

ANATOMY

☒ Sheet

☐ Slide

☐ Handout

Number

15

Subject

The Vision

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Date: 10/03/2017

Price:

- this sheet is written according to section 1 recording
- Pay attention to the Doctor's figures, they are very important ♡

❄ The Vision ❄

🌸 The Eye Ball

Consists of:

1. Outer Fibrous layer (Fibrous Coat)
2. middle vascular and muscular layer or coat
3. inner nervous layer, (Nervous Coat)

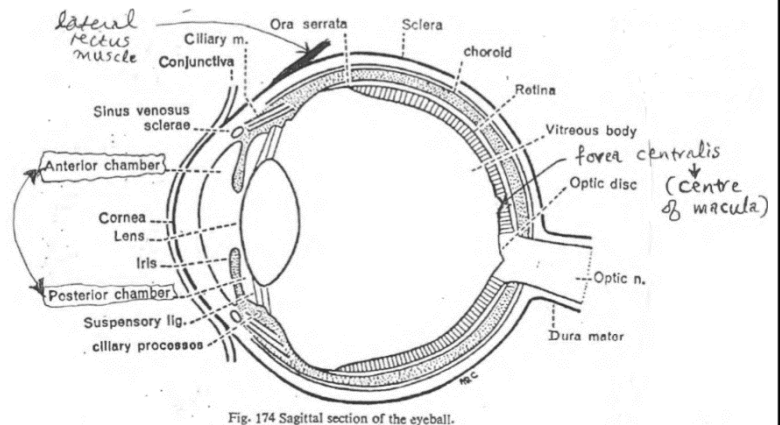
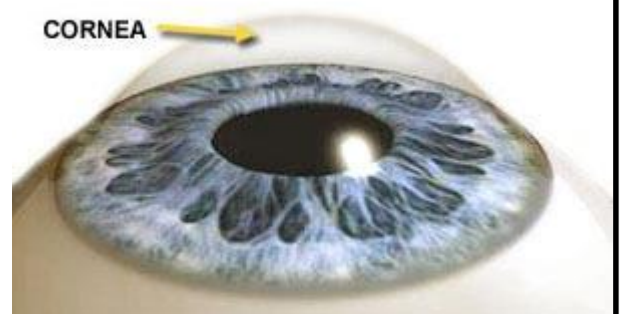
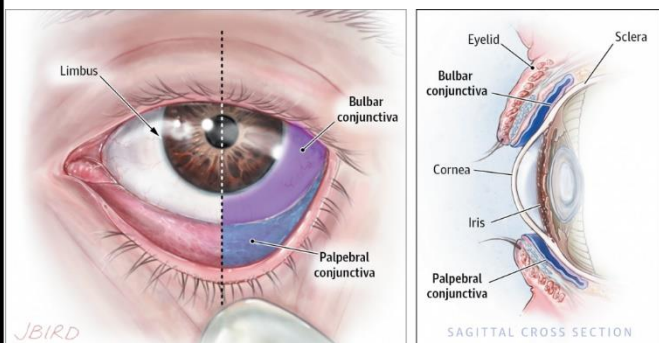


Fig. 174 Sagittal section of the eyeball.

🔗 Outer Fibrous Layer:

(Consist of the Cornea & the Sclera)

- the anterior sixth of the fibrous coat is **the Cornea**, which is transparent,
- And the posterior 5 sixths is a dense white fibrous tissue called **the Sclera** (*white of the eye*)
- The sclera lies behind the conjunctiva, which is a thin, transparent membrane covering the sclera and the eyelid تلحم العين بالجبف
- The conjunctiva is very rich in blood vessels, and prone to inflammation; a condition called conjunctivitis, (*when the eye becomes red*)
- we look at the sclera through conjunctiva

