Visual pathway and visual field defect

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AP Ophthalmology

Visual pathway

- **objectives**
- Describe the different components of visual pathway
- Lesions/ defects of visual pathway

Anatomy of different components of visual pathway

OPTIC NERVE

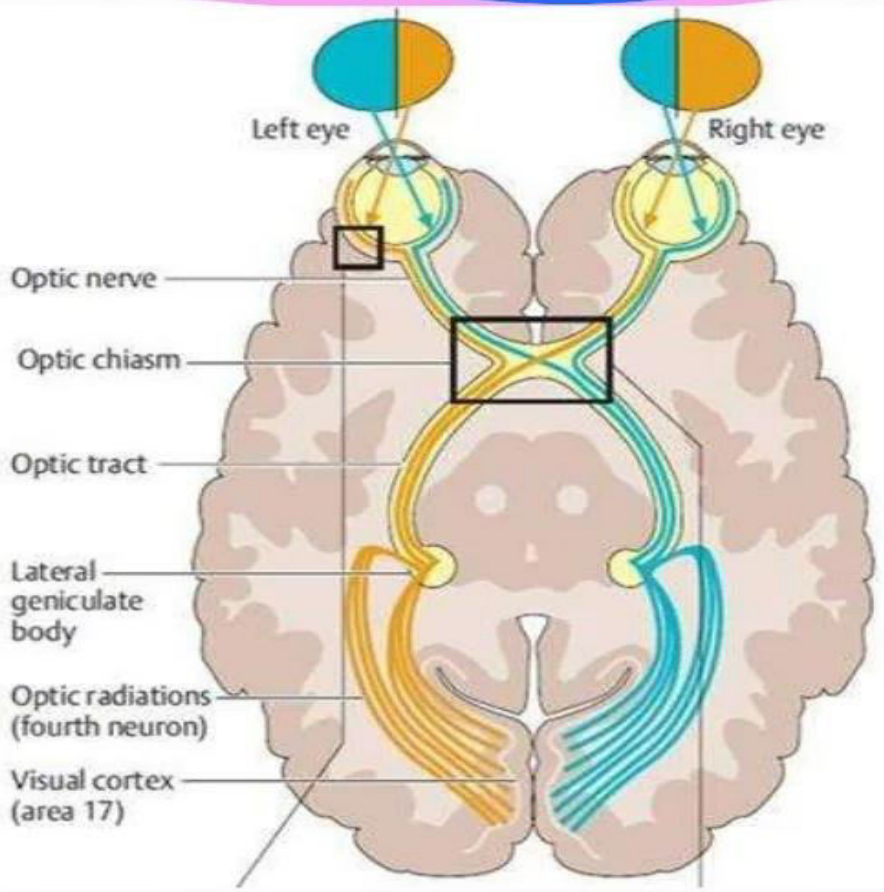
OPTIC CHIASMA

OPTIC TRACT

LATERAL GENICULATE BODY

OPTIC RADIATIONS

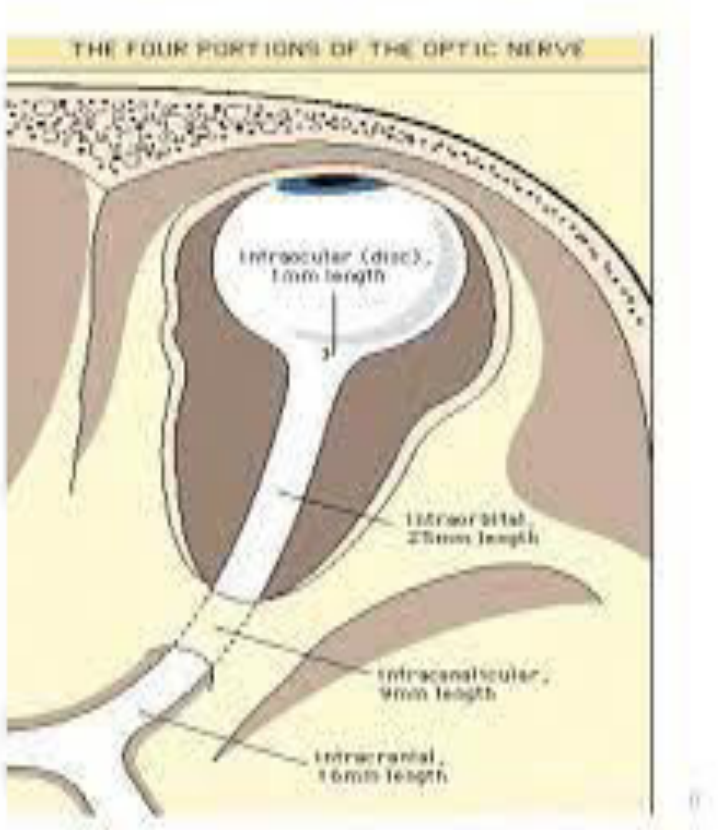
VISUAL CORTEX



Laxmi eye institute

Optic Nerve

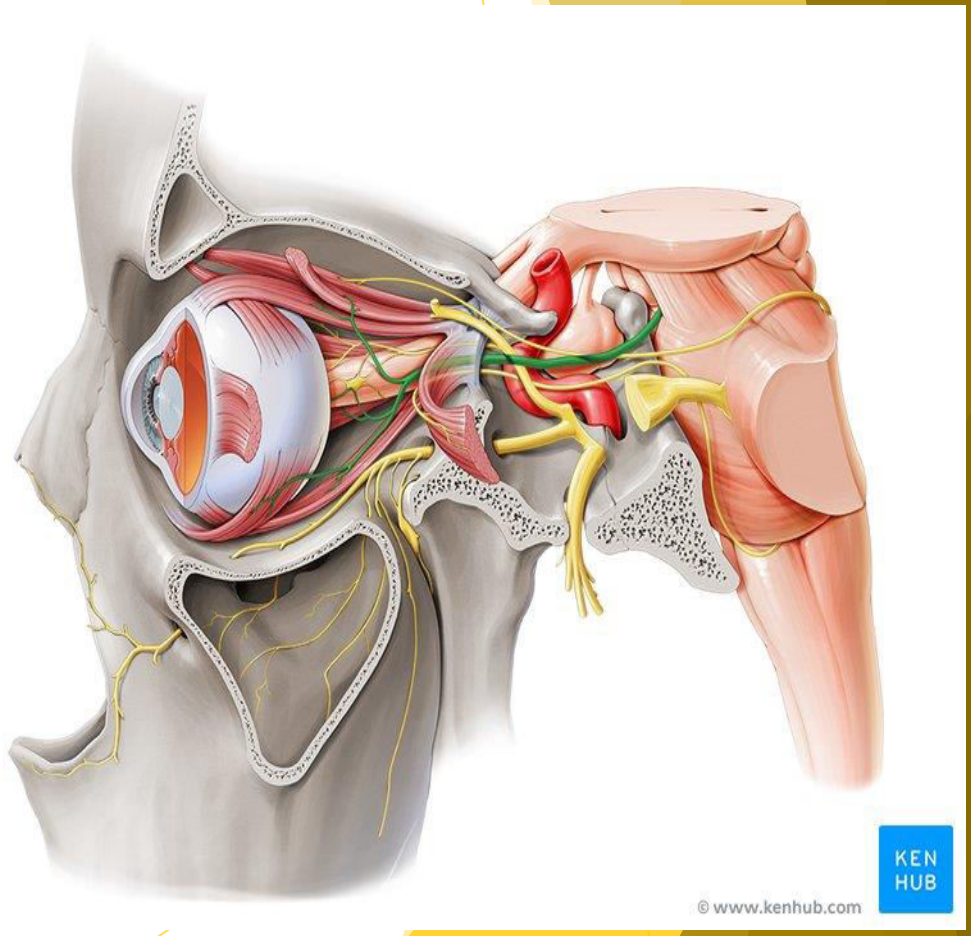
- **Parts of optic nerve**
  - Intraocular (1 mm)
  - Intraorbital (30 mm)
  - Intracanalicular (6- 9mm)
  - Intracranial (10 mm)



