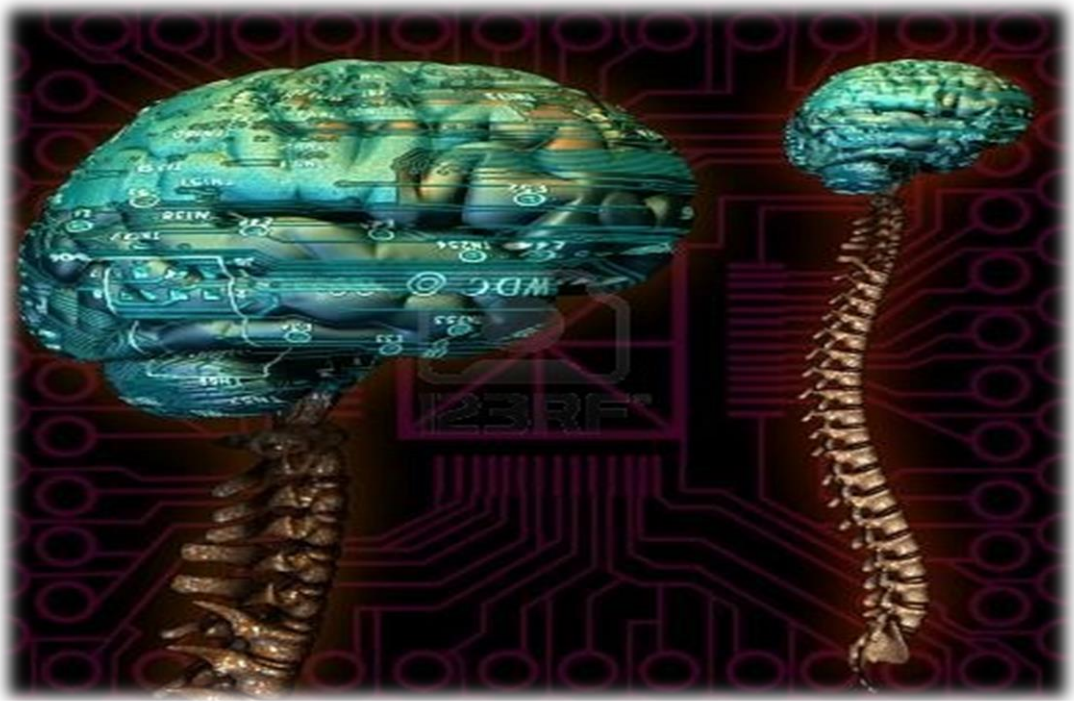
CNS Block



LECTURE (15)

THE CRANIAL NERVES 2,3,4 & 6

Done by: Salman Al Hammad

Reviewed by: Manar AlEid

If there is any mistake please feel free to contact us:

(Anatomyteam32@gmail.com)

Both - Black

Male Notes - BLUE

Female Notes - GREEN

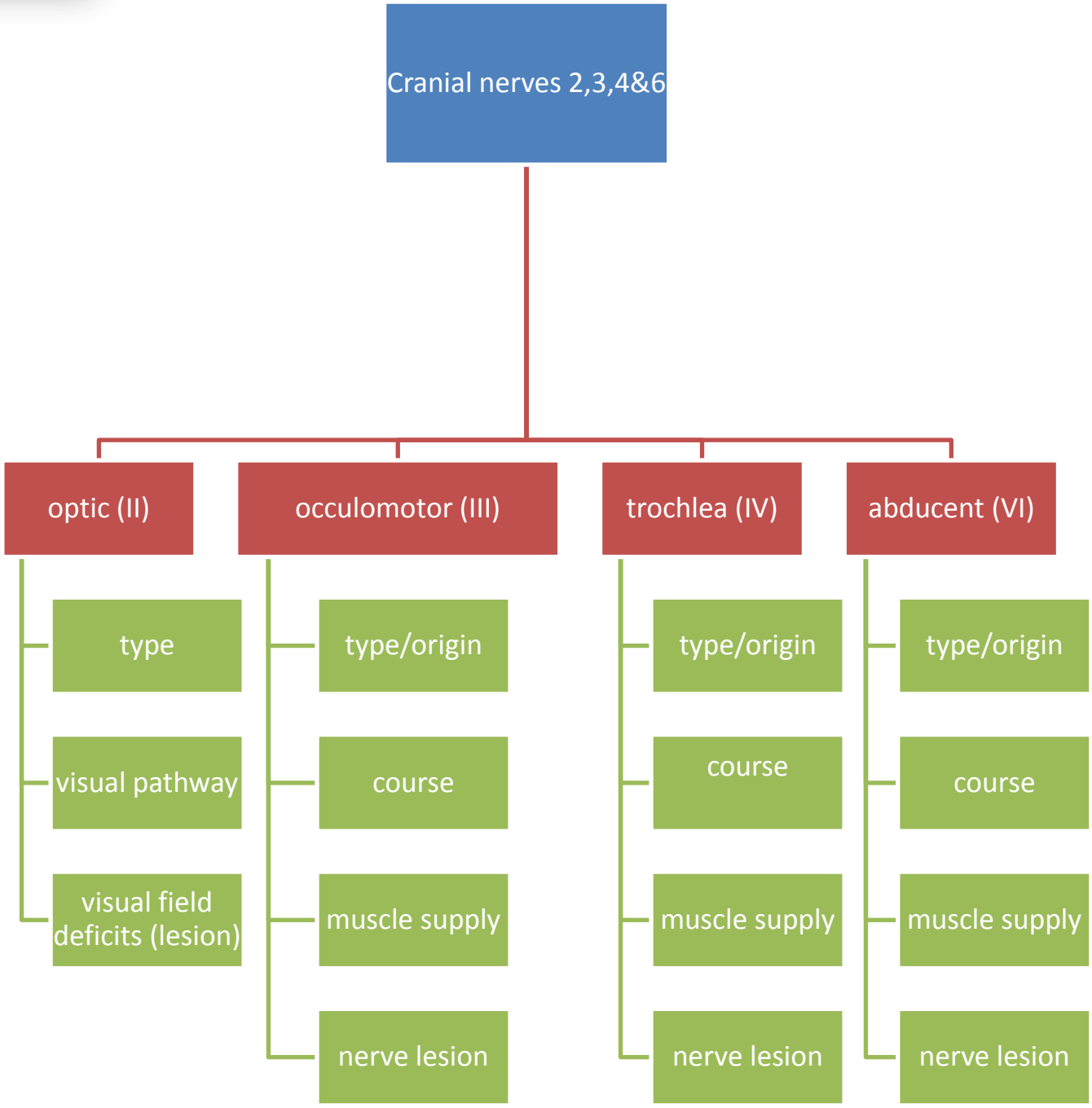
Explanation and additional notes - ORANGE