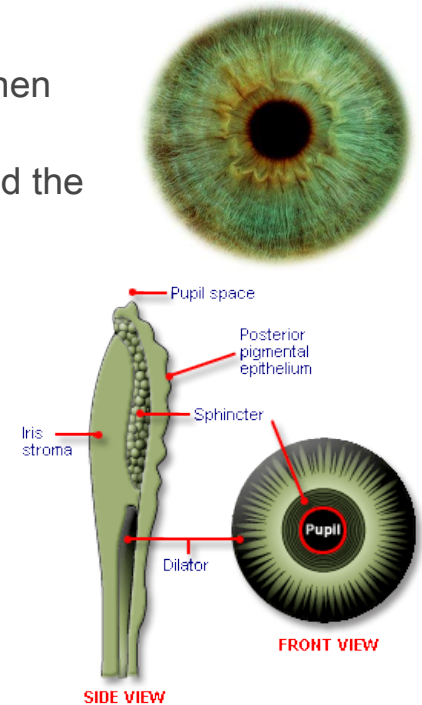


🔗 The Middle Layer (Vascular & Muscular Coat):

Formed by the Iris, Ciliary Body & the Choroid

▪ The iris:

- The anterior part is the Iris, then the ciliary body, then the choroid
- The Iris is a colored circular diaphragm lying behind the cornea, it has a central hole called **the pupil**,
- The Iris is pigmented and the color varies between people,
- it has two smooth muscles, constrictor pupillae & dilator pupillae, they receive Parasympathetic and Sympathetic fibers



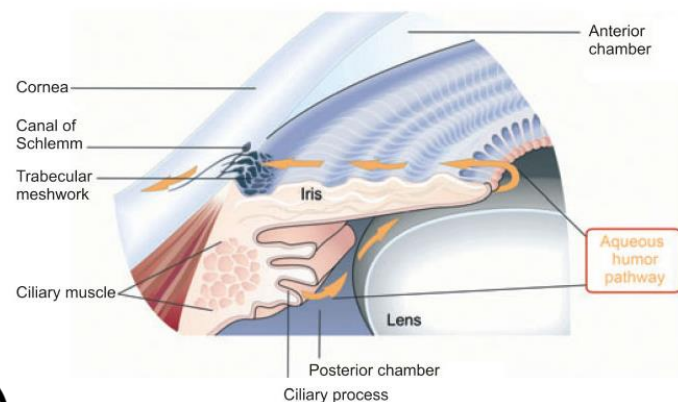
▪ The Ciliary Body

Composed of:

- a. **Ciliary muscle:** for accommodation
- b. **Ciliary processes:** produces the aqueous humor, which is secreted into the posterior chamber and then passes through the pupil into the anterior chamber, then absorbed via the sinus venosus sclerae (**canal of Schlemm**), that is found between the junction of cornea and sclera, if an obstruction occurs at this canal, the aqueous humor will accumulate → resulting in an increase in ocular pressure, “a state called **glaucoma**”

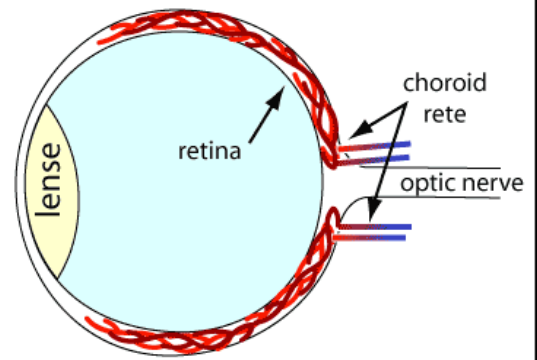
“The canal of Schlemm drain into the anterior ciliary veins”

- c. **Ciliary Ring:** a narrow vascular zone at the junction with the choroid



■ The Choroid

- Largest part of the middle layer, lies between the sclera and the retina, it is highly pigmented and rich in blood vessels.
- It is pierced posteriorly by the optic nerve



✂ The inner Nervous layer (Nervous Coat)