- Intraocular part
  - Passes through sclera , choroid and appears in eye as optic disc
  - Intraocular portion is of 1.5mm which expands to 3mm just behind eye because of myelin sheath
  - ONH has 4 portions

- Intraorbital part

  - Extends back from eyeball to optic foramina
  - Covered by dura, arachnoid and pia.
  - Central retinal artery enters nerve on its inferomedial aspect about 10mm behind eyeball
  - Some fibers of superior rectus and medial rectus are adherant to its sheath so painful ocular movements in retrobulbar neuritis.



- Intracanalicular part
  - 6-9mm length
  - closely related to ophthalmic artery
- Intracranial part
  - 10mm length
  - above cavernous sinus and converges with its fellow to form chiasma
  - covered by pia matter only

Optic Chiasma

- Flattened structure measuring 12mm Horizontally and 8mm Anterio-posteriorly
- It lies over diaphragma sella
- Continues posteriorly as optic tracts and forms anterior wall of third ventricle
- Nerve fibers arising from nasal halves of the two retinae decussate at the chiasma

Optic Tracts

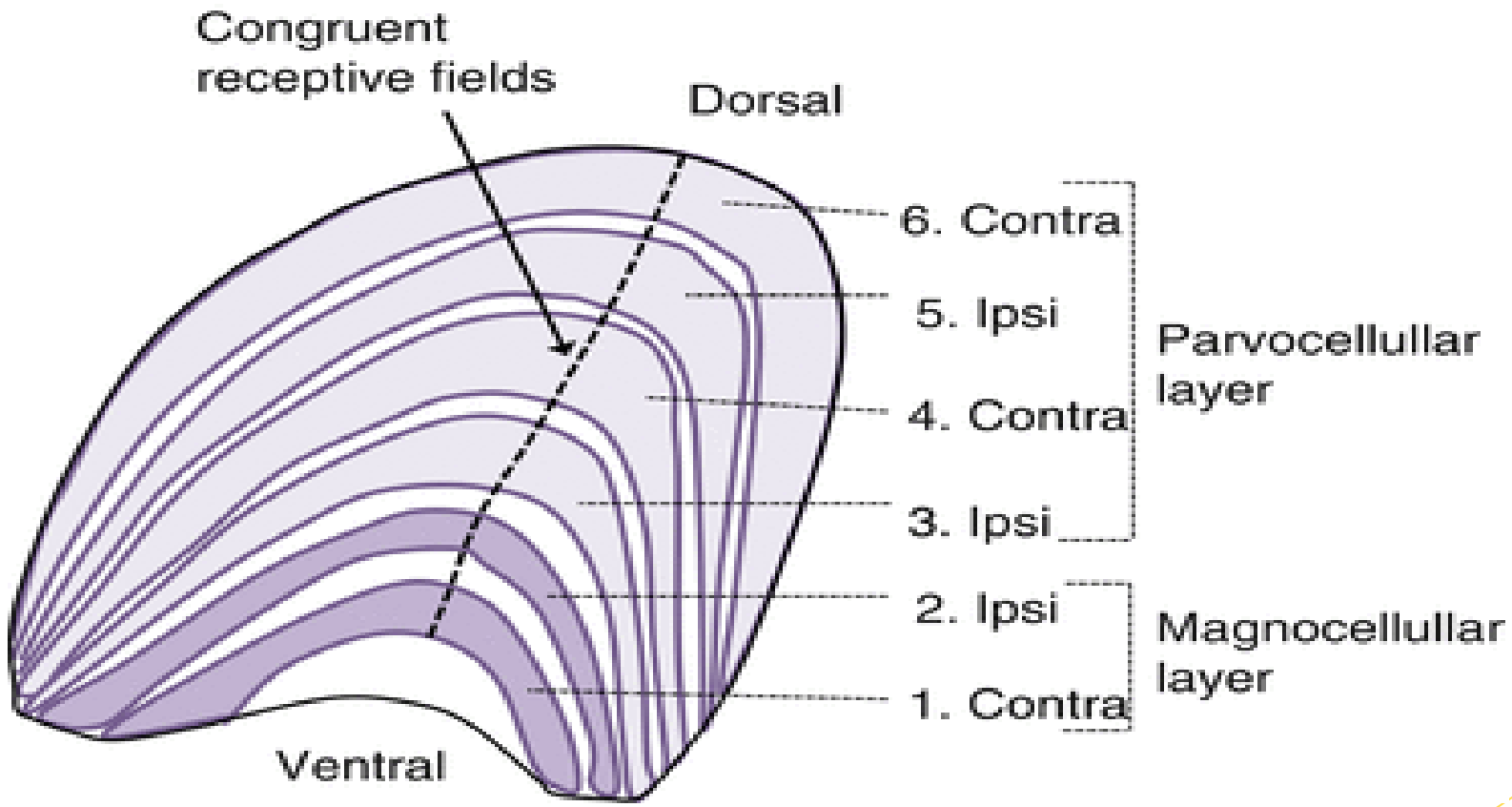
- Bundles of nerve fibers running outwards and backwards from postero-lateral aspect of optic chiasma
- Consist of temporal fibers of retina of same eye and nasal half of opposite eye
- Each optic tract end in LGB

