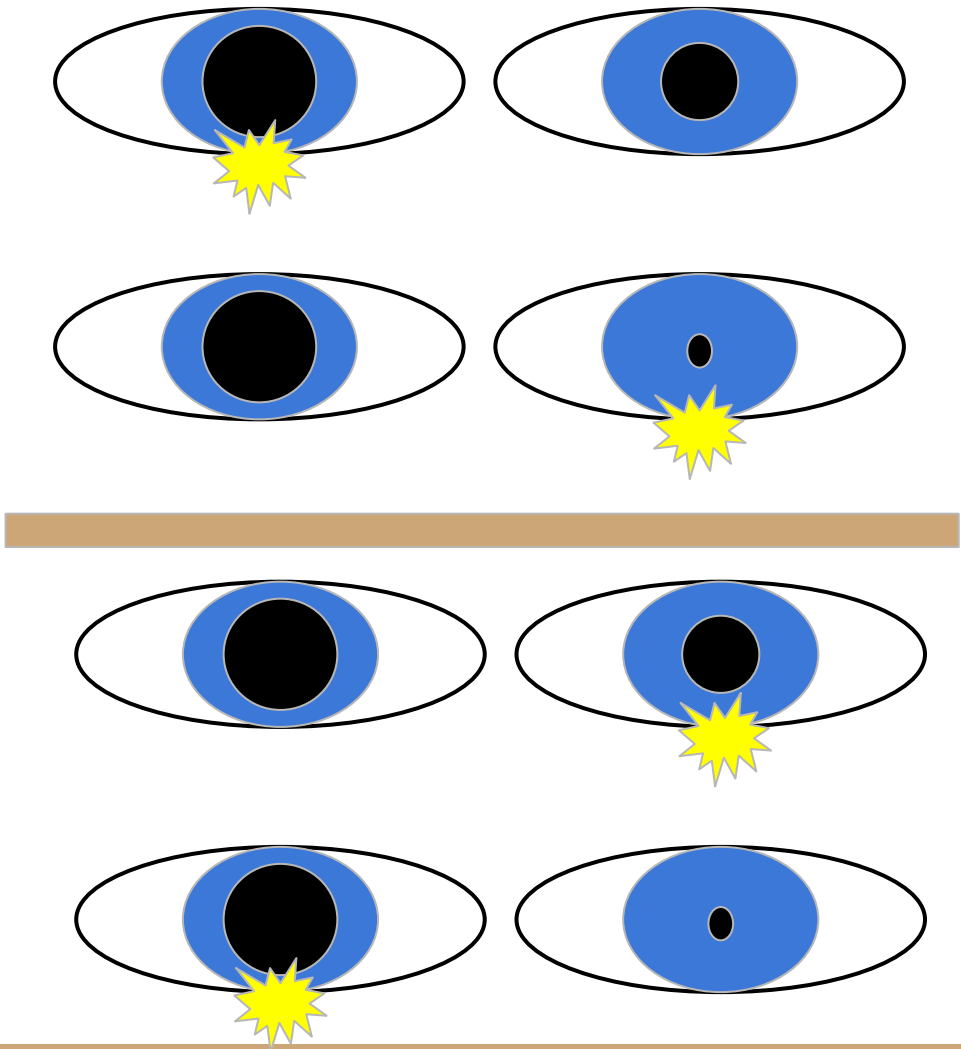
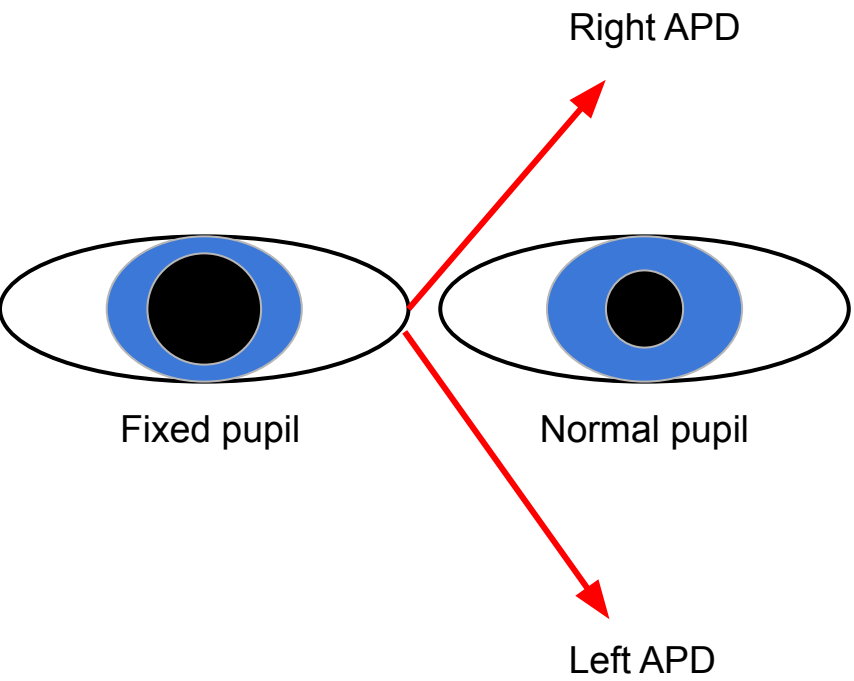
Normal pupil