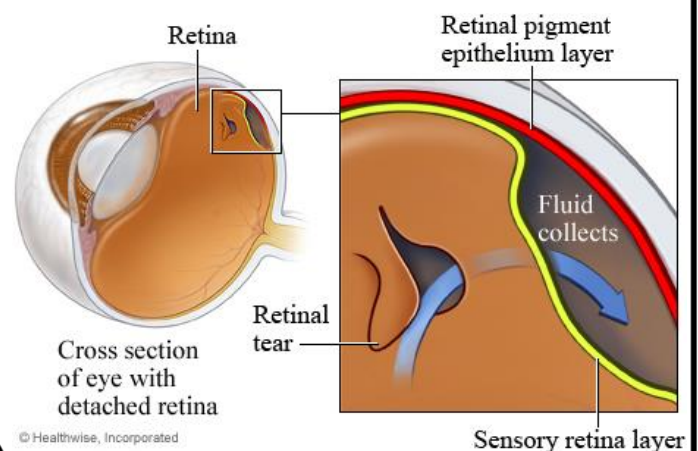
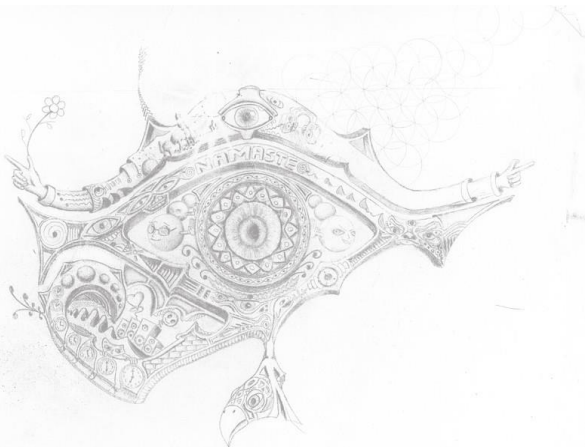
“Mainly formed by the Retina”

- The **Retina** is composed of two layers:
 - I. Outer pigmented layer. (attached to choroid)
 - II. Inner nervous layer. (in contact with the vitreous body)

☆ Retinal detachment:

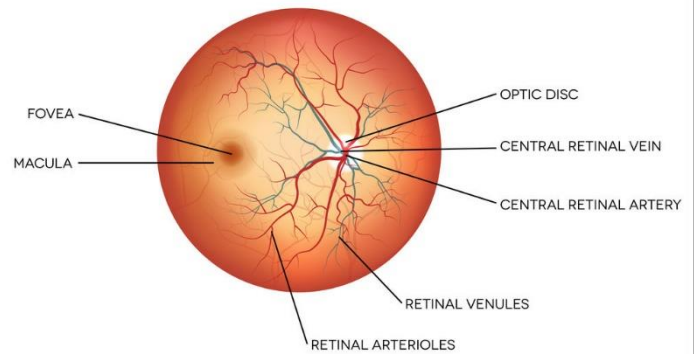
(A condition where the nervous part of the retina detach from the pigmented part)

- Results in Retinal deprivation from blood supply → blindness
- Retinal detachment is treated nowadays by cauterization using laser.



THE RETINA

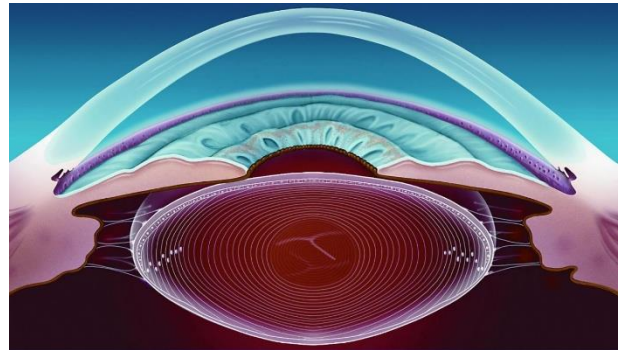
- The blind spot:
- ❖ in the retina we have an area called the blind spot (physiological cup), lies in front of the **optic disc**, this area contains no cones nor rods (hence the name blind spot)



- The Macula Lutea:
- ❖ The macula is a depression in the retina, a vascular and yellow in color, the center of this depression is called **fovea centralis**, which is the site with highest accuracy of vision, in this area there's no rods, just cones.

& The Lens:

