



**14 Th
Lecture**

The Cranial Nerves

2,3,4,6

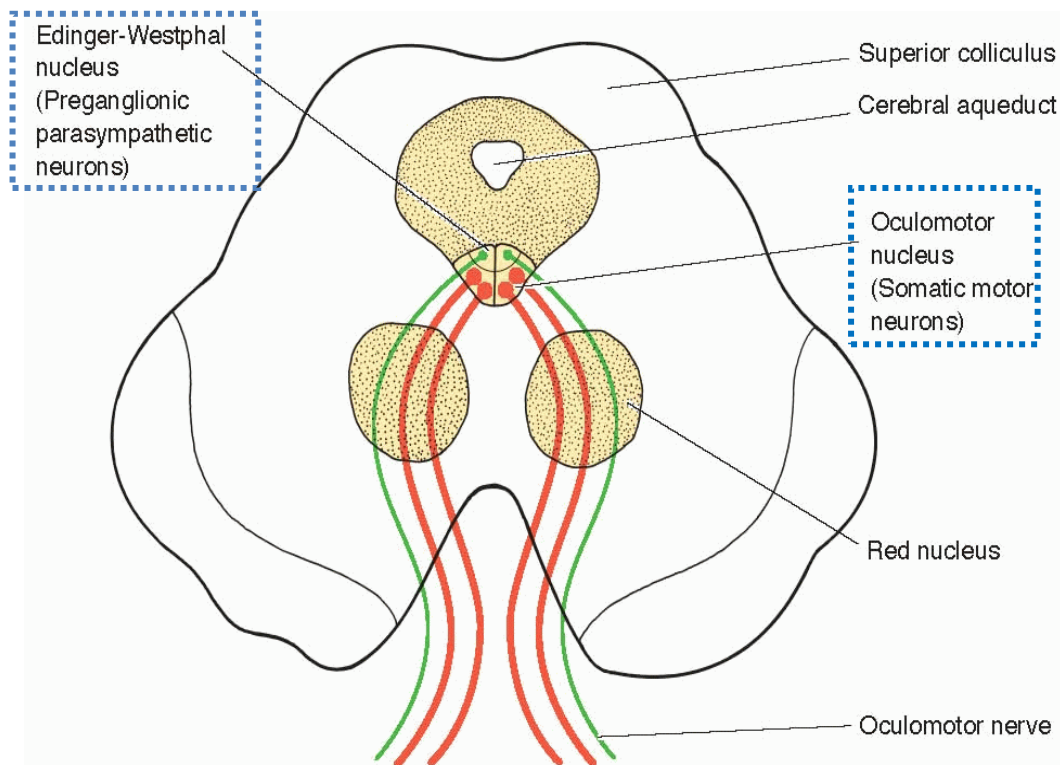
(Optic, Occulomotor, Trochlear & Abducent)

This Lecture is done by:

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Occulomotor nerve (3):

Type	Motor
nuclei	<p><u>Has two nuclei:</u></p> <p>1-<u>Main oculomotor nucleus:</u> Located in the mid brain, at the level of <u>superior_colliculus</u>.</p> <p>2-<u>Accessory nucleus (Edinger-Westphal nucleus):</u> Situating dorsal to the main motor nucleus.</p>
Other	<p>*It has <u>parasympathetic neurons</u>.</p> <p>*It receives <u>corticonuclear fibers</u> for the <u>accommodation reflex</u>.</p> <p>*It receives <u>fibers from pretectal nucleus</u> for the <u>direct and consensual reflex</u>.</p>



Pathway of Axons

Axons from oculomotor nucleus

1-Curve ventrally through the tegmentum and the red nucleus

2-Emerges on the anterior surface of the midbrain in the interpeduncular fossa.

