EYE

- **Eye are organ of the visual system. They provide organism with vision.**

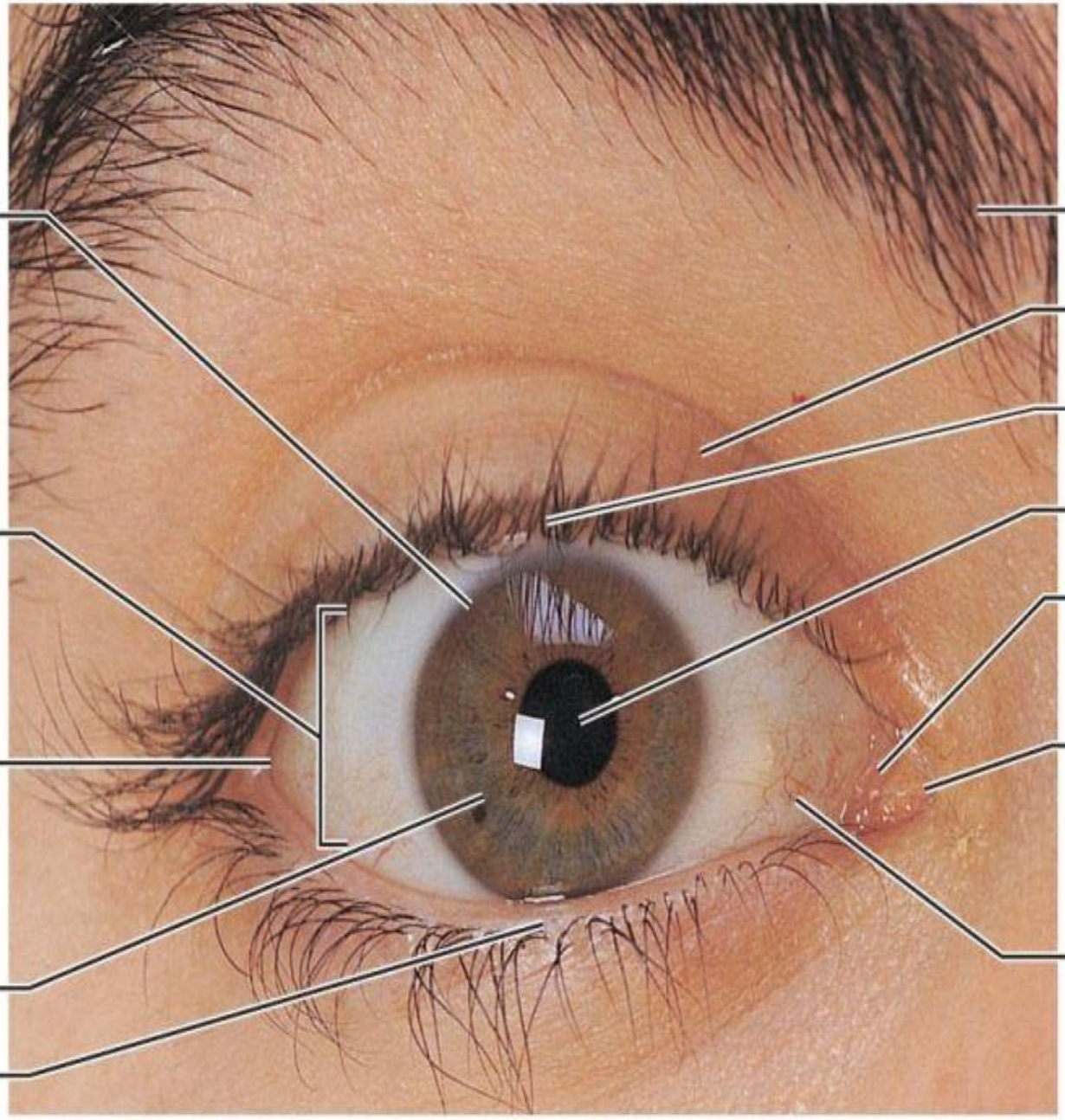
Accessory Structures of the Eye

The accessory structures of the eye include the

- **Eyelids**
- **Eye Lashes**
- **Eyebrows**
- **Lacrimal (Tearing) Apparatus**
- **Extrinsic Eye Muscles**

Main structure

- **Eye ball**



Eyelids

- An eyelid is a thin fold of skin that covers and protects the human eye.
- The levator palpebrae superioris muscle retracts the eyelid to "open" the eye
- Canthus (palpebral commissures) is either corner of the eye where the upper and lower eyelids meet.
- More specifically, the inner and outer canthi are, respectively, the medial and lateral ends/angles of the palpebral fissure

- **The upper and lower eyelids, or palpebrae 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 and contains in its superior region the levator palpebrae superioris muscle**