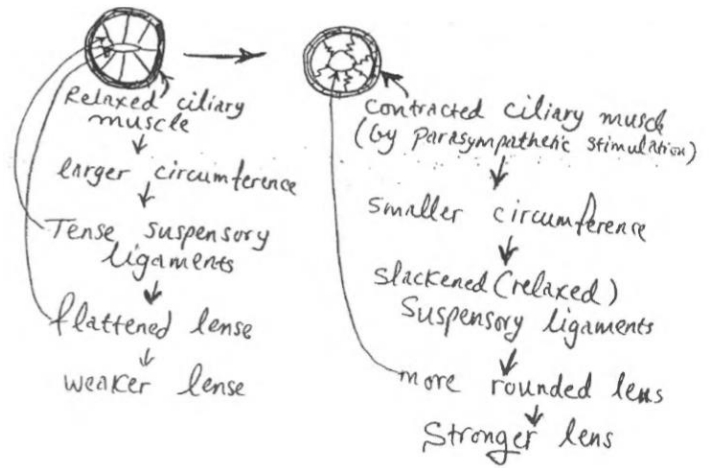
- The lens is a biconvex transparent structure.
- Elasticity of the lens is important for accommodation.
- Lens's thickness is changed by the **ciliary muscle**, ciliary muscles is a ring-shaped **smooth** muscle, responsible for the accommodation
- The ciliary muscle is connected to the lens by **suspensory ligament**.



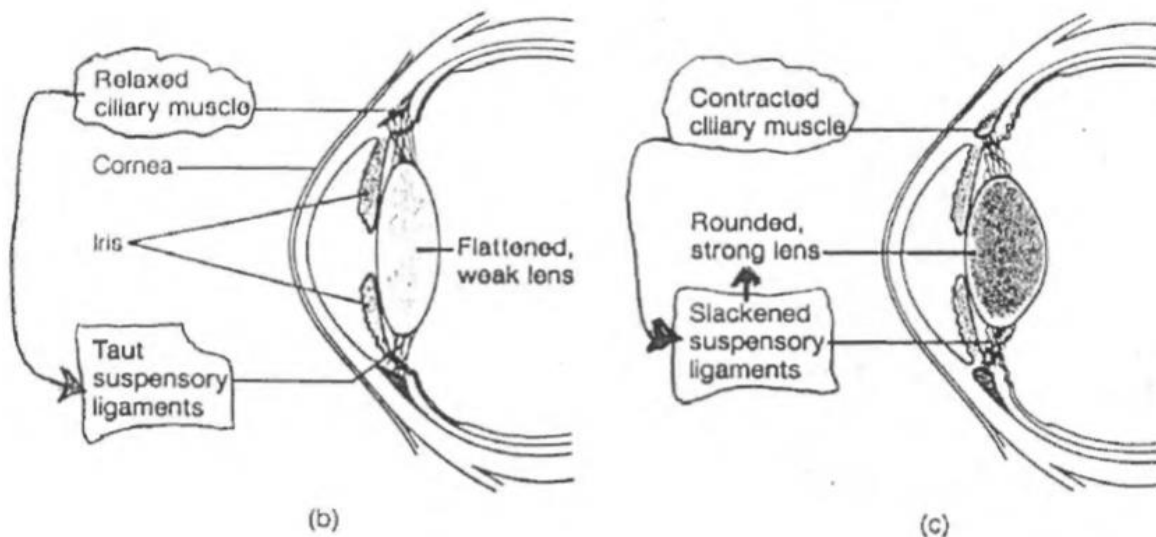
- Relaxed ciliary muscle means a larger circumference of its ring, when the ciliary muscle is **relaxed**, it pulls the suspensory ligament and makes it taut (tense) and the lens becomes

thin and less convex so its effect or power will be low

- When the ciliary muscle **contracts**, the circumference becomes smaller, the suspensory ligaments gets relaxed and the lens become more convex (thicker) resulting in higher power or effect.



“the Lens is elastic & transparent”



☆ Presbyopia:

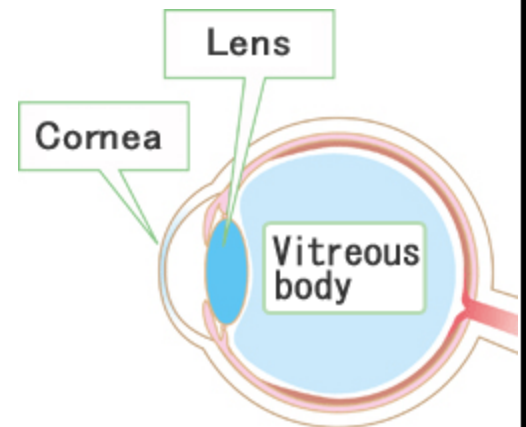
- Physiologically, above the age of 40 (especially in diabetics), the lens becomes less flexible (or less elastic), which results in loss of accommodation, a condition called presbyopia (person can't see close objects without glasses).

