2nd NERVE

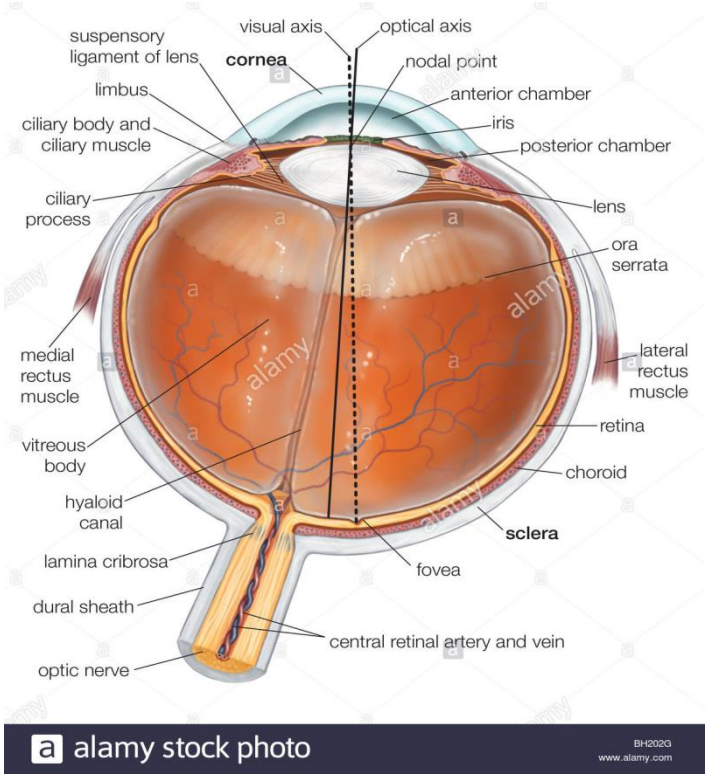
Dr Mohsin Manzoor
DNB SS resident Neurology

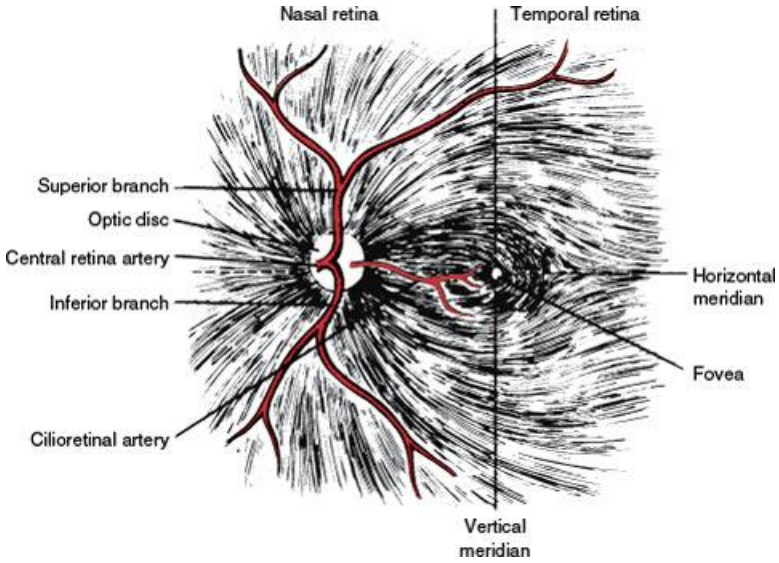
- Optic nerve is the CNS fibre pathway connecting the retina and the brain.

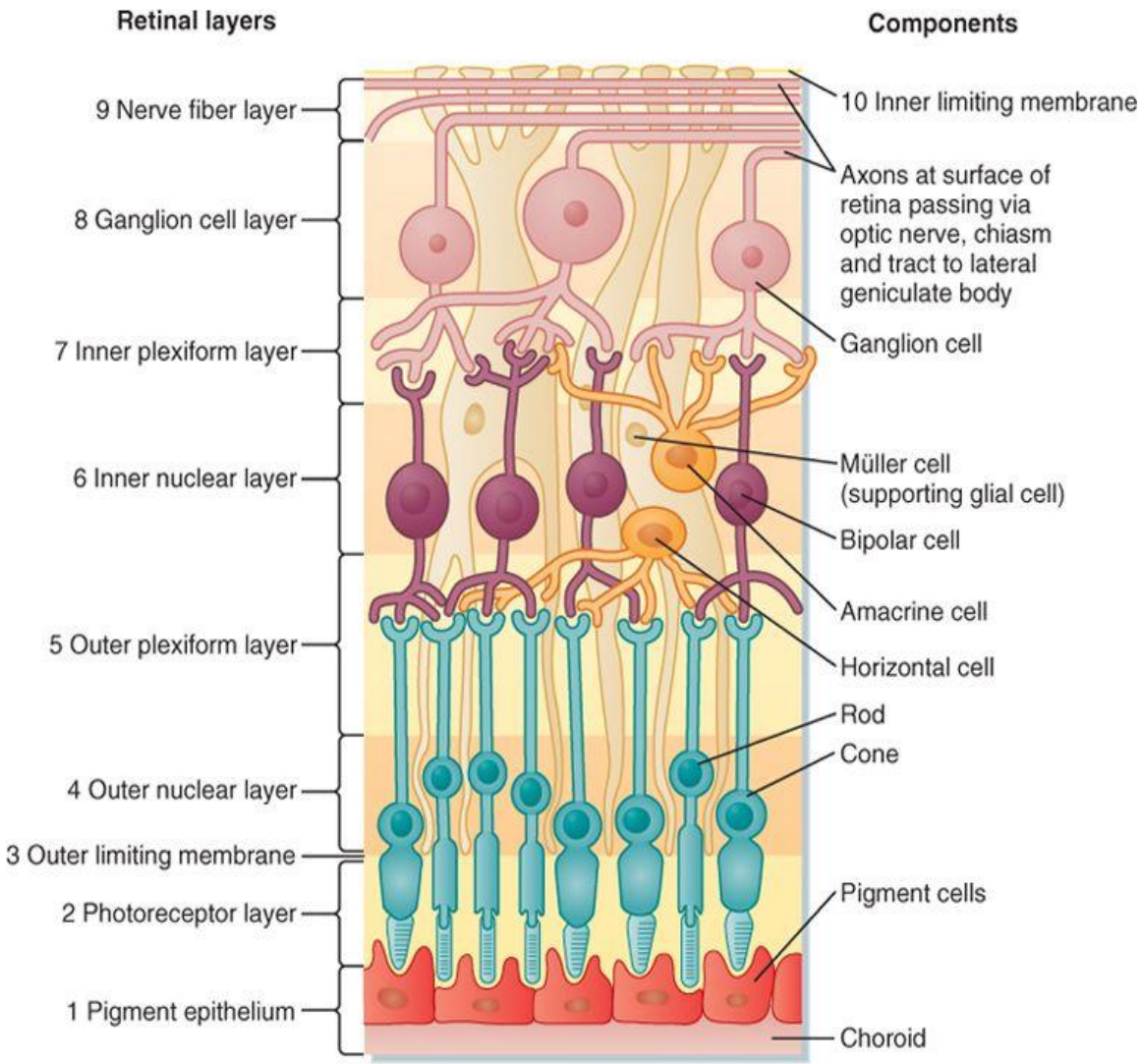
- RETINA

…extends anteroposteriorly from ora serata to optic disc .

…can be divided into 4 quadrants by a vertical and horizontal meridian intersecting at the level macula


suspensory ligament of lens
visual axis
optical axis
cornea
nodal point
limbus
anterior chamber
ciliary body and ciliary muscle
iris
posterior chamber
ciliary process
lens
ora serrata
medial rectus muscle
lateral rectus muscle
vitreous body
retina
choroid
hyaloid canal
sclera
lamina cribrosa
fovea
dural sheath
central retinal artery and vein
optic nerve
alamy stock photo
BH202G
www.alamy.com


Nasal retina
Temporal retina
Superior branch
Optic disc
Central retina artery
Inferior branch
Horizontal meridian
Fovea
Cilioretinal artery
Vertical meridian



Koeppen & Stanton: Berne and Levy Physiology, 6th Edition.

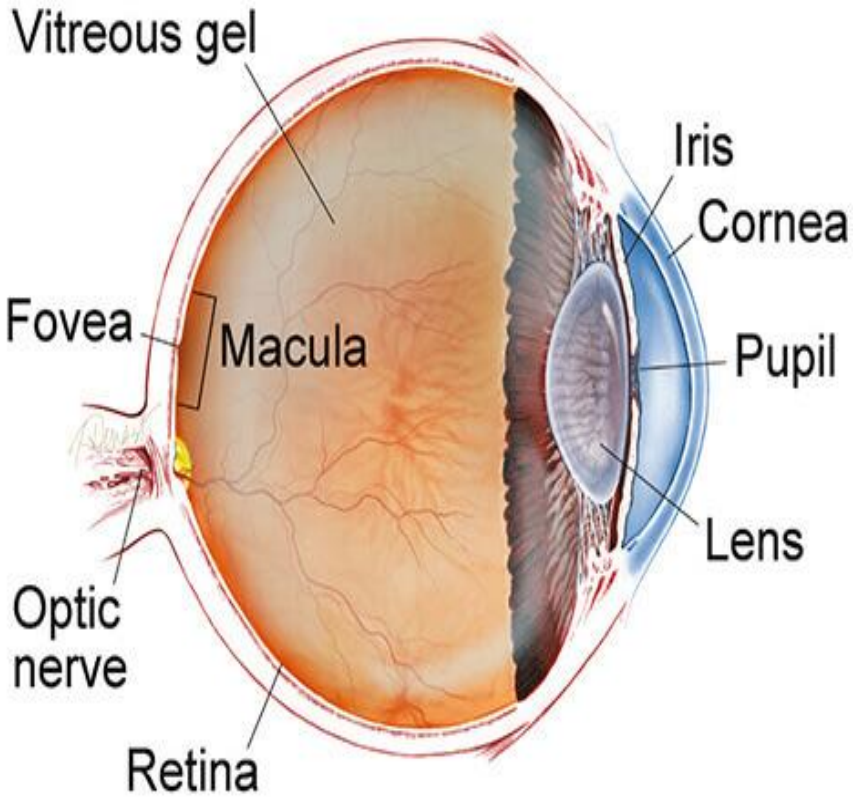
- Rods are more numerous than cones ,are scattered throughout the retina but are absent in macula
- They mediate

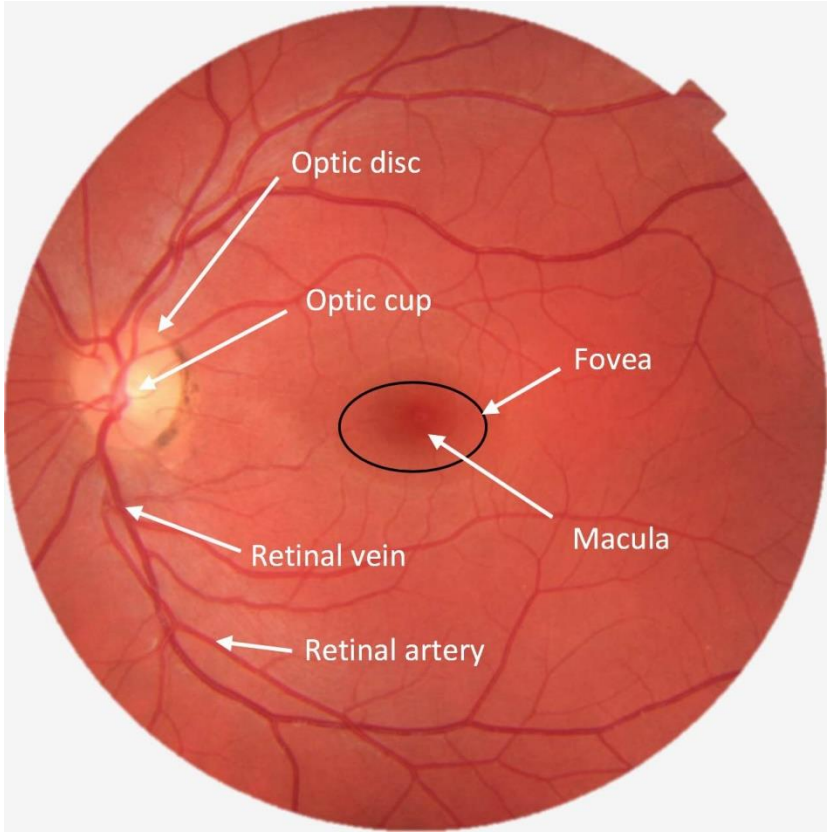
….night vision

…peripheral vision

…perception of movement

- Cones are present throughtout the retina but are concentrated in macula.
- It is the site of greatest visual acquity and colour perception.

