HUMAN ANATOMY AND PHYSIOLOGY-I, BP-101(T)

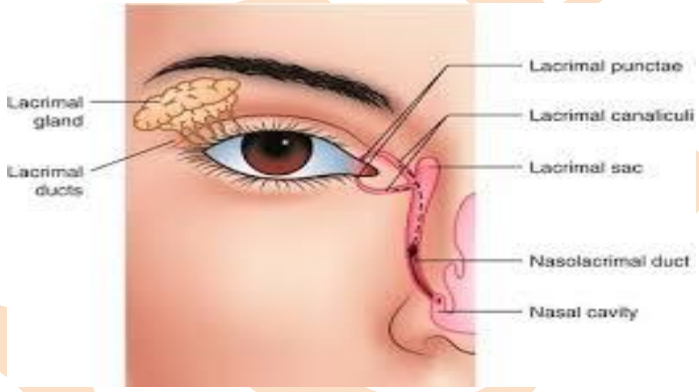
UNIT-IV (Special Senses)

CLASS:1

TOPIC –Introduction to Special Senses-Structure, functions and disorders of Eye

The eyes are responsible for the detection of visible light, the part of the electromagnetic spectrum with wavelengths ranging from about 400 to 700 nm. **Accessory Structure of Eye:**

The accessory structures of the eye include the eyelids, eyelashes, eyebrows, the lacrimal(tearing) apparatus, and extrinsic eye muscles.



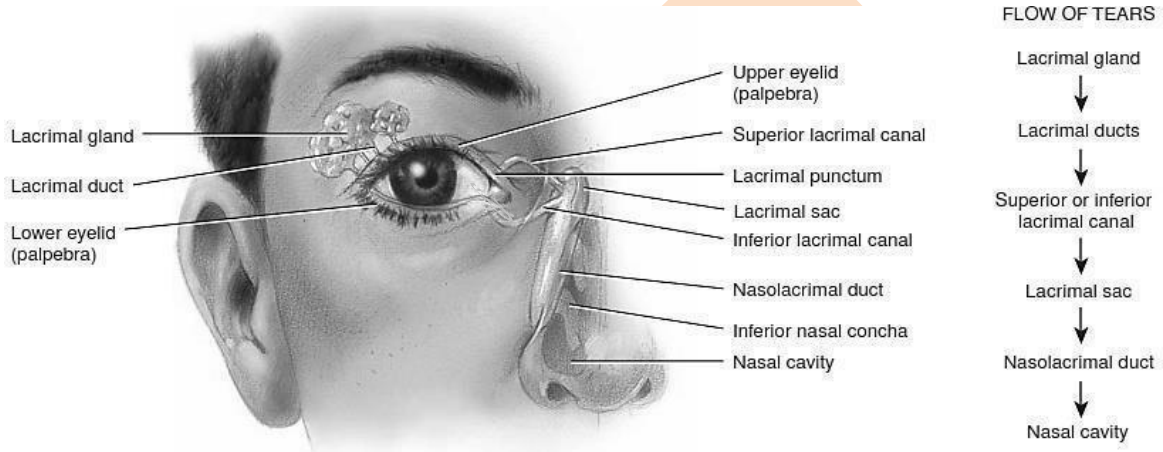
- The upper and lower eyelids shade the eyes during sleep, protect the eyes from excessive light and foreign objects, and spread lubricating secretions over the eyeballs.
- The upper eyelid is more movable than the lower.

Eyelashes and Eyebrows

- The eyelashes from the border of each eyelid and the eyebrows which locatedtransversely above the upper eyelids.
- It helps to protect the eyeballs from foreign objects, perspiration, and the direct rays ofthe sun.
- Sebaceous glands at the base of the hair follicles of the eyelashes, called sebaceous ciliary glands, release a lubricating fluid into the follicles.
- Infection of these glands is called a sty.

The Lacrimal Apparatus

- The lacrimal apparatus is a group of structures that produces and drains lacrimal fluid or tears.
- The lacrimal glands, each about the size and shape of an almond, secrete lacrimal fluid,which drains into 6–12 excretory lacrimal ducts that empty tears onto the surface of theconjunctiva of the upper lid.
- From here the tears pass medially over the anterior surface of the eyeball to enter two small openings called lacrimal puncta.
- Tears then pass into two ducts, the lacrimal canals, which lead into the lacrimal sac andthen into the nasolacrimal duct.



Anatomy of the Eye Ball:

The adult eyeball size is about 2.5 cm (1 in.) in diameter. Out of total surface area, only the anterior one-sixth is exposed and the remaining part is protected by the orbit in to which it fits.