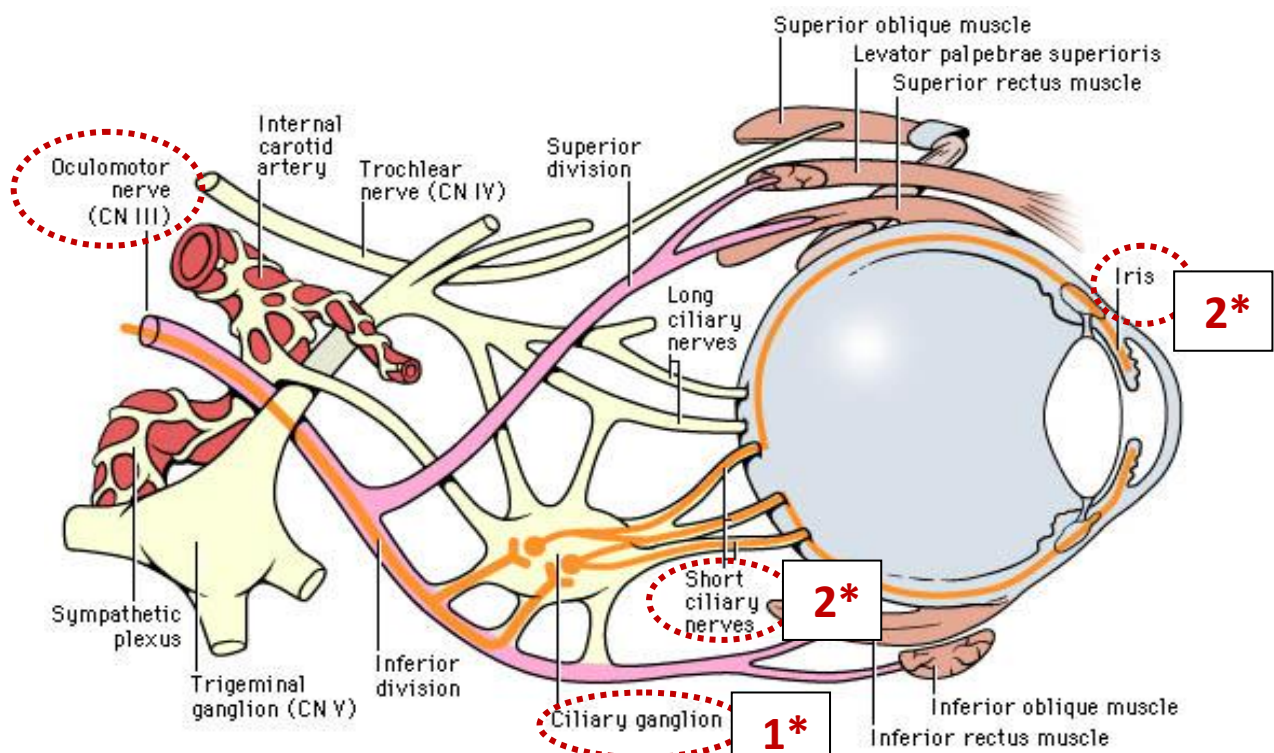
3-It passes forward between the posterior cerebral and superior cerebellar arteries.

4-In the middle cranial fossa lies in the lateral wall of the cavernous sinus, here it divides into superior and inferior rami which enter the orbit through the superior orbital fissure.