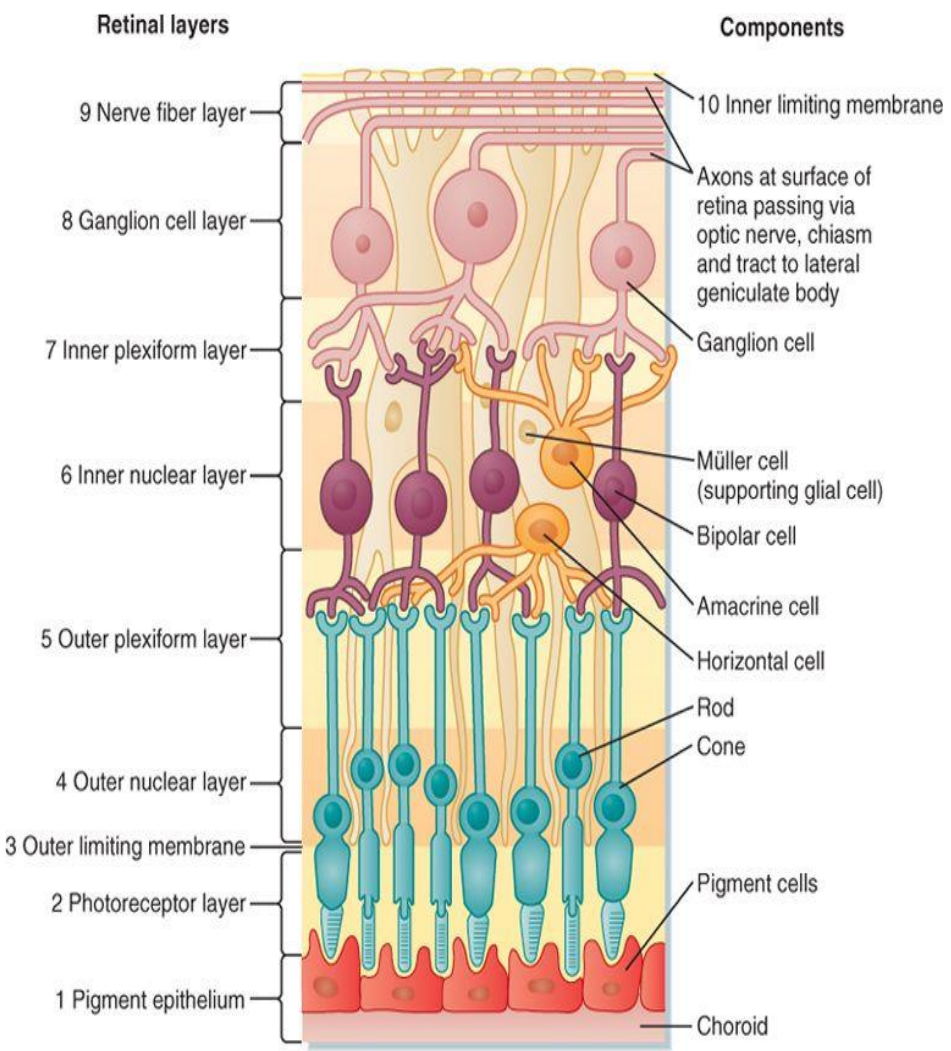

Vitreous gel
Iris
Cornea
Fovea
Macula
Pupil
Lens
Optic nerve
Retina

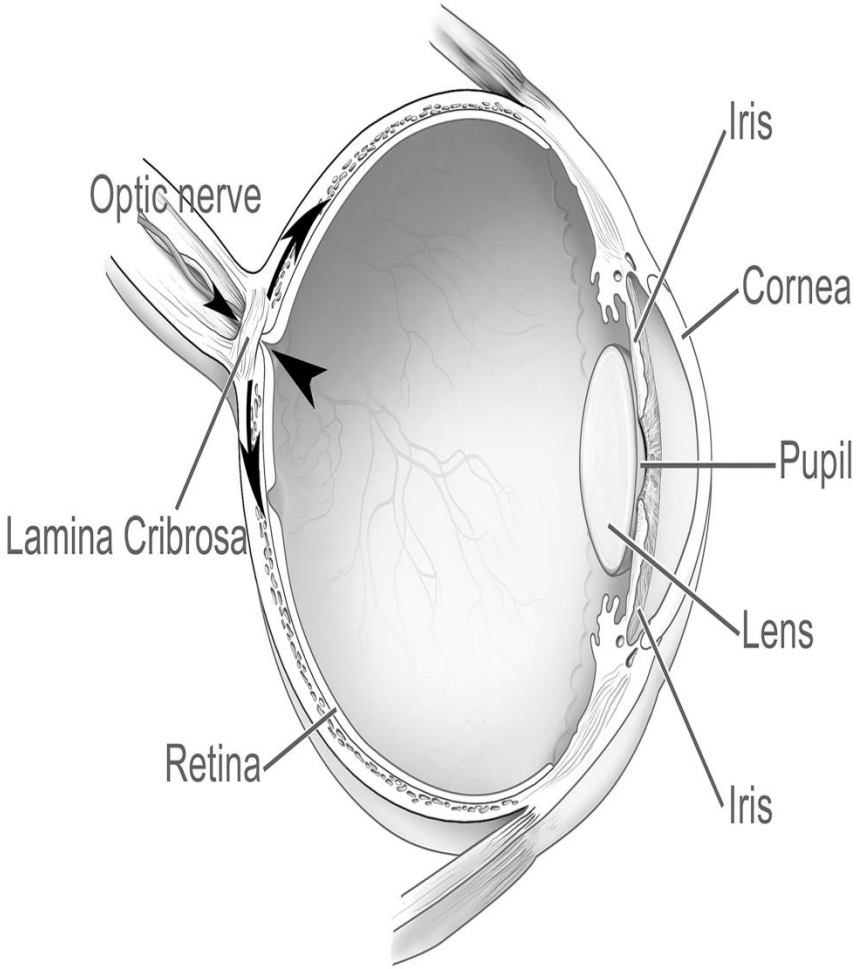

Optic disc
Optic cup
Fovea
Macula
Retinal vein
Retinal artery

- Macula is responsible for centre 15 degree of vision,discrimination of colors and fine visual visual details.
- Optic disc head (blind spot) visible intraocular portion of optic nerve .

  1.5mm by 1.8mm vertical ellipse

  pink to yellow in colour



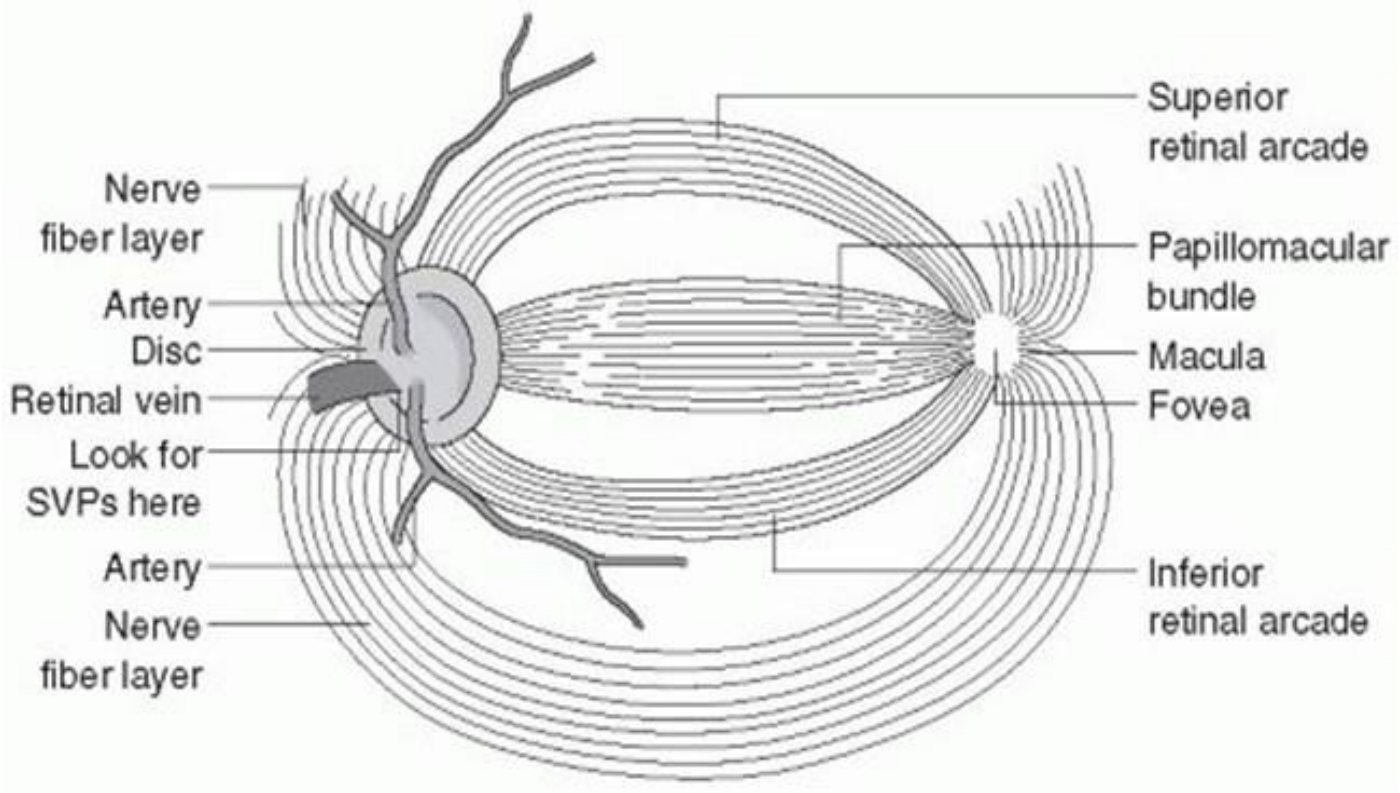


- There are 1.2 million fibres in each optic nerve; 90% arise from macula.
- Early signs of optic nerve disease reflect macular function:

impaird color vision

impaired acquity

central scotoma


Superior
retinal arcade
Nerve
fiber layer
Papillomacular
bundle
Artery
Disc
Macula
Retinal vein
Fovea
Look for
SVPs here
Artery
Inferior
retinal arcade
Nerve
fiber layer

- Fibres from the temporal hemiretina are located in temporal half of optic nerve,while fibres from nasal hemiretina are located medially.
- Upper retinal fibres are located superiorly and lower retinal fibres are located inferiorly in the optic nerve ,this relationship is retained except in optic tract and lateral geniculate body.