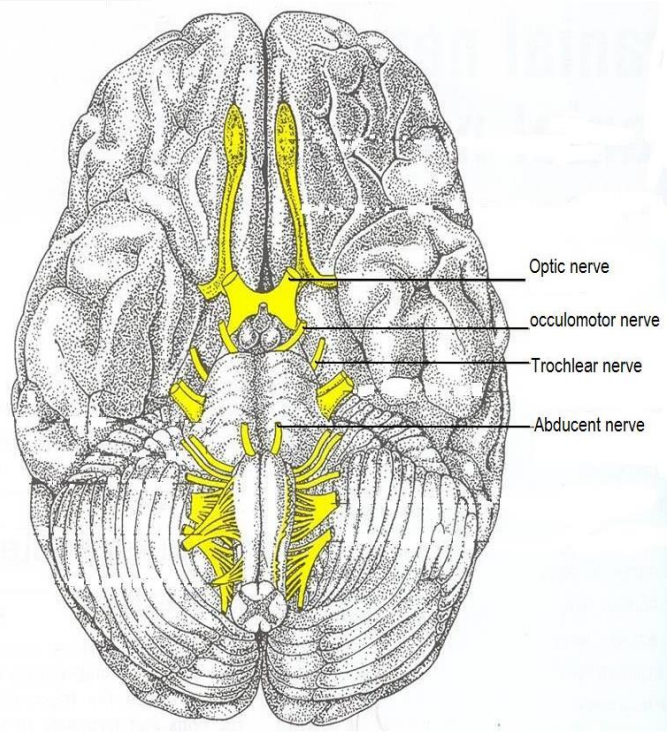
Very Important note - Red

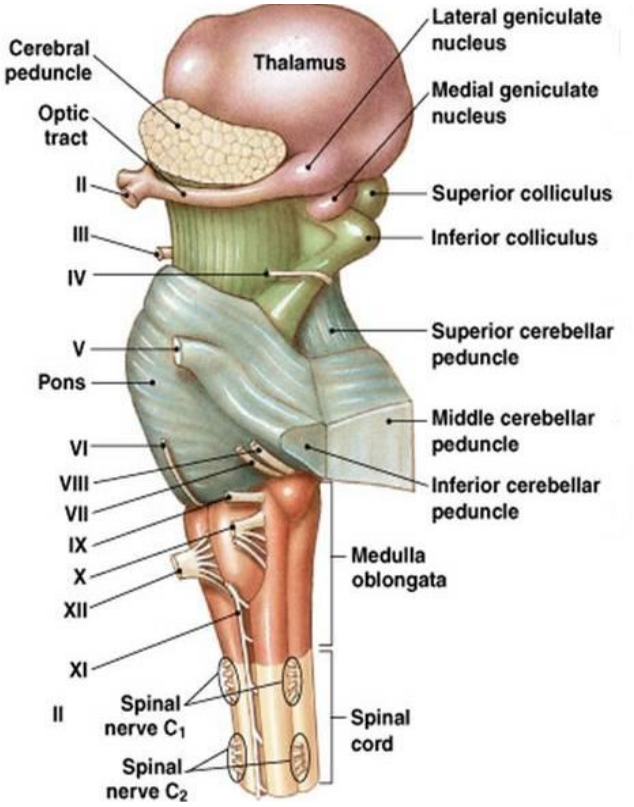
Objectives:

By the end of the lecture, the students should be able to:

- List the cranial nuclei related to occulomotor trochlear, and abducent nerves in the brain stem.
- Describe the type and site of each nucleus.
- Describe the site of emergence and course of these 3 nerves.
- Describe the important relations of optic, occulomotor trochlear, and abducent nerves.
- List the orbital muscles supplied by each of these 3 nerves.
- Describe the effect of lesion of each of these 3 nerves.
- Describe the visual pathway and main lesions associated with it.


Cranial nerves 2,3,4&6
optic (II)
occulomotor (III)
trochlea (IV)
abducent (VI)
type
visual pathway
visual field deficits (lesion)
type/origin
course
muscle supply
nerve lesion
type/origin
course
muscle supply
nerve lesion
type/origin
course
muscle supply
nerve lesion





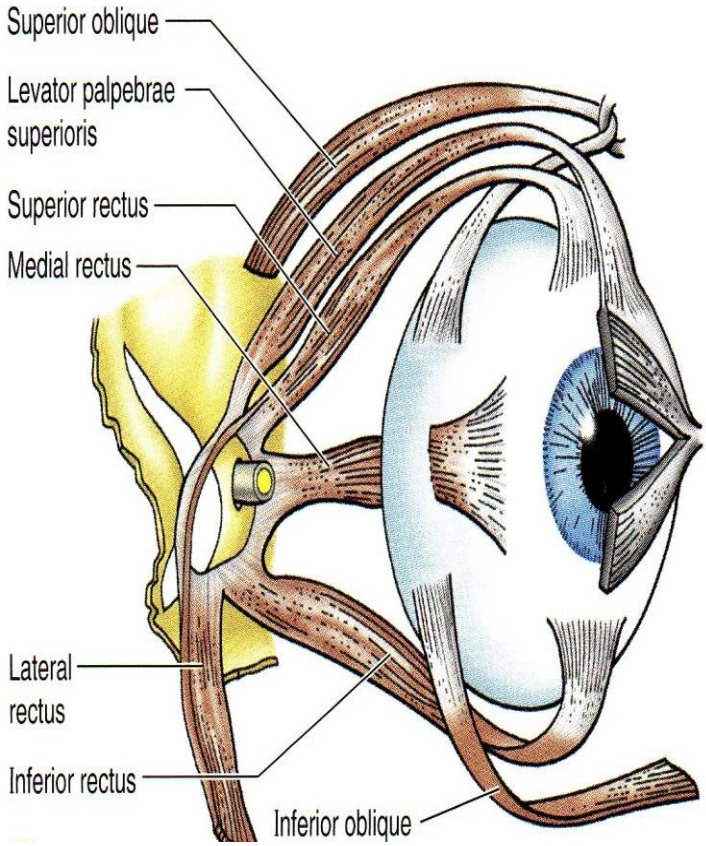
EXTRA-OCULAR MUSCES (**7 muscles**).