The wall of the eyeball consists of three layers:

(i) Fibrous tunic:

- The fibrous tunic is the superficial layer of the eyeball and consists of the anterior corneaand posterior sclera.
- The cornea is a transparent coat that covers the colored iris. Because it is curved, the cornea helps focus light onto the retina.
- The sclera is the white portion of the eye.
- The sclera covers the entire eyeball except the cornea.
- It gives shape to the eyeball.
- At the junction of the sclera and cornea is an opening known as the scleral venous sinus(canal of Schlemm). A fluid called aqueous humor drains

into this sinus

(ii) Vascular tunic:

- The vascular tunic also known as uvea. It is the middle layer of the eyeball.
- It is composed of three parts: **choroid, ciliary body, and Iris.Choroid**
- It is the posterior portion of the vascular tunic and its lines most of the internal surfaceof the sclera.
- It is highly vascularized and numerous blood vessels provide nutrients to the posteriorsurface of the retina.
- The choroid also contains melanocytes that produce the pigment melanin, which causesthis layer to appear dark brown in color.
- Melanin in the choroid absorbs stray light rays so it prevents reflection and scattering of light in to the eyeball. Due to that, the image cast on the retina by the cornea and lensremains sharp and clear.
- In the anterior portion of the vascular tunic, the choroid consist the ciliary body.

Ciliary processes

- These are protrusions or folds on the internal surface of the ciliary body.
- They contain blood capillaries that secrete aqueous humor.

Iris

- It is the colored portion of the eyeball.
- It is located between the cornea and the lens and is attached at its outer margin to the ciliary processes.
- It consists of melanocytes and circular and radial smooth muscle fibers.
- The amount of melanin in the iris determines the eye color.
- The eyes appear brown to black when the iris contains a large amount of melanin, bluewhen its melanin concentration is very low, and green when its melanin concentrationis moderate.
- A principal function of the iris is to regulate the amount of light entering the eyeball through the pupil, the hole in the center of the iris.
- **Retina.**
- It is the third and inner layer of the eyeball.
- The retina, lines the posterior three-quarters of the eyeball and is the beginning of the visual pathway.
- The surface of the retina is the onlyplace in the body where blood vessels

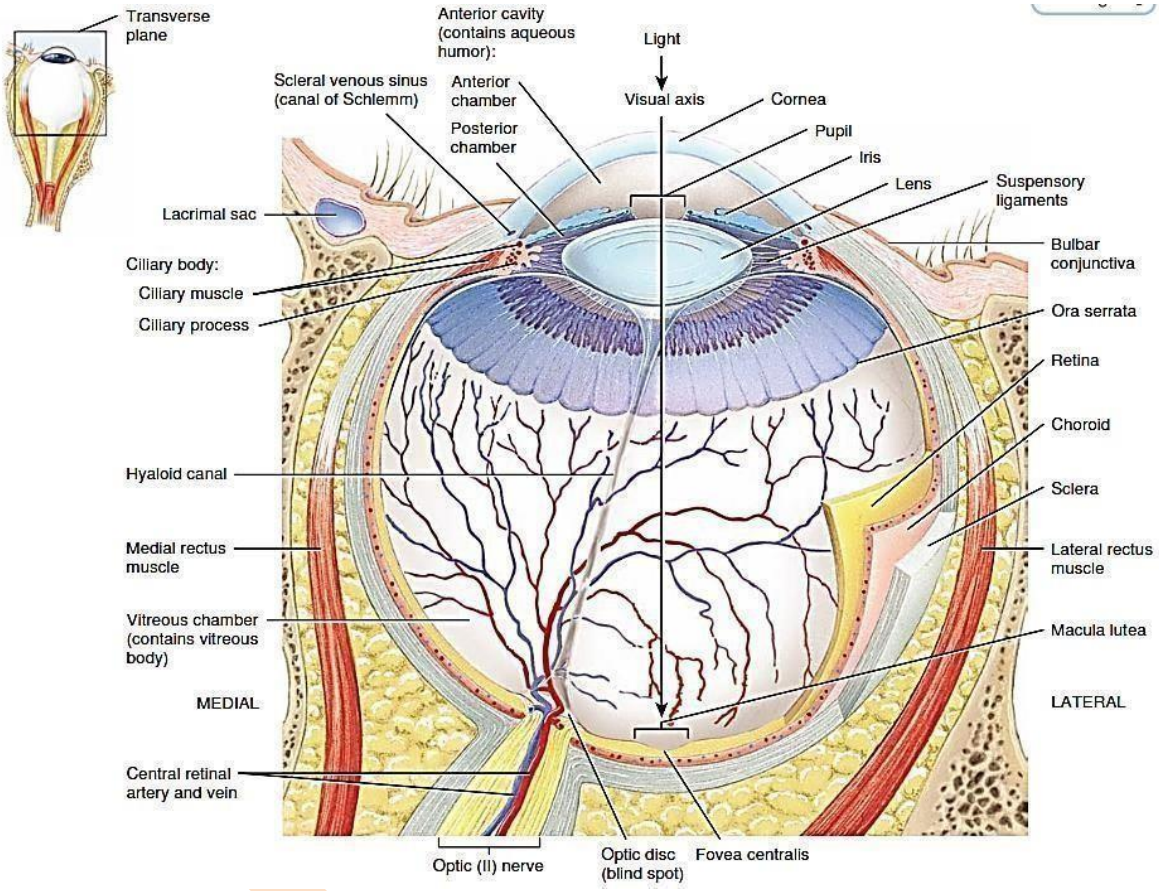
can be vieweddirectly and examined for pathological changes, such as those that occur with hypertension, diabetes mellitus, cataracts, and age-related macular disease.

