Vestibulocochlear Nerve And Vision

The vestibulocochlear nerve (8)

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- The VIII cranial nerve has two functional parts, the vestibular and the cochlear components .
  - The cochlear branch for hearing
- Examination;
  - Whispered voice test
  - Weber's test (using 256 Hz or 512 Hz)
  - Rinne's test (using 256 Hz or 512 Hz)

Whispered voice test

- Stand behind the patient about 15 cm from the patient , rub the tragus of the other ear to mask hearing in the patient's other
- Ask the patient to repeat a combination of numbers and words
- Start with a normal speaking voice to confirm that the patient understands the test
- Lower your voice to a clear whisper
- Repeat the test but this time at arm's length from the patient's ear.

- People with normal hearing can repeat words whispered at 60 cm.

Weber's test

- Place the base of the vibrating tuning fork in the middle of the patient's forehead
- Ask the patient, 'Where do you hear the sound
- **Normal test : the noise is heard in the middle, or equally in both ears.**

- In conductive hearing loss the sound is heard louder in the affected ear
- In unilateral sensorineural hearing loss it is heard louder in the unaffected ear
- If there is symmetrical hearing loss it will be heard in the middle

Rinne’s test

- Place the vibrating tuning fork on the mastoid process
- Wait until the sound disappears then place it at external auditory meatus and ask, ‘Is it louder in front of your ear or behind?

- **With normal hearing : air conduction (AC) is better than bone conduction (BC) is recorded as 'Rinne-positive'**

- In conductive hearing loss, bone conduction is better than air conduction (BC>AC) , Rinne-negative

- In sensorineural hearing loss, Rinne's test will be positive

- A false-negative Rinne's test may occur if there is profound hearing loss on one side. This is due to sound being conducted through the bone of the skull to the other 'good' ear

Rinne test

Rinne test 2

Weber's test

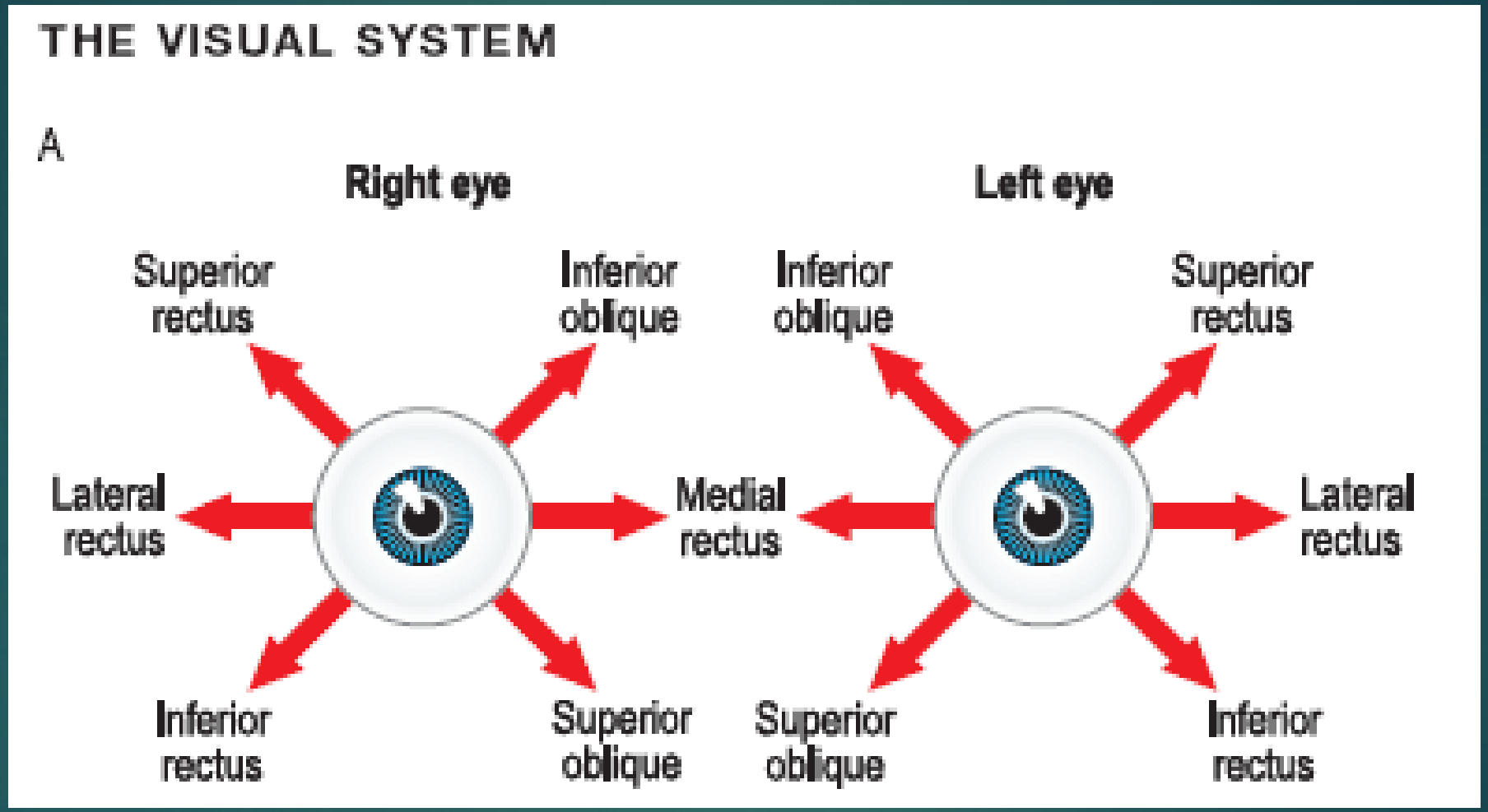

Vision

Anatomy

- The eye is located inside the orbit
- It is covered by eyelids to maintain tear film
- Elevation of the eyelid is done by:
  1. Levator palpebrae superioris (CN3)
  2. Muller muscle (sympathetic nerves)
- Closure by orbicularis oculi (CN7)

- Conjunctiva is a thin mucous membrane lining the posterior aspects of the eyelids. The conjunctiva is coated in a tear film that protects and nourishes the ocular surface.

- There is six extraocular muscles:



- All are supplied by CN 3 , except superior oblique by CN 4 (**SO4)** and lateral rectus by CN 6 **(LR6)**

- 3rd , 4th CN originate form midbrain and 6th CN from pons then all of them pass through cavernous sinus