Look only at
the left pupil's
response



*do not spend longer
on one eye than the
other*



Swinging Flashlight / Marcus Gunn Test

- Grading an APD can help identify
 - Subtle defects
 - Monitor progression
- Visual acuity does not necessarily correlate with RAPD
 - However, always look carefully for an APD in cases of reduced BCVA in one eye

Swinging Flashlight / Marcus Gunn Test

Grading Scale of RAPD

- Grade 1+: weak initial pupillary constriction followed by greater redilation
- Grade 2+: initial pupillary stall followed by greater redilation
- Grade 3+: immediate pupillary dilation
- Grade 4+: no reaction to light (amaurotic)

Swinging Flashlight / Marcus Gunn Test

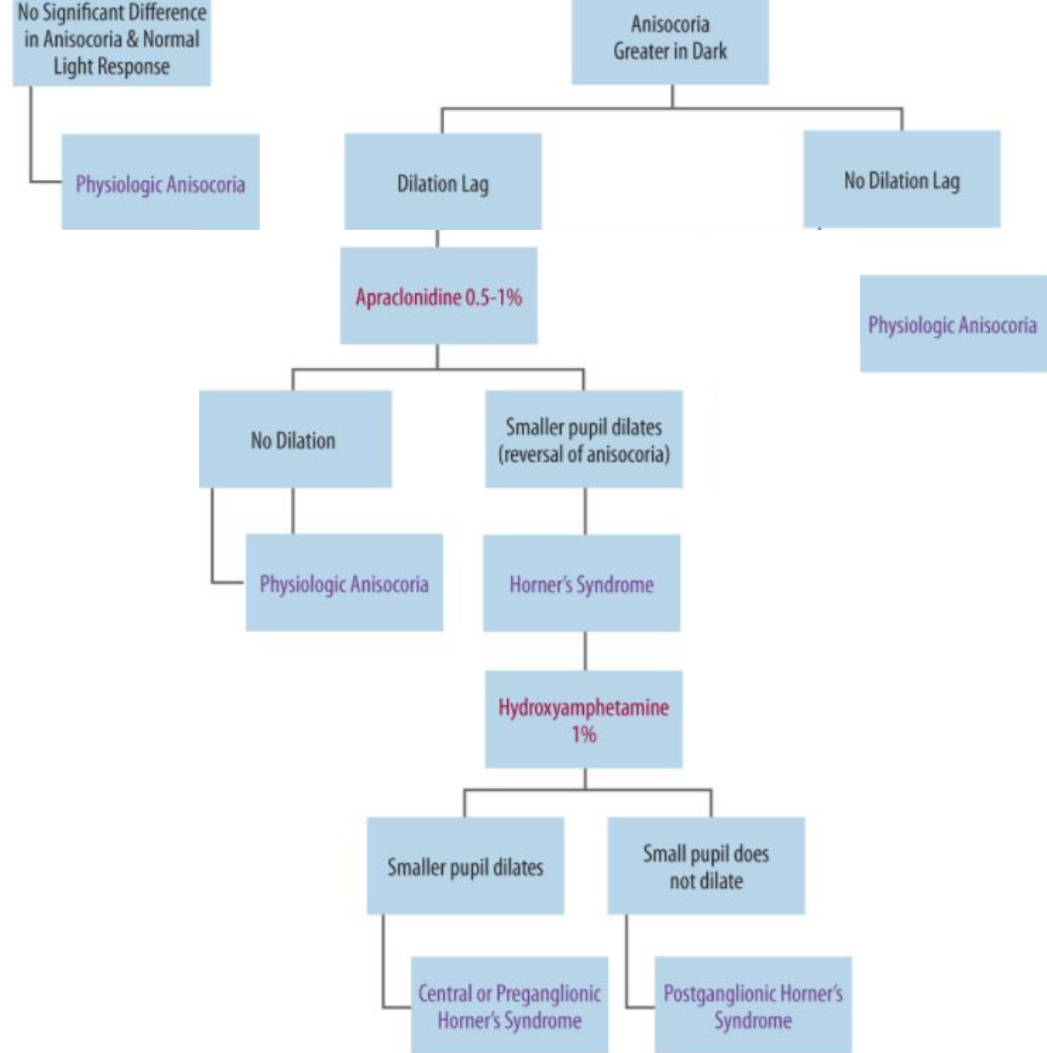
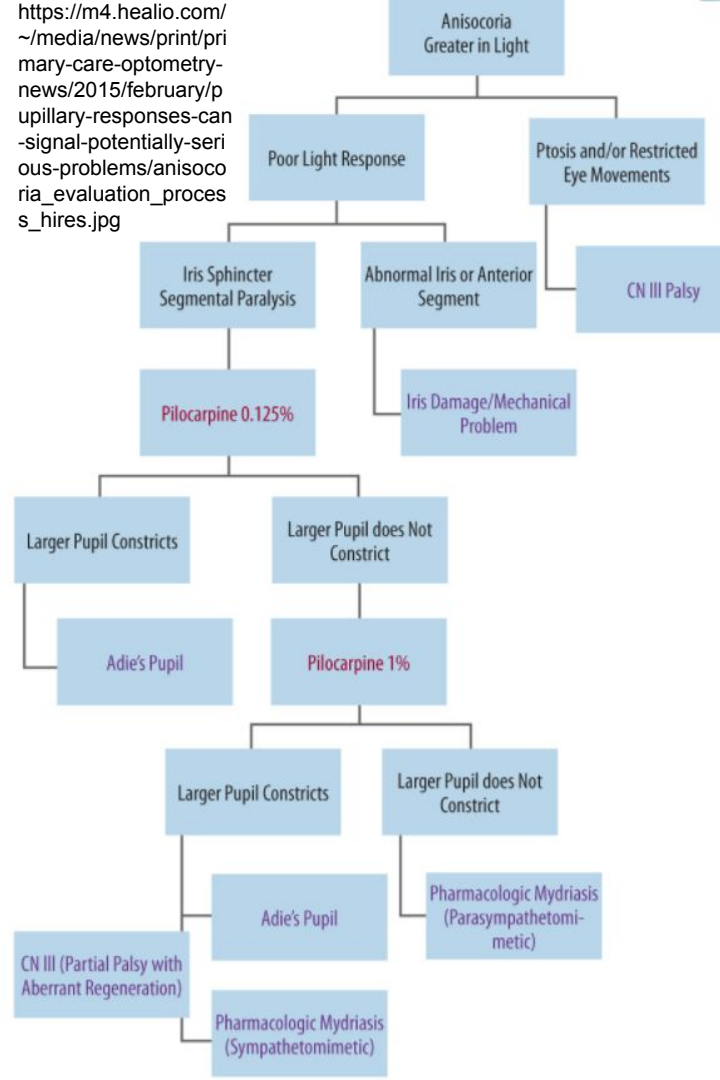
- Neutral density filter