☆ **Cataracts:**

- The lens proteins degenerate, resulting in loss of its transparency and it becomes opaque, diabetics may have more chance for developing this condition.
- Generally it's a benign condition, treated by lens replacement

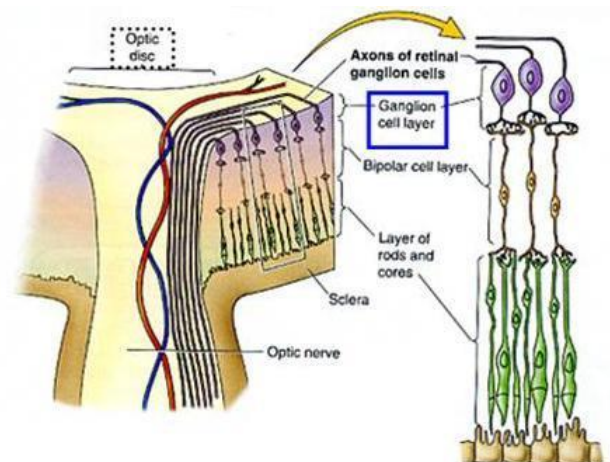
🔗 **The Vitreous Body:**

- Behind lens, the vitreous body fills most of the eye cavity, keeping the retina attached to the choroid.
- if it was removed the retina will detach, and will get no blood supply → retina will be destroyed resulting in blindness “retinal deattachment”



The optic nerve:

- the optic nerve pierces the sclera & the choroid posteriorly
- mother cells of the optic nerve are in the retina (Axons of the ganglion cells)



The Visual Pathway

The retina is composed of 10 layers, but there are three main layers:

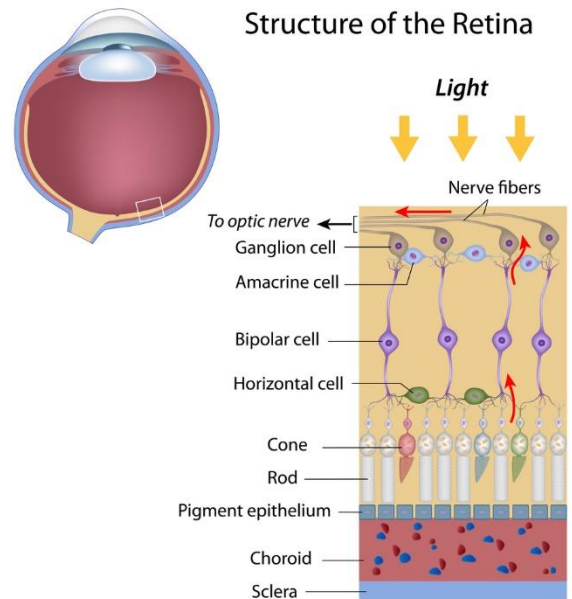
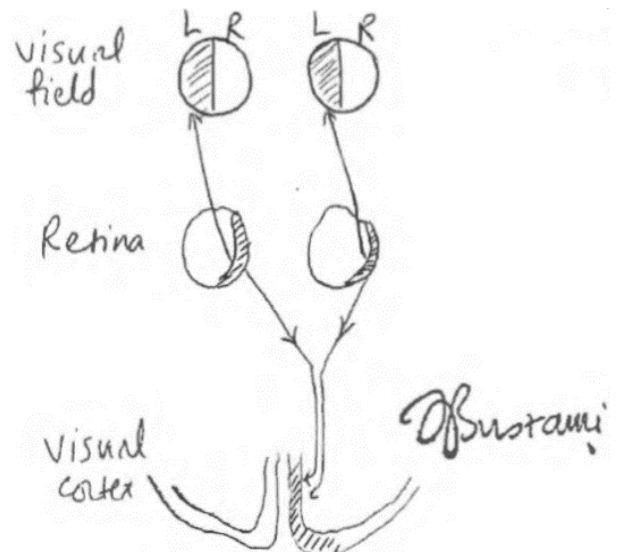
1. Photoreceptors layer (cons and rods).
2. Bipolar cell layer.
3. Ganglion cells layer and its axons that will form the **optic nerve**.

Other layers work like interneurons, like the horizontal cells, Amacrine cells etc...