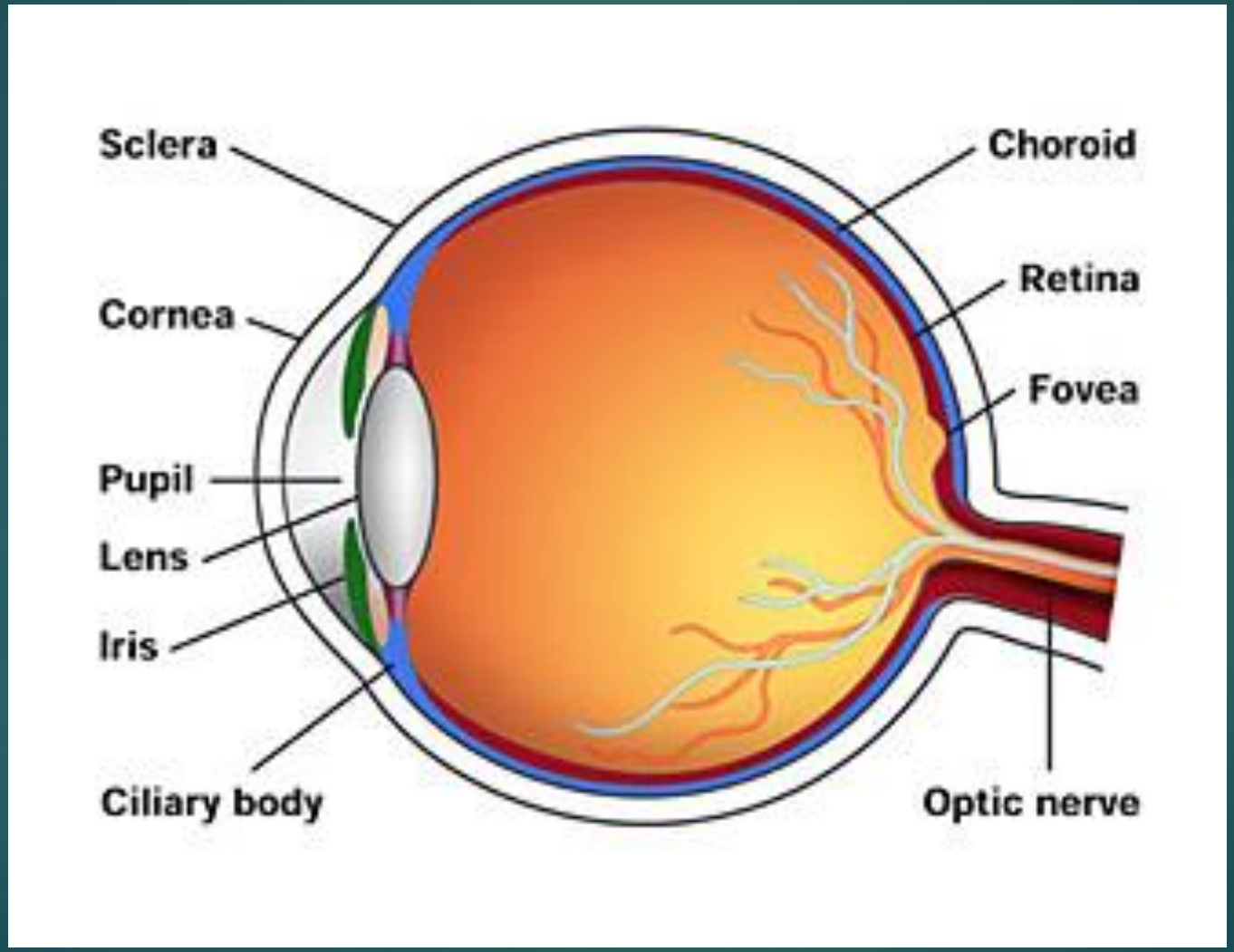
- The eyeball comprises three distinct layers:

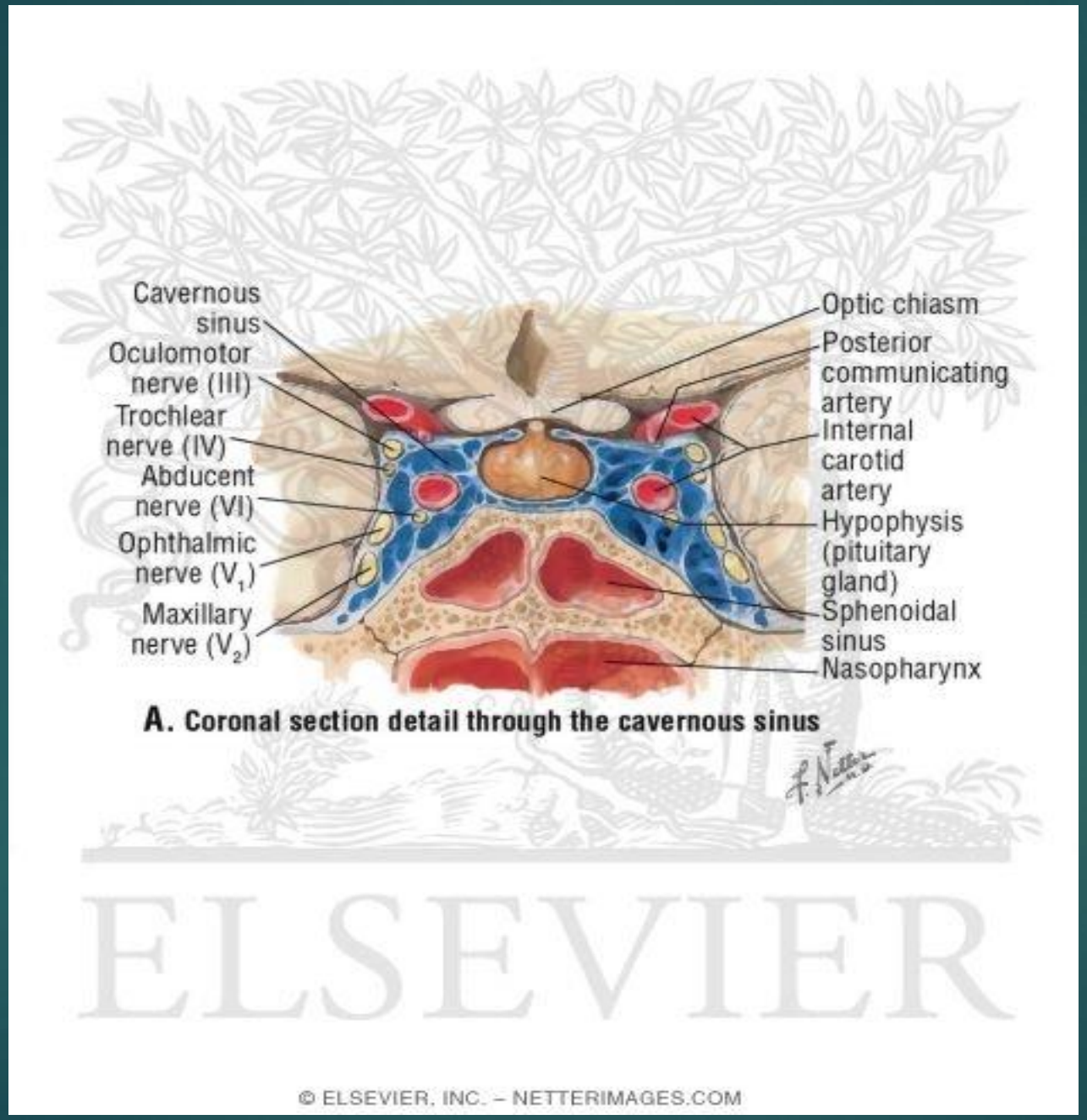
1. Outer fibrous layer: this includes the sclera and the clear cornea. The cornea accounts for two-thirds of the refractive power of the eye focusing incident light on to the retina.