1- **Levator palpebrae superioris**

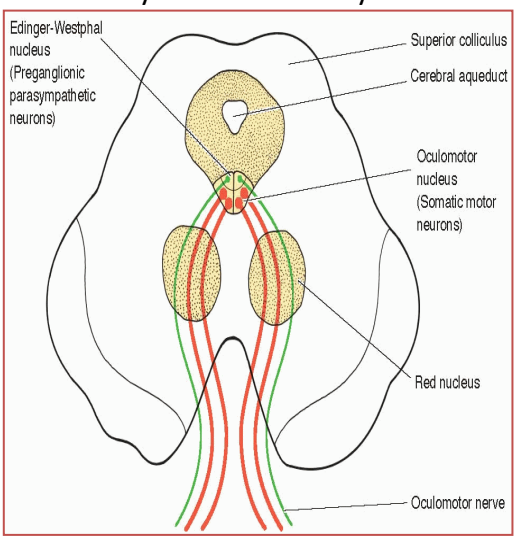
2- **4 Recti muscles:**
   a. Medial rectus
   b. Lateral rectus
   c. Superior rectus
   d. Inferior rectus

3- **2 Oblique muscles:**
   a. Superior oblique,
   b. Inferior oblique.

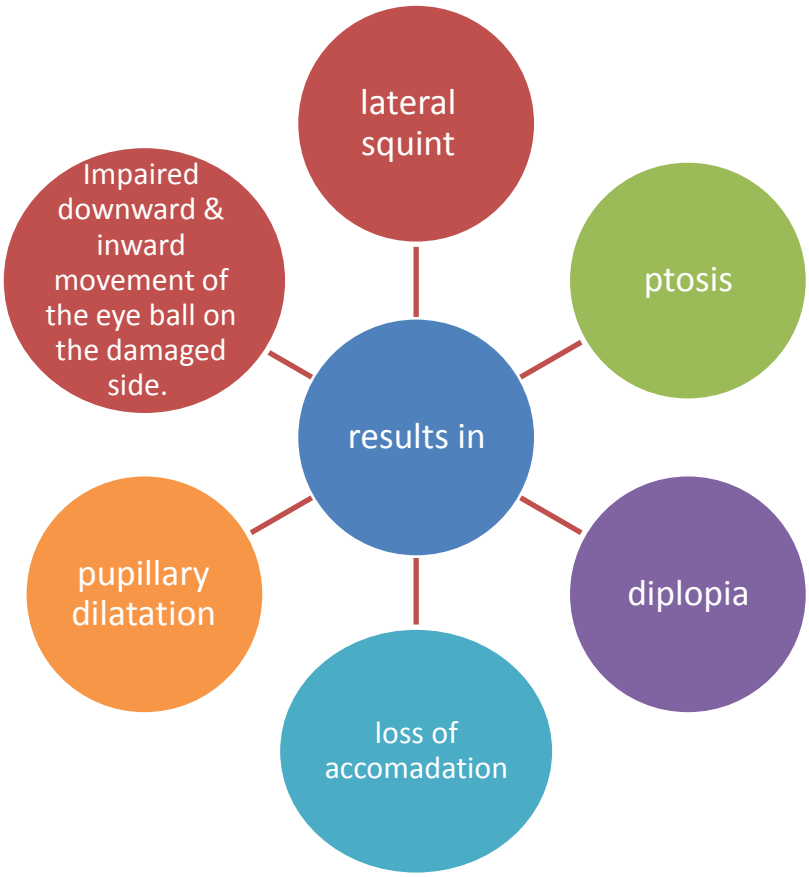
NB. All muscles of the eye are supplied by the oculomotor nerve , EXCEPT ***LR6 + SO4***



Occuluomotor (III)

Type of fibers	Motor for most of the extraocular muscles	Preganglionic parasympathetic for pupillary constrictor and ciliary muscle.
Nucleus	**Main occulomotor nucleus**	**Accessory nucleus**(Edinger-Westphal)
Origin	Lies in the mid brain, at the level of **superior colliculus**	Lies dorsal to the main motor nucleus. (Its cells are preganglionic parasympathetic neurons) It receives: **1-** **Corticonuclear fibers** for the accommodation reflex **2-** From **the pretectal nucleus** for the direct & indirect (consensual) pupillary reflexes
Course	• Axons curve ventrally through the **tegmentum and the red nucleus**. • The nerve emerges on the anterior surface of the midbrain in **the interpeduncular fossa**. • Then it passes forward between **posterior cerebral and superior cerebellar arteries.** • In the middle cranial fossa it runs in **the lateral wall** of the **cavernous sinus**, then it divides into **superior and inferior divisions** which enter the orbit through **the superior orbital fissure.**	**Accompany** the occulomotor nerve where they terminate in **the ciliary ganglion**. Postganglionic fibers pass through the short ciliary nerves to the eyeball 
supplies	**1-** Levator palpebrae superioris **2-** Superior rectus muscle **3-** Medial rectus muscle **4-** Inferior rectus muscle **5-** Inferior oblique muscle.	**1-** Constrictor pupillae of the iris **2-** Ciliary muscles.
Main functions	• Elevation of upper eyelid. • Moving the eye upward, downwards and medially. • Constricting the pupil. • Accommodating reflex for near objects.	

Occulomotor nerve lesion:



The preganglionic parasympathetic fibers run superficially in the nerve and are therefore the first axons to suffer when a nerve is affected by external pressure.