Eyelashes and Eyebrows

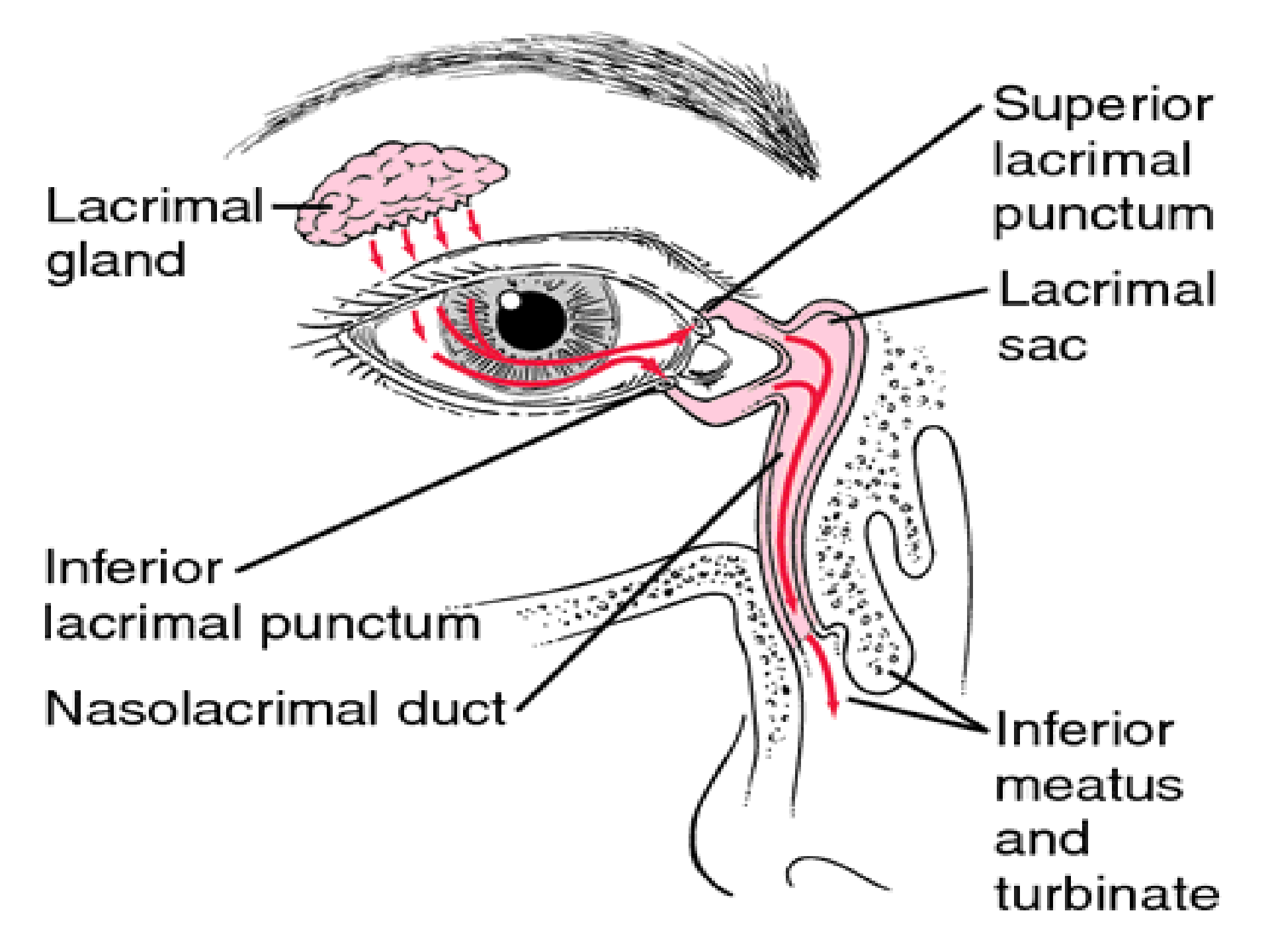
- **The eyelashes, which project from the border of each eyelid, and the eyebrows, which arch transversely above the upper eyelids, help protect the eyeballs from foreign objects, perspiration, and the direct rays of the sun.**

