LECTURE 2

Vision

Accomodation& pupillary light reflex

By

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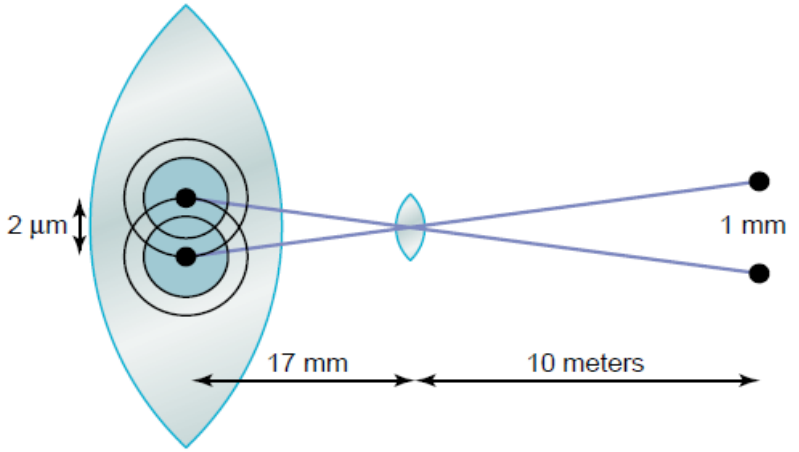
Objectives:

-Describe visual acuity
-Contrast photopic and scotopic vision
-To know visual pathway and field of vision
-Describe the process of accommodation reflex and its pathway, contrasting the refraction of light by the lens in near vision and in far vision
-Identify and describe pupillary light reflex and its pathway and -relate these to clinical situations as argyl Robertson pupil
-Identify the lateral geniculate body and visual cortex



VISUAL ACUITY

-Difinition :-

- The degree to which the details and contours of objects are perceived, and it is usually defined in terms of the shortest distance by which two lines can be separated and still be seen as 2 lines

-Visual threshold / is minimal amount of light that elicit sensation of light

Snellen s chart to measure visual acuity

Normal acuity = (d/D = distance of Patient / distance of normal person = 6/6)

A person of / 6/12 has less vision than normal vision

DUPLICITY THEORY OF VISION (2 kinds of vision under diff conditions)

Q.Differentiate between cones & rodes vision.

1-PHOTOPIC VISION (bright light vision)

-served by cones
-high visual acuity = colors & details
- low sensitivity to light = needs high visual threshold to be stimulated

2-SCOTOPIC VISION (night vision, dimlight vision)

- served by rodes
- low visual acuity = no colors or details
- great sensitivity to light =low visual threshold

VISUAL PATHWAY:-

- Cones & rods-→bipolar cells → ganglion cells- → optic nerve (axons of ganglion cells) → optic chiasma → optic tract →lateral geniculate body in thalamus → axons of cells form geniculocalcarine tract----- optic radiation → visual cortex in occipital cortex (Broadmann area 17)

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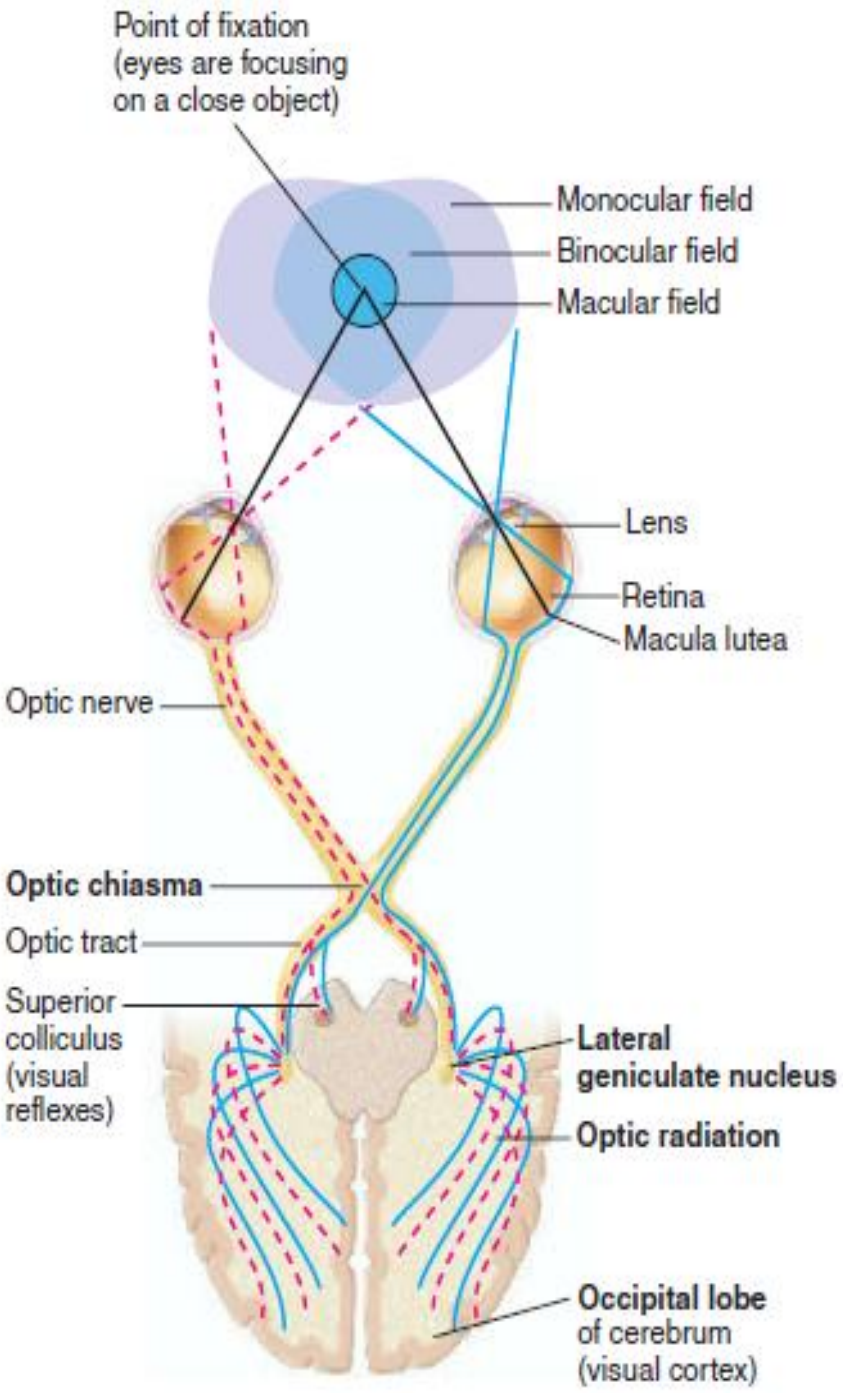
* 1- some ganglion cells axons pass from optic tract to pretectal region of midbrain for pupillary reflexes & eye movement