- ✿ The retina is divided into two halves, outer (lateral) **Temporal** half & inner (medial) **Nasal** half (related to the temporal/nasal bones)

✂ The Visual fields in the Retina:

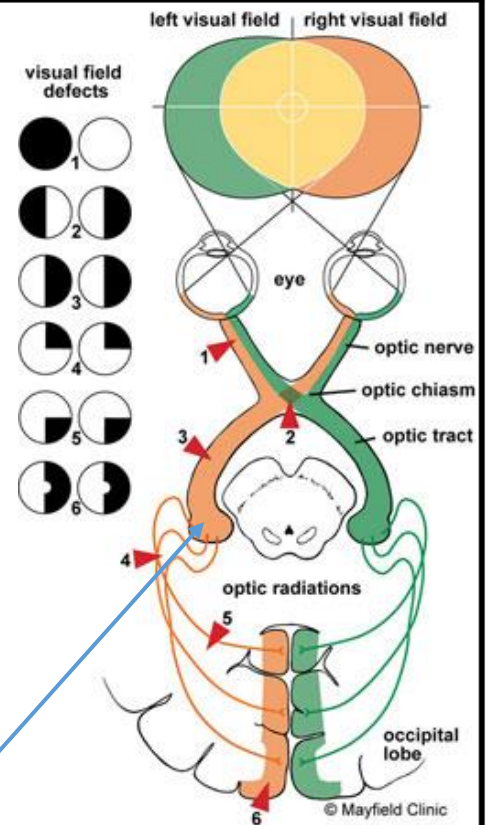
- The Retina works like a camera, the picture is presented upside down and inverted,
- The picture viewed from the temporal half of the eye will go to the receptors on the nasal side of the retina.
- The picture viewed from the nasal half of the eye will go to the receptors on the temporal side of the retina.



🔗 Visual Pathway parts:

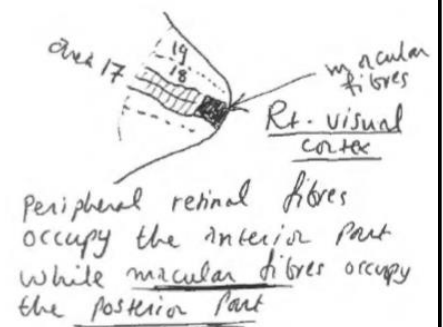
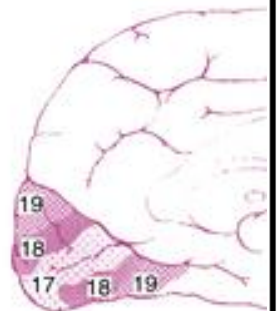
Ganglion cells axons → optic nerve (temporal + nasal half) → optic chiasm → optic tract (containing temporal part of the same side and nasal part of the opposite)

- Optic chiasm is related to the pituitary gland!
 - Only nasal fibers cross in the optic chiasm.
- ❖ Tumor in the pituitary gland would destroy the optic chiasm, causing **heteronymous bitemporal hemianopia**.



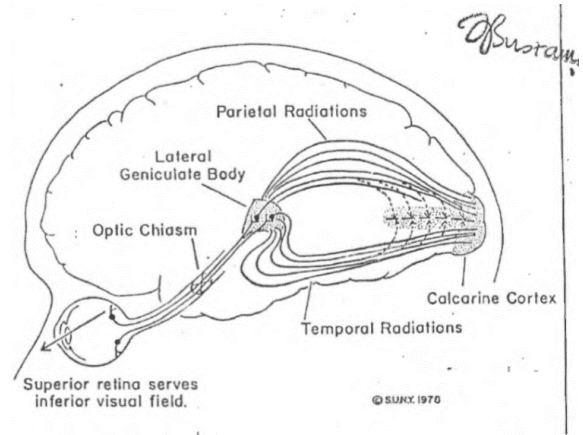
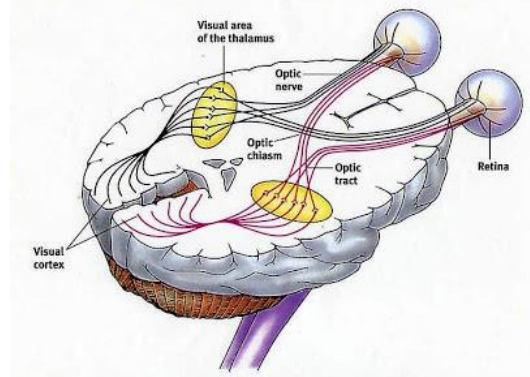
Optic chiasm → optic tract → optic radiation → visual cortex