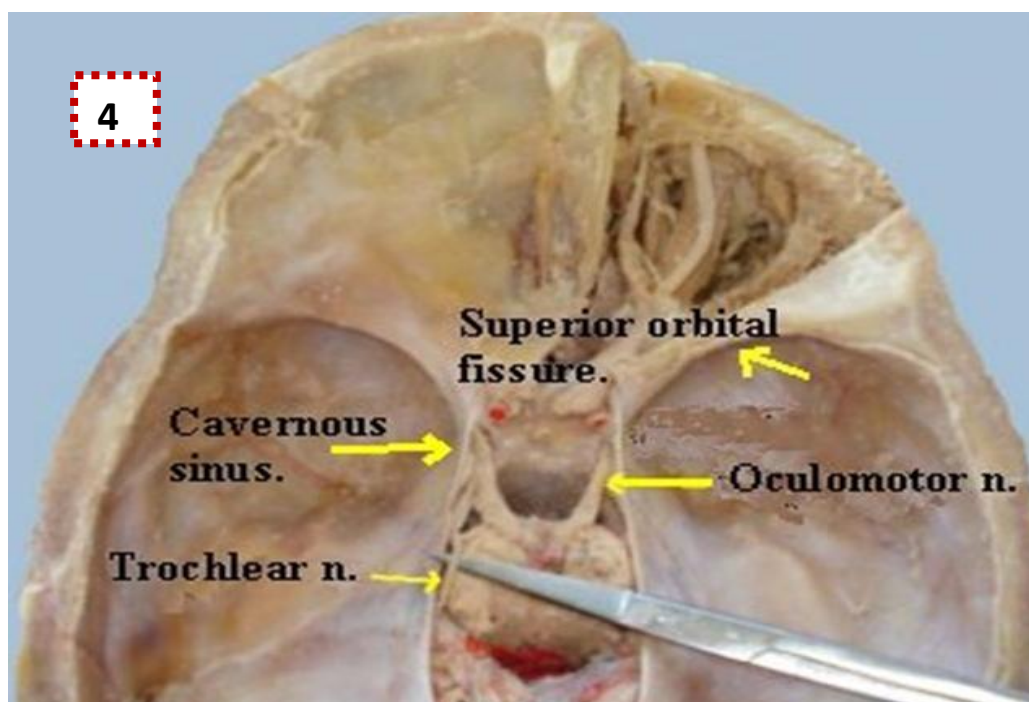
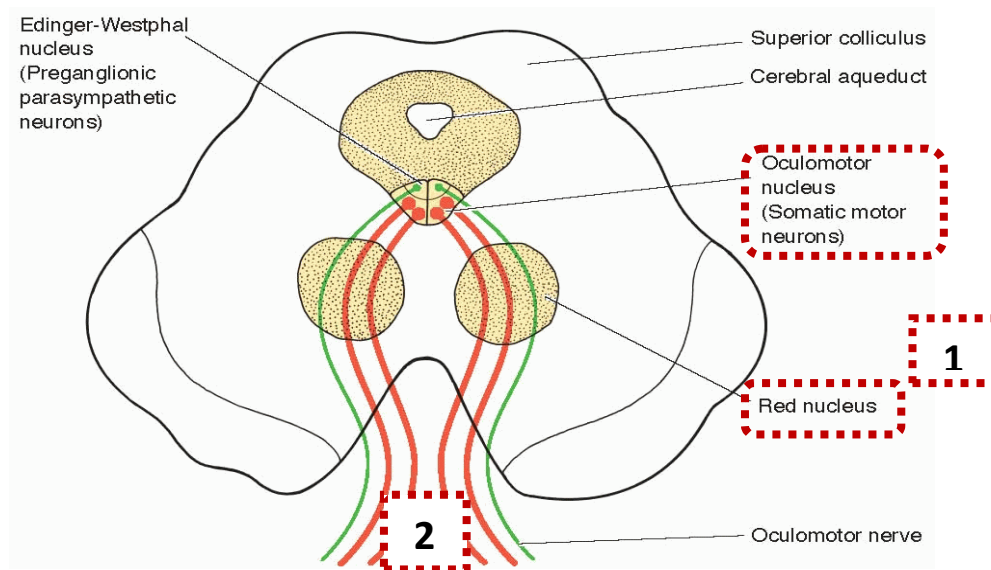
Axons from the Edinger-Westphal nucleus

1*-terminate in the ciliary ganglion.

2*-Postganglionic fibers pass through the short ciliary nerves to the eyeball, where they supply the sphincter pupillae muscle of the iris and the ciliary muscle.