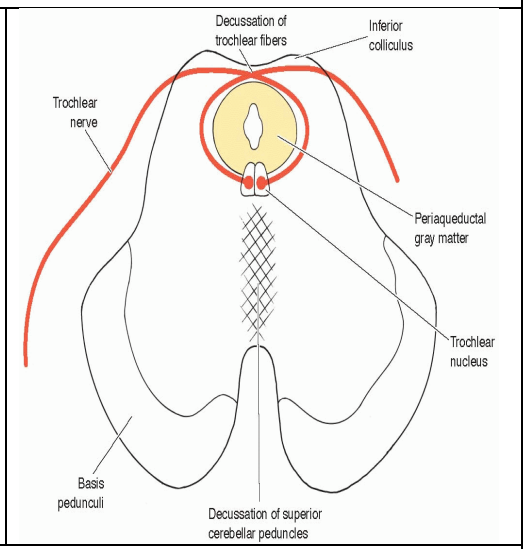
Consequently, the first sign of compression of the occulomotor nerve is **ipsilateral slowness of the pupillary response to light.**

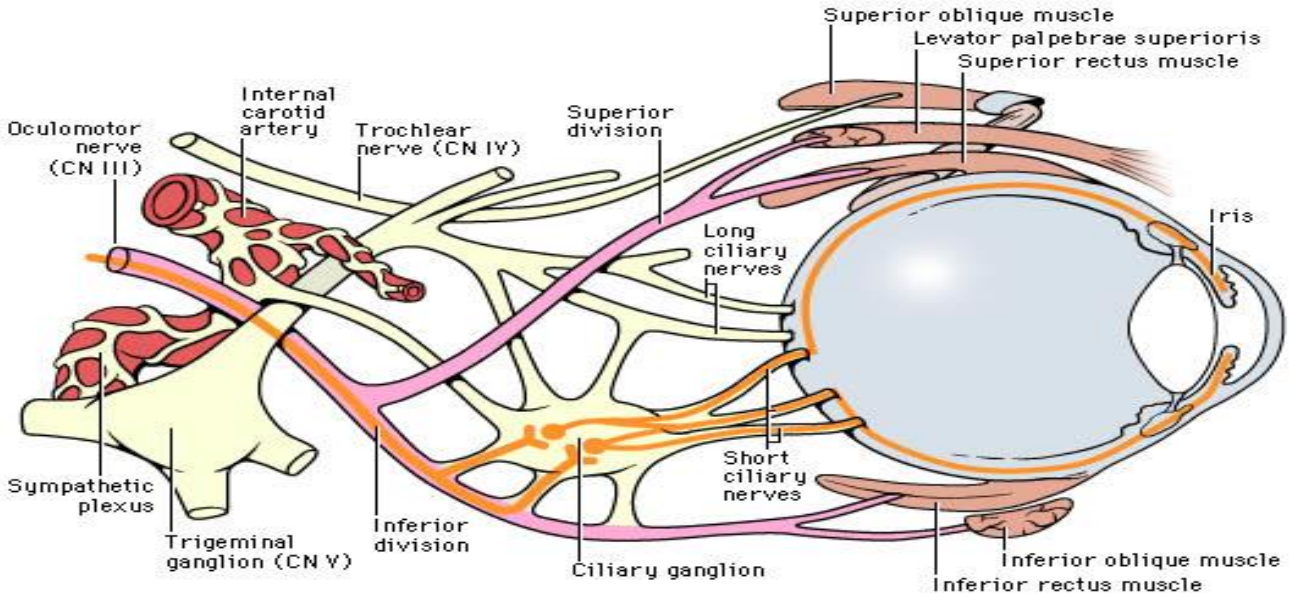

Normal eye alignment

Ptosis (drooping of the eyelid)


Lateral squint

Trochlear (IV)	
Type of fibers	Motor
Nucleus	Small motor nucleus located in **the periaqueductal grey** matter at the **level of inferior colliculus.** • Fibers curve backwards and decussate.
Site & Course	• The nerve **emerges** immediately **caudal to the inferior colliculus**, on the **dorsal surface of brain stem.** • It passes forward through middle cranial fossa in the **lateral wall of the cavernous sinus.** • Then it enters the orbit through **the superior orbital fissure.**
Supplies	**Superior oblique muscle**
Main function	**Rotates the eye ball downwards and laterally.**



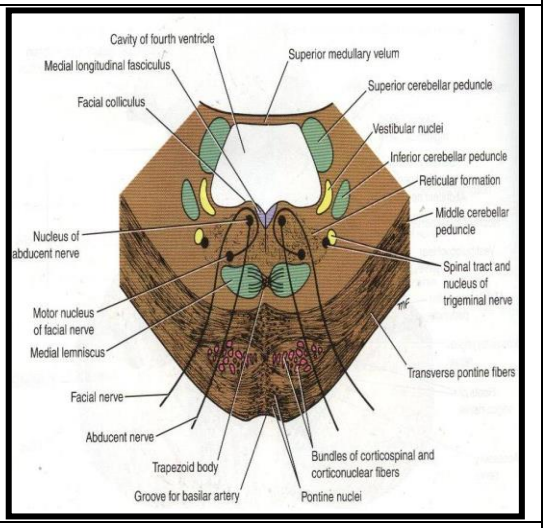


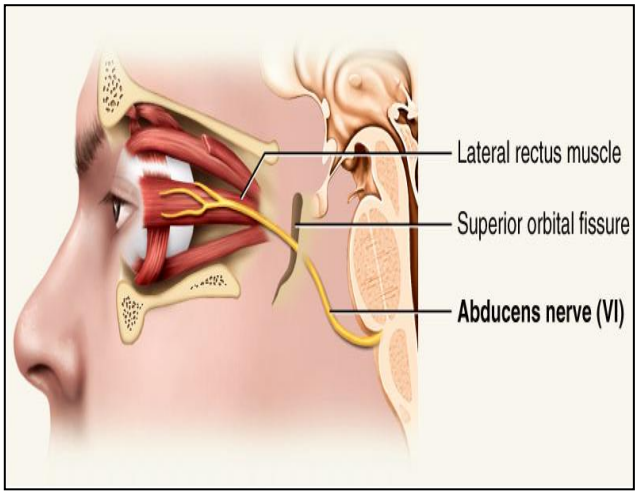
Trochlear nerve lesion:

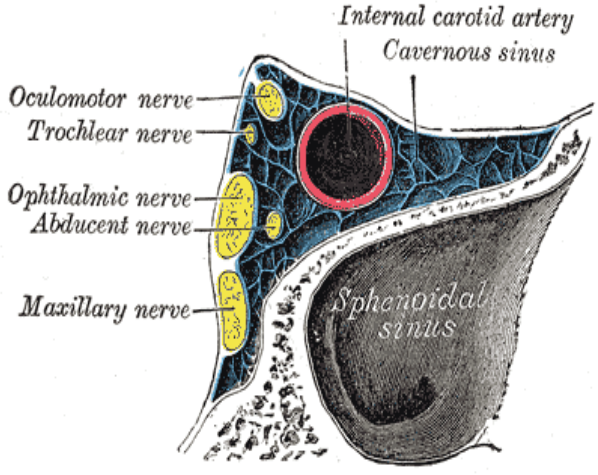
Lesion results in **diplopia** & Inability to rotate the eye **infero-laterally**.