2. Middle vascular layer (uveal tract): anteriorly this consists of the ciliary body and the iris, and posteriorly the choroid

3. Inner neurosensory layer (retina): responsible for converting light to neurological signals

The eye


Sclera
Cornea
Pupil
Lens
Iris
Ciliary body
Choroid
Retina
Fovea
Optic nerve


Cavernous sinus
Oculomotor nerve (III)
Trochlear nerve (IV)
Abducent nerve (VI)
Ophthalmic nerve (V_1)
Maxillary nerve (V_2)
Optic chiasm
Posterior communicating artery
Internal carotid artery
Hypophysis (pituitary gland)
Sphenoidal sinus
Nasopharynx
A. Coronal section detail through the cavernous sinus
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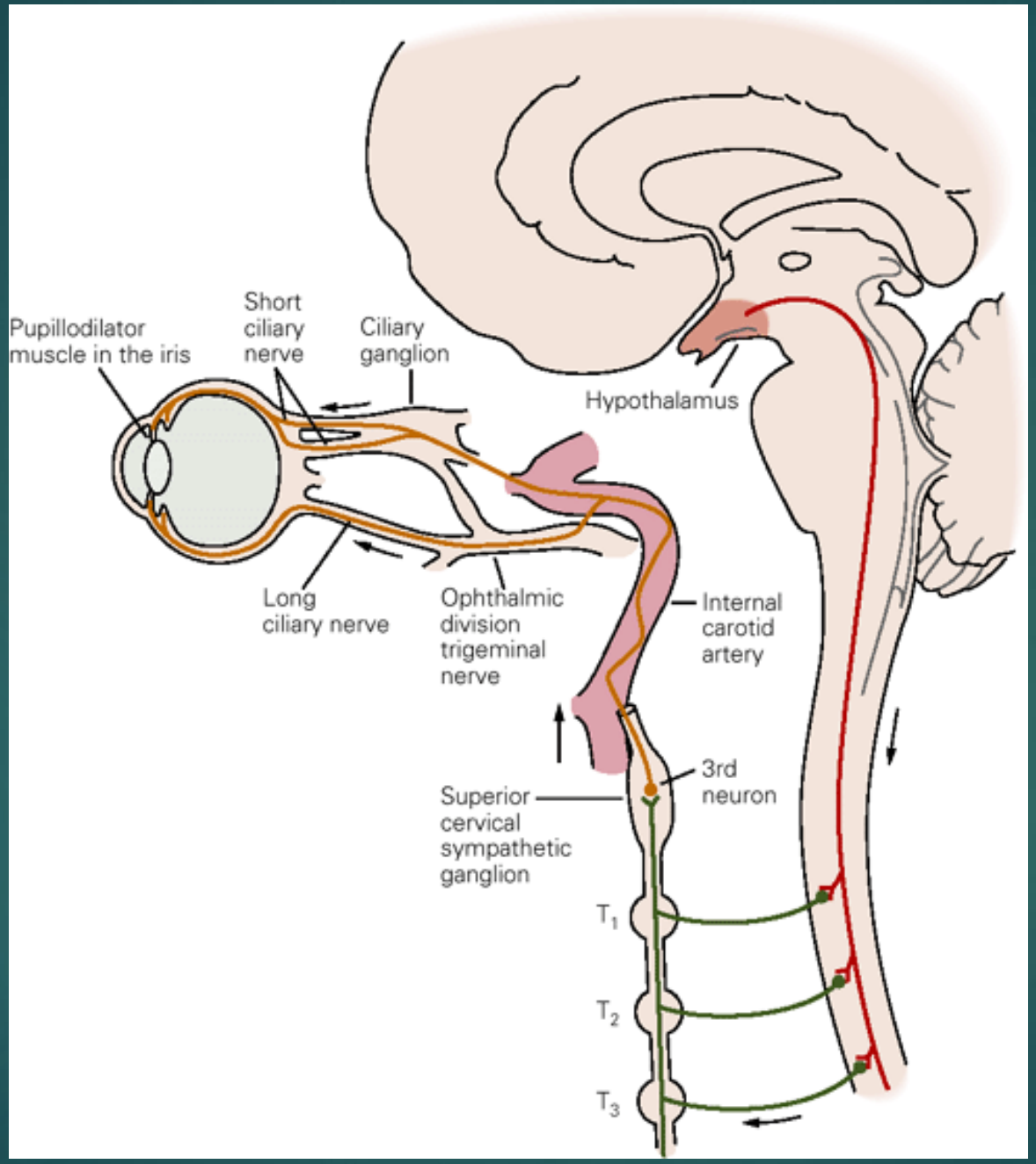
Pupillay pathway

- Pupils control the amount of light entering the eyes

Pupillary dilataion

- The sympathetic pathway originates in the hypothalamus, passing down to the ciliospinal centre of Budge at the level of T1. Fibres then synapse in the superior cervical ganglion before joining the surface of the internal carotid artery and passing to the pupil along the nasociliary and the long ciliary nerves


Pupillodilator muscle in the iris
Short ciliary nerve
Ciliary ganglion
Hypothalamus
Long ciliary nerve
Ophthalmic division trigeminal nerve
Internal carotid artery
3rd neuron
Superior cervical sympathetic ganglion
T1
T2
T3

The pupillary reflex (2-3) : Pupillary constriction

- The afferent limb involves the optic nerve, chiasm (where some fibres decussate) and the optic tract, bypassing the lateral geniculate nucleus , synapsing in the pretectal nucleus of the midbrain then terminate in the III nerve (Edinger–Westphal) nucleus.

- The efferent limb involves the inferior division of the III nerve, passing through the ciliary ganglion in the orbit to the constrictor muscle of the iris via ciliary nerves.