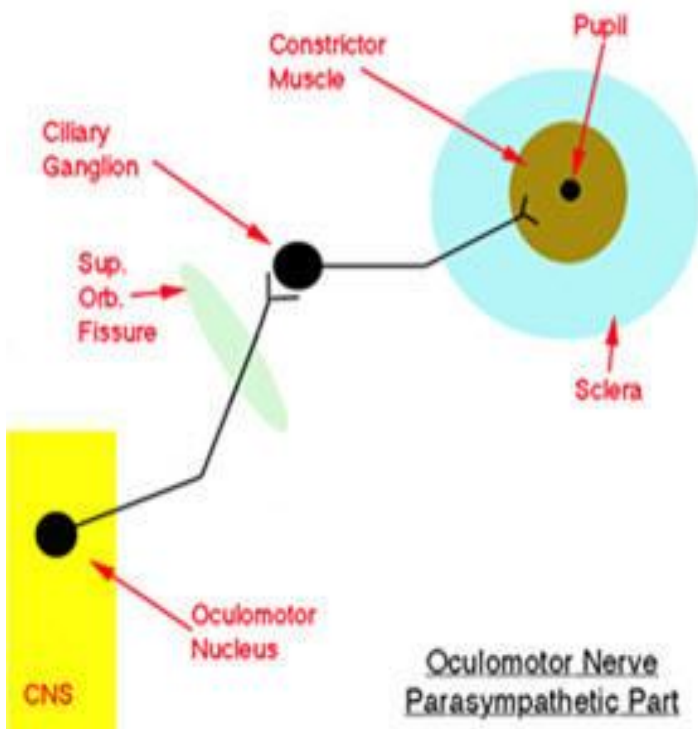


Axons from oculomotor nucleus



Oculomotor nerve supplies and palsy

supplies	responsible for	Lesion results
<ul style="list-style-type: none"> ➤ Motor innervation to <u>levator palpebrae superiors</u>, <u>the superior, medial & inferior rectus & inferior oblique</u> muscle of the eyeball. ➤ Parasympathetic fibers to <u>constrictor pupillae and ciliary muscles</u>. 	<ul style="list-style-type: none"> ➤ 1-Elevation of the <u>upper eyelid</u>, 2-Turning the eye <u>upward, and downwards medially</u> ➤ 1-<u>Constricting the pupil</u>. 2-<u>Accommodating</u> the eyes. 	<ul style="list-style-type: none"> ➤ 1-<u>Lateral</u> squint 2-<u>Impaired downward & outward movement</u> of the eye ball on the damaged side. 3-Ptosis 4-Diplopia ➤ 1-Pupillary <u>dilatation</u> 2-<u>Loss</u> of accommodation *The preganglionic parasympathetic fibers run <u>superficially</u> in the nerve and are affected by external pressure. Consequently, the first sign of compression of the oculomotor nerve is ipsilateral slowness of the pupillary response to light.
Clinical Tests	1-Note the ability to move each eye <u>upward, downward and inward</u> by asking the person to follow a target moved by the examiner. 2-Also examine the <u>constriction of pupil & accommodation</u> .	



Ptosis (drooping of the eyelid)



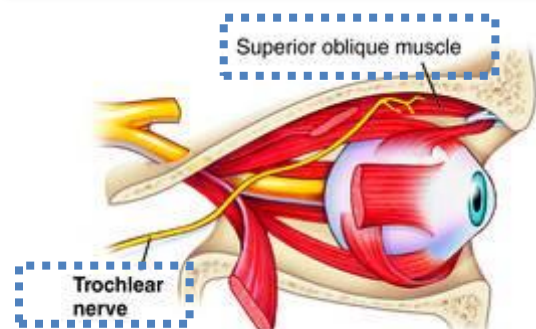
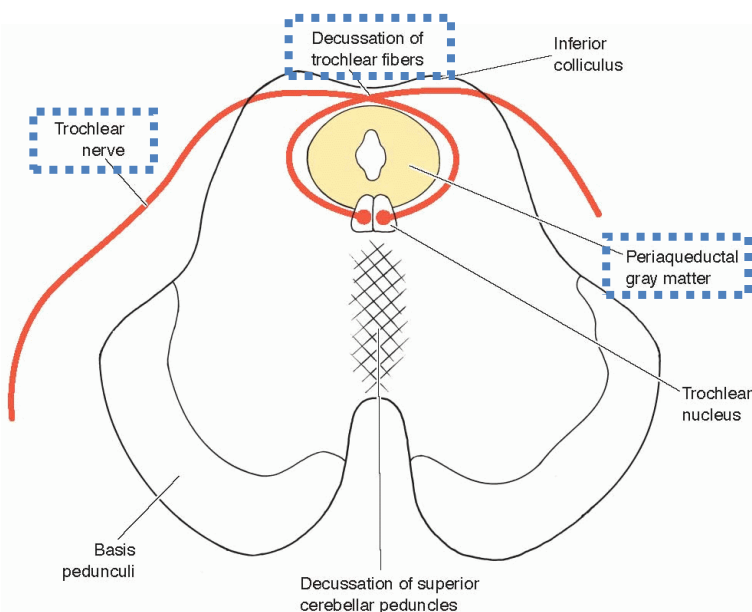
Lateral squint



Diplopia

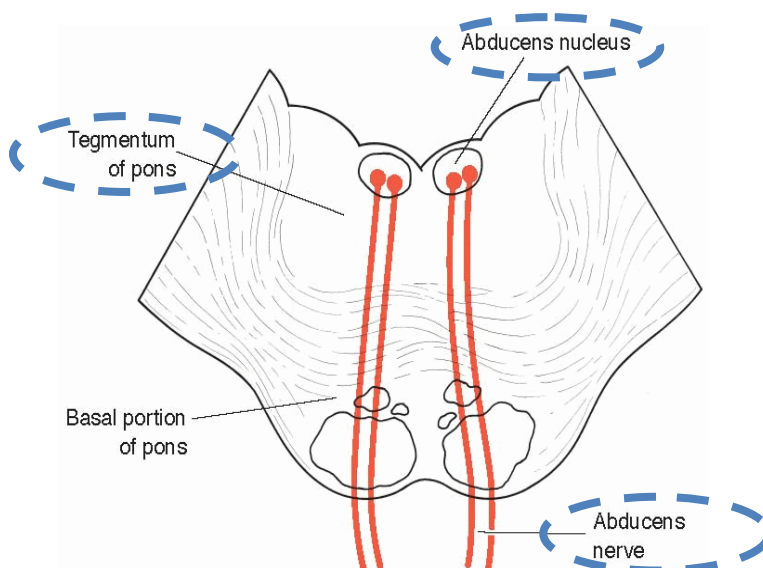
Trochlear Nerve (4):