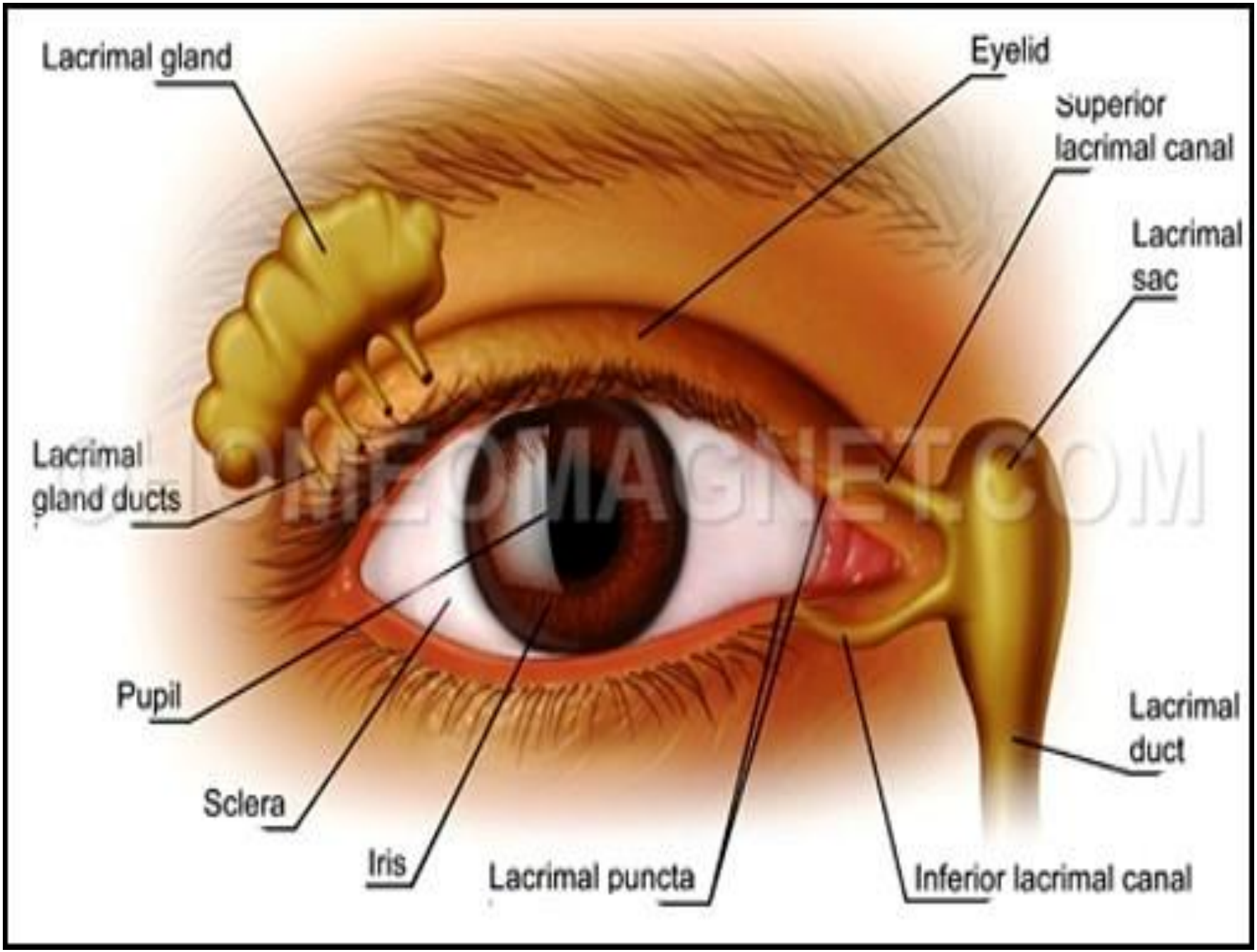
- **Sebaceous glands at the base of the hair follicles of the eyelashes, called sebaceous ciliary glands, release a lubricating fluid into the follicles.**

- **Infection these glands is called a sty**

Lacrimal Apparatus

- **The lacrimal apparatus (lacrim- tears) 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 the conjunctiva 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 and then into the nasolacrimal duct.**


Lacrimal gland
Superior lacrimal punctum
Lacrimal sac
Inferior lacrimal punctum
Nasolacrimal duct
Inferior meatus and turbinate


Lacrimal gland
Eyelid
Superior lacrimal canal
Lacrimal sac
Lacrimal gland ducts
Pupil
Sclera
Iris
Lacrimal puncta
Inferior lacrimal canal
Lacrimal duct

- **This duct carries the lacrimal fluid into the nasal cavity just inferior to the inferior nasal concha. An infection of the lacrimal sacs is called Dacryocystitis**

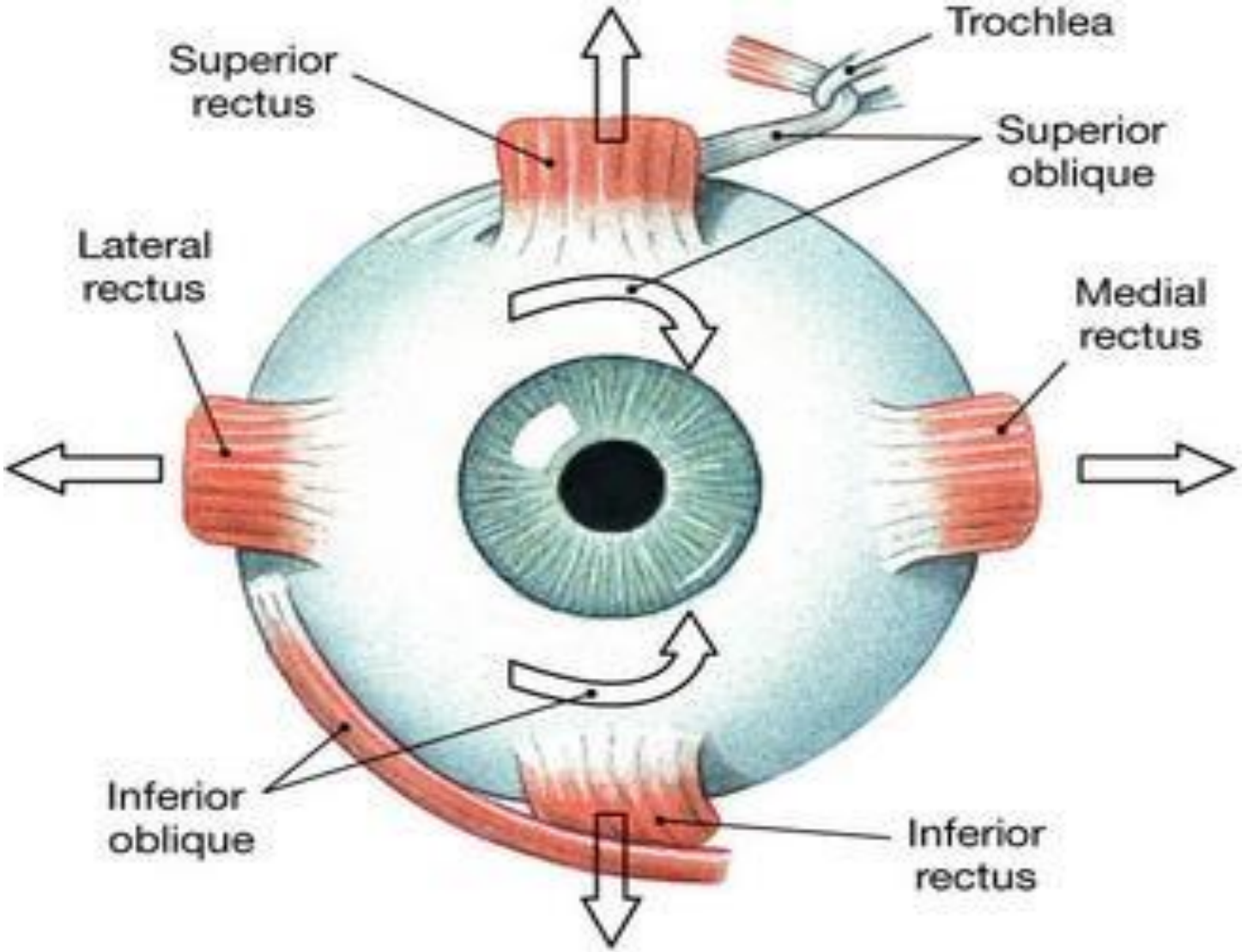
- **It is usually caused by a bacterial infection and results in blockage of the nasolacrimal ducts.**