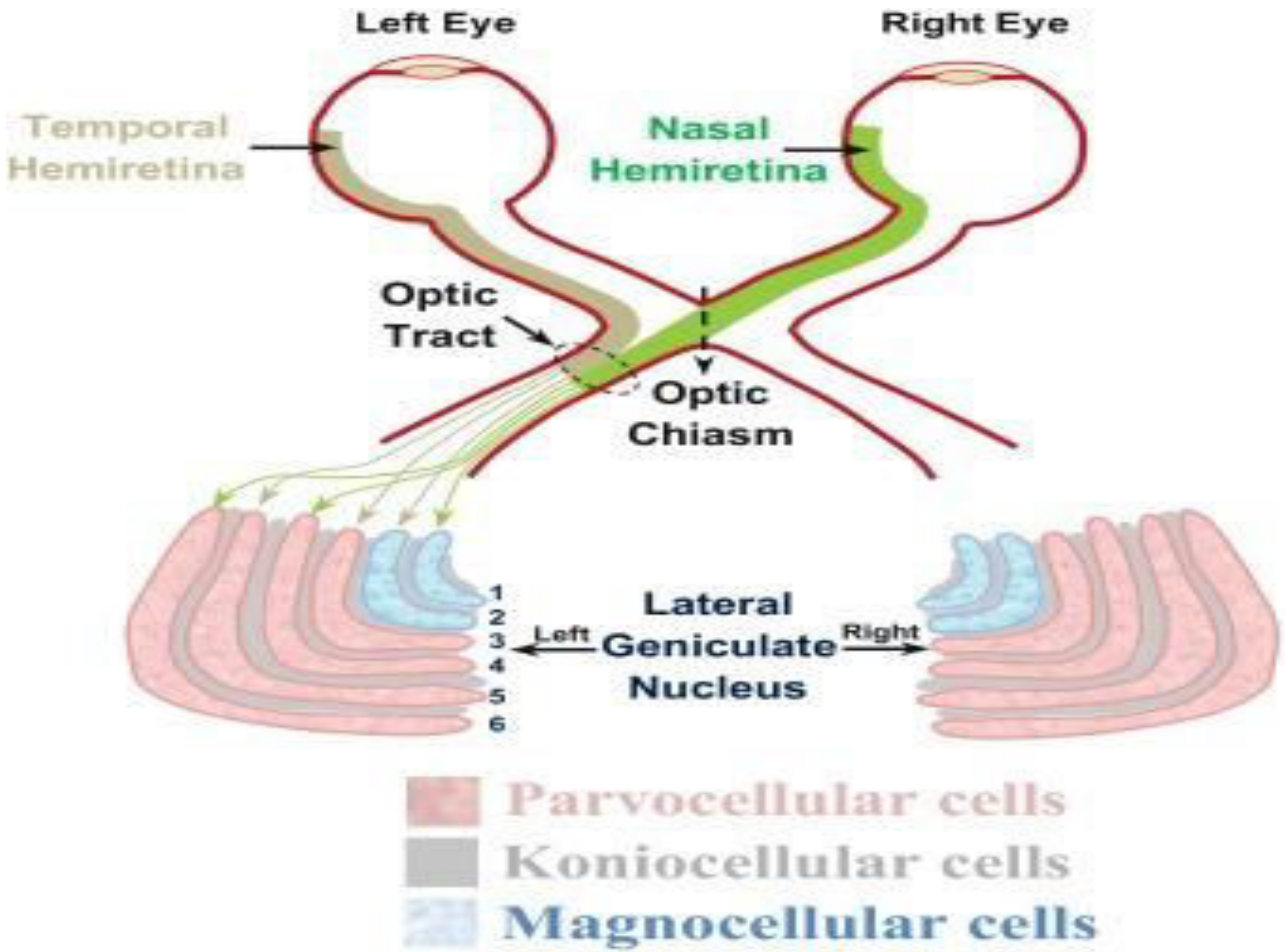
Lateral Geniculate Body

- Oval structures situated at termination of optic tract
- Each LGB consist six layers of neurons alternating with white matter
- Each body is split into 6 laminae
- Fibers from Ipsilateral Temporal Retina End in Lamina 2,3,5 and contralateral nasal retina end in Lamina 1,4,6.

  This 6 laminae divide LGB into 2 portions

Lateral Geniculate Body




Left Eye
Right Eye
Temporal Hemiretina
Nasal Hemiretina
Optic Tract
Optic Chiasm
1
2
3
4
5
6
Left
Lateral Geniculate Nucleus
Right
Parvocellular cells
Koniocellular cells
Magnocellular cells

Functions Lateral geniculate body

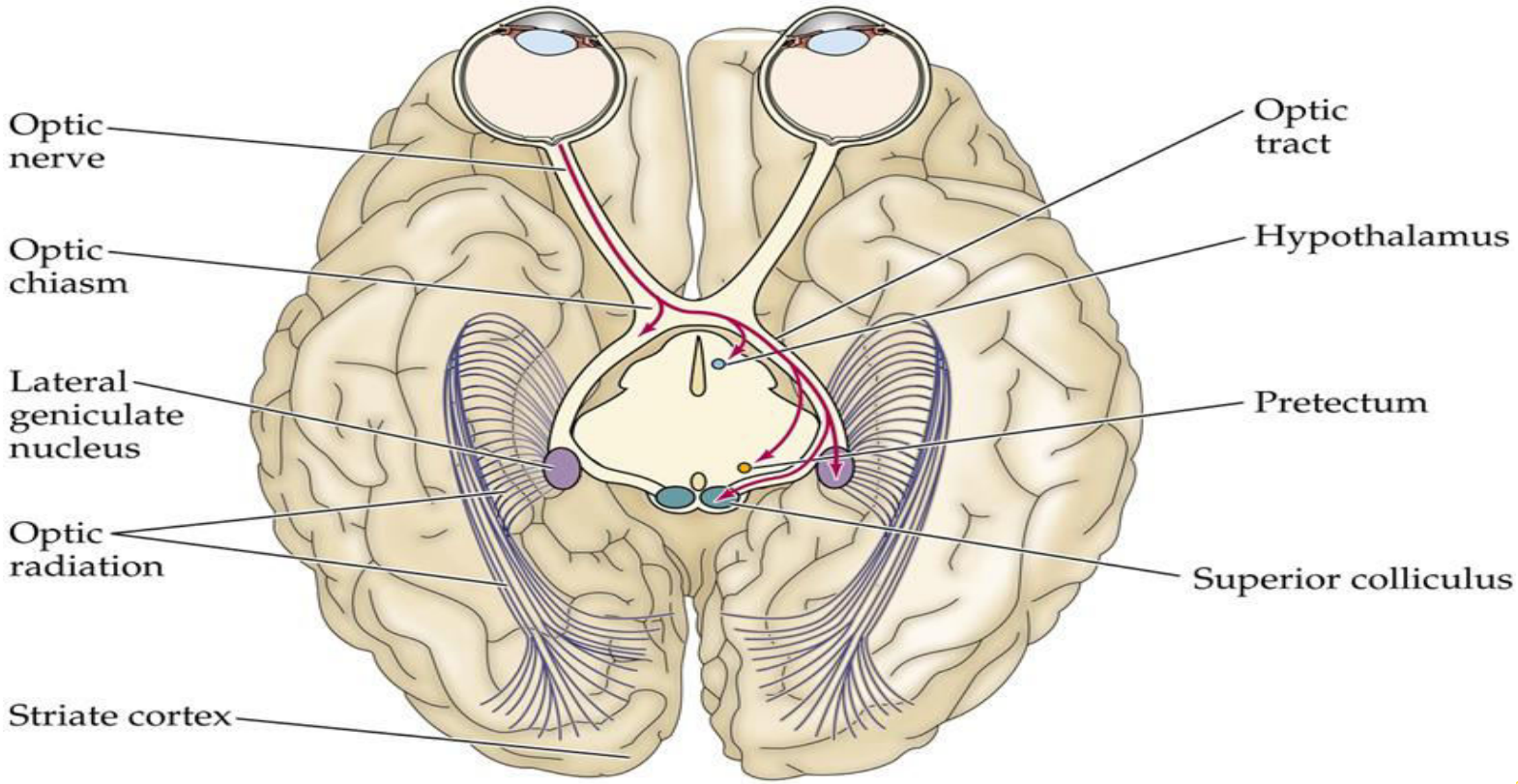
- Relay station to relay visual information from optic tract to visual cortex