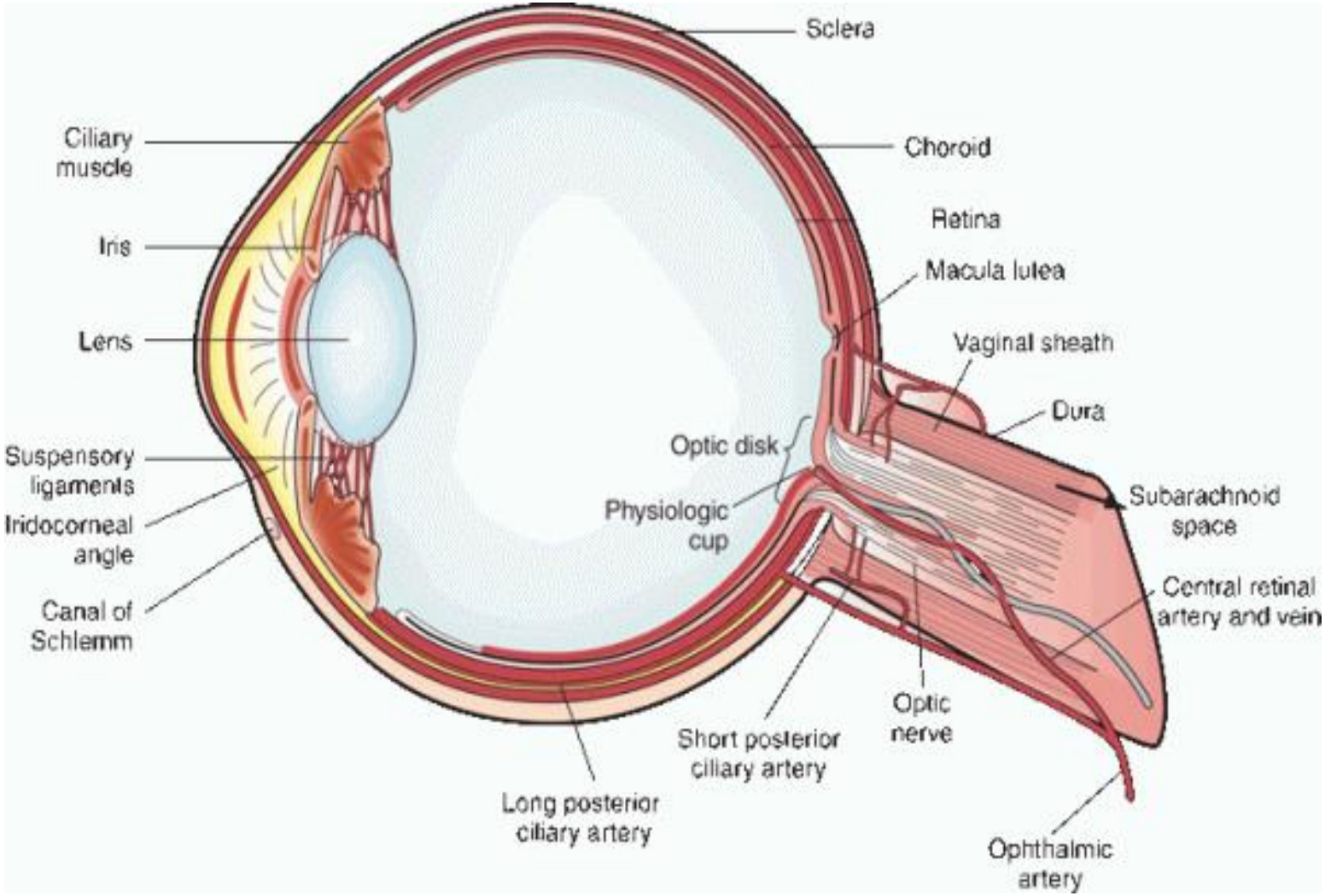
- Optic nerve extends from the retina to the optic chiasm.it is 5cm long.
- It is divided into 4 parts:

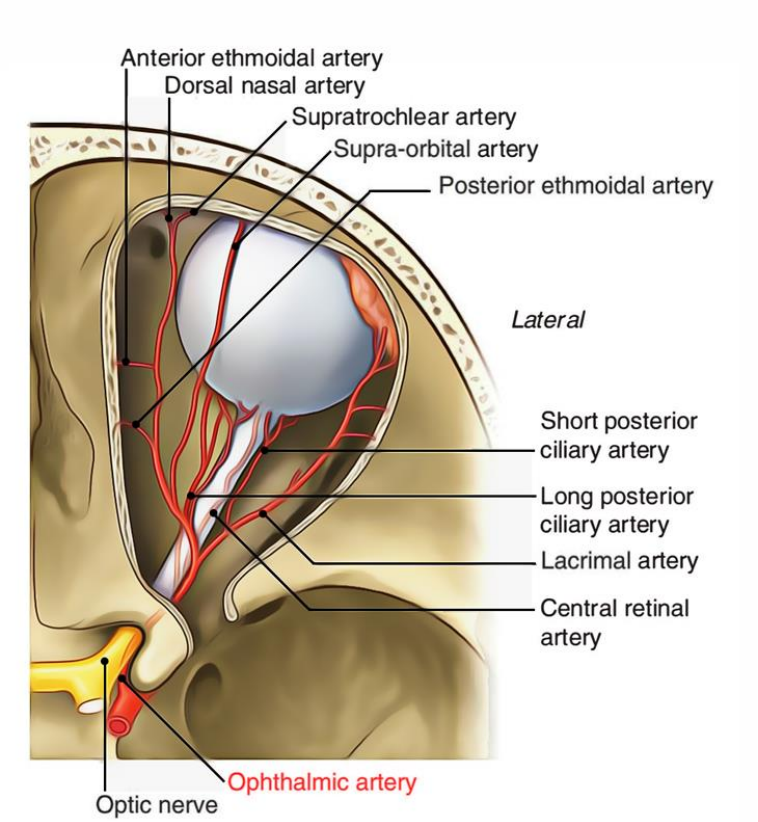
….intraocular (1mm;the disc)

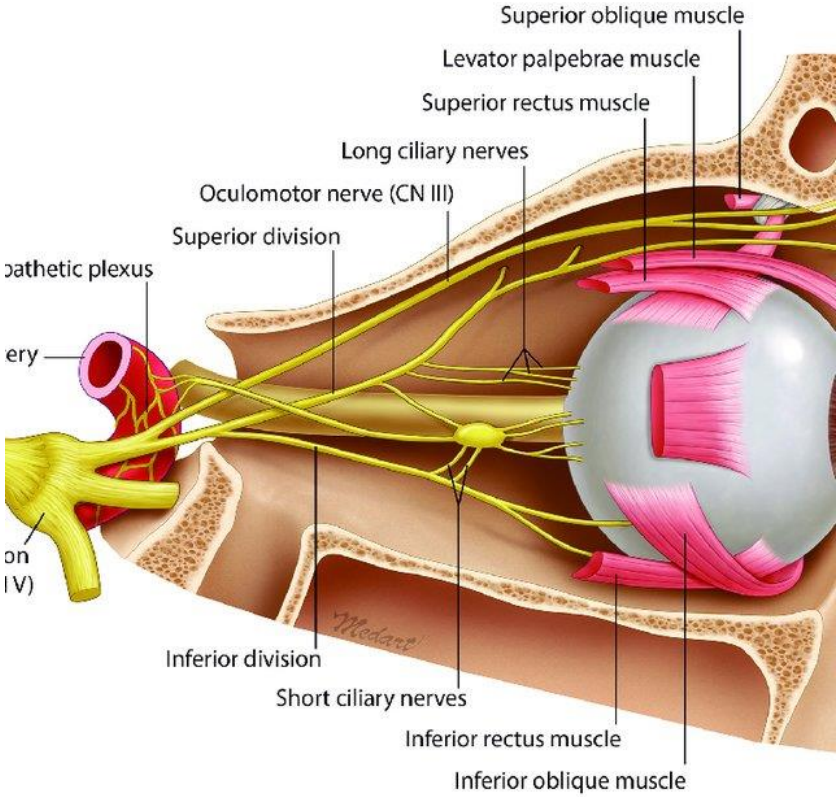
…intraorbital (about 25mm)

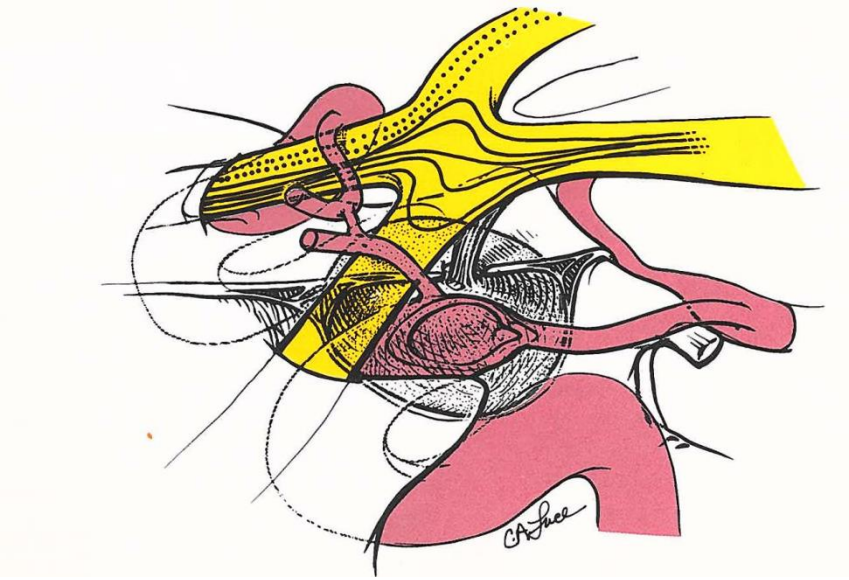
…intracanalicular (about 9mm)

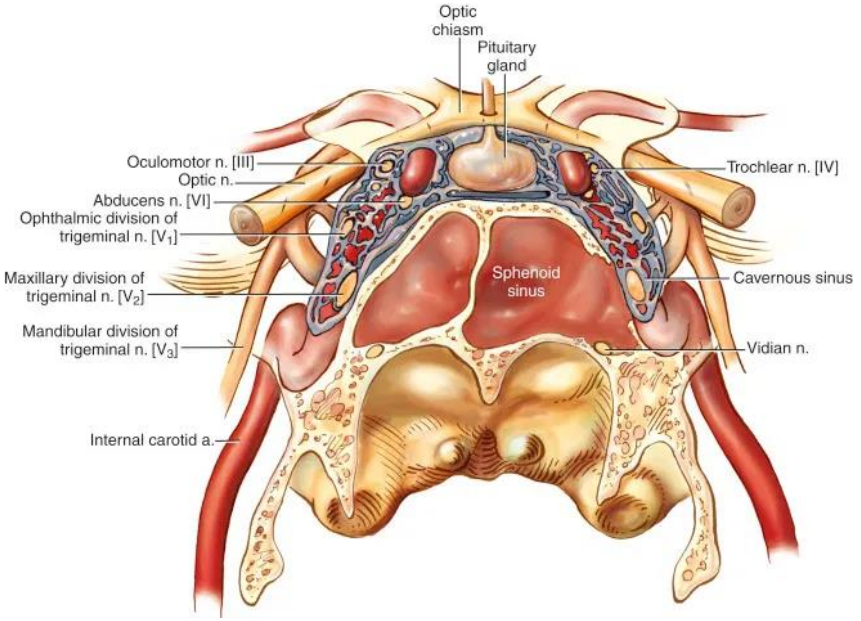
…intracranial (12-16mm)


Sclera
Ciliary muscle
Choroid
Retina
Iris
Macula lutea
Lens
Vaginal sheath
Dura
Optic disk
Suspensory ligaments
Physiologic cup
Subarachnoid space
Iridocorneal angle
Central retinal artery and vein
Canal of Schlemm
Optic nerve
Short posterior ciliary artery
Long posterior ciliary artery
Ophthalmic artery


Anterior ethmoidal artery
Dorsal nasal artery
Supratrochlear artery
Supra-orbital artery
Posterior ethmoidal artery
Lateral
Short posterior ciliary artery
Long posterior ciliary artery
Lacrimal artery
Central retinal artery
Ophthalmic artery
Optic nerve


Superior oblique muscle
Levator palpebrae muscle
Superior rectus muscle
Long ciliary nerves
Oculomotor nerve (CN III)
Superior division
Inferior division
Short ciliary nerves
Inferior rectus muscle
Inferior oblique muscle




Optic chiasm
Pituitary gland
Oculomotor n. [III]
Optic n.
Abducens n. [VI]
Ophthalmic division of trigeminal n. [V1]
Maxillary division of trigeminal n. [V2]
Mandibular division of trigeminal n. [V3]
Internal carotid a.
Trochlear n. [IV]
Sphenoid sinus
Cavernous sinus
Vidian n.