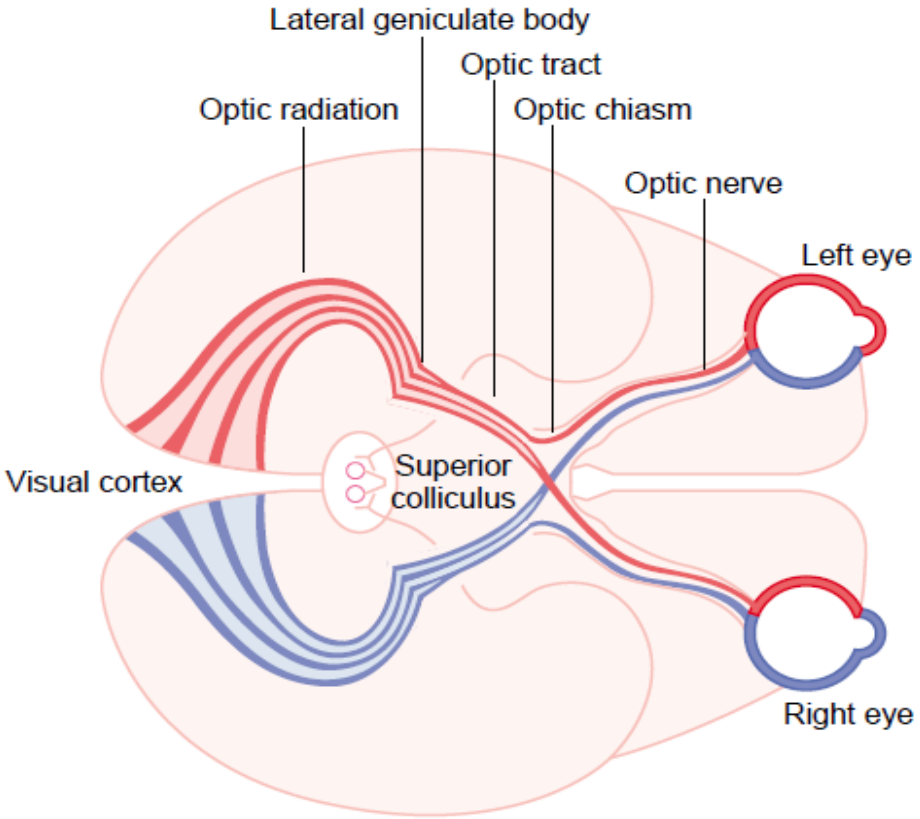
*

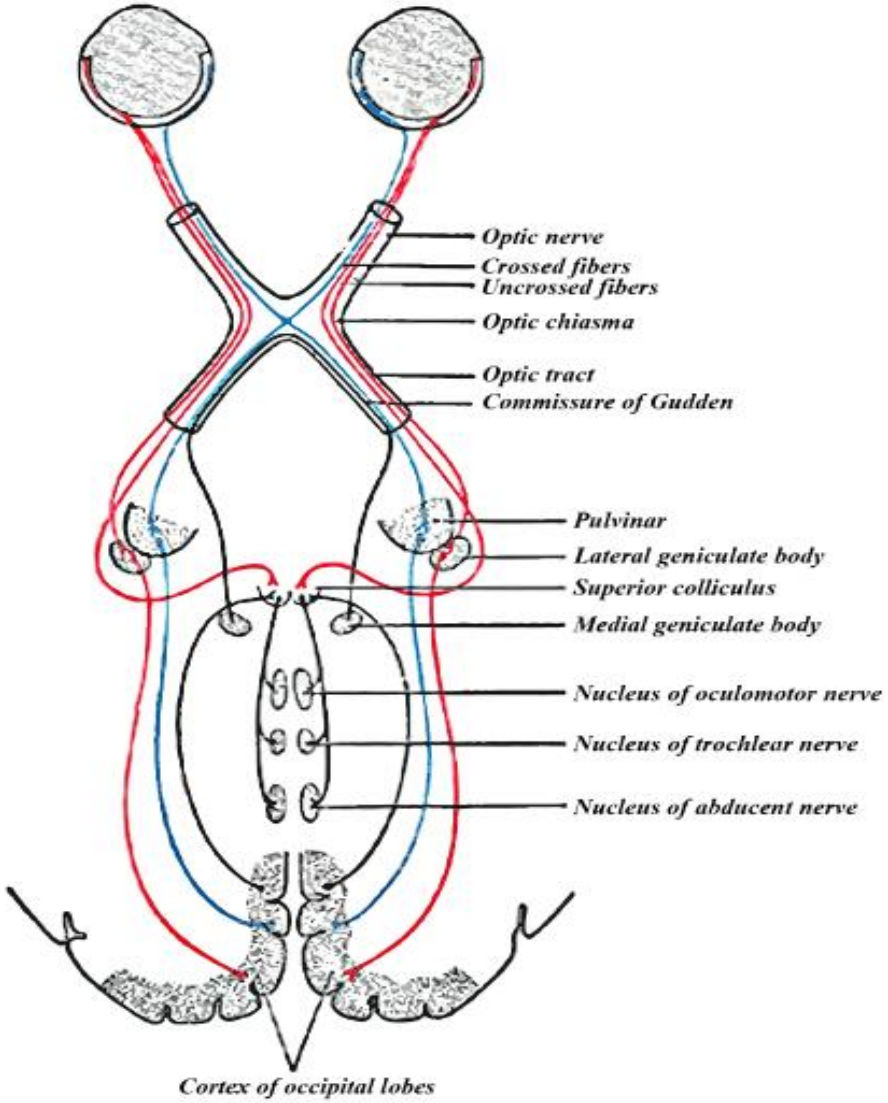
2- Some axons of ganglion cells from optic chiasma pass directly to hypothalamus for circadian rhythm (light-dark cycle)