- The retina consists of a **pigmented layer and a neural layer.**
- The pigmented layer is a sheet of melanin-containing epithelial cell located between the choroid and the neural part of the retina.
- The neural (sensory) layer of the retina is a multilayered outgrowth of the brain that processes visual data extensively before sending nerve impulses into axons that form the optic nerve.
- Three distinct layers of retinal neurons are: The photoreceptor layer, The bipolar cell layer and The ganglion cell layer which are separated by two zones, the outer and innersynaptic layers
- The axons of ganglion cells extend posteriorly to the optic disc and exit the eyeball as the optic (II) nerve.
- The optic disc is also called the blind spot.
- Because it contains no rods or cones, we cannot see an image that strikes the blind spot.
- Normally, we are not aware of having a blind spot, but we can easily demonstrate its presence.
- Hold this page about 20 in. from your face with the cross shown below directlyin front of your right eye. You should be able to see the cross and the square when you close your left eye.
- Now, keeping the left eye closed, slowlybring the page closer to your face whilekeeping the right eye on the cross.
- At a certain distance the square will disappear from your field of vision becauseits image falls on the blind spot.
- The macula lutea is in the exact center of the posterior portion of the retina, at the visualaxis of the eye.

LENS

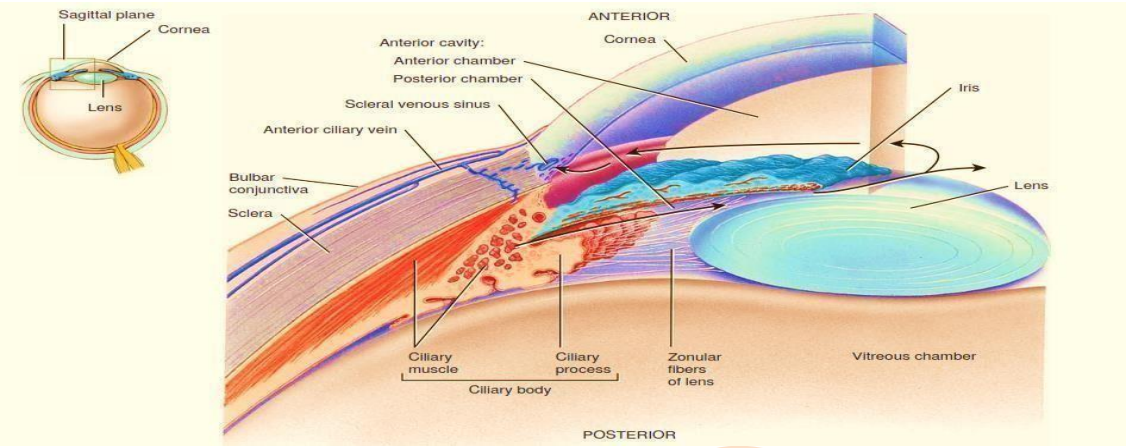
- It is located behind the pupil and iris, within the cavity of the eyeball.
- It is made up by proteins called crystallins.
- The lens divides the interior of the eyeball into two cavities

- The anterior cavity:
- The anterior cavity—the space anterior to the lens—consists of two chambers.The anterior chamber lies between the cornea and the iris.
- The posterior chamber lies behind the iris and in front of the zonular fibers andlens.



  - Both chambers of the anterior cavity are filled with aqueous humor a transparentwatery fluid that nourishes the lens and cornea.