- In 80% ,chiasma rests directly above the sella.
- In 10 % it sits forward over the tuberculam sella with short optic nerves and long optic tracts .(prefixed)
- In other 10%, it sits posteriorly over the dorsum sella with long optic nerves and short optic tracts(postfixed).

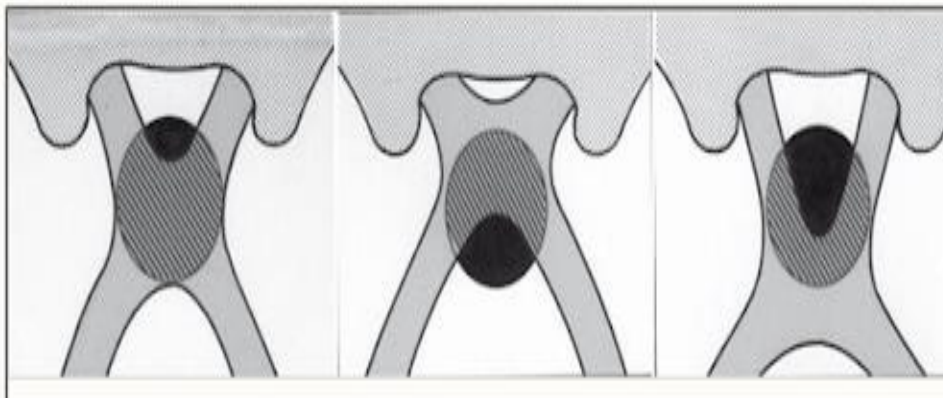
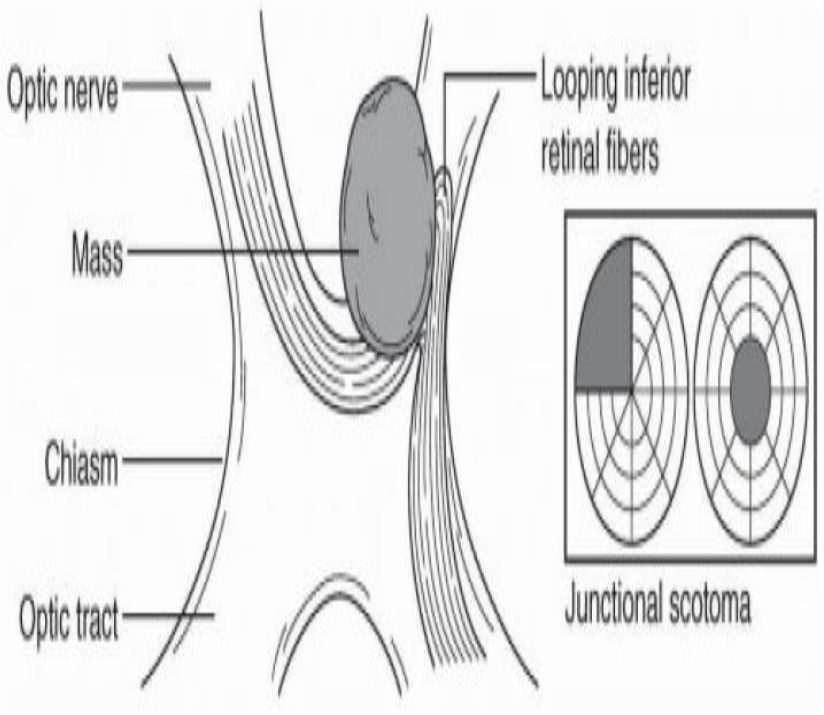


Fig.1. Normal (A), prefixed (B) and postfixed (C) positions of the optic chiasm relative to the tuberculum sellae

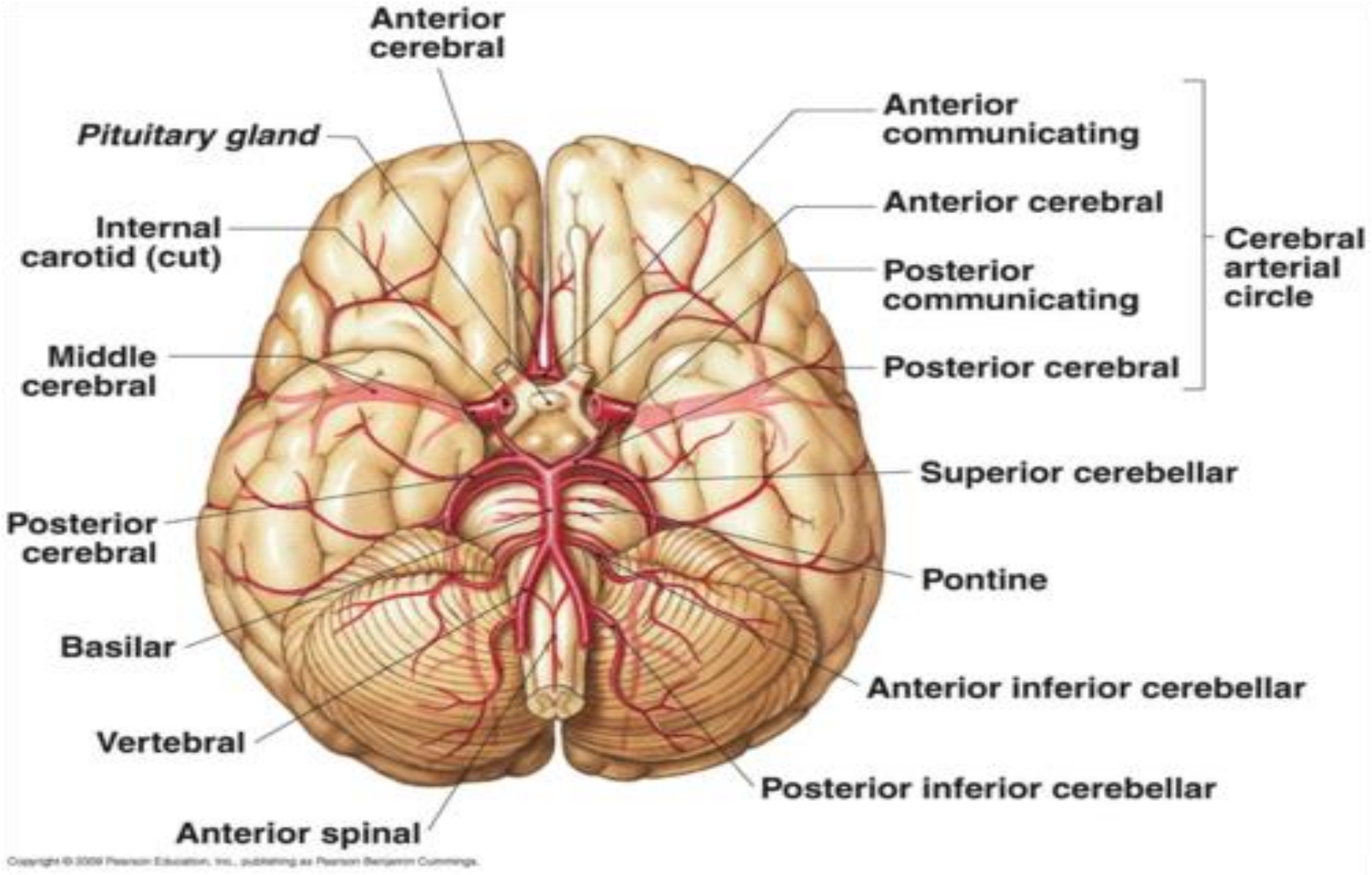
Optic chiasma

- There are some intracacies in chiasmial crossing
- Fibres from inferior nasal quadrant loop forward into opp optic nerve for short distance before turning back again forming WILBRANDS KNEE and then continue with the lateral aspect of optic tract.



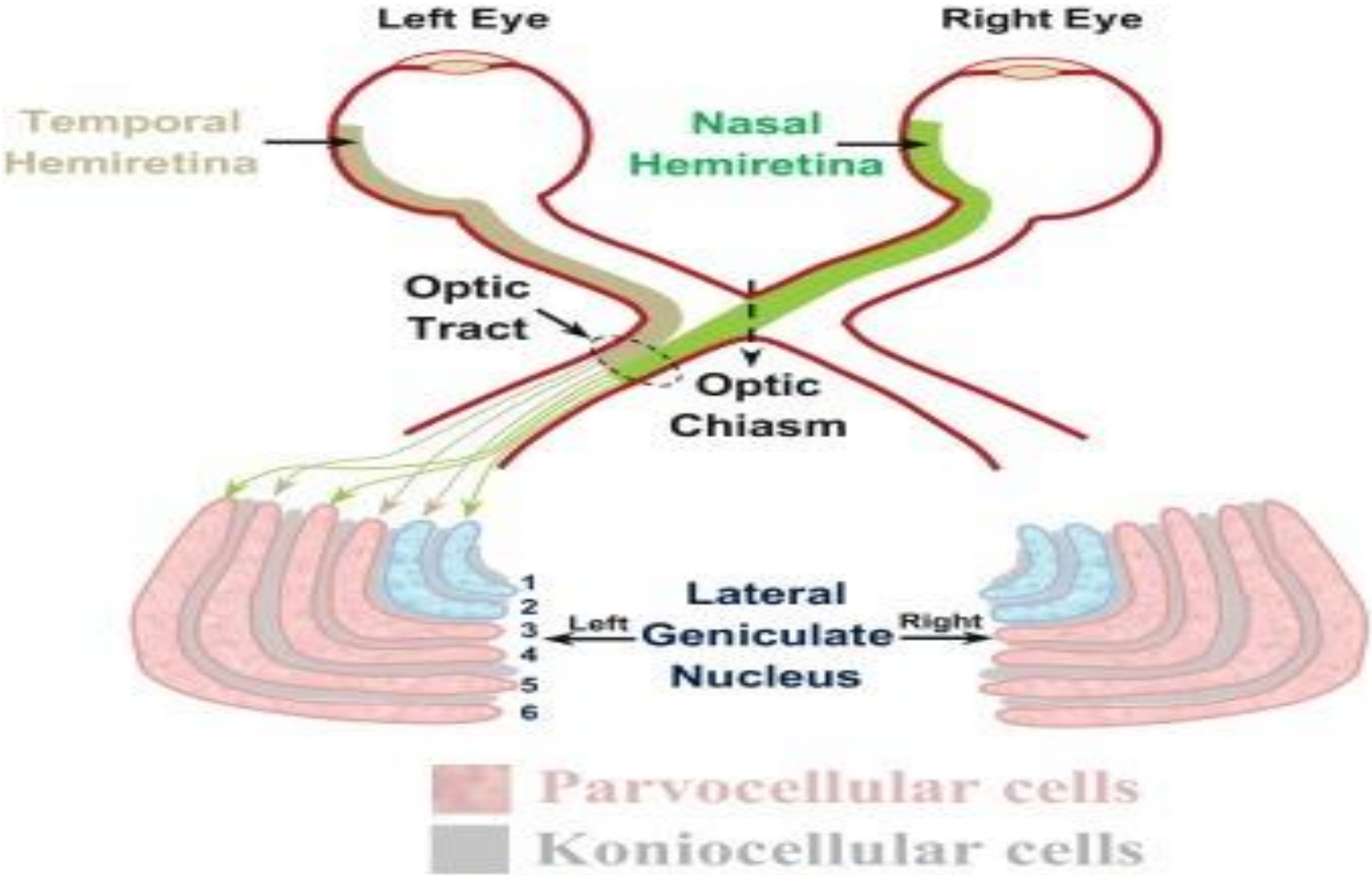
- Fibres from superior nasal retina remain dorsal in chiasma and become medial in optic tract.
- Inferior nasal fibres decussate anteriorly and inferiorly in the chiasma , while superior nasal fibres cross posteriorly and superiorly.
- Uncrossed fibres originating from temporal retina ,maintain their dorsal and ventral position in chiasm