*3-Some axons from lateral geniculate body in thalamus to superior colliculus in midbrain for accomodation. R & its miosis component

- N.B/-70% to 80% of the axons from the retina pass to the lateral geniculate bodies ➔This geniculostriate system
- -20% to 30%of the fibers from the retina, ➔ superior colliculus of the midbrain (also called the optic tectum).Axons from the superior colliculus activate motor pathways
- leading to eye and body movements.


Point of fixation
(eyes are focusing
on a close object)
Monocular field
Binocular field
Macular field
Lens
Retina
Macula lutea
Optic nerve
Optic chiasma
Optic tract
Superior
colliculus
(visual
reflexes)
Lateral
geniculate nucleus
Optic radiation
Occipital lobe
of cerebrum
(visual cortex)


Lateral geniculate body
Optic tract
Optic radiation
Optic chiasm
Optic nerve
Left eye
Visual cortex
Superior
colliculus
Right eye


Optic nerve
Crossed fibers
Uncrossed fibers
Optic chiasma
Optic tract
Commissure of Gudden
Pulvinar
Lateral geniculate body
Superior colliculus
Medial geniculate body
Nucleus of oculomotor nerve
Nucleus of trochlear nerve
Nucleus of abducent nerve
Cortex of occipital lobes

-**VISUAL PATHWAY & FIELD :-**

- -The nasal fibers (medial) cross to opposite side
- - The temporal fibers (lateral) do not cross
- -Nasal fibers conveys temporal field (outer)of vision
- -Temporal fibers conveys nasal field (inner)of vision

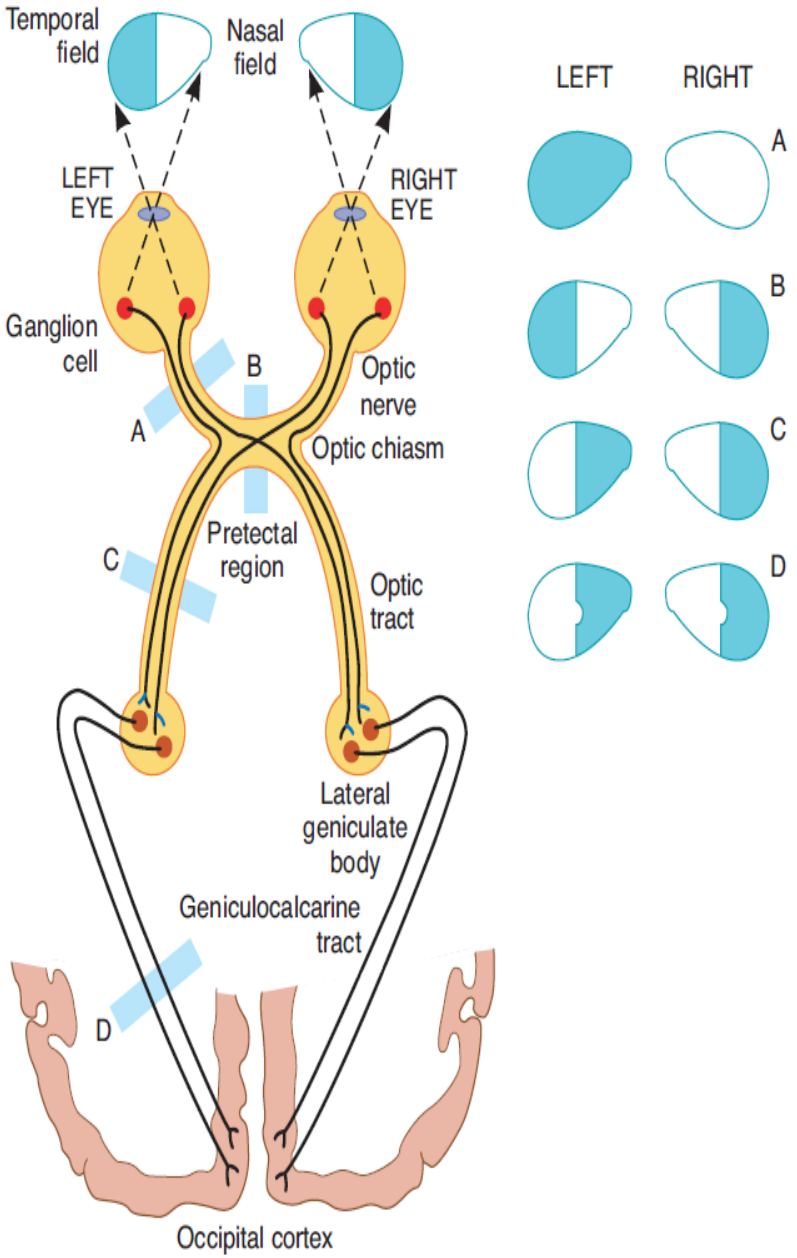
- **OPTIC TRACT :-**
- includes temporal fibers of the same side i.e nasal field of same eye (inner)+ nasal fibers of the opposite side i.e temporal field of other eye(outer)

exp//LEFT OPTIC TRACT:-

Conveys temporal fibers of the left eye
+ nasal fibers of the right eye
=half of visual field of left eye)+ half of visual field of right eye),
both form right half of visual field of both eyes.