- To gate transmission of signals to visual cortex

Optic Radiations

- Extend from LGB to visual cortex
- Fibers of optic radiation spreads out fanwise to form medullary optic lamina
- Superior fibers of radiation (which subserve inferior field) proceed directly posteriorly through parietal lobe
- Inferior fibers of radiation (which subserve Superior field) first sweep anteriorly in meyers loop around anterior tip of temporal horn of lateral ventricle and then into temporal lobe

Optic Radiations



Visual cortex

- Located on medial aspect of occipital lobe
- Subdivided into
  - Visuosensory area (striate area 17)
  - Visuopsychic area (striate area 18 and 19)

Arrangement of nerve fibers

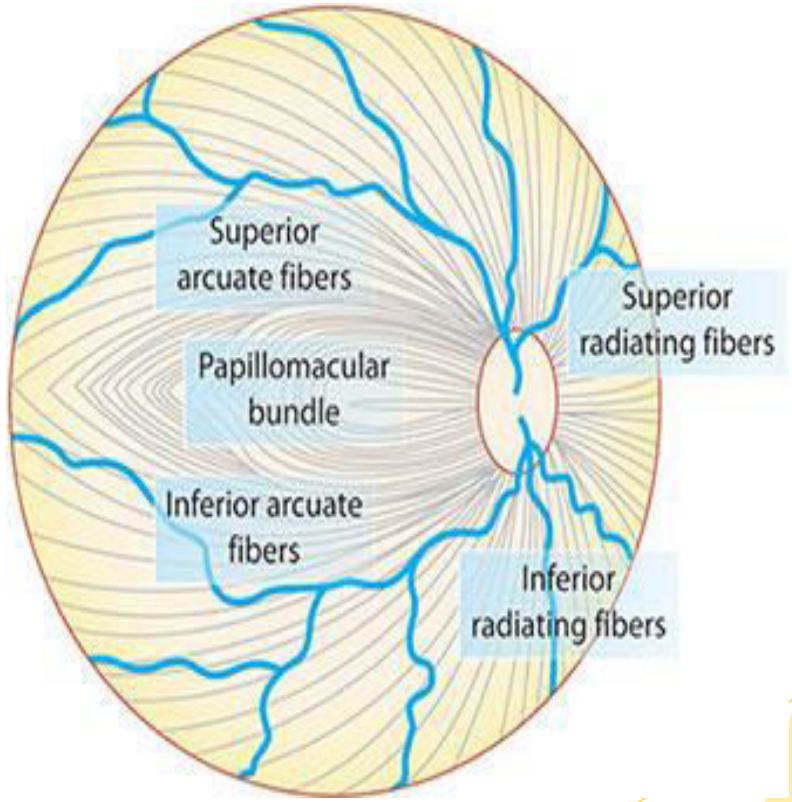
Arrangement of nerve fibers

- **Retina**

- Fibers from nasal half come directly to optic disc as superior radiating fibre and Inferior radiating fibre.

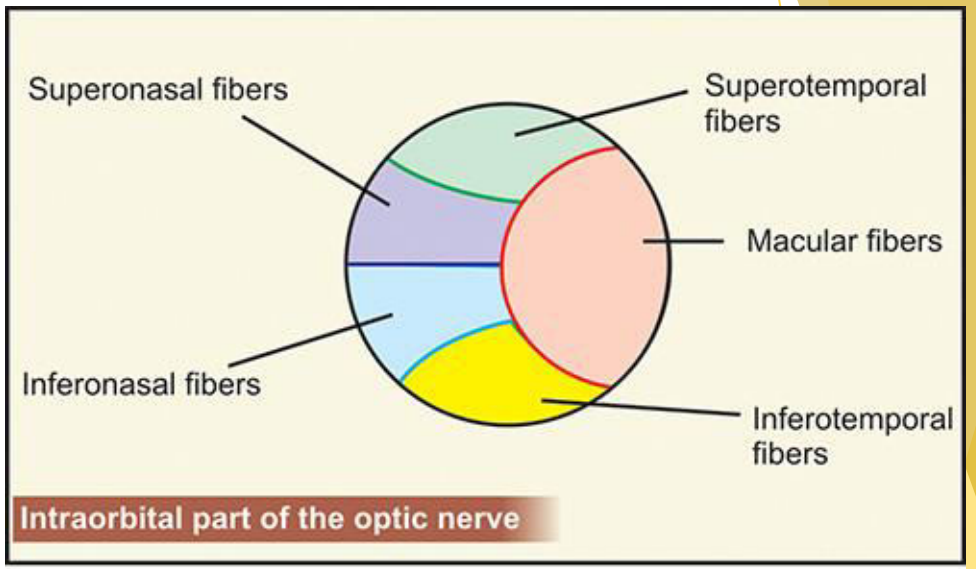
- Fibers from temporal half as superior Arcuate fibre and inferior arcuate fibre.

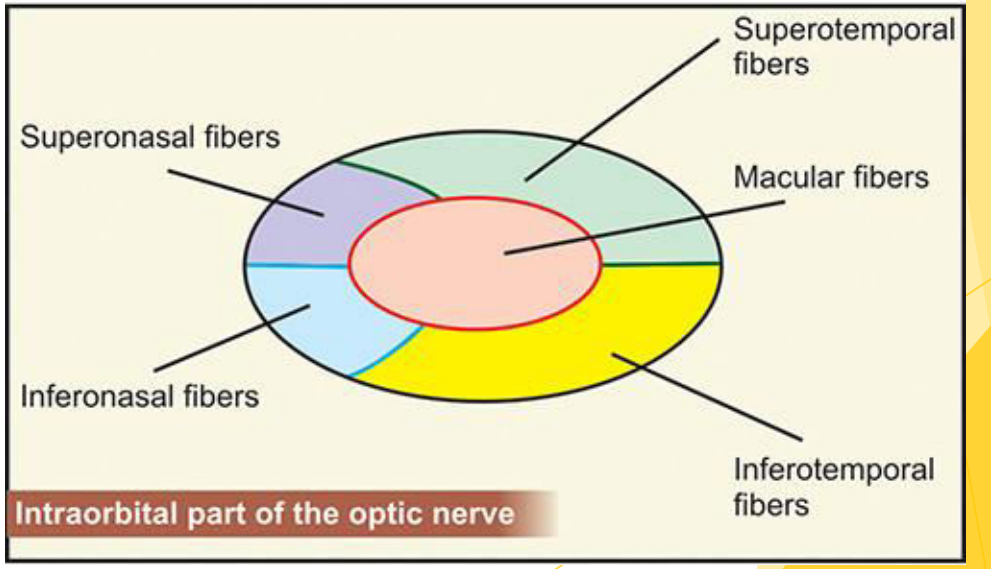
- Fibers from macular region pass straight in temporal part of optic disc as pmb



Arrangement of nerve fibers

- **Optic nerve**
- 1. **Optic nerve head** arrangement of fiber exactly same as retina
- **2. Proximal region of optic nerve**
- -macular fibers present centraly
- -Temporal fibers present temporaly and
- nasal fibers present nasally