Type	Motor		
nuclei	1- Small motor nucleus located in <u>the anterior part of the periaqueductal gray matter</u> at the level of <u>inferior colliculus</u> .		
pathway	<ul style="list-style-type: none"> ➤ Its fibers curve around the <u>periaqueductal gray matter</u> decussates in the <u>superior medullary velum</u>. ➤ The nerve emerges immediately <u>caudal to the inferior colliculus</u>, on the <u>dorsal</u> surface of brain stem. ➤ It passes forward through <u>middle cranial fossa</u> in the <u>lateral wall of the cavernous sinus</u> ➤ The nerve then enters the orbit through the <u>superior orbital fissure</u>. 		
Other	(Supplies) <u>Superior oblique muscle (SO)</u> of the eye ball.	(Function) Rotates the eye ball <u>downwards and laterally</u> .	(Trochlear palsy) *Lesion results in diplopia & inability to rotate the eye <u>infero-laterally</u> . *The eye deviates; <u>upward and slightly inward</u> . *Person has <u>difficulty in walking downstairs</u>
Clinical Tests	➤ Note the ability to move each eye <u>downward and outward</u> .		



Abducent Nerve (6):

Type	Motor		
nuclei	1-Small motor nucleus located in the <u>floor of upper part of 4th ventricle beneath the facial colliculus</u>		
pathway	<ul style="list-style-type: none"> ➤ <u>A bundle of facial nerve fibers</u> (known as the internal genu) <u>curves over the nucleus</u>, contributing to the <u>facial colliculus</u>. ➤ Its axons pass through <u>the pons in a ventrocaudal direction</u>, emerging from the brain stem at the junction of the pons and the pyramid. ➤ It passes forward through <u>cavernous sinus</u>, lying <u>below and lateral to the internal carotid artery</u>. ➤ The nerve then enters the orbit through the <u>superior orbital fissure</u>. 		
Other	(Supplies) <u>Lateral rectus muscle</u> of the eye ball	(Function) Rotates the eye ball <u>laterally</u> .	(Abducent palsy) * <u>Medial squint</u> with an inability to direct the affected eye <u>laterally</u> . *A nuclear lesion may also involve the nearby nucleus or <u>axons of the facial nerve</u> , causing <u>paralysis of all the ipsilateral facial muscles</u> .
Clinical Tests	➤ Note the ability to move each eye <u>outward</u> beyond the midline.		