N.B
-- The left optic tract corresponds to the right ½ of the visual field
--The right optic tract corresponds to the left ½ of the visual field

Visual pathways. Transection of the pathways
at the locations indicated by the letters causes the visual field defects shown in the diagrams on the right.



Accomodation(focusing)

Is an active process for modification of the refractive power of the eye to view a nearby object by increasing the curvature of lens

- **At rest (looking at far objects):-**

- **Ciliary muscles are relaxed + taut (tense) ligaments + flat lens**

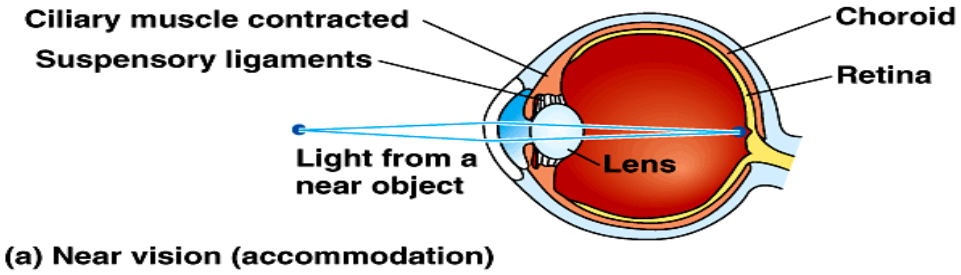
- **- looking at near objects:- from near (close) objects parallel rays focus behind retina(if ciliary muscles remain relaxed)>>>>>>>>blurred vision**
- **Solution is to increase curvature & refractive power of lens by accomodation to bring focus on retina.**

- **Accomodation reflex:-**
-
- **- Focusing at near object(increased anterior surface curvature of lens by ciliary muscles contraction , slack = relaxed ligaments, increased anterior surface curvature of lens . why?**
- **-to add 12D to refractive power of lens.**
- **-both circular & longitudinal cilliary muscles contract to pull cilliary muscle forwards & inwards>>>>>cilliary muscles edges come close to each other to increase anterior surface curvature of lens.**
- **Test//sanson purkinje image**

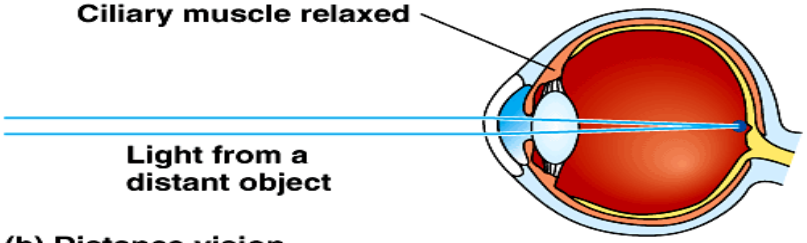
Accommodation is the focusing of light in the retina.
We focus by changing the shape of the lens.

-The lens is flattened for distant objects.

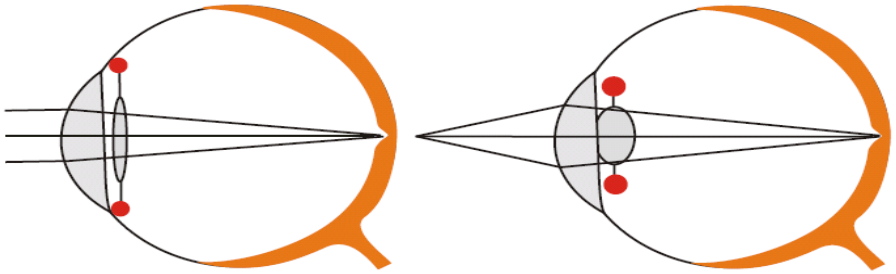
-The lens is rounded for near objects.



(a) Near vision (accommodation)



(b) Distance vision



When the ciliary muscles are **relaxed** the lens is flat and distant objects are focussed onto the retina