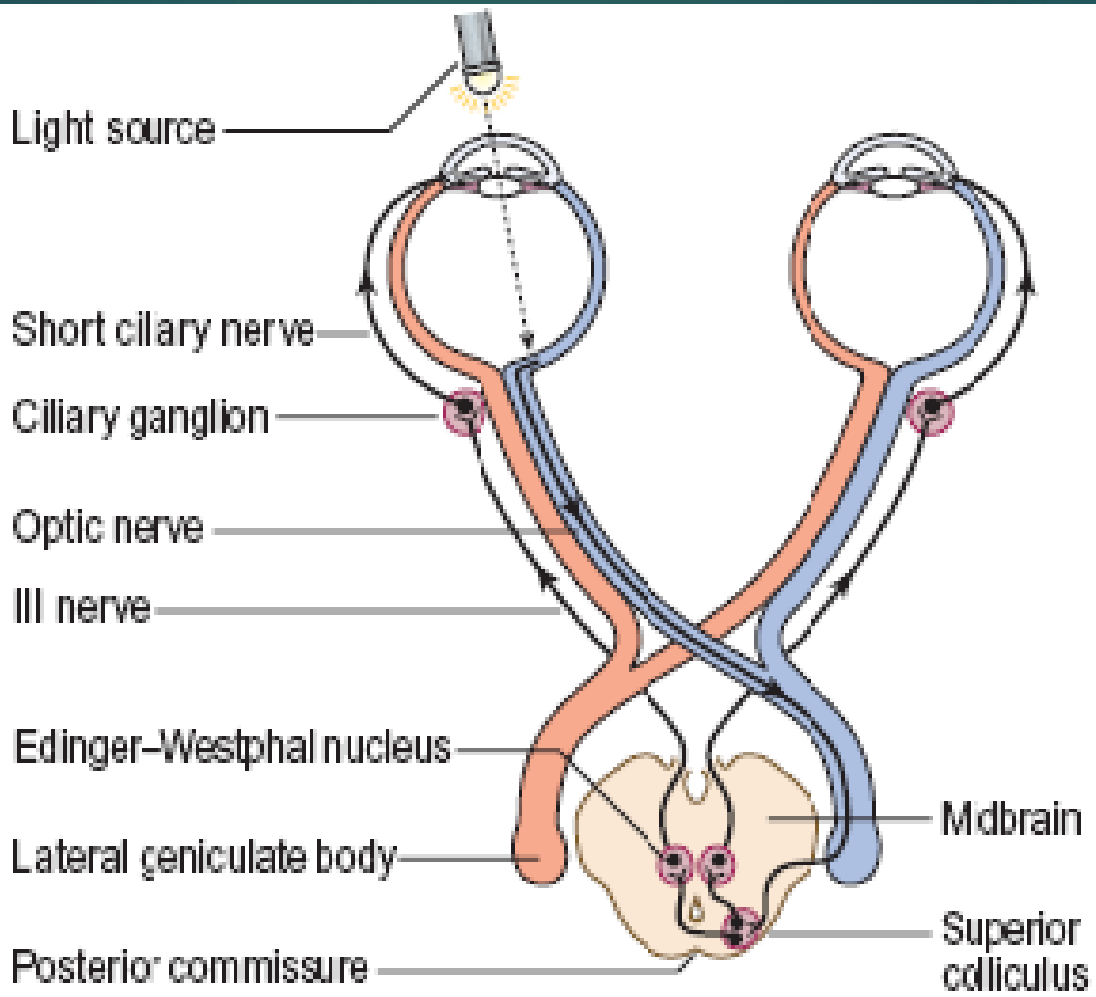


Fig. 12.5 Pathway of pupillary constriction and the light reflex (parasympathetic).

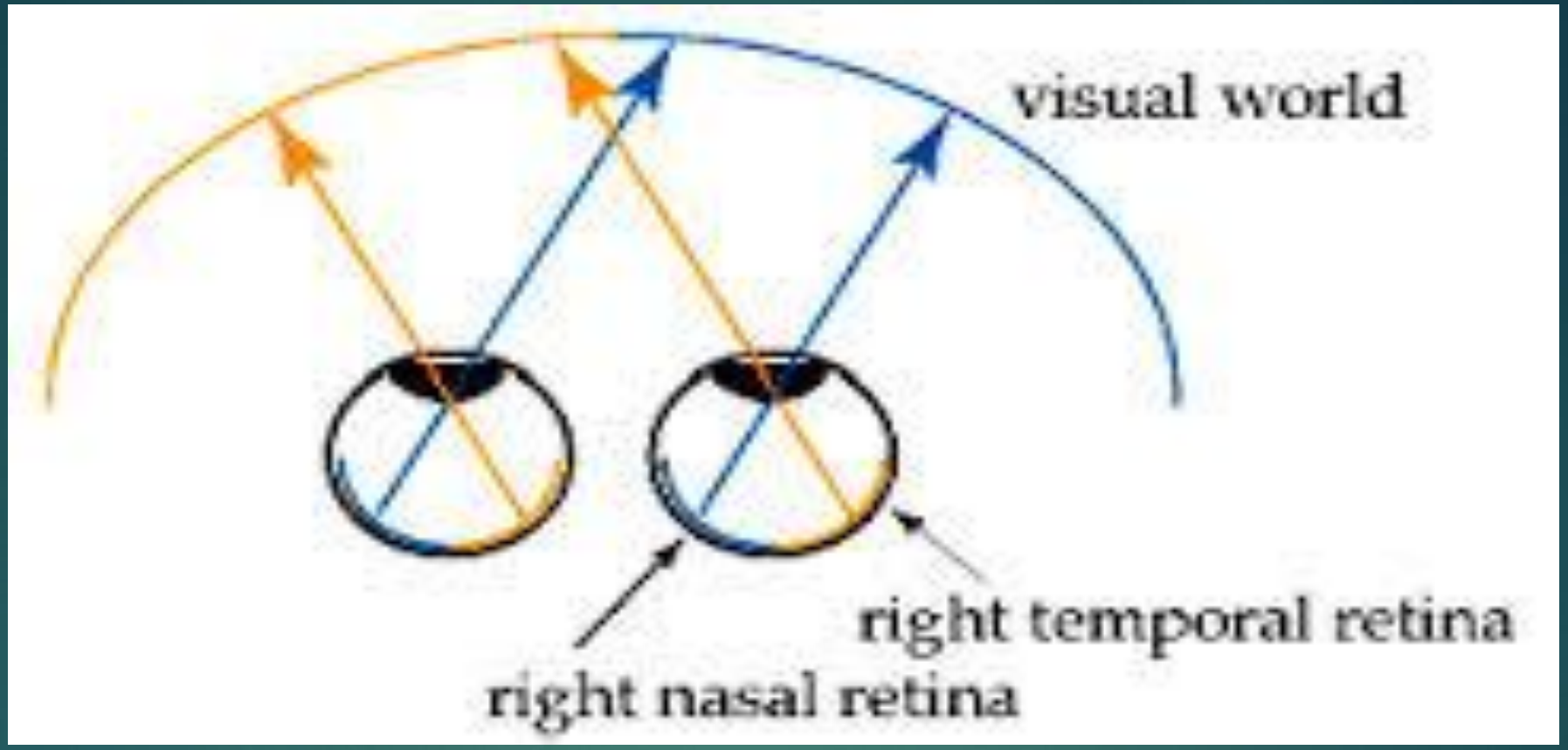
The optic nerve (2)

- Purely sensory
- Similar to white matter rather than peripheral nerve, is unable to regenerate
- **Function:**