So, the **eye deviates upward** and slightly **inward.**

This person has difficulty in walking downstairs

Abducent (VI)		
Type of fibers/Nucleus	One **Motor** Nucleus	
Site	• Lies in **caudal** pons in the floor of the **4th ventricle** • Lies close to the middle line, in a line with **3rd, 4th & 12th** nerves. • It forms **the facial colliculus** with the fibers of facial nerve looping around the nucleus.	
Course	• It emerges from **the ventral aspect of brain stem**, at the junction of the pons and the pyramid of the medulla. • It passes through cavernous sinus, lying below and lateral to the **internal carotid artery** • Then it enters the orbit through the **superior orbital fissure.**	
Supplies (only one)	**The lateral rectus muscle**	
Main functions	**Rotates the eye ball laterally**; (abduction).	



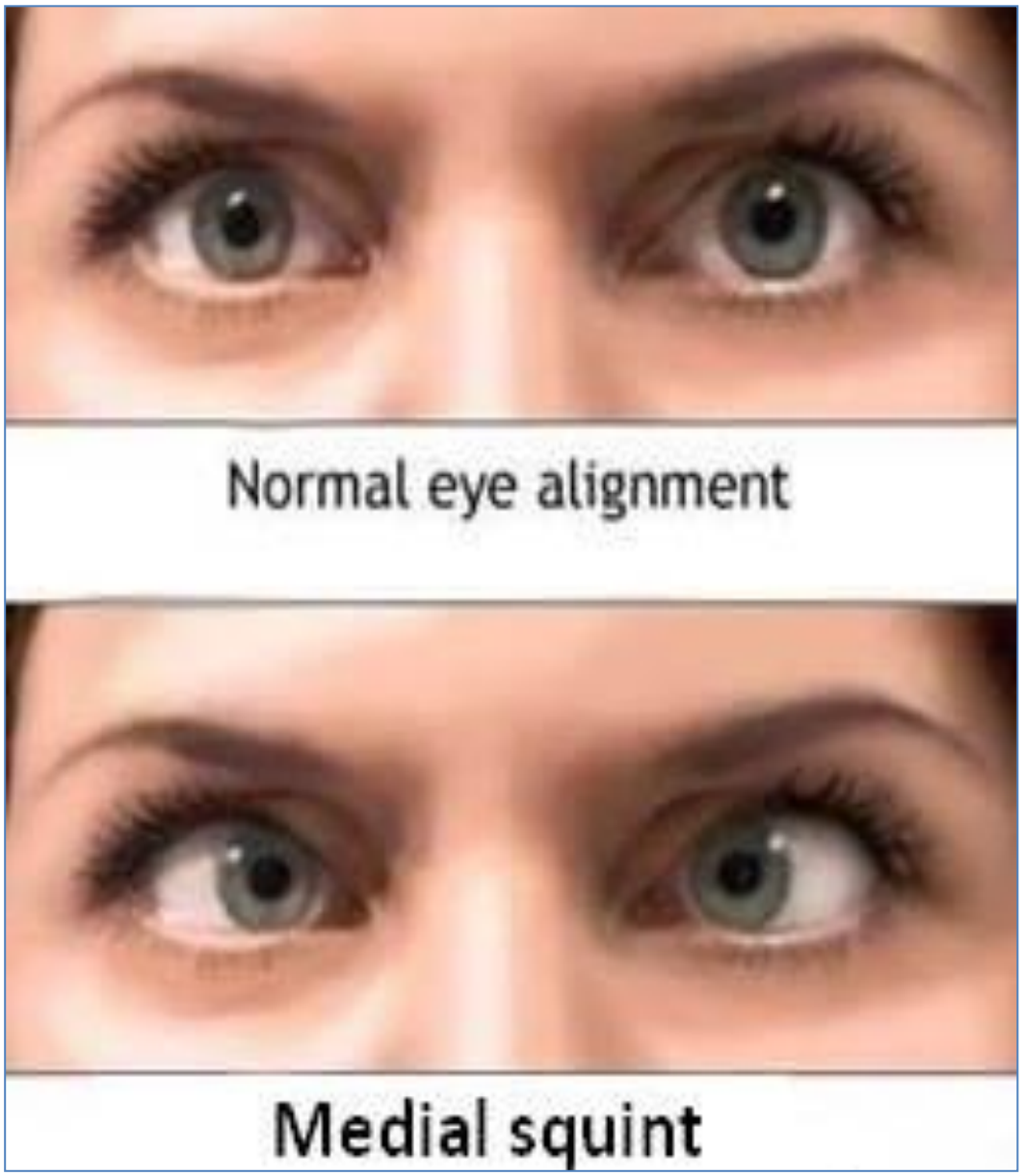


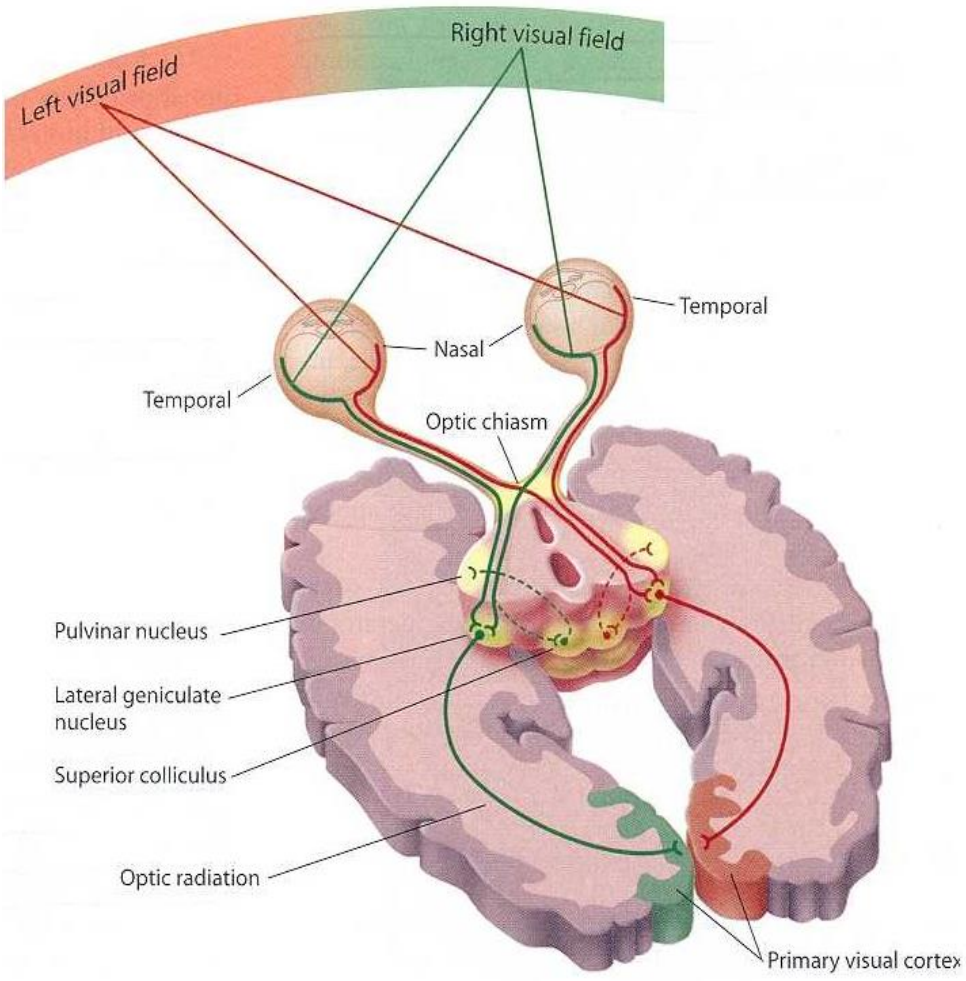
Abducent nerve lesion:

Results in:

1. Inability to direct the affected eye laterally. **(Medial squint).**

2. A nuclear lesion may also involve the nearby nucleus or axons of the **facial nerve,** causing **paralysis of all the ipsilateral facial muscles**



Optic (II)	
Type & function	Special sensory for Vision
Visual pathway	1. Optic nerve 2. Optic chiasm 3. Optic tract 4. Lateral geniculate body (nucleus) 5. Optic radiation 6. Visual cortex
	

Visual pathway:

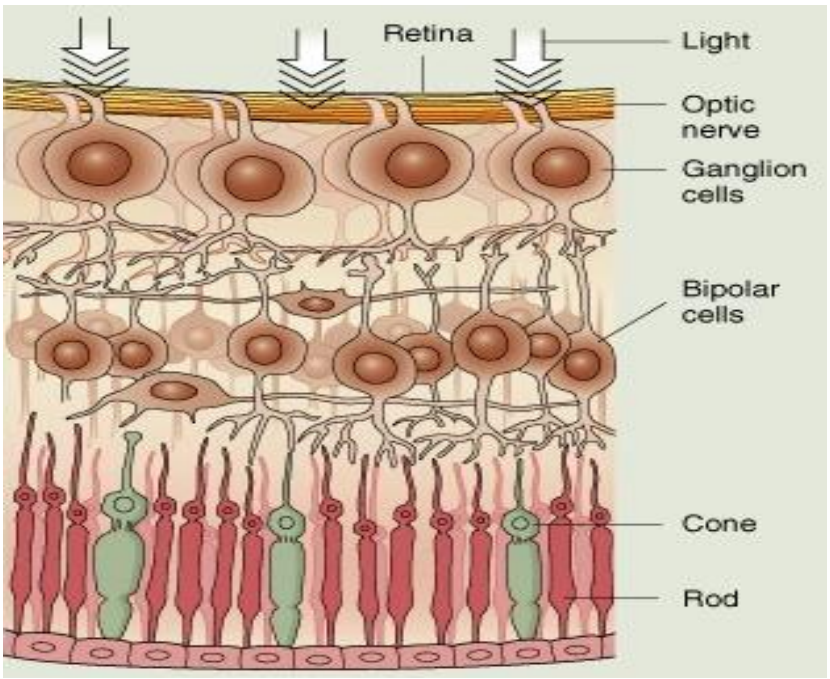
Photoreceptors: Rods & cones of retina

3 neuron pathway:

1st order
- **Bipolar cells** of the retina

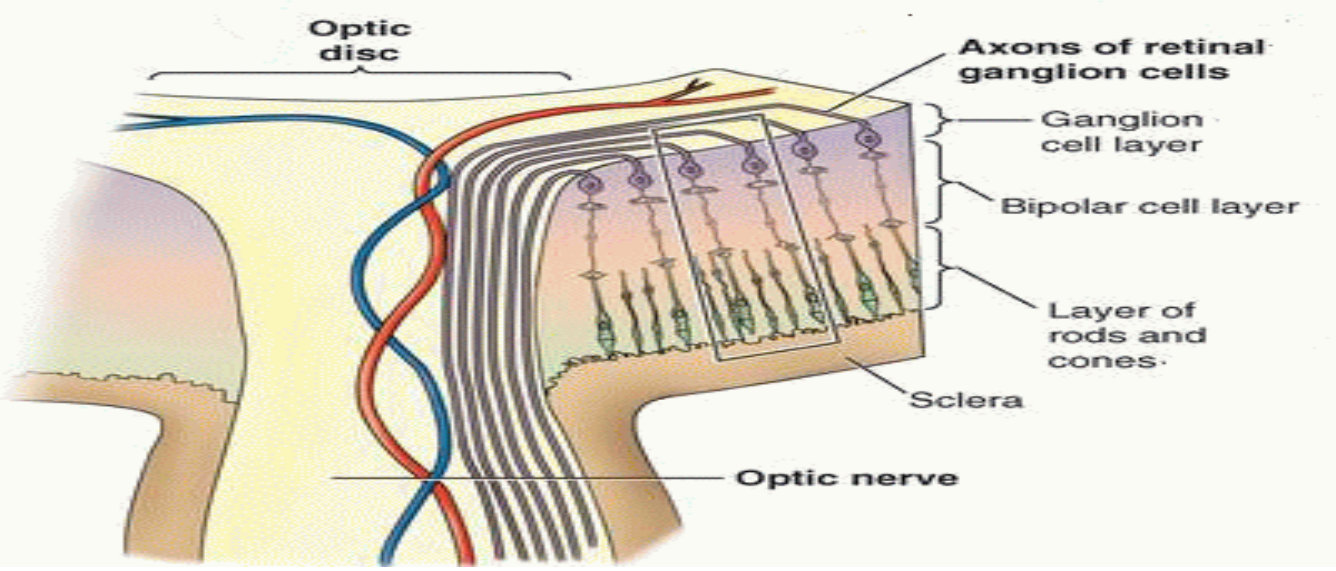
2nd order
- **Ganglion cells of retina**
- Their axons form the optic nerve