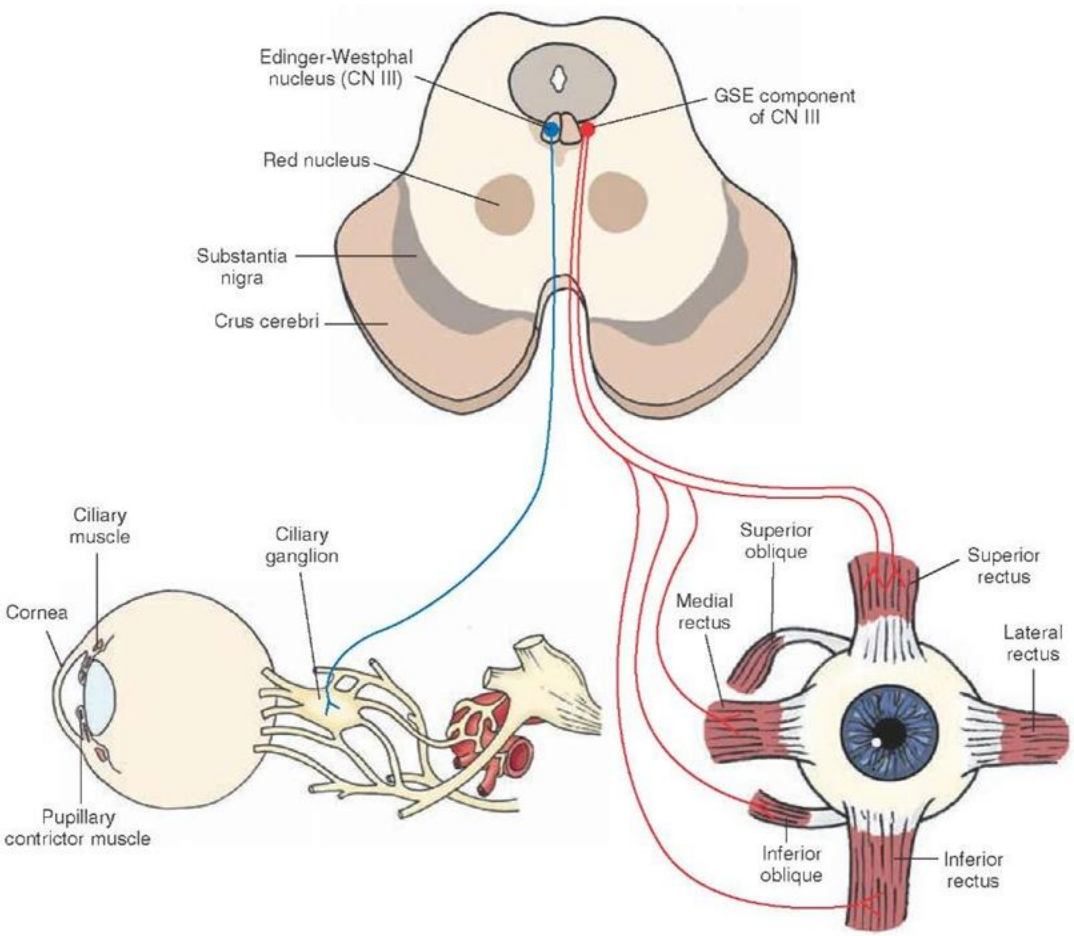
When the ciliary muscles are **contracted**, the lens becomes more round and a close object is focussed onto the retina

- looking at a close object (near response)
- a- convergence of both visua axis. Why?
- b- pupil constriction. Why?
- c- Accomodation. Why?
- Near point:-
- Nearest point to eye at which object can brought into focus on retina by ACCOMODATION
- -10 years-----9 cm
- -At 60 years-----80-100 cm, due to hardness of lens & loss of accomodation.
- -(presbyopia:-((triade)
- 1-loss of accomodation 2-loss of lens elasticity
- 3- near point receed
- -correction by biconvex lens

Near point and amplitude of accomodation

Age (yrs)	Near point (cm)	Amplitude of Accomodation
10	9.0	11.0
20	10.0	10.0
30	12.5	8.0
40	18	5.5
60	83	1.2
70	100	1.0

- **Pathway of accomodation:-**
- **Light on eye>>>>>>retina >>>>>optic nerve >>>>>optic chiasma>>>> optic tract->>>> lateral geniculate body in thalamus & to superior colliculus in midbrain for- >>>>EWN>>>>> cilliary ganglion to oculomotor N>>>>>>cilliary body contraction (accomodation. R) & contraction of iris muscles for miosis of near response**
- **- This pathway of near response is not the same to pupillary light reflex)**


Edinger-Westphal nucleus (CN III)
GSE component of CN III
Red nucleus
Substantia nigra
Crus cerebri
Ciliary muscle
Ciliary ganglion
Cornea
Pupillary contrictor muscle
Superior oblique
Superior rectus
Medial rectus
Lateral rectus
Inferior oblique
Inferior rectus

Pupilary light reflex:-

Light on one eye pupil>>>>>>constiction of this pupil (direct) & the other pupil (indirect)

Pathway of consensual Pupilary light reflex (indirect):-

Light on eye>>>>retina>>>optic nerve >>>optic chiasma>>>>>optic tract>>>>pass through superior colliculus to end in pretectal nucleus >>>>>both oculomotor nerve nuclei (EWN)>>>>> both ciliary ganglia>>>>>supply both eyes by oculomotor nerves>>>>>>>(short ciliary nerve to constrictor pupillae)>>>>>>miosis in both eyes.