- **The fluid protects, cleans, lubricates, and moistens the eyeball.**

- **Each gland produces about 1 ml of lacrimal fluid per day**

Extrinsic Eye Muscles

- **The extrinsic eye muscles extend from the walls of the bony orbit to the sclera (white) of the eye**
- **These muscles are capable of moving the eye in almost any direction.**
- **Six extrinsic eye muscles move each eye: the**
- **Superior rectus, inferior rectus, lateral rectus, medial rectus, superior oblique, and inferior oblique**
- **They are supplied by cranial nerves III, IV, or VI.**
- **The extrinsic eye muscles move the eyeball laterally, medially, superiorly, and inferiorly.**



(c) Anterior view, right eye

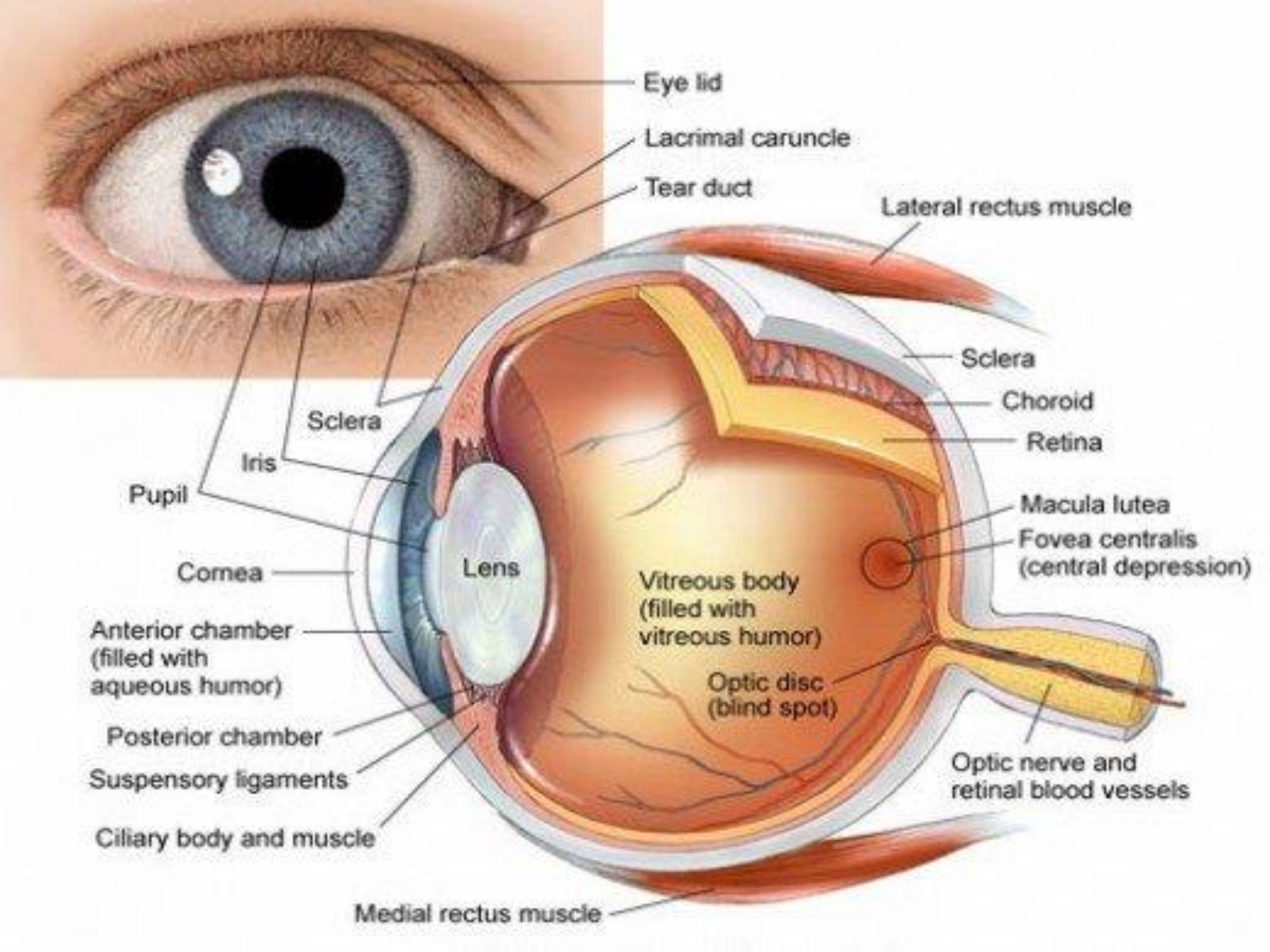