- The Optic tract enters thalamus (**LGB** nucleus, lateral geniculate body nucleus), the LGB is the thalamic center for vision,
- Optic radiation arise out from thalamus (also containing temporal fibers of same side and nasal fibers of the opposite)
- Optic radiation goes to the visual cortex area 17 on both sides of the calcarine sulcus,
- Cuneus gyrus is above the sulcus and lingual gyrus below it, in the cuneus gyrus above area 17 there is area 18 and 19, in the lingual gyrus below area 17, there is also 18 and 19
- Area 17 is the primary visual area, تری ولا تفهم ماتری
- Areas 18 & 19 are the secondary or association visual area, تفهم ما یری



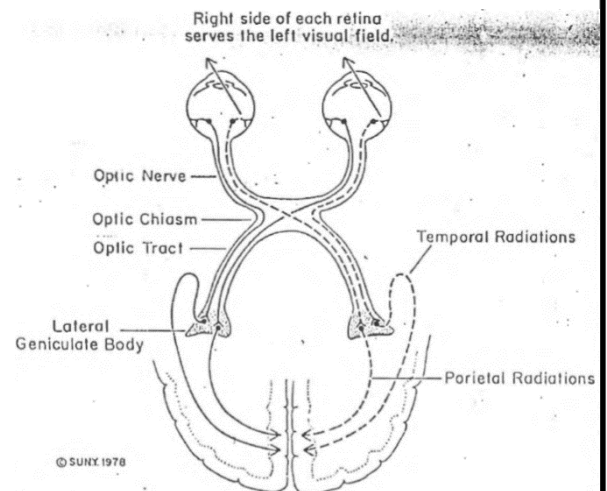
- Optic radiation is diffused, not restricted to only one lobe, it runs through the retrolentiform part of the internal capsule “4th part”
- One part below in the temporal lobe, and another part in the parietal lobe
- Lesions affect the whole optic radiation are rare, commonly a lesion will affect either on the temporal or parietal part!

*Optic tract lesion = whole optic radiation destruction = visual cortex destruction




Visual Cortices:

- The right visual cortex receives light which enters the right half of each retina (temporal of the ipsilateral eye & nasal of the opposite “contralateral” eye), which means **the left visual field** of each eye (حطها خارطة فمخك)
- The left visual cortex is apparently the opposite!



& Visual pathway injuries:

- ❖ Optic nerve cut, or multiple sclerosis → blindness of the ipsilateral eye
 - ❖ Optic chiasm central part “nasal fibers” destruction → heteronymous bitemporal hemianopia (*called heteronymous because the two nasal fibers are destroyed*)
 - Why heteronymous? 
 - Because the right nasal fibers receive the right half of the visual field, while the left nasal fibers receive the left half of the visual field
 - ❖ Optic tract injury → (temporal fibers of the same side and nasal fibers of the opposite side) → **Contralateral homonymous hemianopia**
 - **Right optic tract injury** ⇒ we lose the left visual field, and vice versa
 - Why is it called homonymous hemianopia?
 - Because as we said, **right** temporal fibers receives left visual field, left nasal fibers receive left visual field so both receive the same side!
 - Hemianopia because half of visual field is lost
- *btw patient might live 20 years without knowing he has hemianopia
-
- ❖ **Optic radiation**, if all of it is destroyed symptoms will be similar to optic tract injury → **contralateral homonymous hemianopia**, *yet as we said it is rare*
 - Usually either temporal or parietal part is destroyed,
 - Temporal (lower fibers) receives from the lower part of the retina (i.e.

upper half of the visual field)

- While parietal part (upper fibers) receives from the upper part of the retina (lower half of the visual field)
 - ❖ Here we lose half of the half of the vision (one quarter) "not hemi but quadrant" ⇒ so it's called **contralateral homonymous quadrantanopia**
 - ❖ If the temporal part is damaged, we call it contralateral homonymous superior quadrantanopia (superior because the upper visual part is lost)
 - ❖ If the parietal part is damaged it will be called contralateral homonymous inferior quadrantanopia
- This concept is applied on the lingual gyrus "lower part of visual cortex", lesion there is the same as lesion in the temporal part of optic radiation (i.e. contralateral homonymous superior quadrantanopia).