-Atropine drops:- block parasympathetic supply of oculomotor >>>>>>>mydriasis

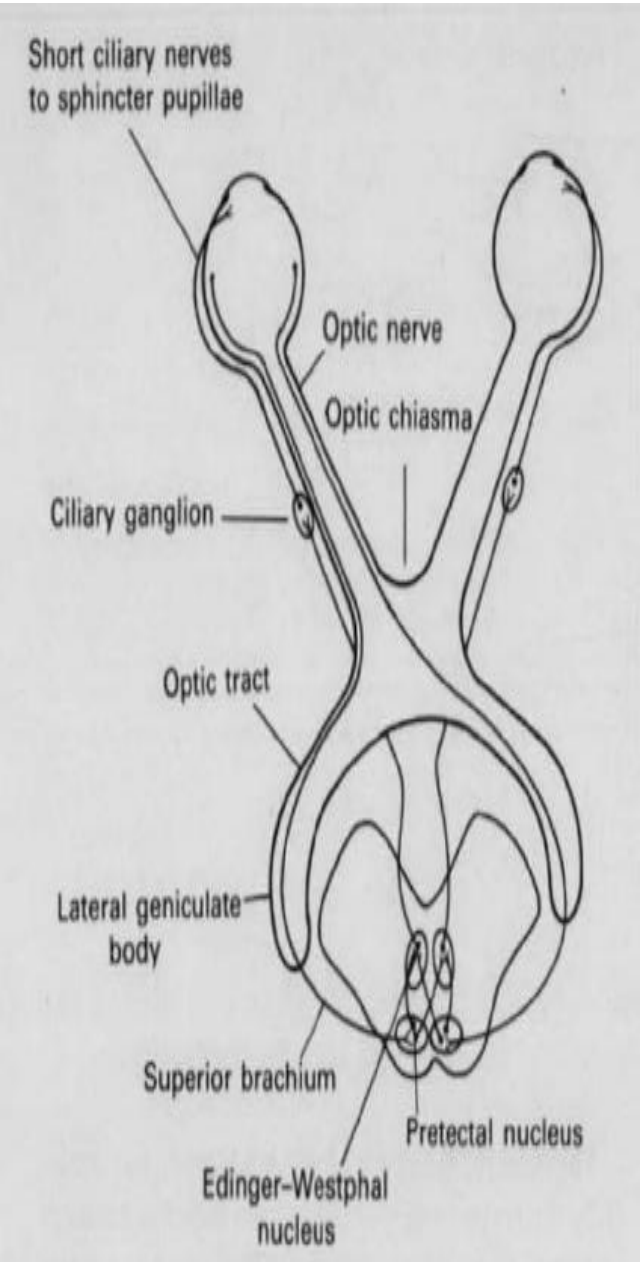
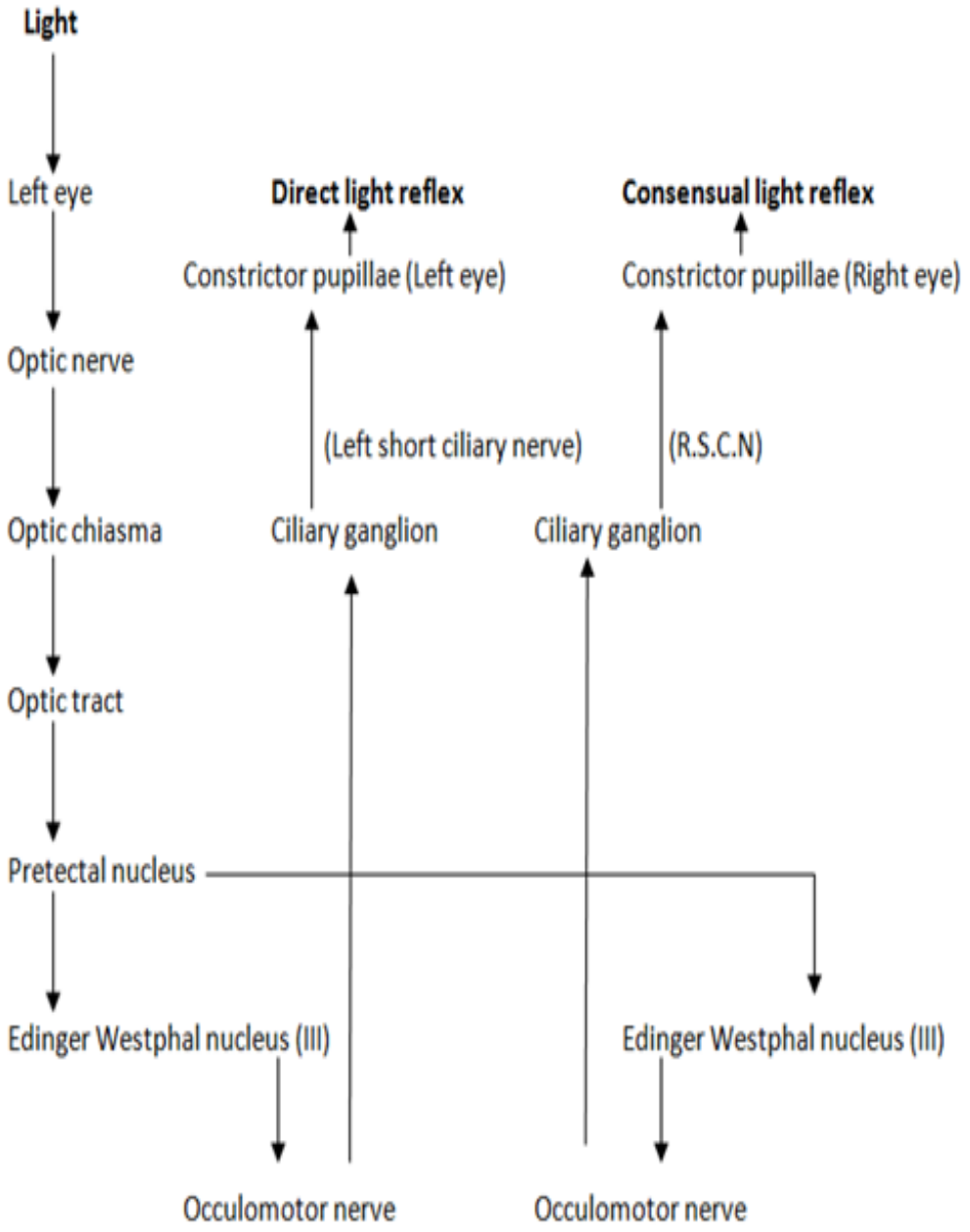


Fig. 6.53 Pathway for pupillary light reflexes.