Anatomy of the Eyeball

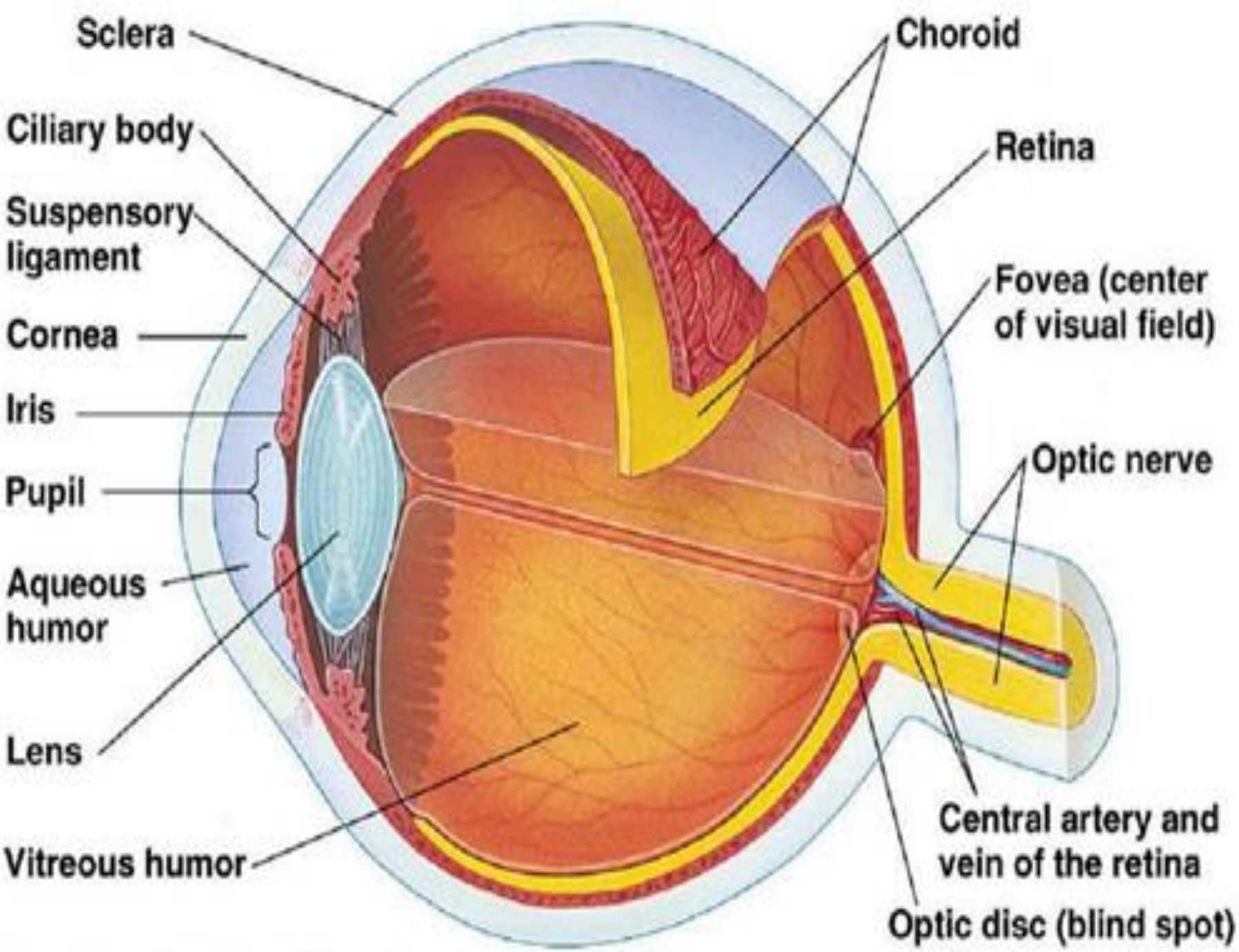
- **The adult eyeball measures about 2.5 cm in diameter. Its total surface area, only the anterior one-sixth is exposed.**
- **Anatomically, the wall of the eyeball consists of three layers:**

(1) Fibrous

(2) Vascular

(3) Retina


Eye lid
Lacrimal caruncle
Tear duct
Lateral rectus muscle
Sclera
Choroid
Retina
Macula lutea
Fovea centralis
(central depression)
Sclera
Iris
Pupil
Cornea
Lens
Vitreous body
(filled with
vitreous humor)
Anterior chamber
(filled with
aqueous humor)
Optic disc
(blind spot)
Posterior chamber
Suspensory ligaments
Ciliary body and muscle
Optic nerve and
retinal blood vessels
Medial rectus muscle