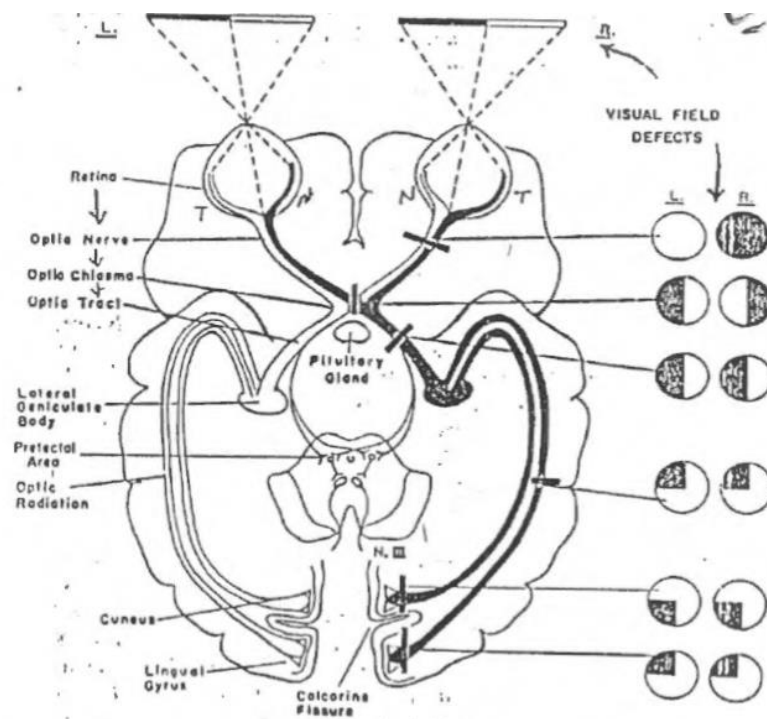


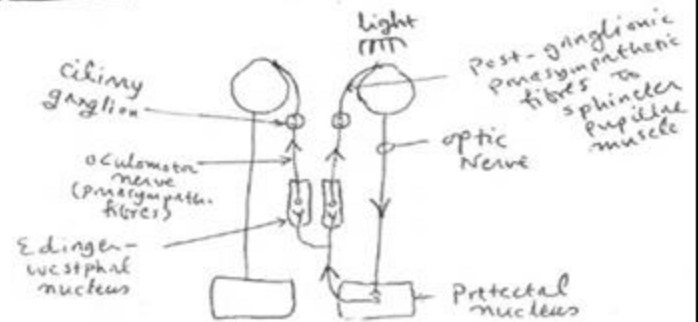
FIGURE 38. The visual pathway. On the right are maps of the visual fields with areas of blindness darkened to show the effects of injuries in various locations.

Lesion	Effect
optic Nerve	blinds the eye
optic chiasma	heteronomous bitemporal hemianopia
optic tract	contralateral homonymous hemianopia
optic radiation (lower part within temporal lobe)	contralateral homonymous superior quadrantanopia (cuneus)
(or) superior part of optic radiation within parietal lobe	contralateral homonymous inferior quadrantanopia

Light reflex

➤ The light Reflex:

- Not all optic tract fibers ends at the thalamus, small portion of them goes to the mid brain, to an area called the **(pretectal area)**, *(which take s part in light reflex)*
- Light reflex is when the light hits the right eye, both eyes pupils will be constricted, even while the left eye is closed. Optic and Oculomotor nerves are responsible for this reflex



- How to differentiate between optic tract and optic radiation injury?

(Because both of them if destroyed will cause contralateral hemianopia)

- If the lesion is in the beginning of the optic tract, light reflex will be **lost!** (A mechanism that we will talk about in details in the next lectures)
- If the lesion was at the end of the optic tract or at the optic radiation the light reflex will **still be working**

Le Fin.

"Reveal less about yourself, and people will wonder more about you." - Saffar

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