3rd order
- **Neurons in the lateral geniculate body**
- Their axons terminate in the primary visual cortex



1. Optic nerve:

- Axons of retinal ganglion cells converge at the **optic disc** and pass into **optic nerve**
- Then the nerve passes posteromedially in the orbit.
- Then exits through the **optic canal** to enter the middle cranial fossa to joins the **optic chiasma.**

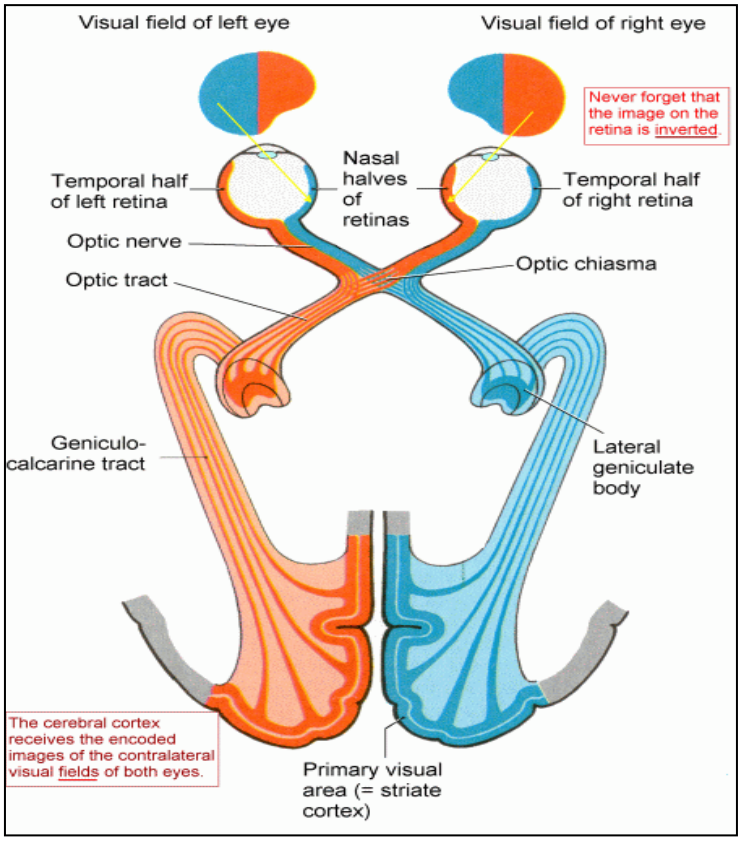


2. Optic chiasma:

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

- The decussation of nerve fibers in the chiasm results in the right optic tract conveying impulses from the left **visual field** and vice versa.

- The **partial crossing** of optic nerve fibers in the optic chiasma is a requirement for **binocular vision, visual acuity and 3D vision.**

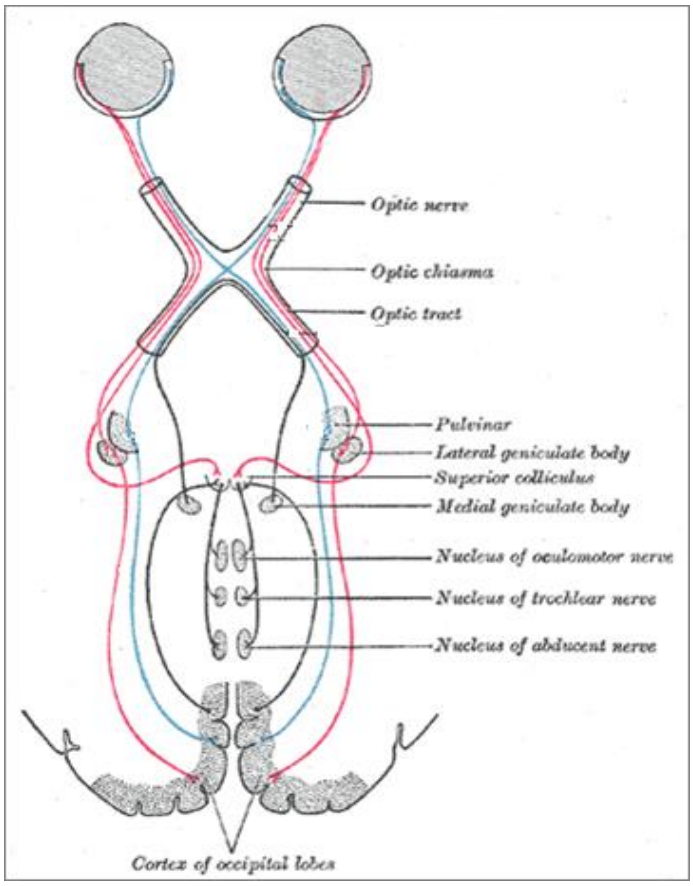


3. Optic tracts:

Fibers in the optic tracts:

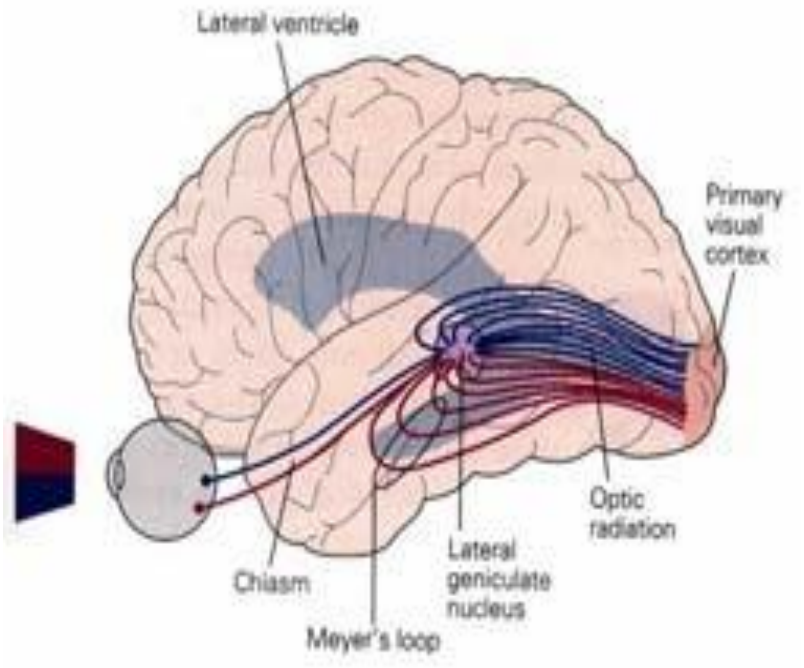
1- Mainly terminate in the (LGB), **lateral geniculate bodies** of the thalamus