Q. Argyll Robertson pupil?

In syphilis tabes dorsalis which destroy pretectal nucleus

-light .R is lost & accomodation .R remains

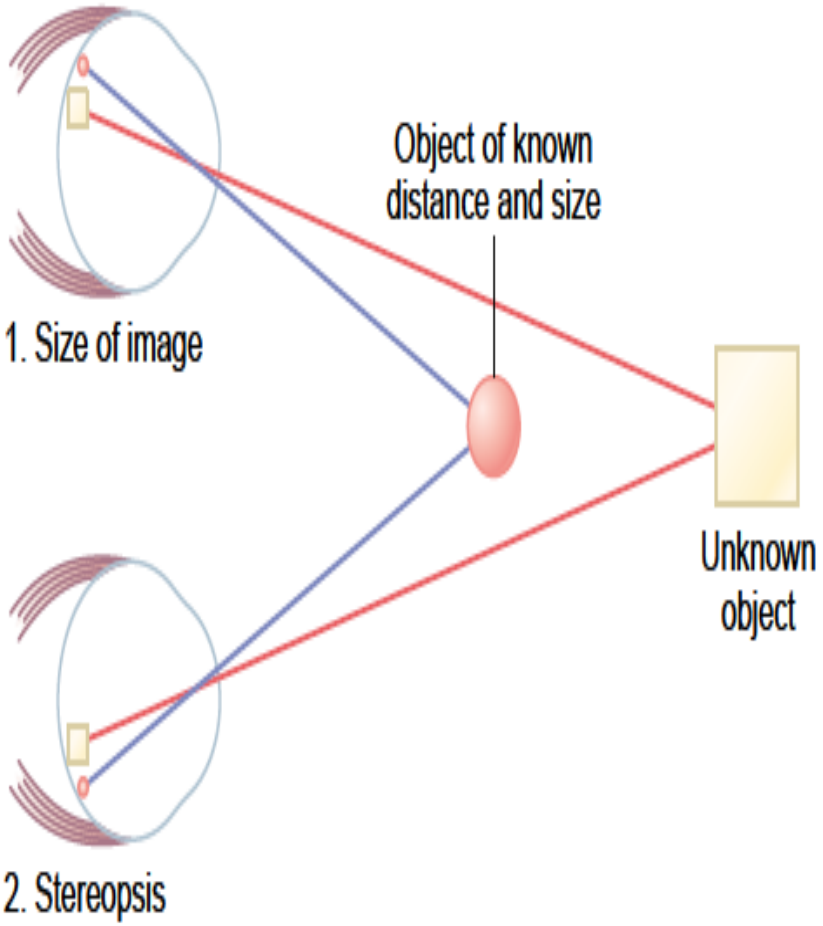
- **because lesion is in pretectal nucleus only, away from superior colliculus & fibers of accomodation.**

Depth Perception”

Ability to determine Distance of an Object from the Eye

Stereopsis is Use both eyes to perceive depth – “depth perception”

-Each visual cortex (R &L) receives information from both eyes so it can compare what each eye sees.



- **Lateral geniculate body (6 layers):-**
- Thus left LGB (similar to left optic tract) has all layers receive from RIGHT ½ of visual field
- - Right LGB (similar to right optic tract) has all layers receive from LEFT ½ of visual field.

- **FUNCTION OF LGB:-**

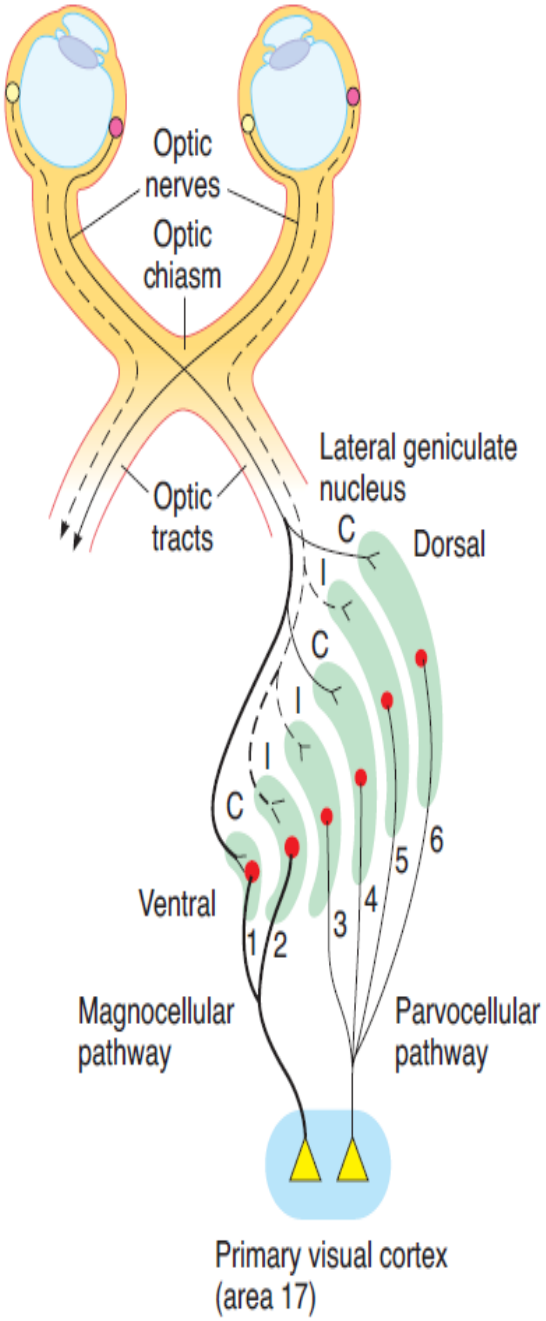
- 1-acts as a relay station for visual information from optic tract to cortex.
- 2-It has point to point transmission(spatial fidelity)
- 3-Acts as gate controls signal transmission to visual cortex i.e control how much signals reach visual cortex
- 4-color vision & detect shapes & texture

- NB/ it is rapidly conducting to visual cortex.

Th e magnocellular pathway,
from layers 1 and 2 which have large cells and are called magnocellular.,
carries signals for detection of movement,depth, and fl icker.

The parvocellular pathway, from layers 3–6 which have small cells and are called parvocellular,
carries signals for color vision, texture, shape, and fine detail.