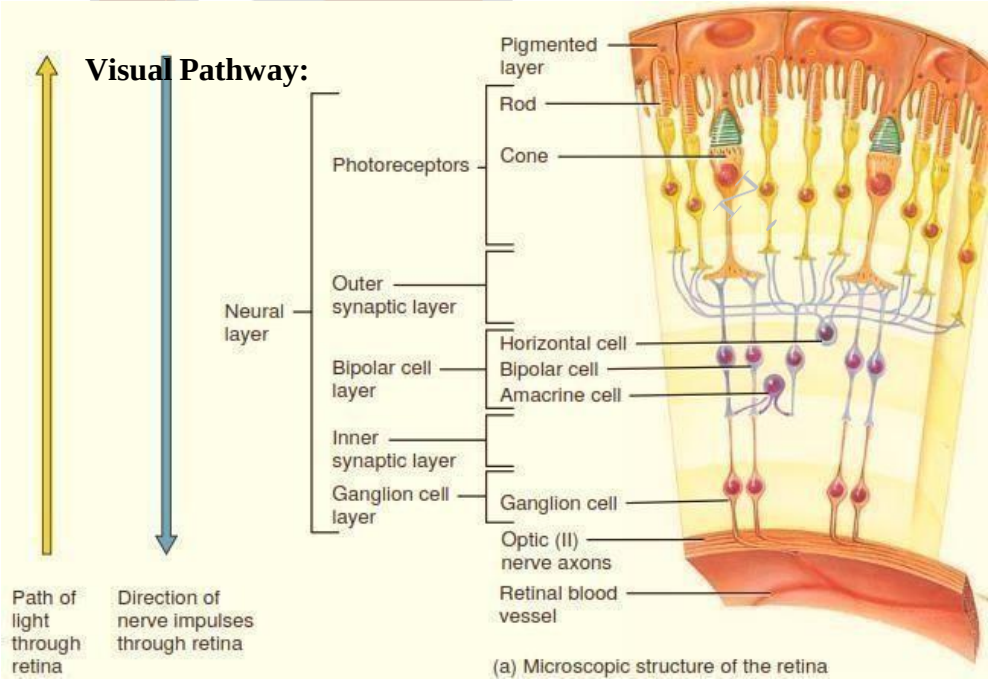
- Vitreous chamber:
  - Vitreous chamber lies between the lens and the retina.
  - It is a transparent jellylike substance that holds the retina flush against thechoroid.



Physiology of vision:

- The first step in visual transduction is absorption of light by a photo pigment, a coloredprotein that undergoes structural changes when it absorbs light, in the outer segment ofa photoreceptor.
- Light absorption initiates the events that lead to the production of a receptor potential.
- The single type of photo pigment in rods is rhodopsin.
- Three different cone photo pigments are present in the retina, one in each of the three types of cones.
- Color vision Photo pigments respond to light in the following cyclical process
- In darkness, retinal has a bent shape, called cis-retinal, which fits tightly into the opsinportion of the photo pigment.
- When cis-retinal absorbs a photon of light, it straightens out to a shape called trans- retinal.

Visual Pathway:



- Neurotransmitter molecules released by rods and cones induce local graded potentialsin both bipolar cells and horizontal cells.
- Between 6 and 600 rods synapse with a single bipolar cell in the outer synaptic layer ofthe retina; a cone more often synapses with a single bipolar cell.
- The convergence of many rods onto a single bipolar cell increases the light sensitivity of rod vision but slightly blurs the image that is perceived.
- Cone vision, although less sensitive, is sharper because of the one- to-one synapsesbetween cones and their bipolar cells.
- Stimulation of rods by light excites bipolar cells; cone bipolar cells may be eitherexcited or inhibited when a light is turned on.
- Horizontal cells transmit inhibitory signals to bipolar cells in the areas lateral to excitedrods and cones.

Disorders of Eye:

Most common disorders of eye include

1. Glaucoma
2. Macular degeneration
3. Diabetic retinopathy
4. Dry eye syndrome
5. Amblyopia
6. Refractive error
7. Strabismus
8. Astigmatism
9. Conjunctivitis
10. Retinal detachment
11. Floater
12. Myopia
13. Retinal disorders
14. Uveitis
15. Farsightedness
16. Corneal diseases

17. Bulging eyes
18. Eye strain
19. Night blindness
20. Optic neuritis

IMPORTANT QUESTIONS:

2M QUESTIONS:

1. Define eye and explain its functions.

5M QUESTIONS:

1. Draw a well labelled diagram of eye with its parts and function.

10M QUESTIONS:

1. Draw a well labelled diagram of eye with its parts and function.

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