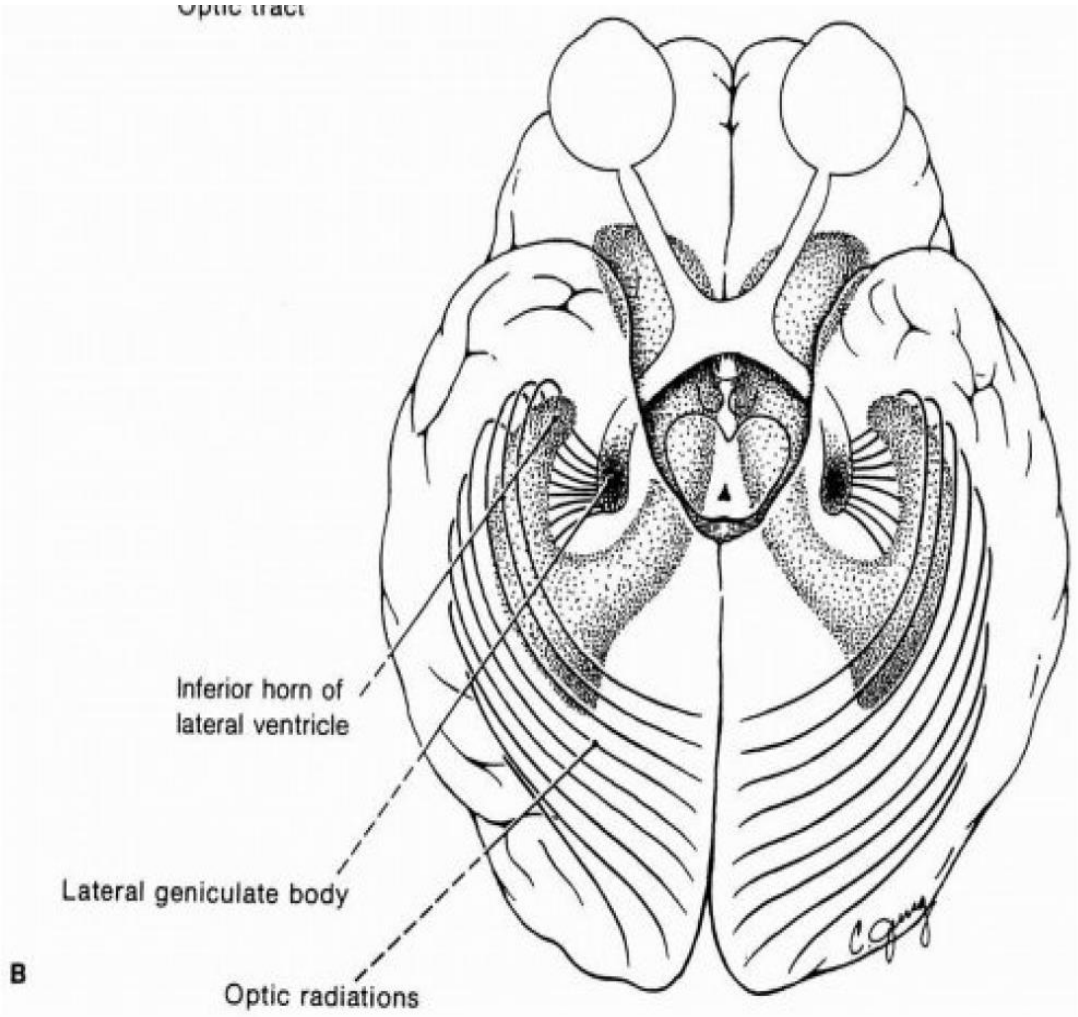

Decussating
superior
retinal fibers
Chiasm
Decussating
inferior retinal
fibers
Optic
nerve
Decussating
macular fibers
Diaphragma
sella
Pituitary
Sella



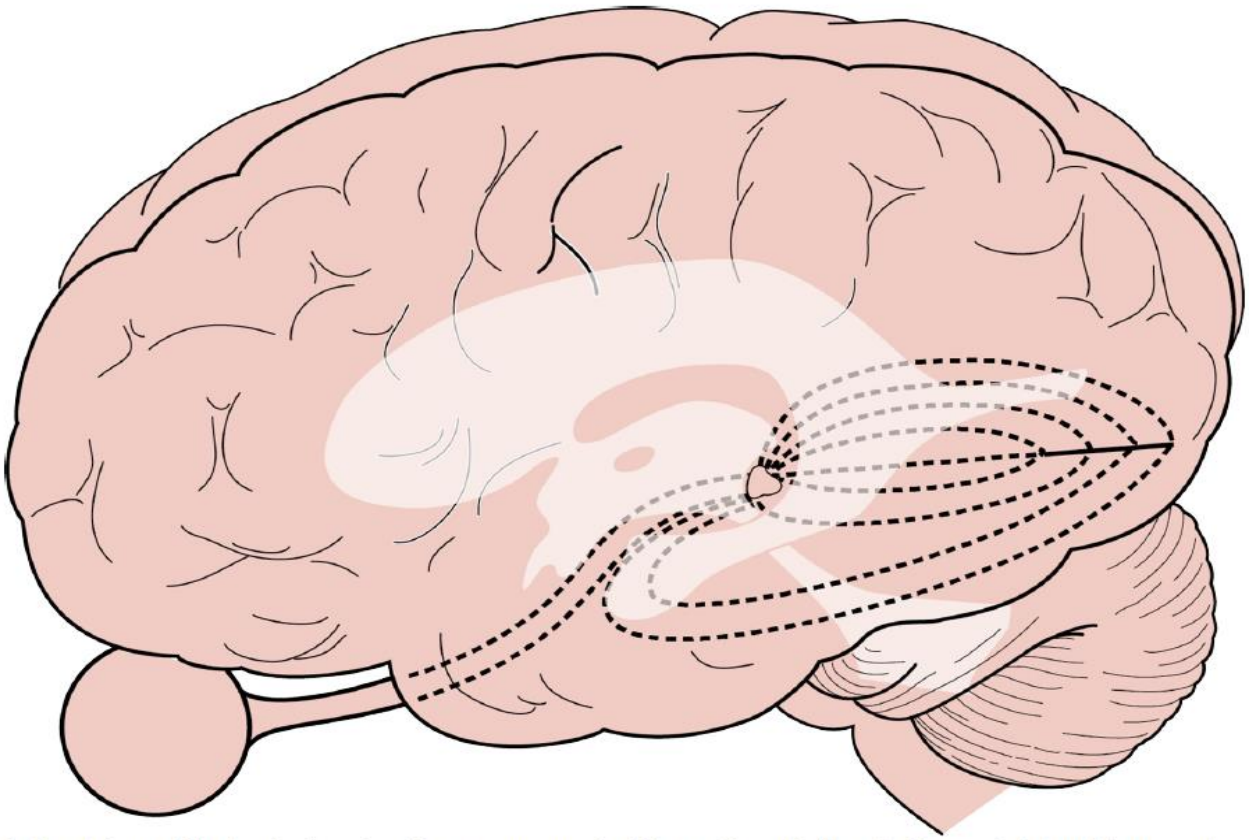
- About 55% of axons of optic tract arise from contralteral nasal retina and 45% from ipsilateral temporal retina.
- Retinotopic organization is maintained in optic tract,but the orientation changes.
- There is gradual inward rotation ,so fibres from upper retina assume a medial position while those from inferior retina lie lateral.

- Macular fibres are also crossed and uncrossed.
- in optic tract ,macular fibres ocupy a dorsal position.

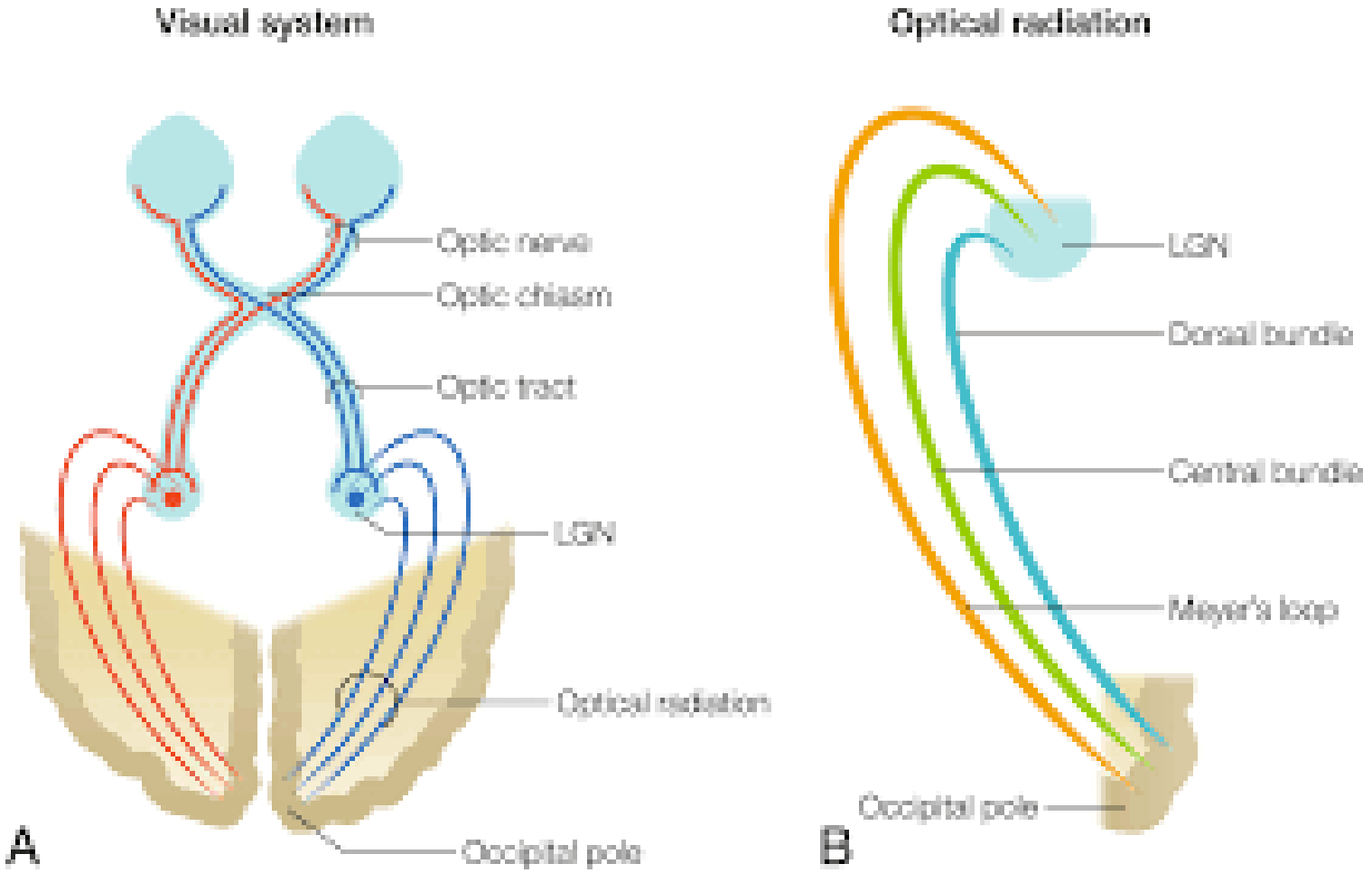

Left Eye
Right Eye
Temporal Hemiretina
Nasal Hemiretina
Optic Tract
Optic Chiasm
1
2
3
4
5
6
Left
Lateral Geniculate Nucleus
Right
Parvocellular cells
Koniocellular cells