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

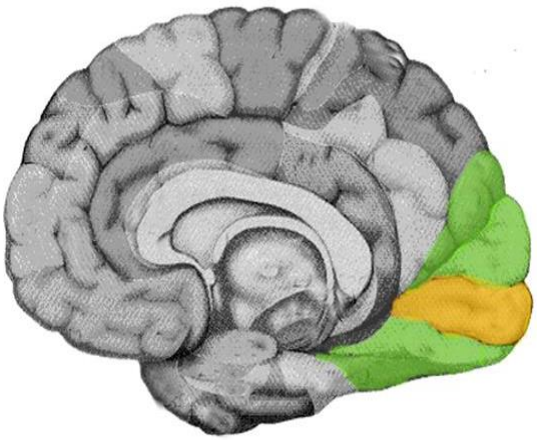


4. Optic radiation:

- Optic radiation or thalam-ocortical or geniculocalcarine fibers originating in the **lateral geniculate nucleus**.
- Passes through the **retrolenticular part** of the posterior limb of the internal capsule to the visual cortex **above and below** the calcarine sulcus.



5. Visual cortex:

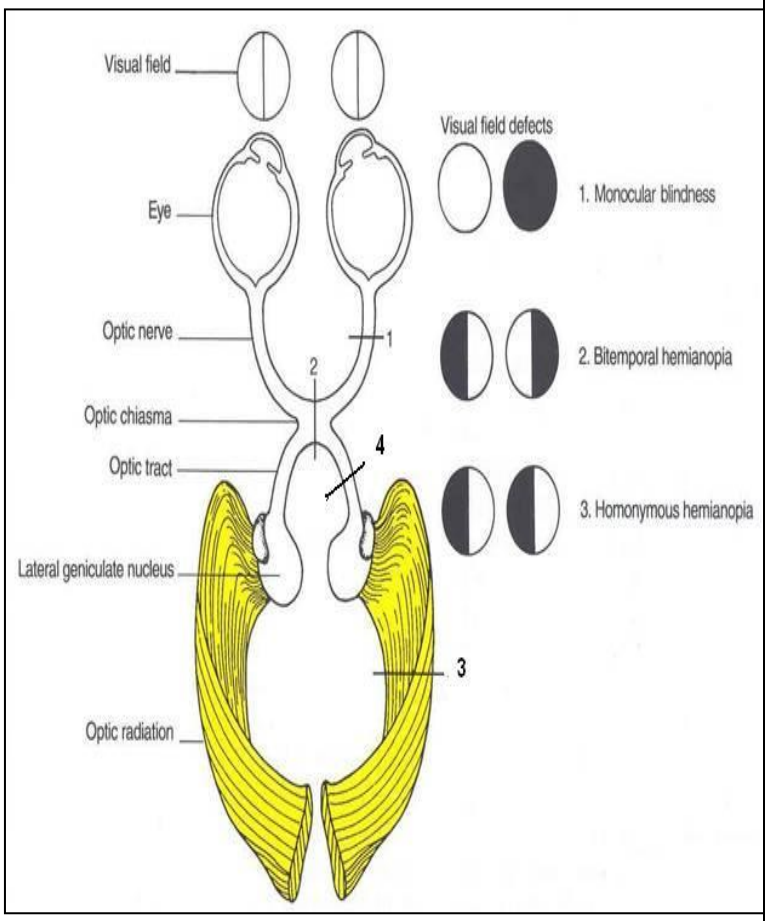


- **The primary visual cortex** (area 17 of Brodmann's): occupies the upper and lower lips of the calcarine sulcus on the medial surface of the cerebral hemisphere

- **The visual association cortex is extensive,** including the whole of the occipital lobe, the adjacent posterior part of the parietal lobe.

- This cortex is involved in recognition of objects and perception of **color, depth, motion, and other aspects of vision.**

Visual field deficits:



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

- **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**.

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

Test your knowledge …!!

MCQs

1) Fibers in the optic tracts mainly terminate in :

a- pretectal area **b**- superior colliculus **c**- lateral geniculate bodies.

2) The geniculocalcarine fibers are originating in the

a- **lateral geniculate nucleus** **b**-inferior colliculus **c**- pretectal area.

3) Abducent nerve lesion results in :

a- Medial squint **b**-lateral squint **c**- A&B

4) The abducent nerve supplies the :

a- medial rectus. **B**- lateral rectus **c**-A&B

5) A lesion of the optic chiasm causes a:

a- total loss of vision (blindness) **b**- bitemporal hemianopsia **c**- contralateral homonymous hemianopsia.

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6) Open questions !!

*What are the 1st, 2nd and 3rd order neurons in the visual pathway?

first: Bipolar cells of the retina

second: Ganglion cells of retina and their axons form the optic nerve

Third: Neurons in the lateral geniculate bod and Their axons terminate in the primary visual cortex. (shade to see the answer)

*What are the components of the visual pathway ?

Optic nerve ,Optic chiasm ,Optic tract

Lateral geniculate body (nucleus) and Optic radiation

(shade to see the answer clearly)

---

fill the gaps

a- the (IV) cranial nerve supplies ……. Muscle and its main function is…….

b- The 4 main functions of the occuluomotor nerve are ……, ……., …… and ……..

Answers' box

*MCQs : 1-c , 2-A , 3-A , 4-B , 5-B

*Gaps are

a- Superior oblique muscle -- Rotates the eye ball downwards and laterally.

b- Elevation of upper eyelid--Moving the eye upward, downwards and medially-- Constricting the pupil.
And Accommodating reflex for near objects.

GOOD LUCK

Anatomy Team Leaders:

Fahad AlShayhan & Eman AL-Bedica.