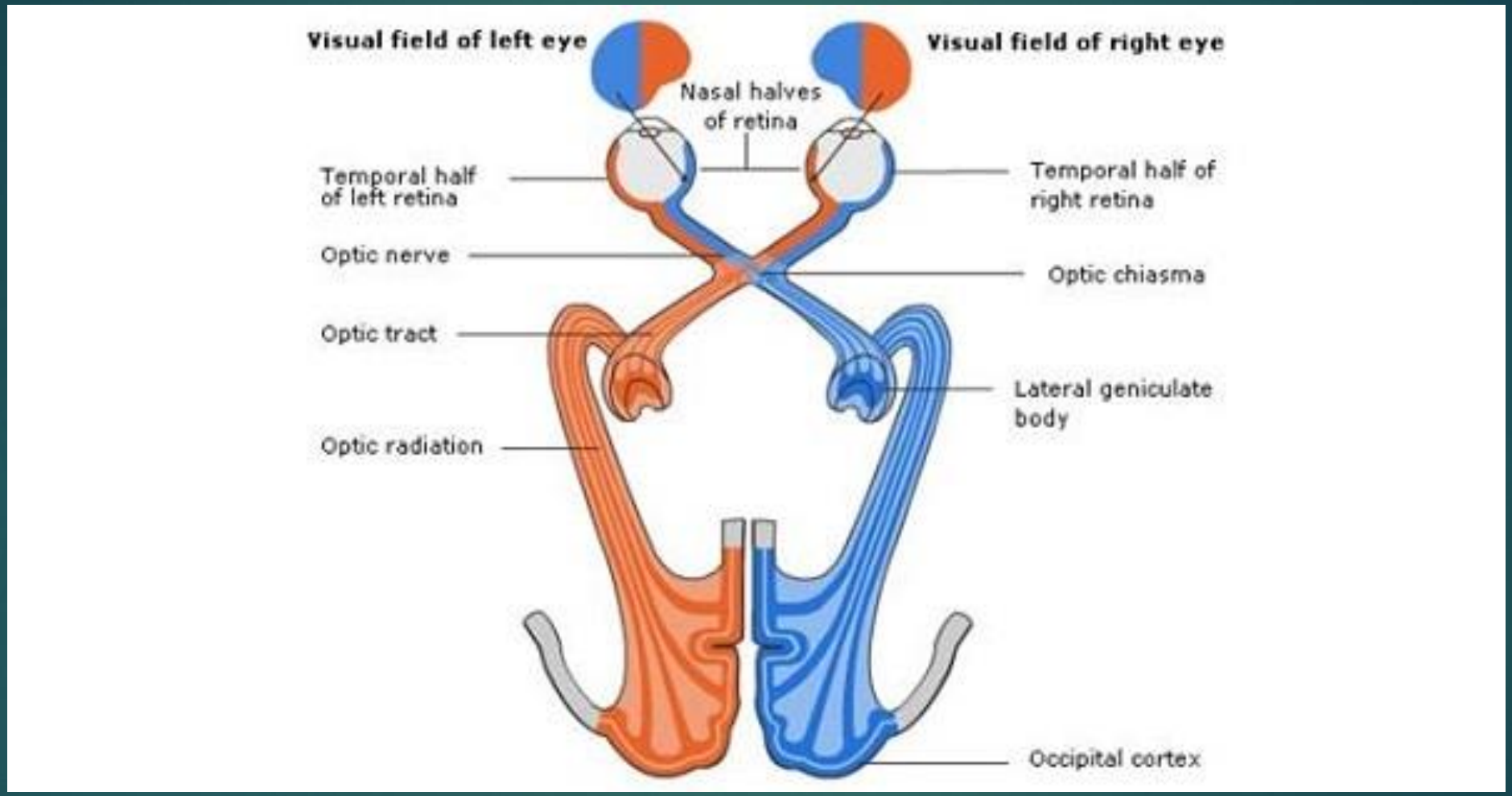
1. responsible for transmitting visual sensory information from the retina to the brain
2. The afferent part of the pupillary reflex

Visual pathway

- **Start from retina >>optic nerve >> the optic chiasm >>optic tract >> optic radiation >> occipital cortex**



The nasal fibers of the optic nerve are responsible for the temporal visual field and vise versa


Visual field of left eye
Visual field of right eye
Nasal halves of retina
Temporal half of left retina
Temporal half of right retina
Optic nerve
Optic chiasma
Optic tract
Lateral geniculate body
Optic radiation
Occipital cortex

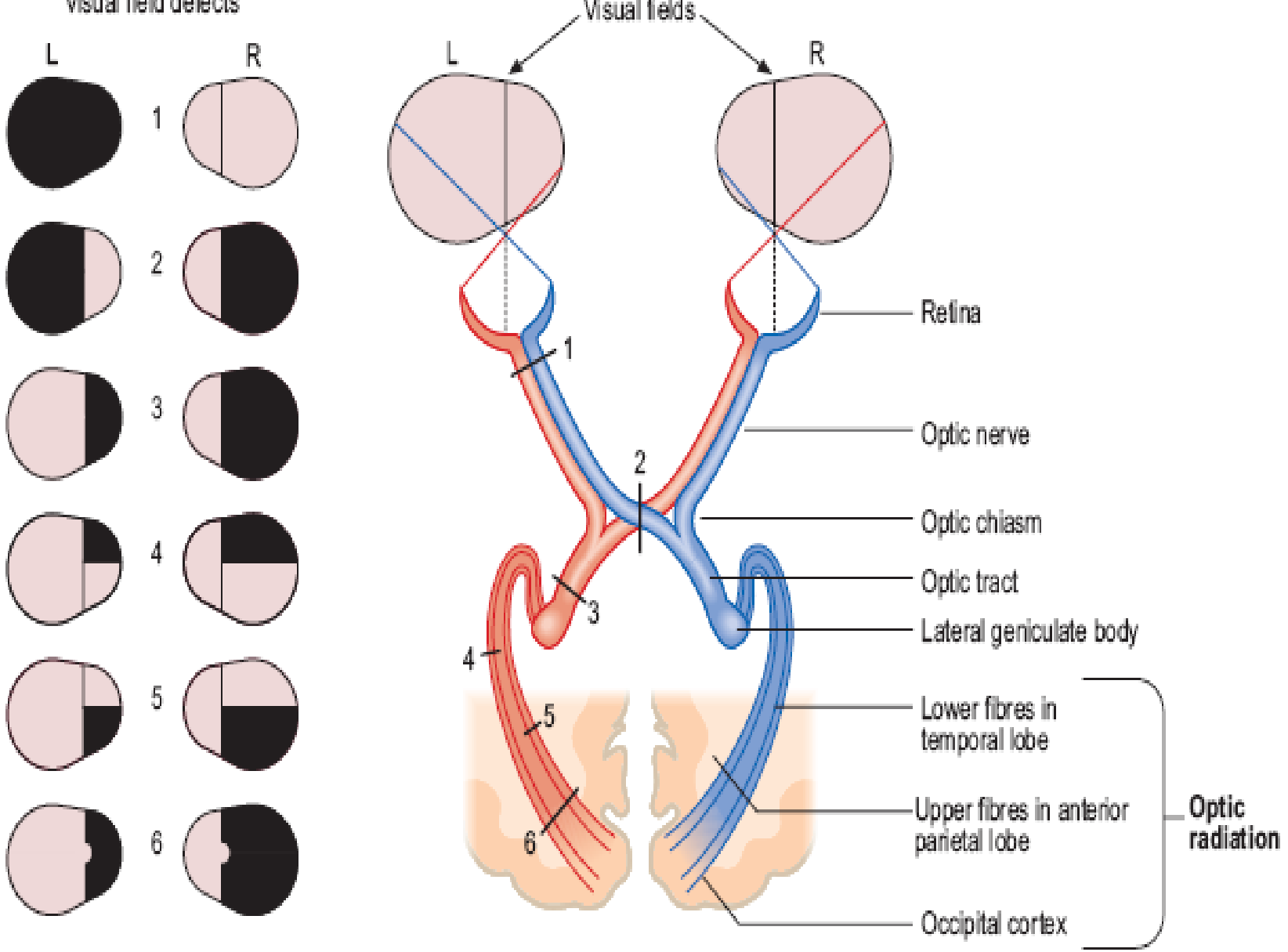


Fig. 12.3 Visual field defects. (1) Total loss of vision in one eye because of a lesion of the optic nerve. (2) Bitemporal hemianopia due to compression of the optic chiasm. (3) Right homonymous hemianopia from a lesion of the optic tract. (4) Upper right quadrantanopia from a lesion of the lower fibres of the optic radiation in the temporal lobe. (5) Lower quadrantanopia from a lesion of the upper fibres of the optic radiation in the anterior part of the parietal lobe. (6) Right homonymous hemianopia with sparing of the macula due to lesion of the optic radiation in the occipital lobe.