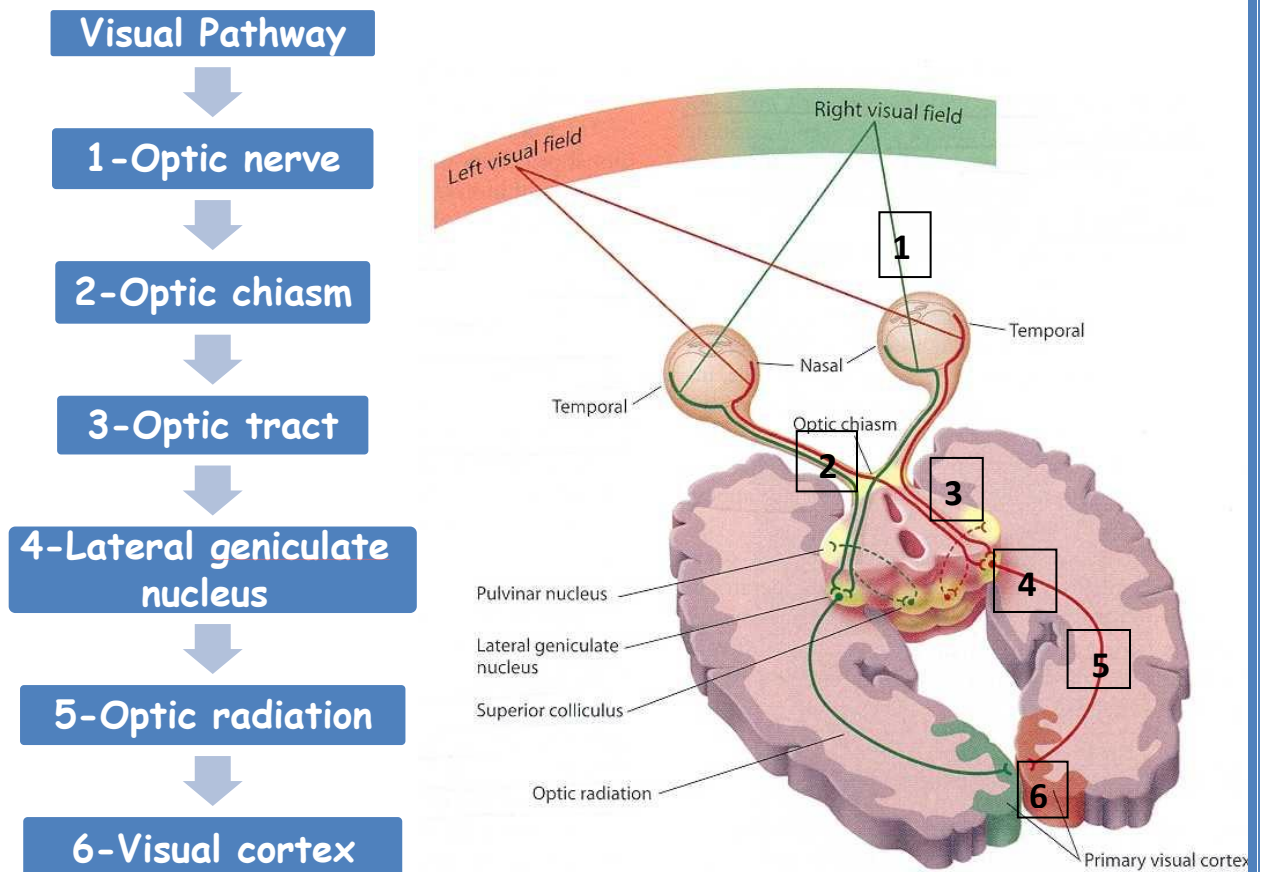
Normal eye alignment



Medial squint

Optic Nerve (2):

Type	Special sensory		
pathway	➤ The nerve passes <u>postero-medially in the orbit</u> , passing through the <u>optic canal</u> to enter the <u>middle cranial fossa</u> , running <u>postero-medially</u> towards the <u>optic chiasma</u> where <u>partial decussation of its fibers</u> occurs.		
General information	➤ The optic nerves are <u>paired, anterior extensions of the forebrain</u> and are formed by axons of <u>retinal ganglion cells</u> . ➤ Its axons are <u>myelinated</u> (sheath derived from the <u>oligodendrocytes</u>) ➤ It is surrounded by the <u>meninges</u> . ➤ The <u>meningeal</u> extensions <u>fuse with the fibrous scleral coat</u> of the eyeball. ➤ The <u>central artery and central vein of the retina</u> pierce the <u>meningeal sheaths</u> and are <u>included in the anterior part of the optic nerve</u>		
Other	(Supplies) -----	(Function) Vision.	(Lesion) * results in: <u>visual field defects</u> and <u>loss of visual acuity</u> , a defect of vision is called <u>anopsia</u> .
Clinical Tests	➤ Ask the patient to read an <u>eye chart</u> . ➤ Peripheral vision is tested by detecting object or movement from corners of the eye.		