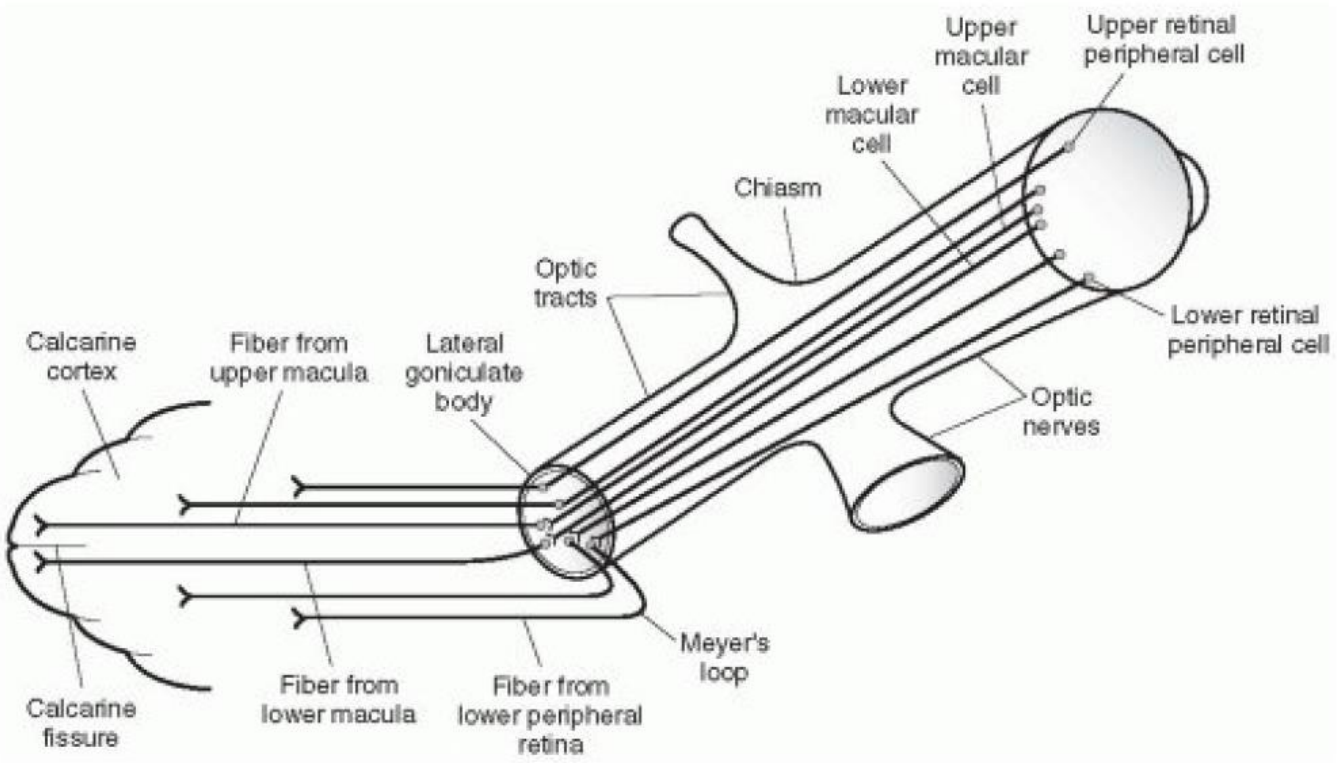

Optic tract
Inferior horn of
lateral ventricle
Lateral geniculate body
Optic radiations

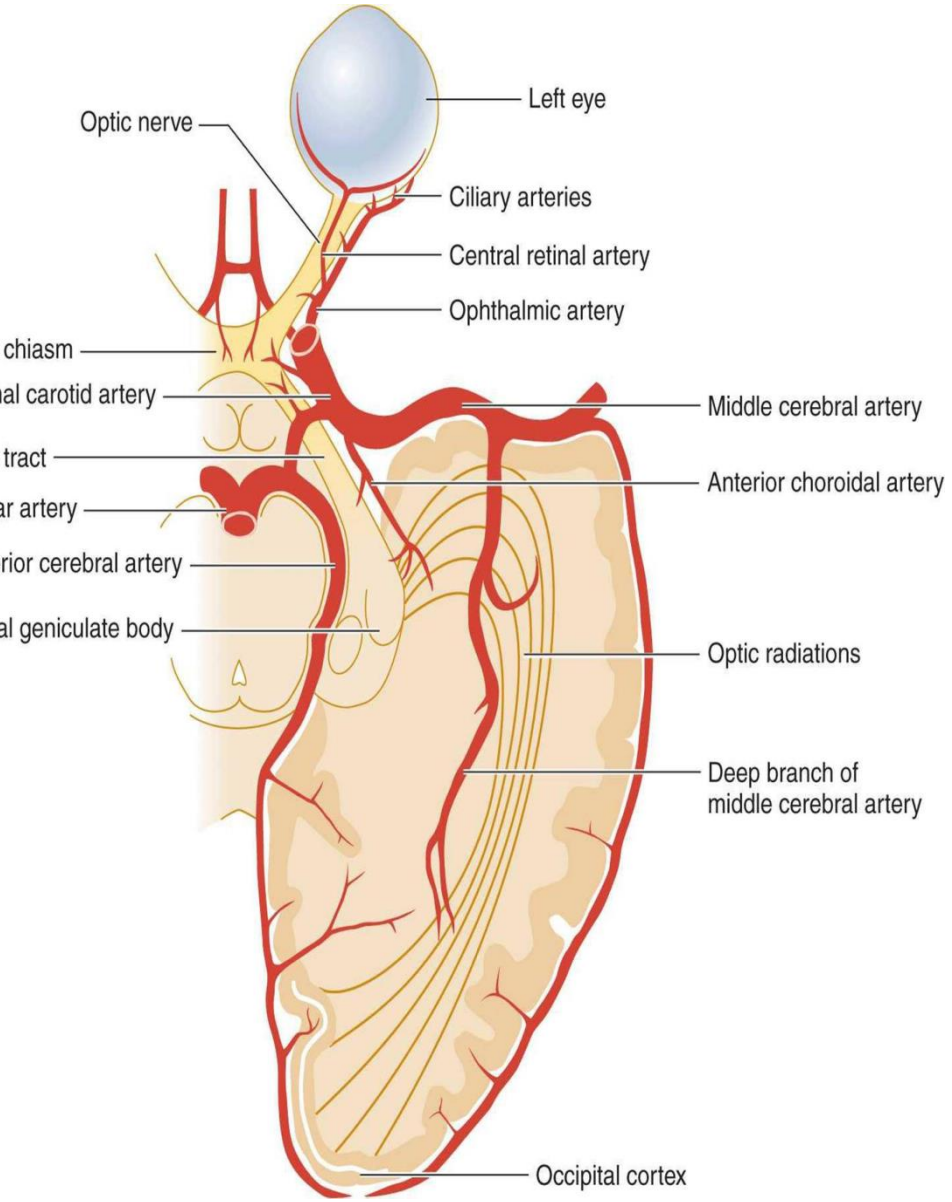
B

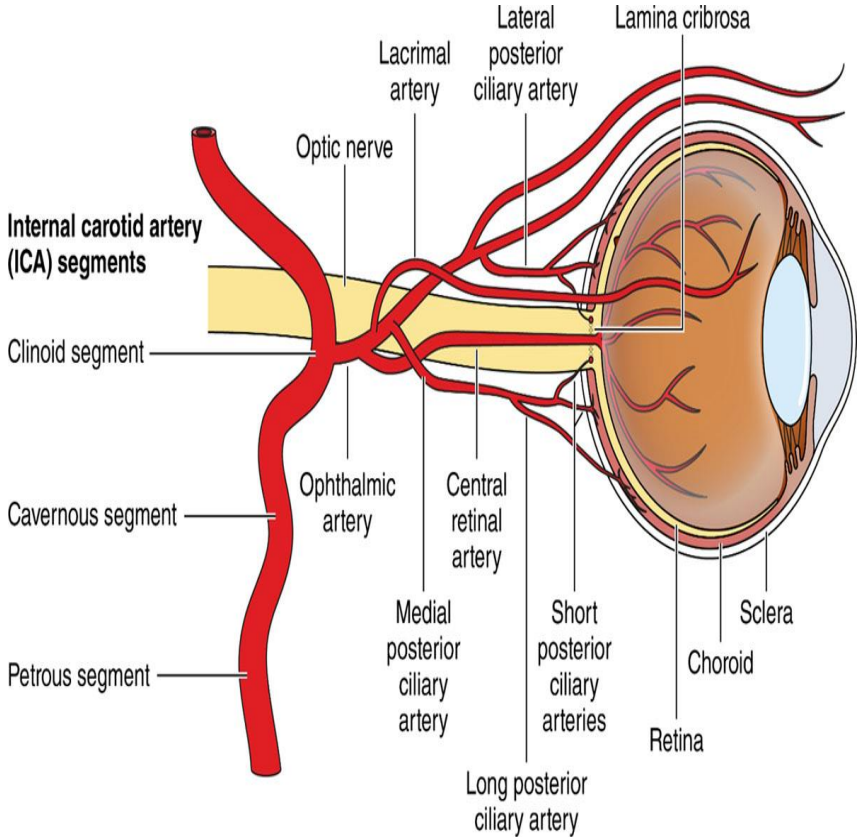


Lateral view of the brain showing the arrangement of the optic radiations in the parietal and temporal lobes, lateral to the ventricular system.


Visual system
Optic nerve
Optic chiasm
Optic tract
LGN
Optical radiation
Occipital pole
A
Optical radiation
LGN
Dorsal bundle
Central bundle
Meyer's loop
Occipital pole
B


Upper macular cell
Upper retinal peripheral cell
Lower macular cell
Chiasm
Optic tracts
Lower retinal peripheral cell
Calcarine cortex
Fiber from upper macula
Lateral geniculate body
Optic nerves
Meyer's loop
Calcarine fissure
Fiber from lower macula
Fiber from lower peripheral retina


Left eye
Optic nerve
Ciliary arteries
Central retinal artery
Ophthalmic artery
chiasm
al carotid artery
tract
ar artery
rior cerebral artery
al geniculate body
Middle cerebral artery
Anterior choroidal artery
Optic radiations
Deep branch of
middle cerebral artery
Occipital cortex


Internal carotid artery
(ICA) segments
Clinoid segment
Cavernous segment
Petrous segment
Optic nerve
Lacrimal
artery
Lateral
posterior
ciliary artery
Lamina cribrosa
Ophthalmic
artery
Central
retinal
artery
Medial
posterior
ciliary
artery
Short
posterior
ciliary
arteries
Long posterior
ciliary artery
Retina
Choroid
Sclera

Clinical Examination

- Visual acquity
- Color vision
- Visual fields
- Pupil examination
- Fundus examination

Visual acquity

- Once refractory error is excluded ,changes in VA are secondary to lesions in macular region or its projections.
- All compressive and noncompressive lesions of optic nerve causes a drop in VA
- Unilateral lesions of optic tract,LGB,optic radiation and striate viual cortex donot impair VA.

- Color vision …..by Ishihara or Hardy-Rand-Rittler pseudoisochromatic colour plates.
- Color viosion mainly reflects macular function
- As optic nerve and chiasmal lesions often affect macular fibres ,color vision may be defective on the side of lesion.