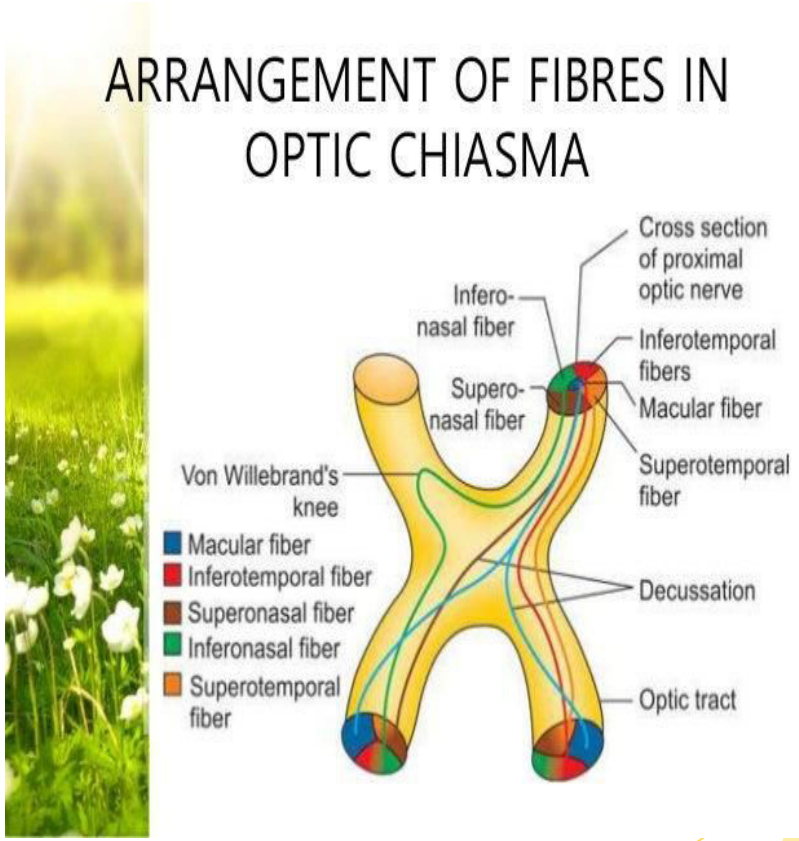




Arrangement of nerve fibers

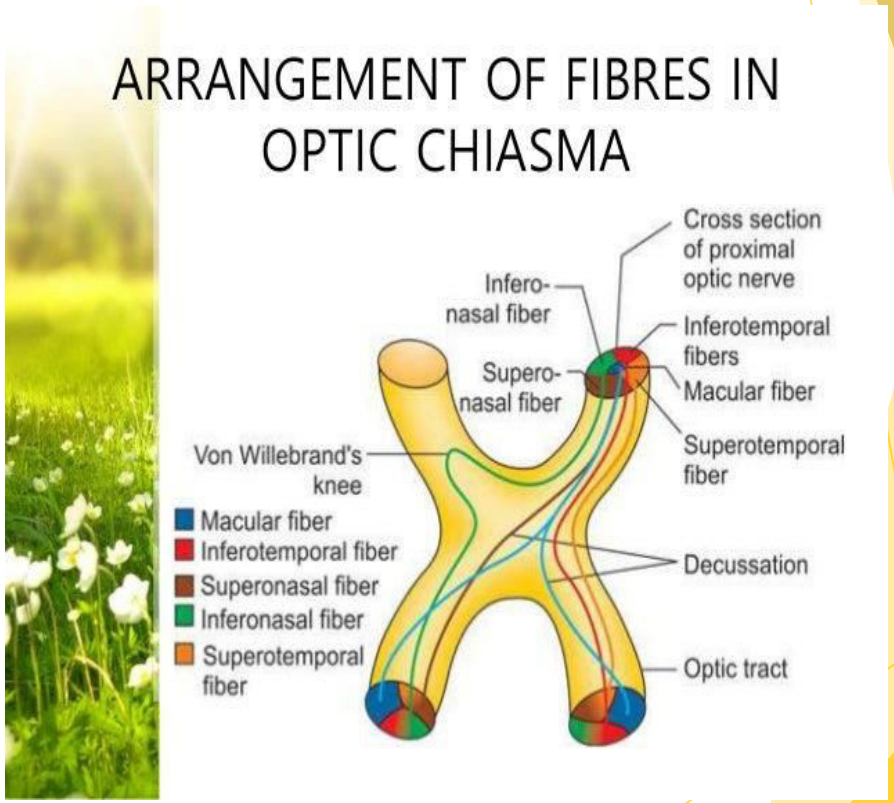
- **Optic Chiasma**

- **Temporal fibers** from retina remains uncrossed and runs backward in lateral part of optic chaisma



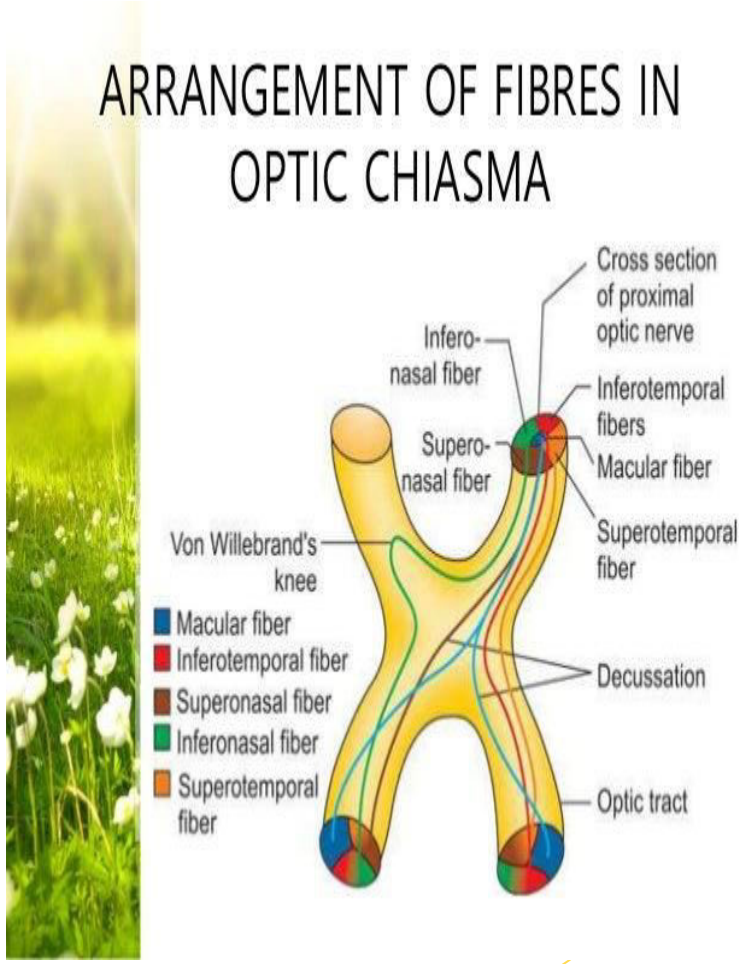
Arrangement of nerve fibers

- **Optic Chiasma Nasal peripheral fibers-**
- ¾ of fibers
- Cross over to enter medial part of opposite optic tract in following manner
- lower nasal fibers in optic tract traverse chiasma low and anteriorly
- Upper nasal fibers in optic tract trasverse chiasma high and posteriorly