Sclera
Ciliary body
Suspensory ligament
Cornea
Iris
Pupil
Aqueous humor
Lens
Vitreous humor
Choroid
Retina
Fovea (center of visual field)
Optic nerve
Central artery and vein of the retina
Optic disc (blind spot)

Fibrous layer

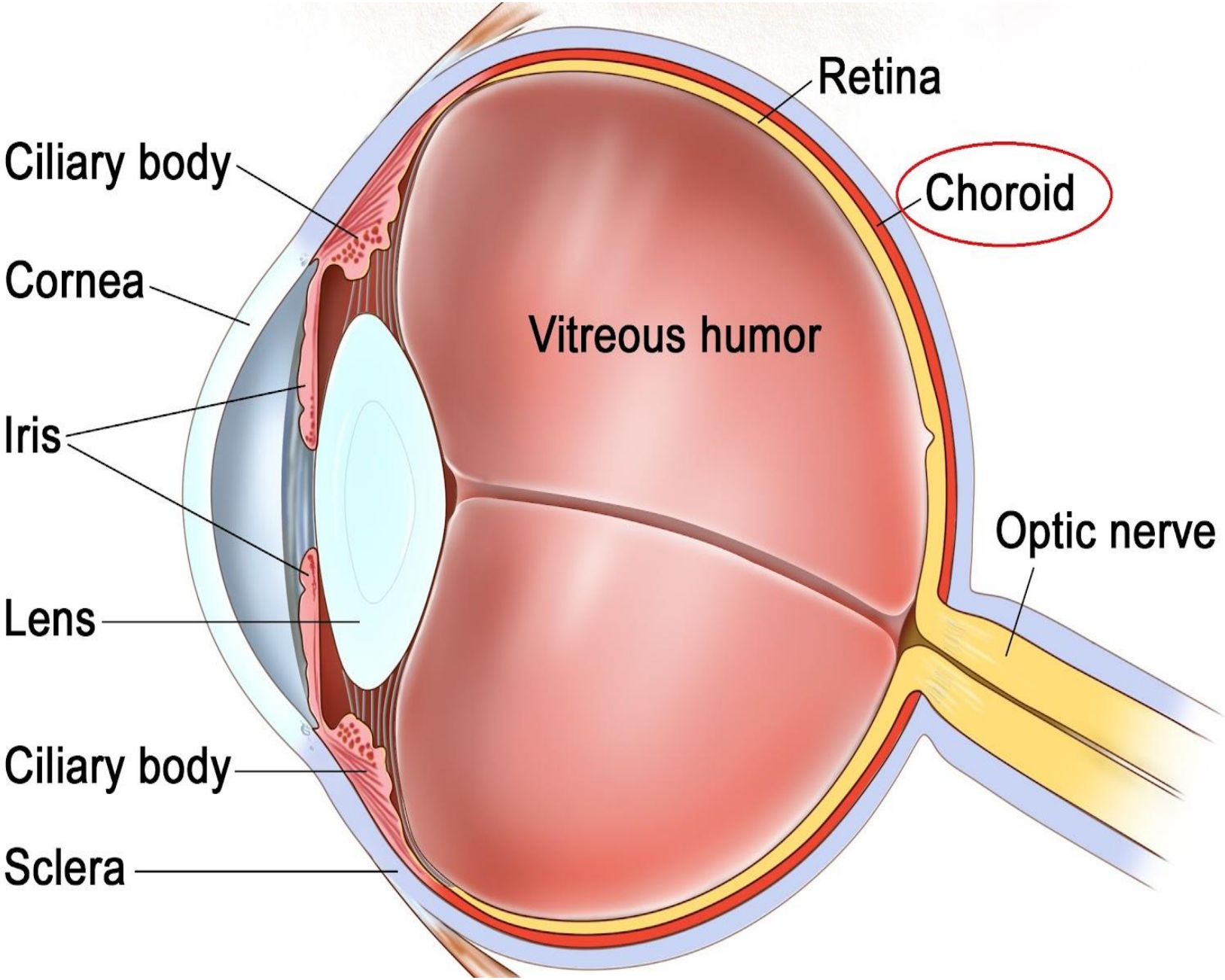
- **The fibrous layer is the superficial layer of the eyeball and consists of the anterior cornea and posterior sclera .**
- **The avascular cornea is the anterior transparent part of outer coat. Convex anteriorly**
- **The cornea consists of five layers, arranged anteroposteriorly**

1. **Corneal Epithelium**
2. **Anterior Limiting Lamina (Bowman's Layer)**
3. **Substantia Propria (Stroma)**
4. **Posterior Limiting Lamina (Descemet's Membrane)**
5. **Endothelium**

- **The sclera the “white” of the eye, is a layer of dense connective tissue made up mostly of collagen fibers and fibroblasts.**
- **The sclera covers the entire eyeball except the cornea; it gives shape to the eyeball, protects its inner parts, and serves as a site of attachment for the extrinsic eye muscles.**
- **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**

Vascular Layer

- **The vascular tunic or uvea is the middle layer of the eyeball. It is composed of three parts: choroid, ciliary body, and iris**
- **The highly vascularized Choroid which is the posterior portion of the vascular tunic, lines most of the internal surface of the sclera. Its numerous blood vessels provide nutrients to the posterior surface of the retina.**
- **The choroid also contains melanocytes that produce the pigment melanin, which causes this layer to appear dark brown in color.**