Visual Pathway

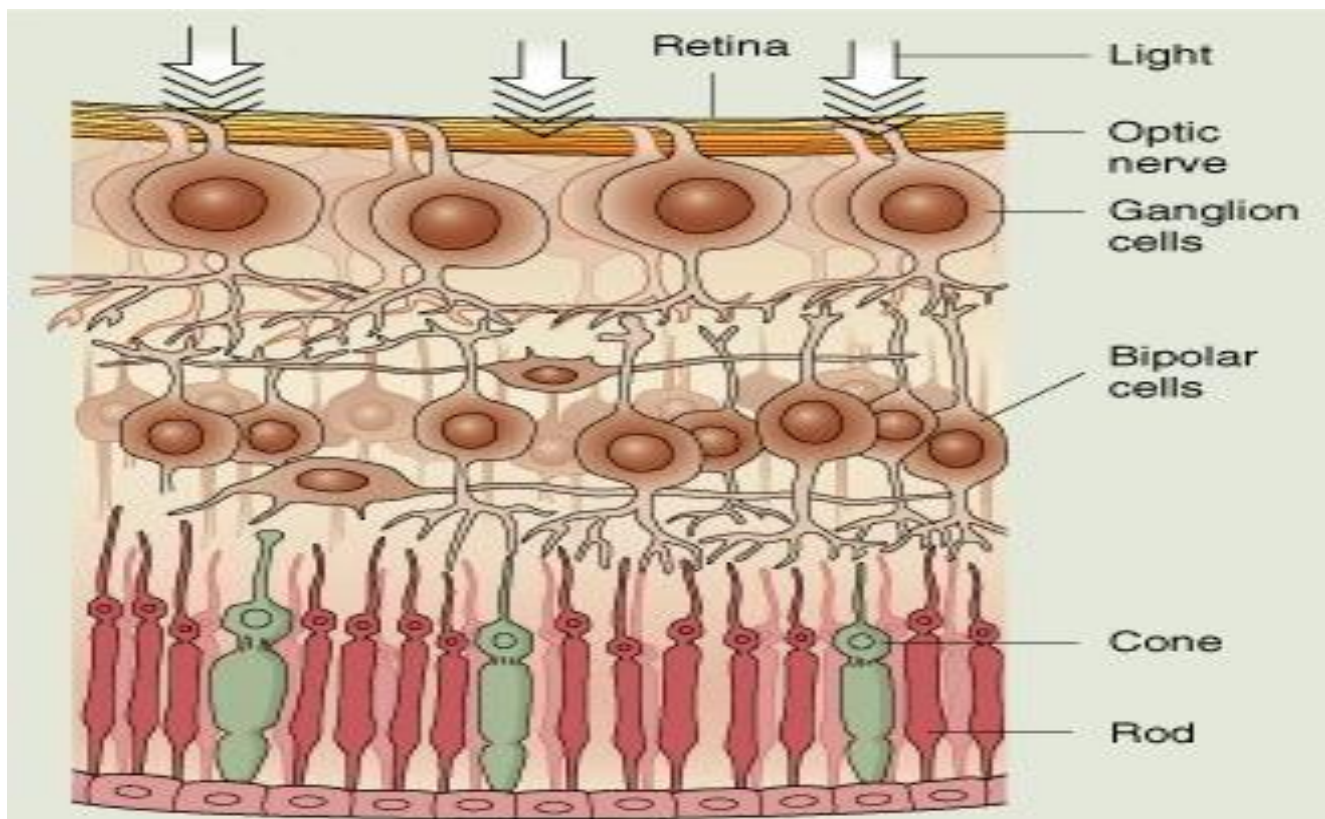
Note: Photoreceptors:
Rods & Cones of retina.

1st order neuron:
Bipolar cells of
retina.

3 neurons pathway

3rd order neuron:
Neurons in the
lateral geniculate
body. Their axons
terminate in
primary visual
cortex.

2nd order neuron:
Ganglion cells of
retina. Their axons
form the optic
nerve



General information about the visual pathway

1-Optic Chiasma

1-Fibers from the nasal (medial) half of each retina decussate in the chiasm to join uncrossed fibers from the temporal (lateral) half of the retina to form the optic tract.

2-The partial crossing of optic nerve fibers in the optic chiasma is a requirement for binocular vision.

2-Optic Tracts

Fibers in the optic tracts:

1-Mainly terminate in the lateral geniculate bodies of the thalamus.

2-A few fibers terminate in pretectal area and superior colliculus. These fibers are related to light reflexes.

3-Lateral Geniculate Body

The lateral geniculate body is a small swelling, part of thalamus

Contains lateral geniculate nucleus

Afferents:

Fibers of the optic tract originated in the ipsilateral temporal hemiretina and the contralateral nasal hemiretina.

Efferents:

To the primary visual cortex as optic radiation.

4-Optic Radiation

1-Contains thalamo-cortical fibers originating in the ipsilateral lateral geniculate nucleus

2-Passes through the retrolenticular part of the internal capsule.

3-The fibers representing the lower part of visual field terminate in the visual cortex above the calcarine sulcus.

4-The fibers representing the upper visual field sweep into the temporal lobe forming Meyer's loop to terminate in the visual cortex below the calcarine sulcus

5-Visual Cortex

1-The primary visual cortex (area 17 of Brodmann) lies on the medial surface of the occipital cortex above & below the calcarine sulcus.