Arrangement of nerve fibers

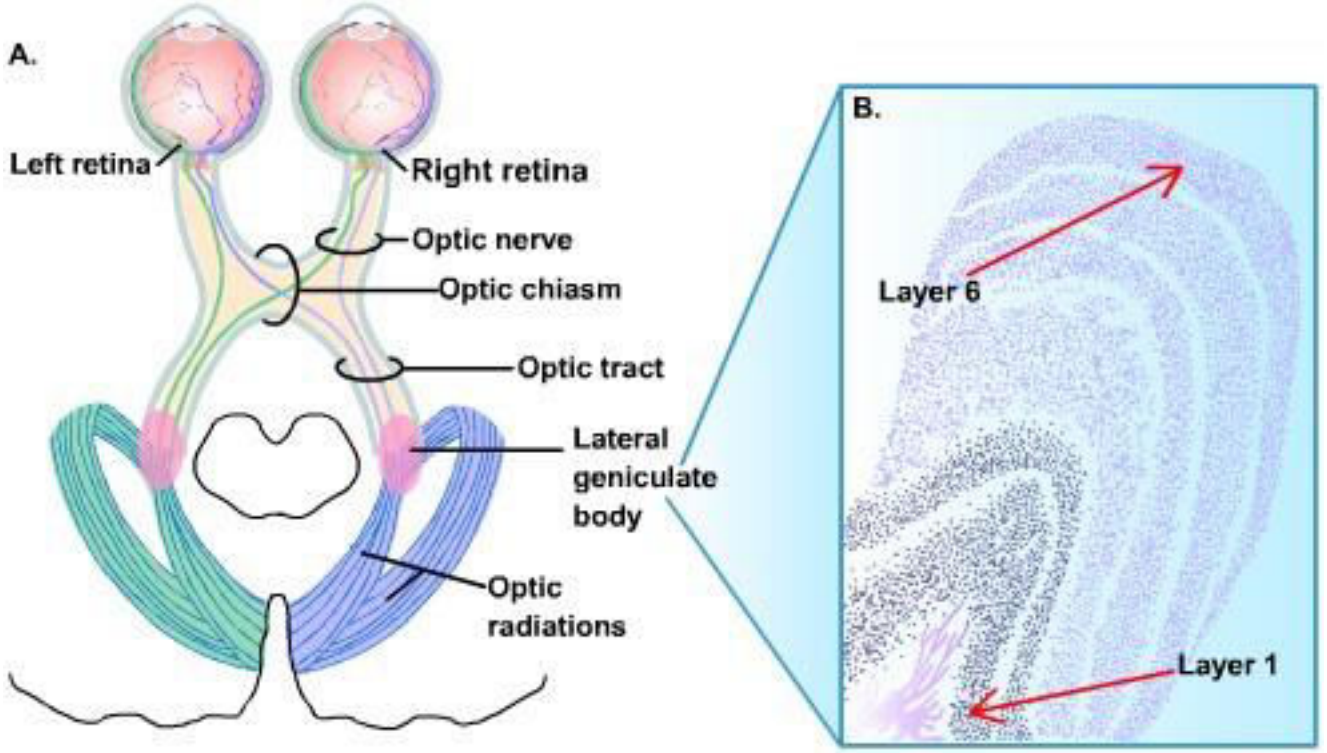
- **Optic Chiasma Macular fibers-**
- Some fibres crossed and runs backward in opposite optic tract
- Some fibers uncrossed and runs on same side in optic tract



Arrangement of nerve fibers

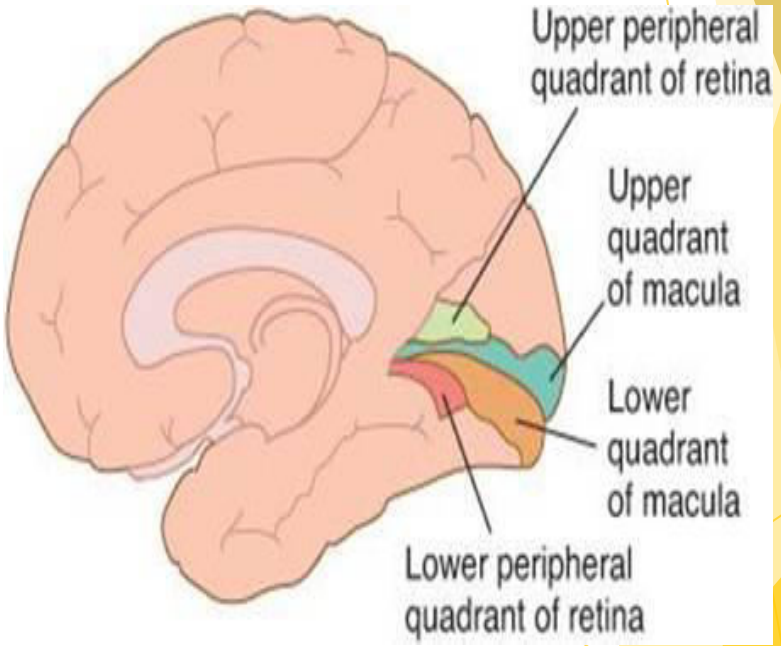
- **Optic Tract**
- Macular fibers – occupy dorso-lateral aspect of the optic tract
- Upper peripheral fibers – situated medially in the optic tract

- **LGB**
- The macula fibres coming in the optic tract occupy the posterior 2/3 of the LGB