Retina
Ciliary body
Choroid
Cornea
Vitreous humor
Iris
Optic nerve
Lens
Ciliary body
Sclera

- **In the anterior portion of the vascular layer, the choroid becomes the ciliary body.**

- **The ciliary body consists of ciliary processes and ciliary muscle.**

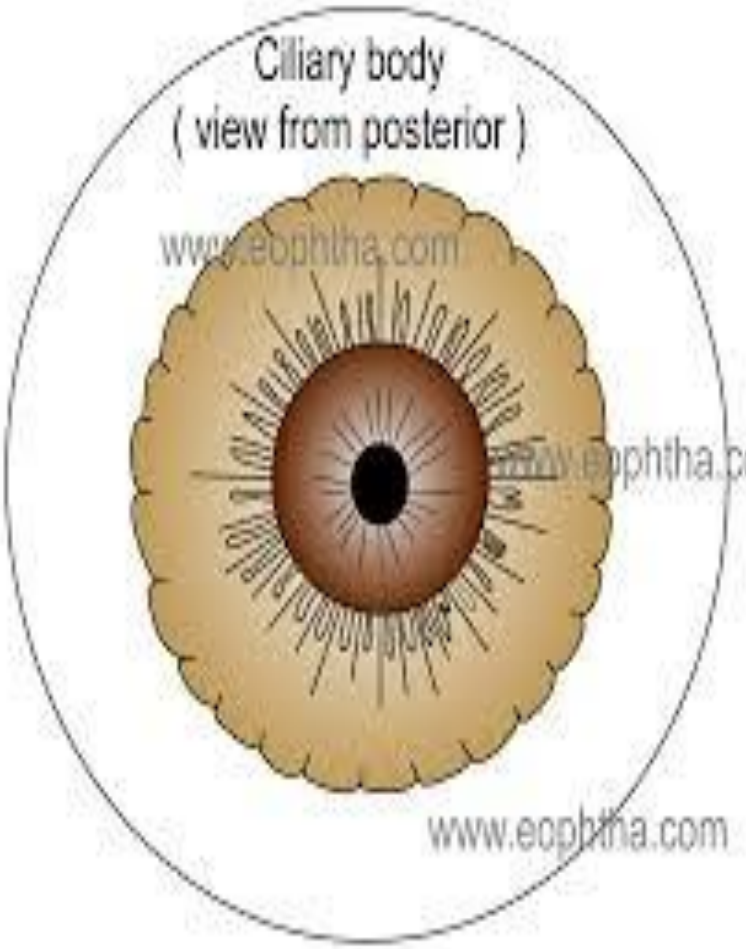
- **The ciliary processes are protrusions or folds on the internal surface of the ciliary body.**

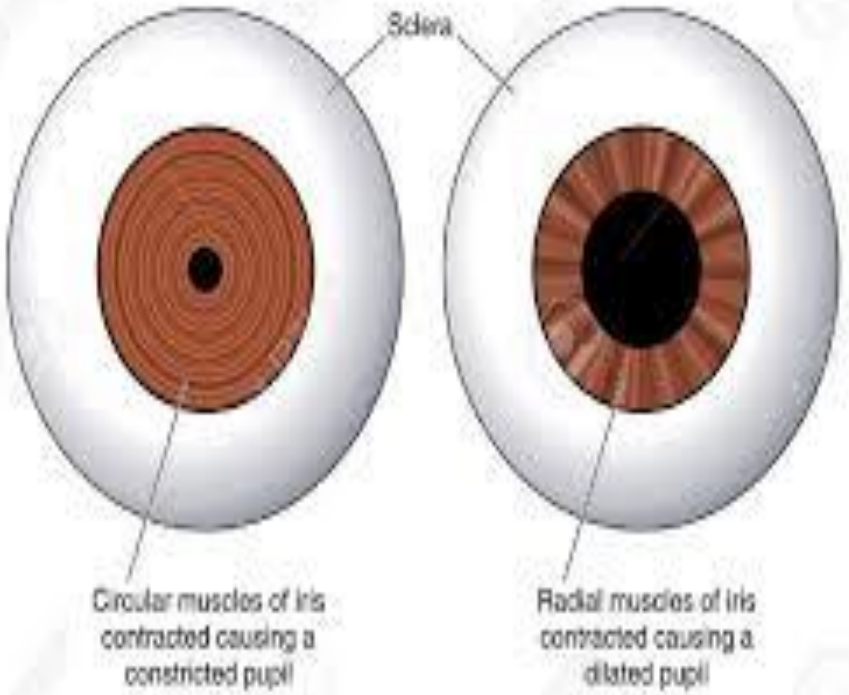
- **They contain blood capillaries that secrete aqueous humor.**
- **Extending from the ciliary process are zonular fibers (suspensory ligaments) that attach to the lens.**
- **The ciliary muscle is a circular band of smooth muscle.**
- **Contraction or relaxation of the ciliary muscle changes the tightness of the zonular fibers, which alters the shape of the lens, adapting it for near or far vision**

- **The iris (rainbow), the colored portion of the eyeball, is shaped like a flattened donut.**

- **It is suspended 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.**


Ciliary body
(view from posterior)
www.eophtha.com
www.eophtha.com
www.eophtha.com


Sclera
Circular muscles of iris contracted causing a constricted pupil
Radial muscles of iris contracted causing a dilated pupil