- **Before the Optic chiasm -** The visual field loss is seen on the same (ipsilateral) side as the lesion

- **After the optic chiasm -** The visual loss is seen on the opposite (contralateral) side of the lesion because the optic nerves have already crossed over at the optic chiasm

The oculomotor nerve (3)

- motor and parasympathetic function
- Innervates the superior, medial, and inferior recti, the inferior oblique and levator palpebrae superioris muscles
- It is course is related to posterior communicating artery and cavernous sinus
- **Function**:

1. It Moves the globe upwards, downwards, and medially
2. It elevate the upper lid
3. Pupillary reflex (constrict pupil)

3rd CN palsy

1. Unilateral ptosis that is often complete
2. Large pupil
3. The eye is looking inferolaterally


Nobody loves you when you're down and out.
OphthoBook.com

The Trochlear nerve (4)

- Supplies the superior oblique muscle
- Function: downward movement of the globe when the eye is adducted (inferiomedially)

The abducens nerve (6)

- Supplies the lateral rectus muscle
- Abducts the eye (lateral gaze)
- Has along course around the brainstem before it pierces the dura to enter the cavernous sinus.
- In direct relation to the internal carotid artery before it passes through the superior orbital fissure to the lateral rectus muscle.

Physical examination

General exam

- Comment on:

1- posture and gait

2- head position

3- face asymmetry and any dysmorphic features

Examination of vision

- **Inspection and palpation**
- **Pupils**
- **Visual fields:**

1. Homonymous defects
2. Sensory inattention
3. Peripheral visual fields
4. Color desaturation
5. Central visual field
6. Blind spot

- **Eye movements**
- **Visual acuity: snellen chart**
- **Ophthlmoscopy**
- **Color vision : ishihara test**
- **Macular function : amsler grid**

1- Inspection and palpation

- look for any swelling or erythema in periocular skin , symmetry of gaze, pupil size and symmetry, ptosis, proptosis (examine from the back by looking from above) , and lid lag

- Palpate for any masses in the orbital rim

Causes of ptosis

- **Neurogenic causes**

1- 3rd nerve palsy

2- horner syndrome (triad of anhydrosis , partial ptosis and miosis)

- ✓ causes:

1-neck surgery or trauma

2-demylination disease

3-pancoast tumour

4- carotid artery dissection

- ✓ Diagnosis : cocaine eye drops

- **Myogenic causes**

1- myotonic dystrophy

2-chronic progressive external ophthalmoplegia

- **Neuromuscular causes**

myasthenia gravis

- **Mechanical**

1- infection

2- trauma

3-inflammation

4-tumor

- **Degeneration**

2- Examine pupils

- **Start testing for anisocoria**

*With the patient fixating at a point in the distance, increase and decrease the illumination and look for any change in the degree of anisocoria

*if the degree of anisocoria more in brighter light then the larger pupil is the abnormal , if more in the dim light the small pupil is the abnormal , if equal in size in both lights then it is physiological

Causes of anisocoria (unequal pupils)

- **Dilated pupil**

1- CN 3 palsy

2- Adie's pupils

3- post surgery

4- physiological in 20%

5- drugs (atropine , tropicamide)

- **Constricted pupil**

1- horner syndrome
2- Late stage of Adie's pupils
3- mechanical (iritis , trauma)
4- physiological in 20%
5- drugs (pilocarpine)

- **Direct and consensual light reflex**

*With the patient fixating on a point in the distance and in **ambient** lighting, shine a bright light from the temporal side into one eye and look for constriction of the ipsilateral pupil

*To test the consensual reflex, assess the pupil response in the contralateral pupil when light is directed towards the ipsilateral pupil.

- **Relative Afferent pupillary reflex**

*is an important clinical sign that occurs when disease of the retina or optic nerve reduces the response of the eye to a light stimulus

*Use a bright light source and move it briskly from one eye to the other, but place it on each eye for a minimum of 3 seconds

*In normal patients, this results in symmetrical constriction of both pupils

*In RAPD, light in the affected eye causes weaker constriction (apparent dilatation) compared to light shone in the normal eye

Accomodation

*Ask the patient to look at a close fixation target (do not use a light) after fixating on a distant target