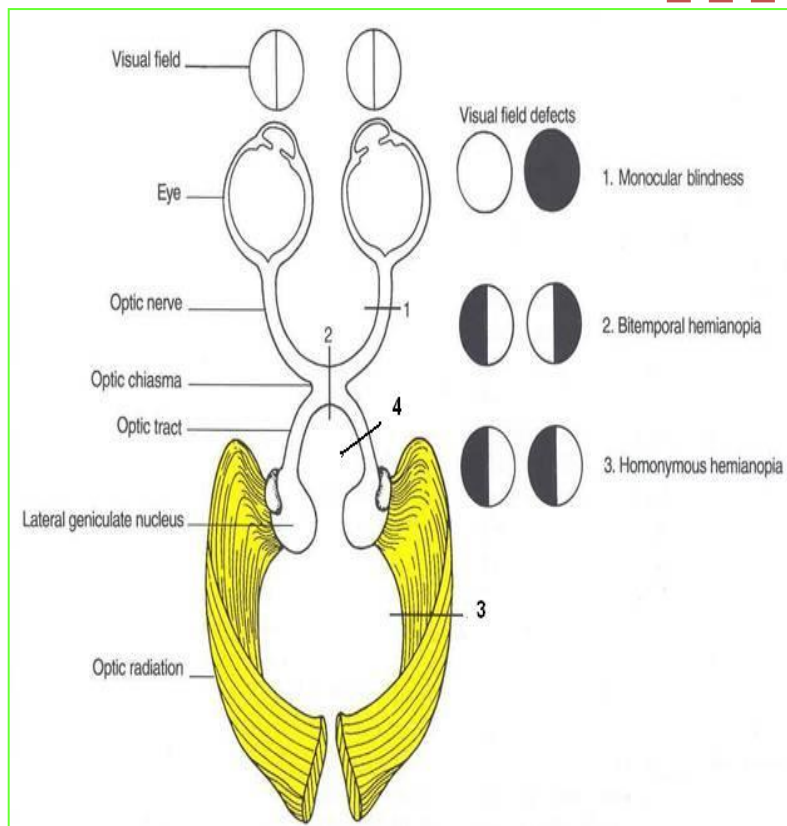
2-The visual association cortex is extensive, including the whole of the occipital lobe surrounding the primary visual area. This cortex is involved in recognition of objects and perception of colour, depth, motion, and other aspects of vision.

6-Visual Field Deficits

1-Cut at level 1: A lesion of the right optic nerve causes a total loss of vision in the right eye.

2-Cut at level 2: A lesion of the optic chiasm causes a loss of vision in the temporal half of both visual fields: bitemporal hemianopsia.

3-Cut at level 3 & 4: A lesion of the right optic tract & right optic radiation causes a loss of vision in the left hemifield: contralateral homonymous hemianopsia.



A lesion of both visual cortices causes a complete blindness.

Visual Reflexes

The light reflex (CN 2, 3) :

occurs when an increased intensity of light falling on the retina causes constriction of the pupil.

The afferent limb of the reflex arc involves fibers in the optic nerve and optic tract that reach nuclei of the pretectal area.

The pretectal area projects to the Edinger-Westphal nucleus, from which fibers traverse the oculomotor nerve to the ciliary ganglion in the orbital cavity.

Postganglionic fibers travel through the short ciliary nerves to the sphincter pupillae muscle of the iris.

Some pretectal fibres cross the midline to the contralateral Edinger-Westphal nucleus.

This results in constriction of the contralateral pupil, the consensual light reflex

Accommodation reflex (CN2,3) :

Fixation upon a nearby object, involves:

Ocular convergence
(contraction of medial rectus muscles)

Pupillary constriction

Thickening of the lens
(contraction of the ciliary muscle)

The stimuli arise from the visual occipital cortex activating Edinger-Westphal nucleus, bilaterally through corticobulbar fibers.

Test your self !

1-Which level does the trochlear nucleus lie?

- Medulla oblongata.
- Pons.
- Midbrain.
- Ponto-medullary junction.

2- Which one of these nerves is related medially to the cerebral peduncles?

- Facial.
- Trochlear.
- Trigeminal.
- Oculomotor.

3-Where does the Abducent nerve lie?

- In the lateral wall of cavernous sinus.
- In the floor of cavernous sinus.
- Outside the cavernous sinus.
- In the intercavernous sinuses.

4-Which one of these structures represents the second order neuron of vision?

- Bipolar cells of retina.
- Lateral geniculate body.
- Optic nerve
- Visual cortex

Good luck