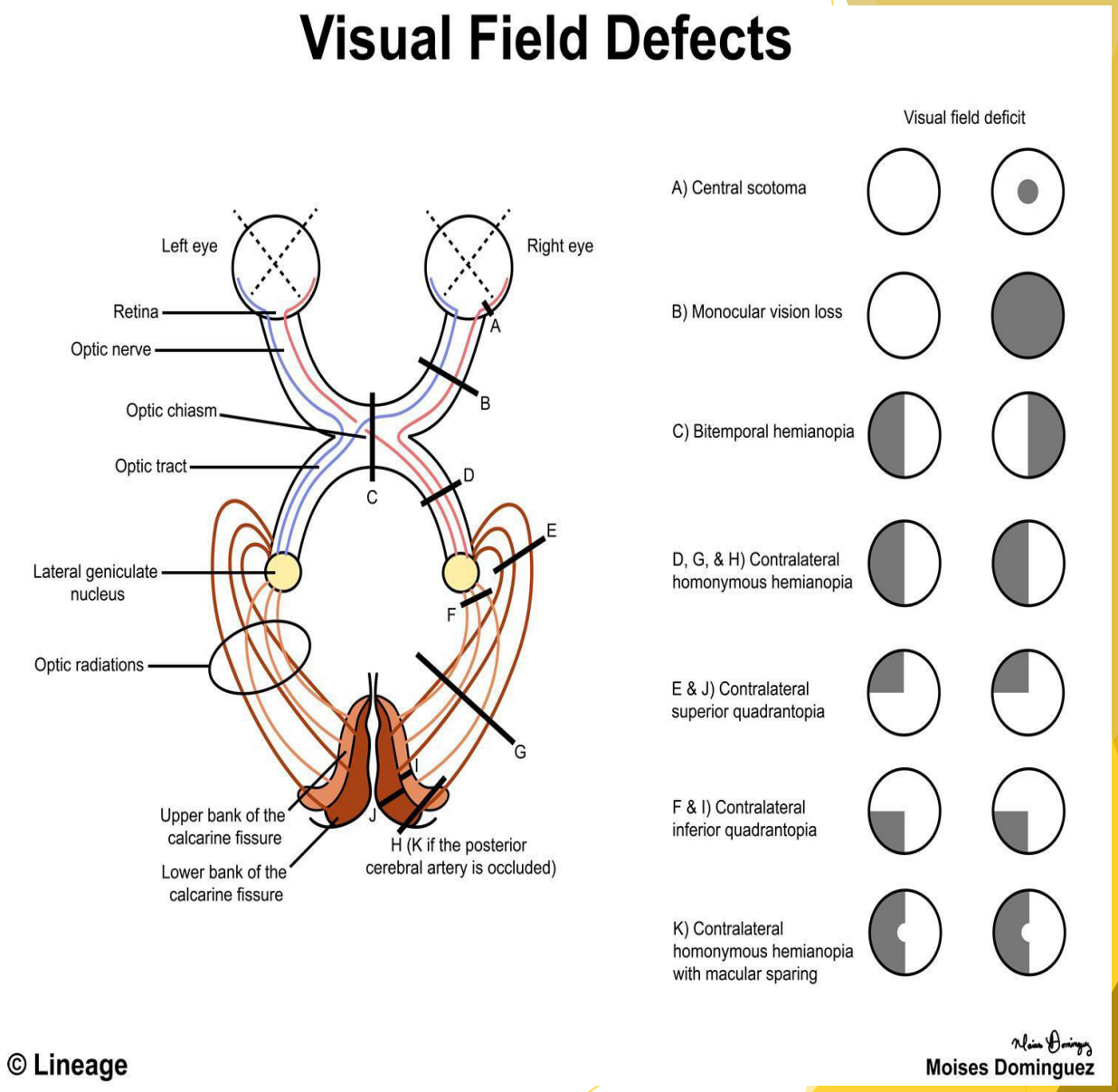

A.
Left retina
Right retina
Optic nerve
Optic chiasm
Optic tract
Lateral geniculate body
Optic radiations
B.
Layer 6
Layer 1

Arrangement of nerve fibers

- **Optic Radiations**
- Upper retinal fibers – upper part of optic radiations
- Lower retinal fibers – lower part of optic radiations
- Macular fibers – central part of optic radiations



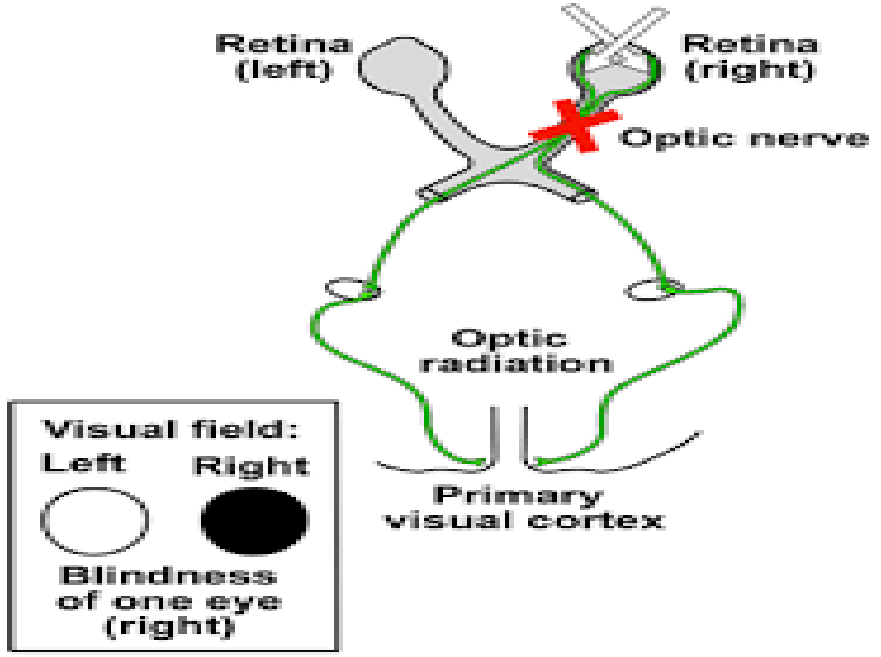
Visual field defect



OPTIC NERVE

- **Lesion of optic nerve-**
- characterised by complete blindness on affected side
- Absence of light reflex on ipsilateral side and consensual on contralateral side
- Near reflex present

- **Cause:**
  - Traumatic optic avulsion,
  - Acute optic neuritis,
  - Optic atrophy.

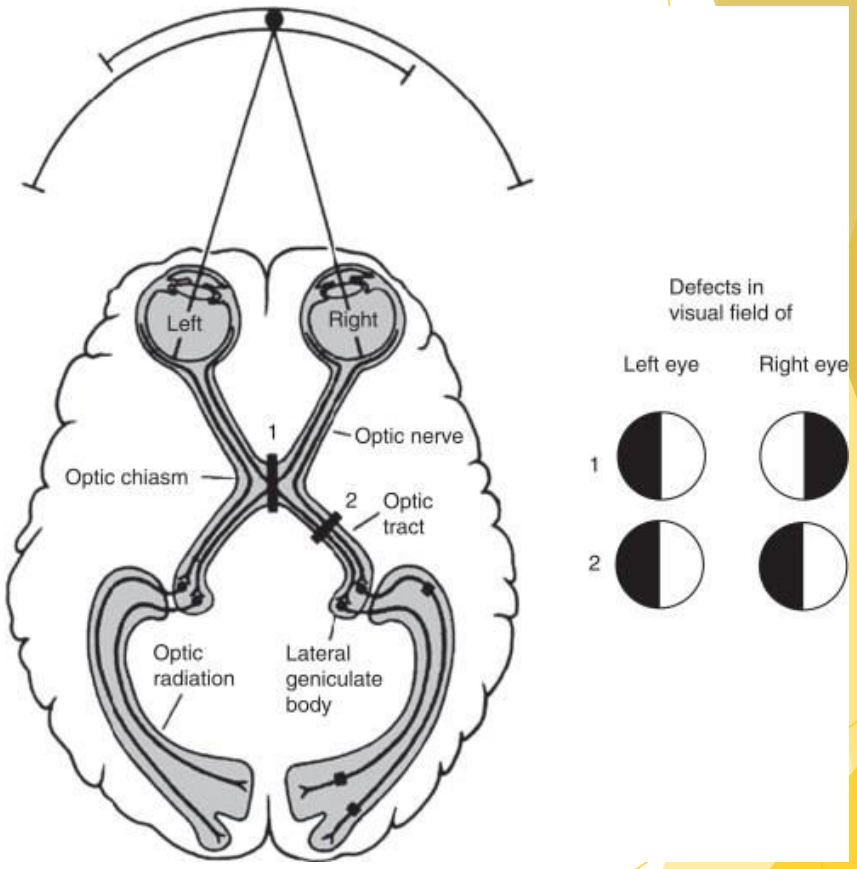


Lesion of optic chaisma-

- **1.Central chiasmal lesion-**

- Bitemporal hemianopia
- Bitemporal hemianopic paralysis of pupillary reflex
- Also leads to partial descending optic atrophy

- **Cause:**
  - Pituitary tumors Craniopharyngioma,
  - Suprasellar aneurysm.