On each side, layers 1, 4, and 6 receive input from the contralateral eye, whereas layers 2, 3, and 5 receive input from the ipsilateral eye



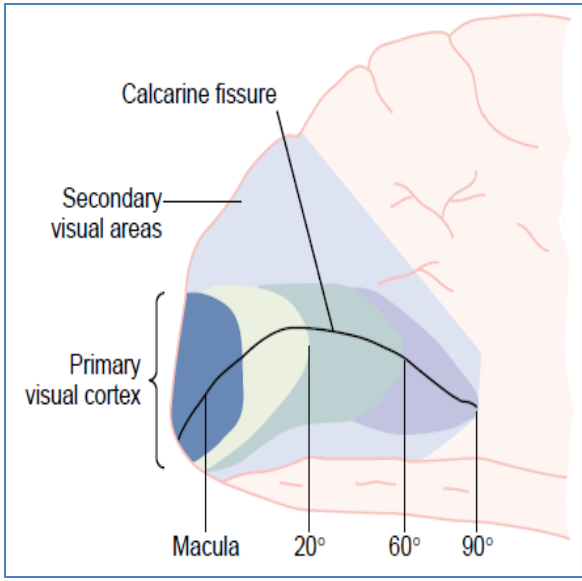
- **Visual cortex**

1-Primary visual cortex(braodmann area 17):-

percieve sensation of vision (movement + shapes+ stereoscopic vision + brightness) &has blobs for color detection

2-Association visual cortex(area 18&19):-

interpretation of visual stimuli



- visual cortex has 6 layers
- -Blobs are clusters of cells responsible for color detection
- -Simple cells detect bars of light, lines and edges
- -Complex cells detect linear movements of a stimulus

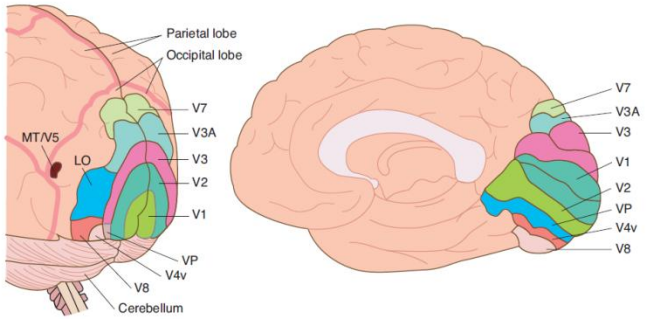
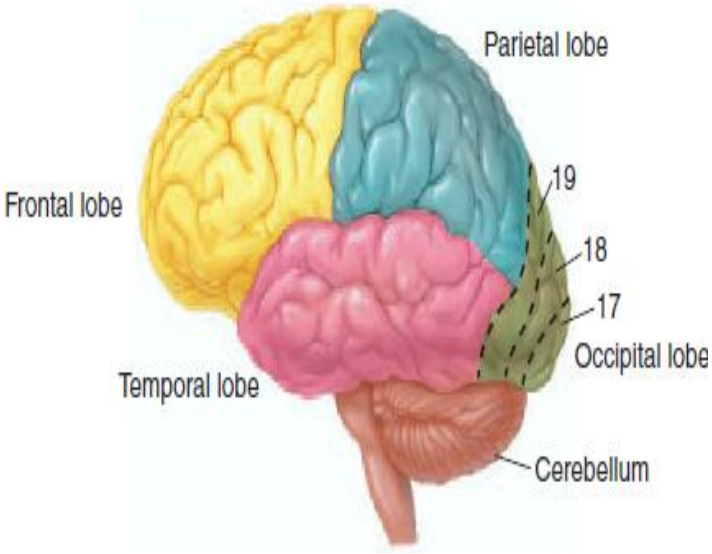
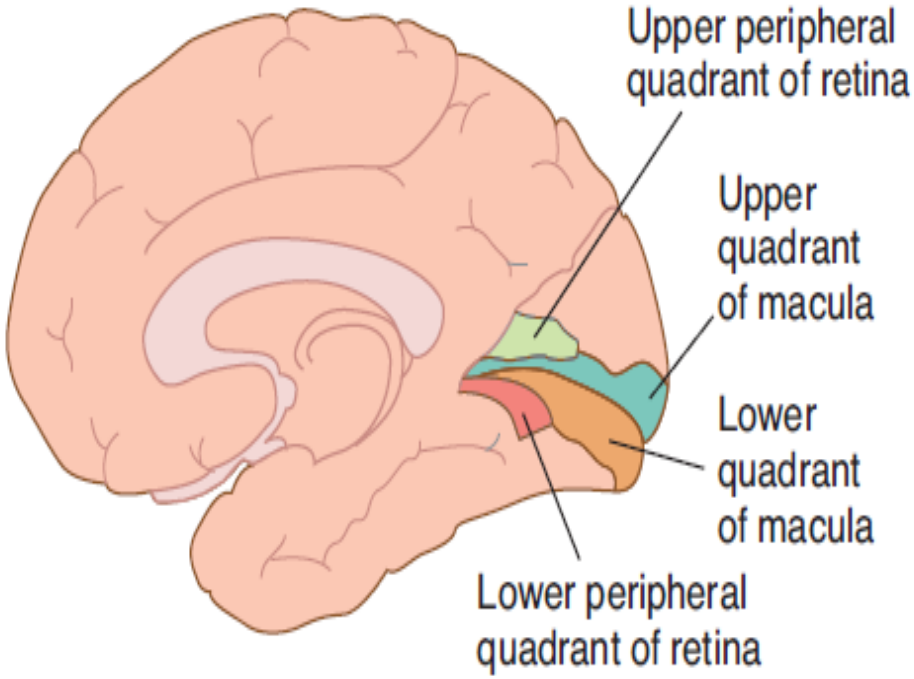


FIGURE 12–19 Some of the main areas to which the primary visual cortex (V1) projects in the human brain. Lateral and medial views. See also Table 8–1. (Modified from Logothetis N: Vision: A window on consciousness. Sci Am [Nov] 1999;281:99.)





Macular sparing, that is, loss of peripheral vision with intact macular vision, is also common with occipital lesions because the macular representation is separate from that of the peripheral
fields and very large relative to that
of the peripheral fields.

Thank you for