VISUAL FIELDS

- 90-100 degree temporally
- 60 degree nasally
- 50-60 degree superiorly
- 60-75 degree inferiorly

- Bed side ….confrontation method
- Formal visual field testing….perimetry and tangent screen examination.
- Central fileds….Amsler grid, graph paper

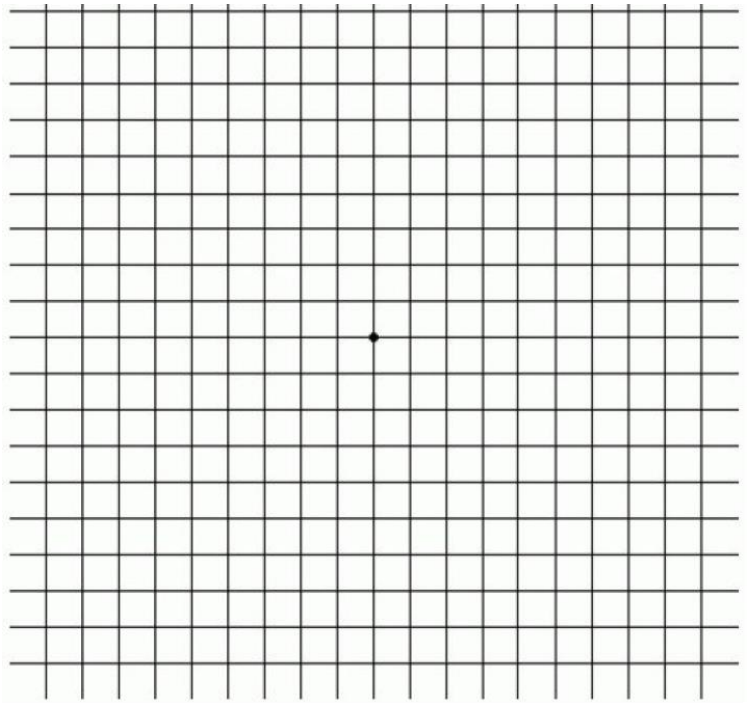


FIGURE 13.15 • The Amsler grid for testing the central visual fields. *(1)* Test vision with one eye at a time, and use normal glasses for reading. *(2)* Hold chart at normal reading distance. *(3)* Stare at central dot and look for distortion or blind spots in the grid.

Visual Field Abnormalities

- Scotomas
- Hemianopias
- Altitudinal defects
- Concentric constriction of visual fields

- Neurological defects produce straight edged defects that respect horizontal or vertical meridian because….

….arching sweep of NFL axons above and below macula

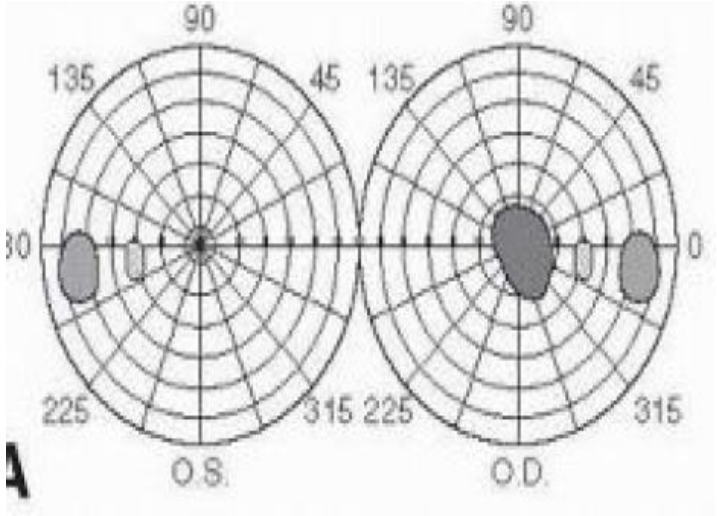
…. Vascular supply of retina

….calcrine cortex organized into superior and inferior bank.

- Vertical medridian is respected ….division of nasal and temporal hemiretina

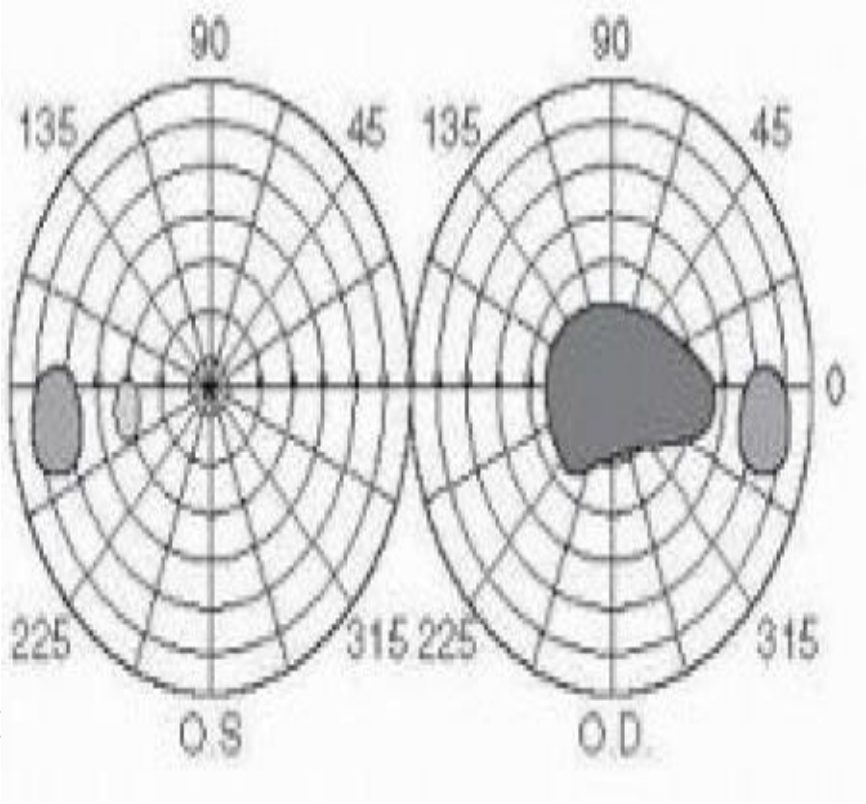
- Scotomas (darkness)…is an area of impaired vision in the field with normal surrounding vision.
- Absolutes scotoma ….no visual function within the scotoma
- Relative scotoma….visual function is depressed
- Positive scotoma….blackness,suggests disease of retina,esp macula and choroid or opacity in the media
- Negative scotoma….suggets optic nerve disease

- Central scotoma …involves fixation point seen in optic nerve and macular disease.

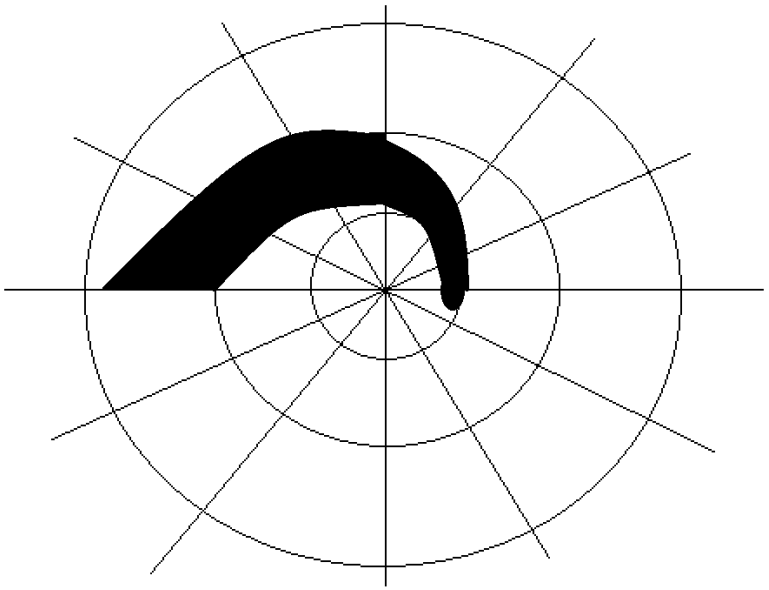


- Paracentral scotoma ….involes area adjacent to fixation point

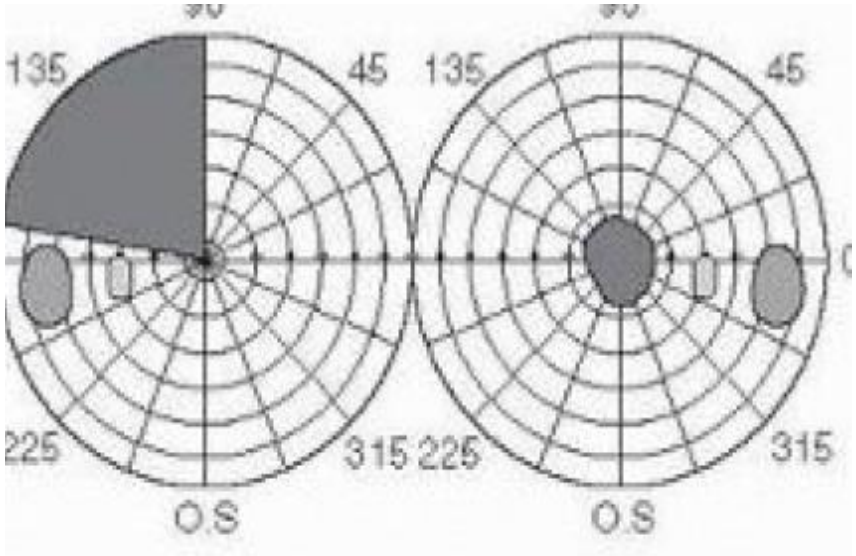
- Caecocentral scotoma…extends from blind spot to fixation.
- Central,paracentral and caecocentral are all suggestive of process involving papillomacular bundle.
- Scotom involving blind spot implies optic neuropathy.