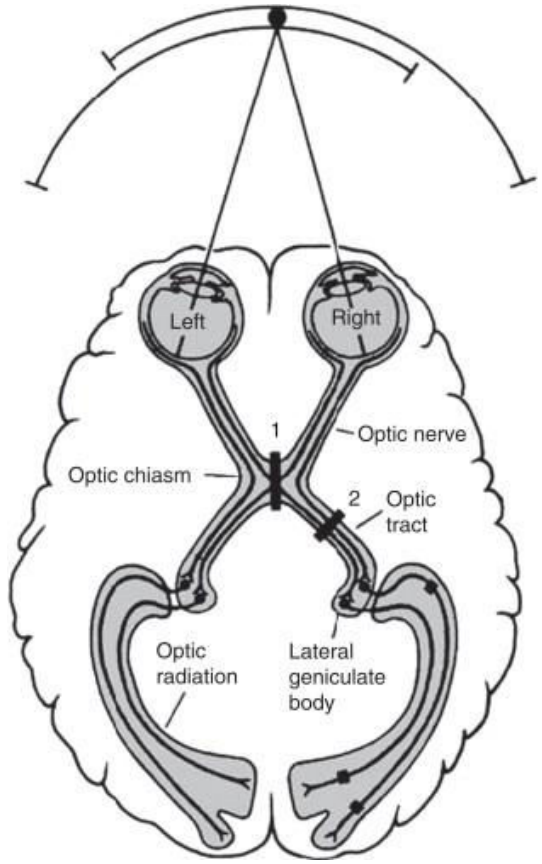
OPTIC CHIASMA

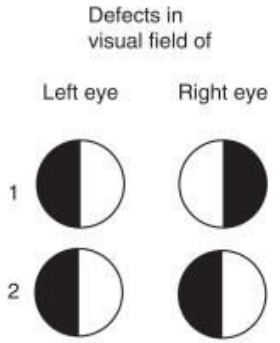
- **2.Lateral chiasma lesion-**
- Binasal hemianopia
- Binasal hemianopic paralysis of pupillary reflex
- Also leads to partial descending optic atrophy
- **Cause:**
  - Internal carotid aneurysm,
  - Lesions causing distension of third ventricle

Lesions of optic tract-

- Incongruous homonymous hemianopia
- contralateral hemianopia pupillary reaction(wernicke's reaction)
- partial descending optic atrophy

- **Causes-**
  - syphilitic meningitis,
  - tuberculosis, and
  - tumors of optic thalamus.





Lesions of Lateral geniculate body

- incongruous homonymous hemianopia
- sparing of light reflex or pupillary reflex
- Partial descending optic atrophy

OPTIC RADIATION

- Features varies depending on site of lesion
- **1.Involvment of total optic radiation-**
  - complete homonymous hemianopia (more congruous)

OPTIC RADIATION

- 2. **Involvement of part of optic radiation in temporal lobe**
  - Superior quandrantic hemianopia (pie in the sky)

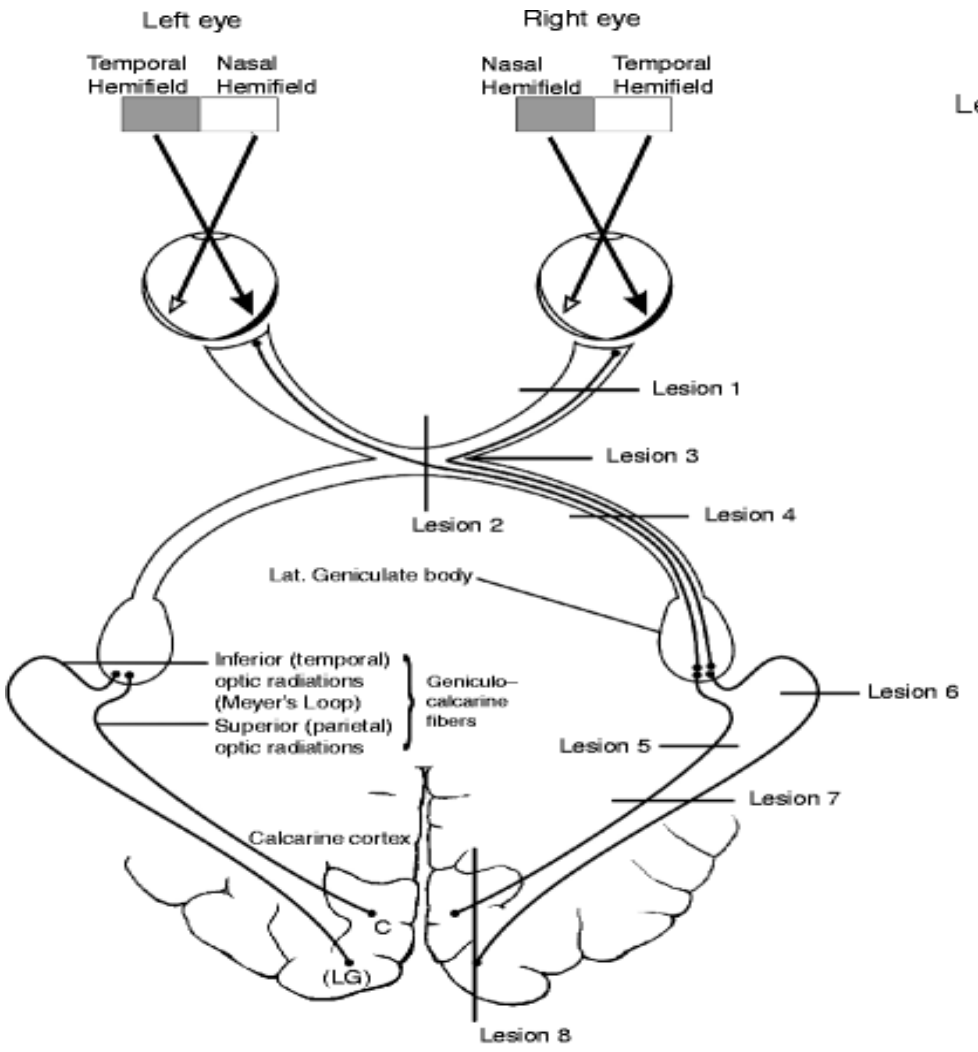
OPTIC RADIATION

- 3. Involvement of part of optic radiation in parietal lobe
  - Inferior quandrantic hemianopia (pie on the floor)

Lesions of visual cortex-

- **Anterior occipital cortex -**
- Homonymous hemianopia(sparing macula)
- **Cause -**
  - occlusion of posterior cerebral artery

- **Tip of occipital cortex**
- Homonymous hemianopia(macula defect)
- **Causes** –
  - head injury,
  - gunshot injury involving tip of cortex



Lesion	Visual fields: Lt. eye	Visual fields: Rt. eye	
1			monocular blindness
2			Bitemporal (heteronymous) heminanopia[1]
3			Ipsilateral Right nasal hemianopia
4			Left homonymous hemianopia
5			Left inferior quadrantanopia[2]
6			Left superior quadrantanopia[3]
7			Left homonymous hemianopia[4]
8			Left homonymous hemianopia with macular sparing

1 May rusult from tumor pressing on Opitc Chiasm. Visual field deficit usually not this cleanly divided or symmetrical.
2 May also result from lesions restricted to Cuneus
3 May also result from lesions restricted to Lingual Gyrus.
4 Total hemianopia less likely as compared to lesions of Optic Tract.

thanks