***normally there should be:**

1-constriction of the pupil on near gaze

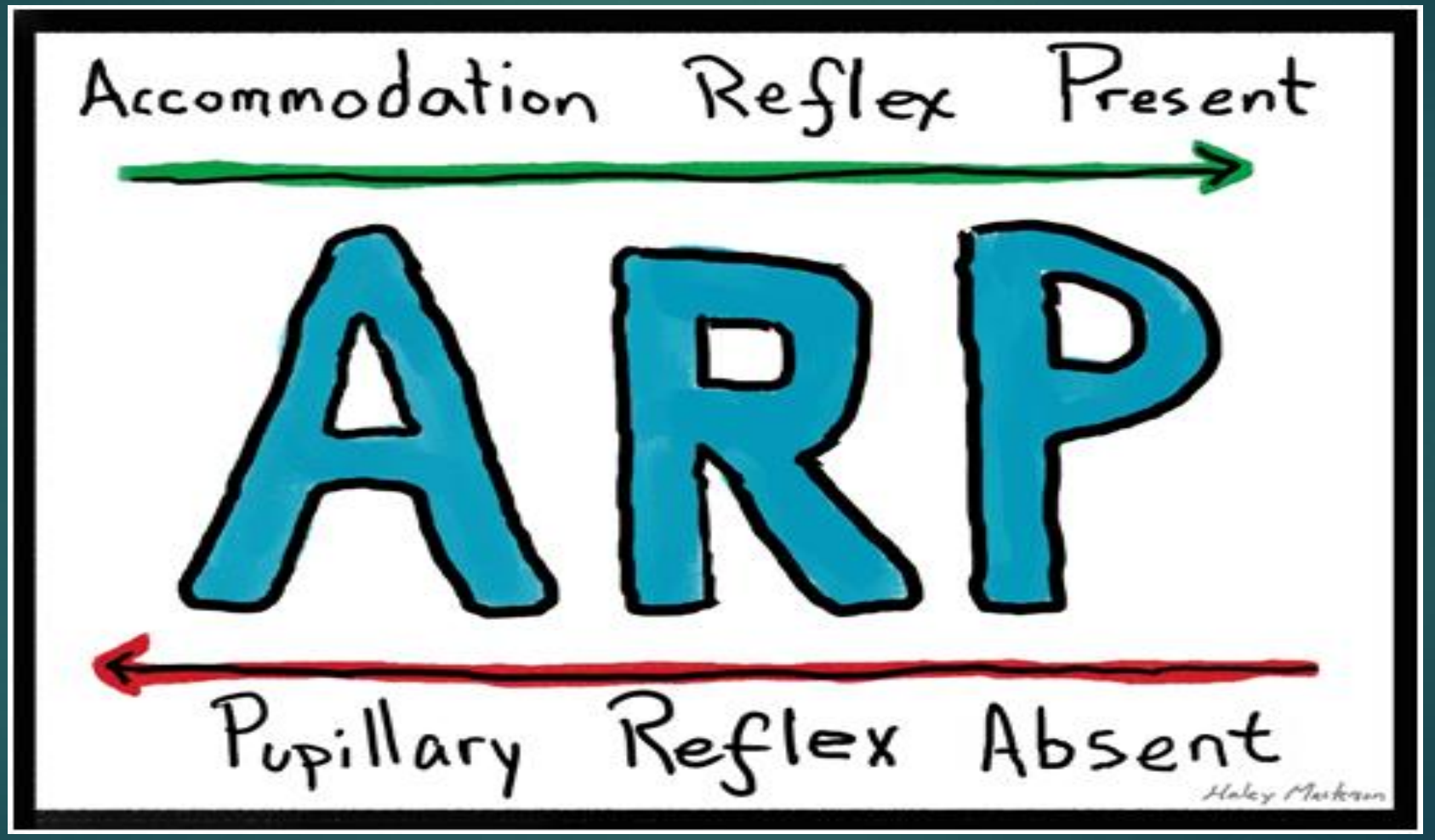
2-covergence

Adie's pupils benign condition , due to parasympathetic dysfuction

It is a neurological disorder characterized by a **mid-dilated pupil** that reacts poorly to **light** and **accommodation**

- When it is associated with decreased ankle reflex it is called Holmes– Adie syndrome
- It is more common in young women
- With time the pupils with constrict

Argyll Robertson pupil



Argyll Robertson pupil = light near dissociation

- Are bilateral small irregular pupils that reduce in size on a near object (i.e., they accommodate), but do not constrict when exposed to bright light (i.e., they do not react to light)

- Causes:

1- syphilis

2- DM

3- severe optic nerve disease

4- midbrain lesions

3- Examine visual fields

- Normal visual field extends 160 degrees horizontally and 130 degrees vertically
- Fixation is the very centre of visual field
- The physiological blind spot is located 15 degrees temporal to the point of visual fixation and represents the entry of the optic nerve head into the eye
- You are comparing the patient visual field with yours , assuming your vision is normal
- Face the patient with 1 meter away and insure the patient can see fingers

1- examine for homonymous defects

*test with both eyes open

*move your extended wiggling finger in four quadrants halfway between you and the patient from the periphery towards the centre of the visual field

*you and the patient should see the finger at the same time

2- test for sensory inattention >> neglect

3- examine peripheral visual fields

*examine each eye separately

*same as in homonymous defects

*For more subtle visual field defects you can use small white hatpin or a white Neurotip

*to assess very early visual field loss, repeat the same test using a red hatpin or a red Neurotip (**When testing each quadrant with a red target, be sure to explain to the patient that they should say when they first see that the target is red and not when they first see it)**

4- test for color desaturation

*It is important to show the patient the red target and ask them to report what colour they see. A dull or pale red suggests colour desaturation, which may indicate optic nerve dysfunction

5- test for central vision

* test each quadrant with a red target

*compare perception of the haptin in each quadrant , ask also about color desaturation

6-test for blind spot

*place a red-tipped target between the patient and yourself at the visual fixation point

*Move the target temporally until it disappears

*Then move the target slowly up and down, as well as from side to side

Homonymous defects test

Visual fields test 1

Visual fields test 2

To asses very early VF loss

4- Examination of the 3rd, 4th and 6th CNs

H

Oculomotor examination

- Ask the patient to look at a target about 0.5-1 m away
- Look for gaze palsy
- Ask the patient to say if he sees double or blurred vision (document if it is vertical or horizontal or combined and on which direction)
- Observe for nystagmus

5- Visual acuity

- Each eye must be tested separately
- Use Snellen chart
- Ask patients to wear their distance spectacles
- Near/reading spectacles should be worn only when testing reading vision.

- Start at 6 metres and dim the room lighting
- If the patient cannot see the largest font, reduce the test distance to 3 metres, then to 1 metre if necessary
- If they still cannot see the largest font, document instead whether they can count fingers, see hand movement or just perceive the difference between light and dark.

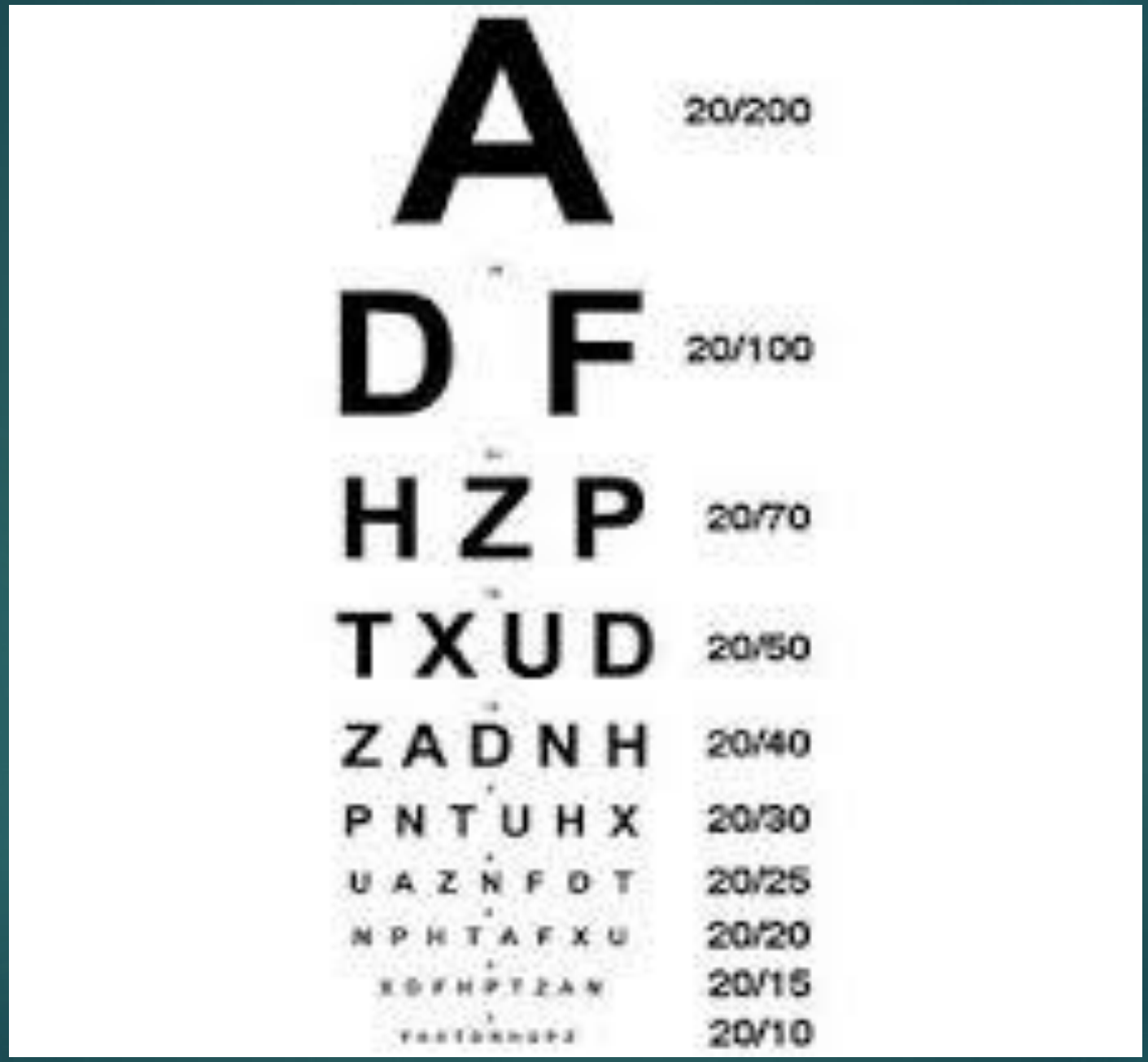
- On the Snellen chart, lines of decreasing font size are numbered according to the distance in metres that a person with normal vision could read them