- Arcuate scotoma …crescent defect arching out of blind spot



- Junctional scotoma



- HEMIANOPIA

….homonymous or heteronymous

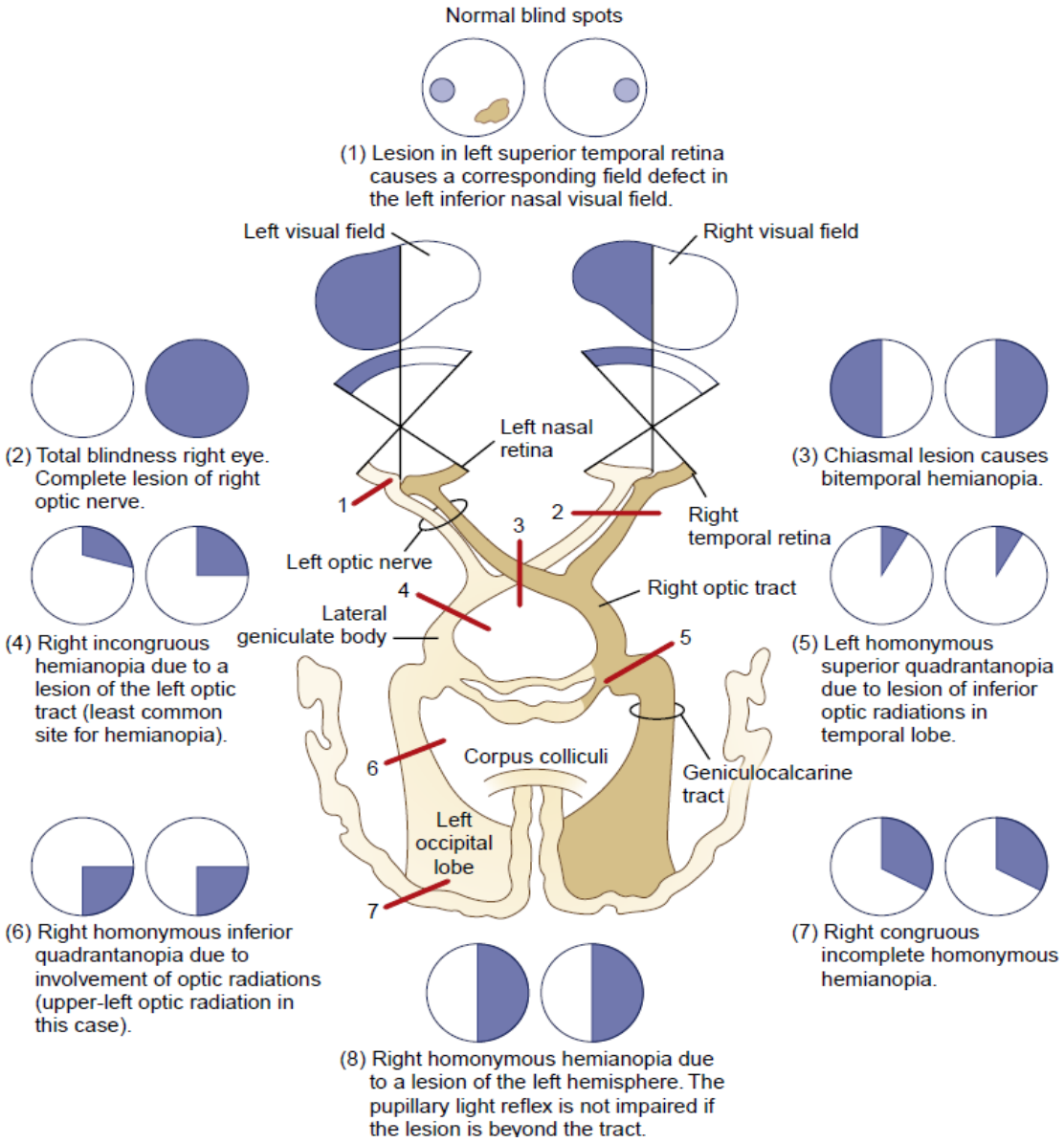
Homonymous hemianopia can be

a.complete

b.incomplete

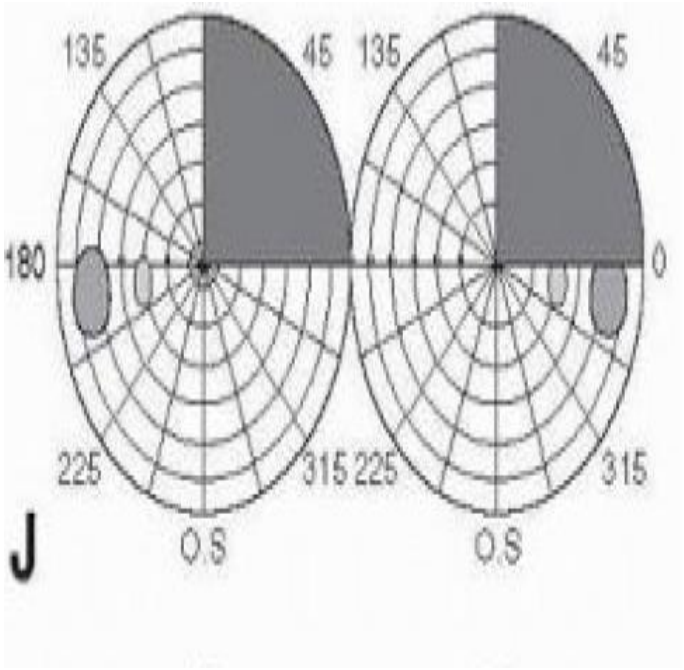
i.congruous

ii.incongrous

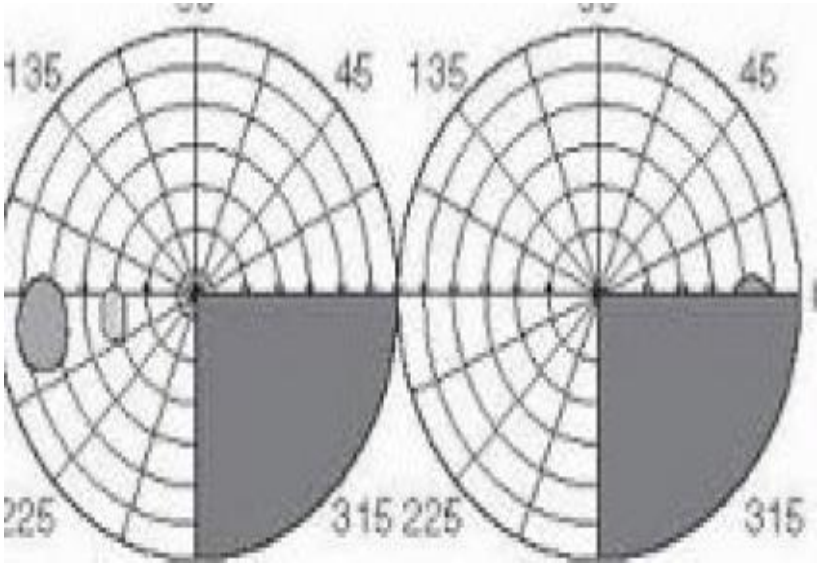

Normal blind spots
(1) Lesion in left superior temporal retina causes a corresponding field defect in the left inferior nasal visual field.
Left visual field
Right visual field
(2) Total blindness right eye. Complete lesion of right optic nerve.
Left nasal retina
1
2
3
Right temporal retina
Left optic nerve
Right optic tract
4
Lateral geniculate body
5
(3) Chiasmal lesion causes bitemporal hemianopia.
(4) Right incongruous hemianopia due to a lesion of the left optic tract (least common site for hemianopia).
(5) Left homonymous superior quadrantanopia due to lesion of inferior optic radiations in temporal lobe.
6
Corpus colliculi
Geniculocalcarine tract
Left occipital lobe
7
(6) Right homonymous inferior quadrantanopia due to involvement of optic radiations (upper-left optic radiation in this case).
(7) Right congruous incomplete homonymous hemianopia.
(8) Right homonymous hemianopia due to a lesion of the left hemisphere. The pupillary light reflex is not impaired if the lesion is beyond the tract.

- The close the optic radiations get to the occipital lobe,the closer lie corresponding visual fibres from both eyes.
- The more congruous the field defect,the most posterior the lesion is likely to be.
- Incongrous defect …lesion is likely to be anteriorly.

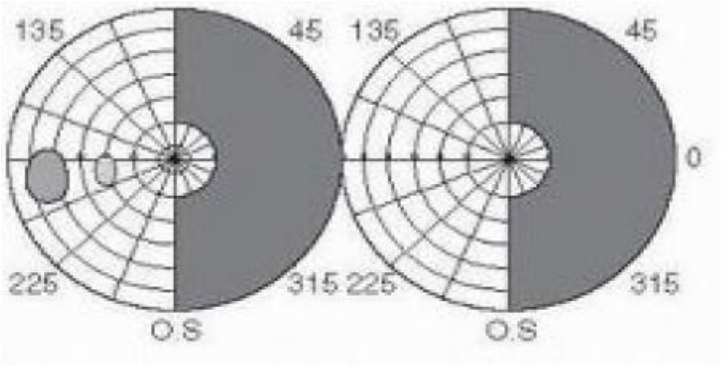
Superior quantrantopsia



Inferior quadrantopsia



- Macular sparing hemianopia



- PUPIL EVALUATION

1.Size….normal size is 2mm-6mm.

2.shape…normal shape is round ,with smooth regular outline

3.Equality…difference of 2mm is considered significant

Mild degree of inequality occurs in 15-20% of normal individuals.

- Normally,the people of abducting eye may dilate and adducting eye constricts with extreme lateral gaze ,causes physiologic anisocoria(Tournay pupillary phenomenon).
- Anisocoria due to horners is greater in dark because the affected pupil don’t dilate
- Anisocoria due to parasympathetic denervation like Adie Tonic pupil is more evident in bright light because the affected pupil don’t constrict.

- Position…normally in the centre of iris.

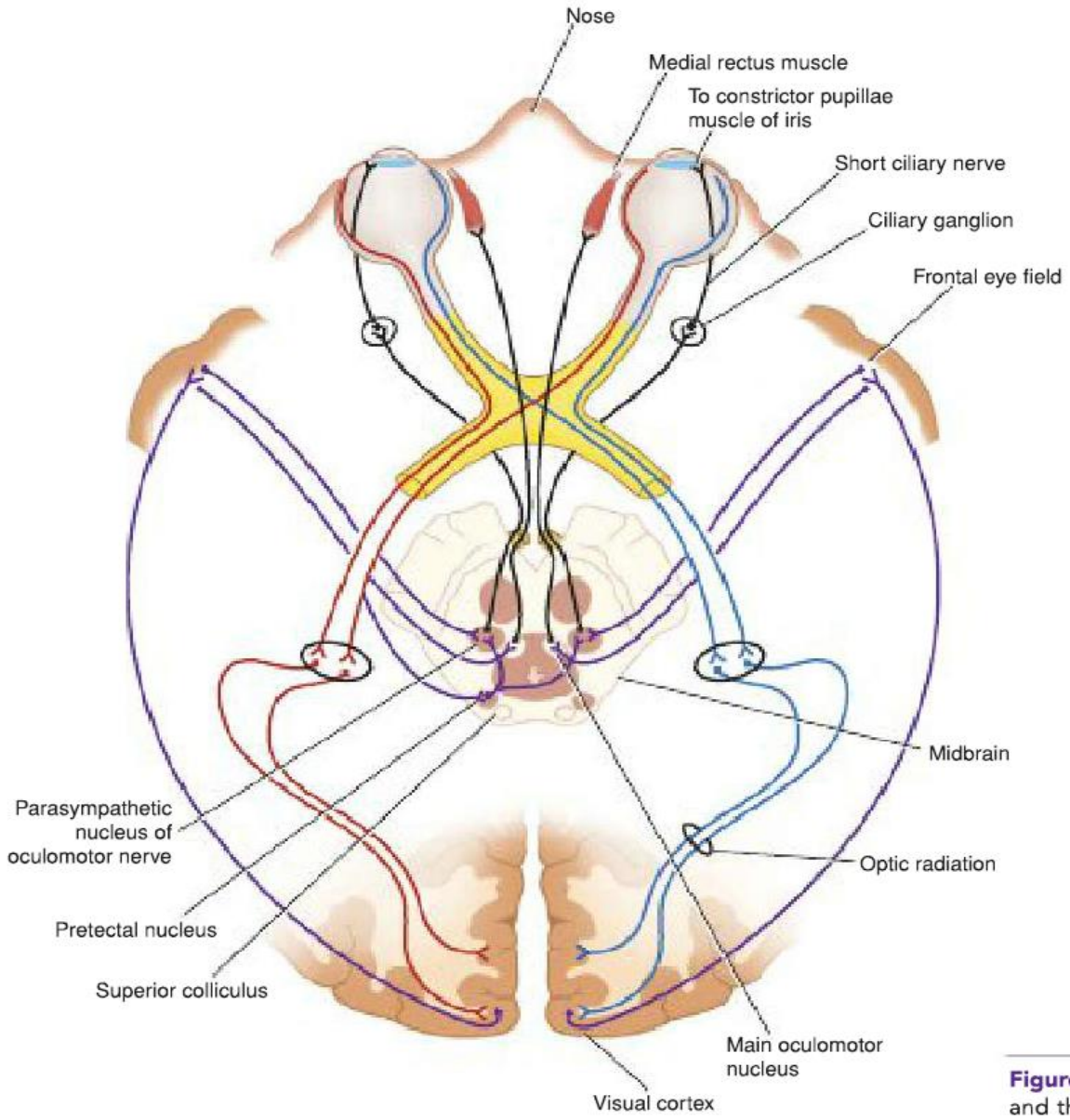


Figure 11-3 Optic pathway and the visual reflexes.