Dim amount of light entering the 'better' eye until the afferent responses are equal and RAPD is resolved



P.E.R.R.L.A (+ / - RAPD / MG)

- PE: pupils are equal
- R: pupils are round
- RL: pupils are equally reactive to light
 - Direct and Consensual
- A: pupils constrict to accommodation (only performed to check for near-light dissociation if pupils poorly constrict to light)
 - Leave off if not checked → PERRL (-) APD
- + or - relative afferent pupillary defect
 - Note grade and which eye if positive



Conclusion

- Pupillary testing is an important component of every comprehensive eye examination
- Careful observation may reveal important information about the anterior visual pathway as well as the autonomic nervous system

Conclusion

A comprehensive history can be key
in proper diagnosis

Loss of vision / BCVA

Loss of visual field

Pain

Diplopia

Ptosis / Proptosis

Color vision / Red desat

Surgical history

Trauma history

Medication history

Medical history

tumor, aneurysm, HA, ear

infection, inflammation

Questions

- Will an afferent pupillary defect produce anisocoria (different pupil sizes)?
- If a pupil constricts well to near viewing but not to a light stimulus, what does that indicate?
- How can you tell if an anisocoria is physiologic or not?
- What does the 'A' in PERRLA stand for and when do we test for it?
- When is a third nerve palsy an emergency vs. an urgency?
- How do you test for an APD if one pupil is synched or fixed and dilated?
- What common glaucoma medication do I have in my office to help confirm a Horner's syndrome?



Thank You

?Questions?

tvpetrosyan@gmail.com