- Express visual acuity as the distance at which text is read (usually 6 metres) over the number of the smallest font line read correctly on the chart For example, 6/60 means that the patient sees at 6 metres the font size that is seen at 60 metres by a person with normal vision

- If the patient cannot read down to line 6 (6/6), place a pinhole directly in front of the eye (with the patient keeping their usual spectacles on, if they wear them) to correct any residual refractive error

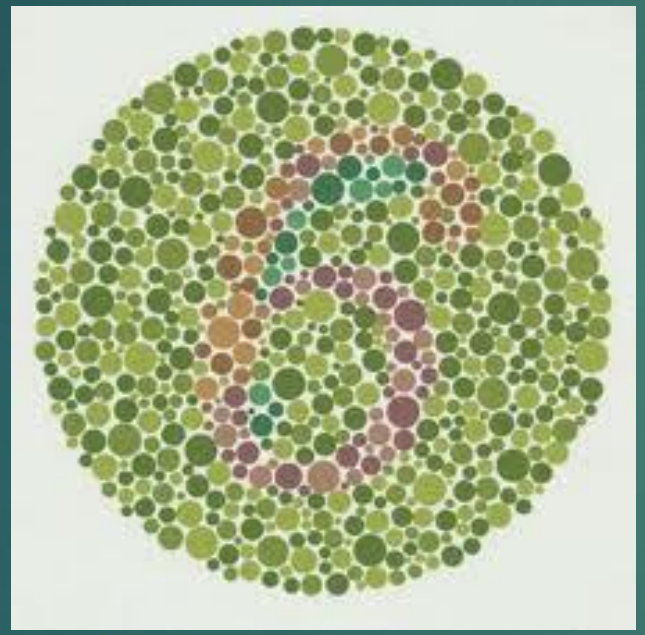
- If the visual acuity is not improved with a pinhole, this indicates the presence of eye disease not related to the refractive apparatus alone, such as retinal or optic nerve pathology

- Note that 6/6 is regarded as normal vision
- Assess near vision with a similar test using text of reducing font size held at a comfortable reading distance.
- It is important to consider the need for reading spectacles in patients over the age of 40 years because of presbyopia (age-related deterioration in near vision).

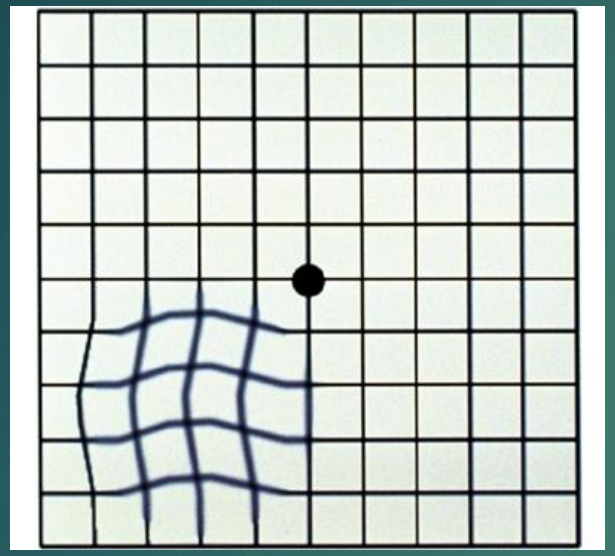

A
20/200
D F
20/100
H Z P
20/70
T X U D
20/50
Z A D N H
20/40
P N T U H X
20/30
U A Z N F O T
20/25
N P H T A F X U
20/20
20/15
20/10

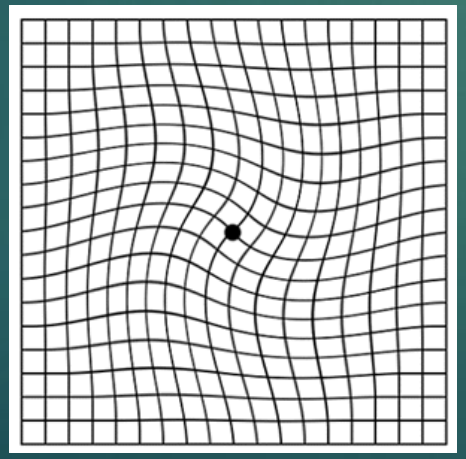
6- ophthalmoscopy

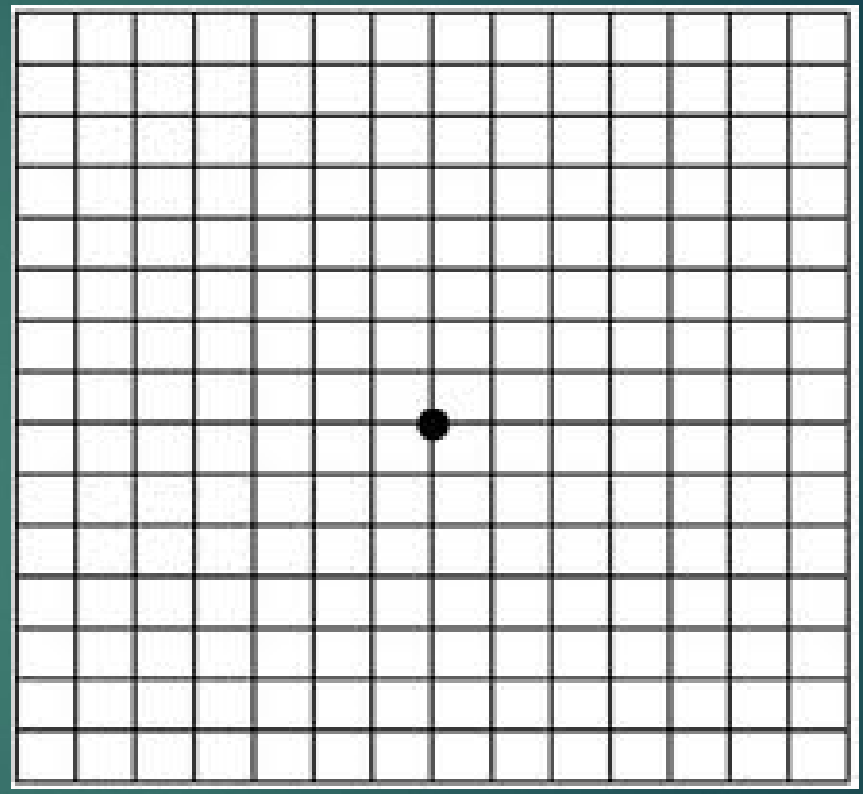
7- ISHIHARA TEST



8- Amsler grid for macular function







Thank you