- **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**

- **Blue when its melanin concentration is very low, and green when its melanin concentration is 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)**

- **The pupil appears black because, as you look through the lens, you see the heavily pigmented back of the eye (choroid and retina).**

- **However, if bright light is directed into the pupil, the reflected light is red because of the blood vessels on the surface of the retina.**

- **Circular muscles (sphincter pupillae) of the iris to contract, causing a decrease in the size of the pupil (constriction).**

- **In dim light, sympathetic neurons stimulate the radial muscles (dilator pupillae) of the iris to contract, causing an increase in the pupil's size**

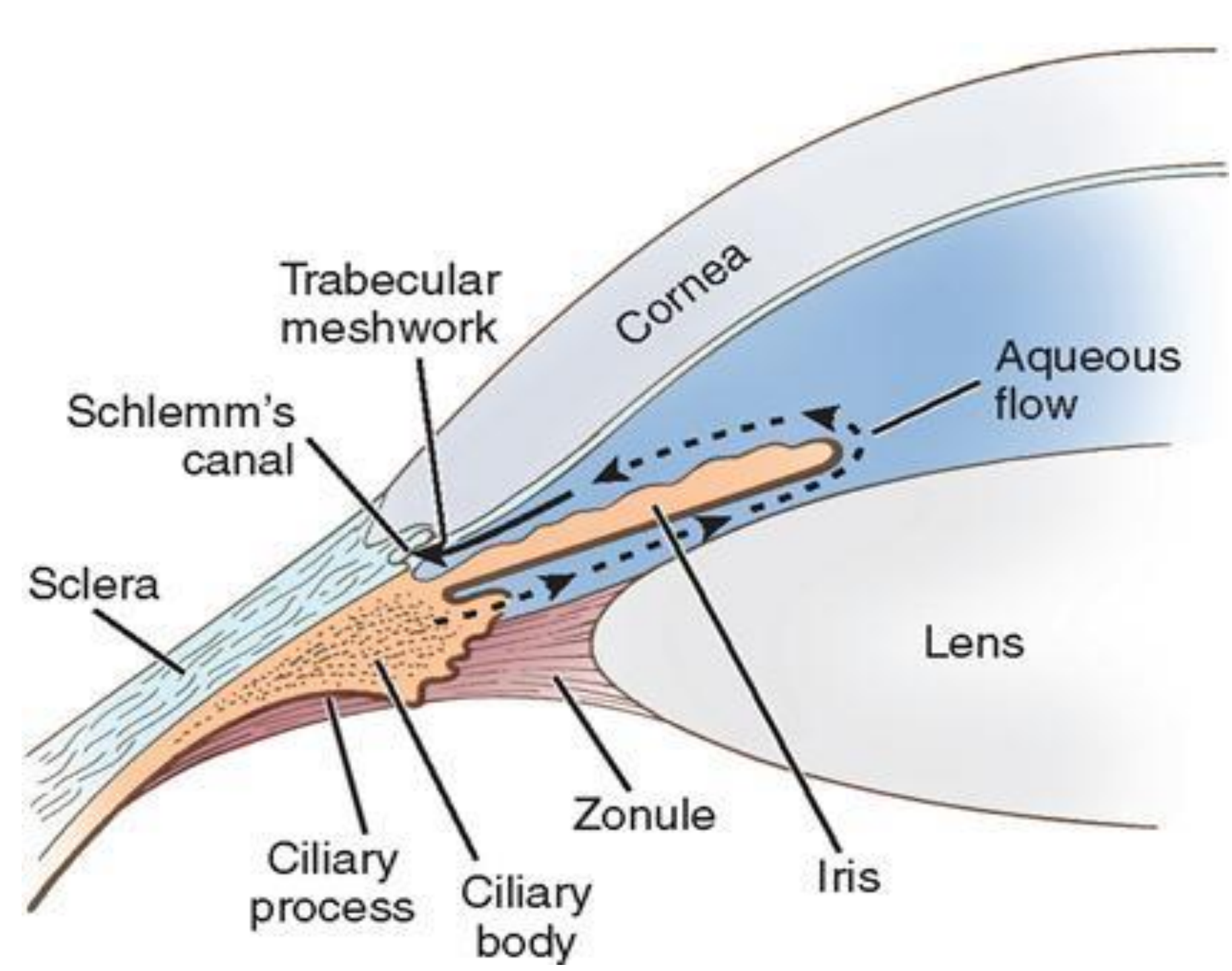
LENS AND HUMOURS

- **The cornea, aqueous humour, lens and vitreous body, often collectively termed the ocular media, serve to form an image on the retina by transmitting and refracting light.**

- **The aqueous provides nutrients to the avascular cornea and lens and removes their metabolic waste, as well as generating the intraocular pressure which maintains the shape of the eye.**

AQUEOUS HUMOUR

- **Aqueous humour is derived from the plasma within the fenestrated capillaries of the ciliary processes.**
- **The major component of aqueous, like plasma, is water and the composition of some electrolytes and organic solutes**
- **The aqueous is actively secreted into the posterior chamber by the epithelium overlying the ciliary processes. It passes around the equator of the lens and flows through the pupil into the anterior chamber**


Trabecular meshwork
Cornea
Aqueous flow
Schlemm's canal
Sclera
Lens
Zonule
Iris
Ciliary process
Ciliary body

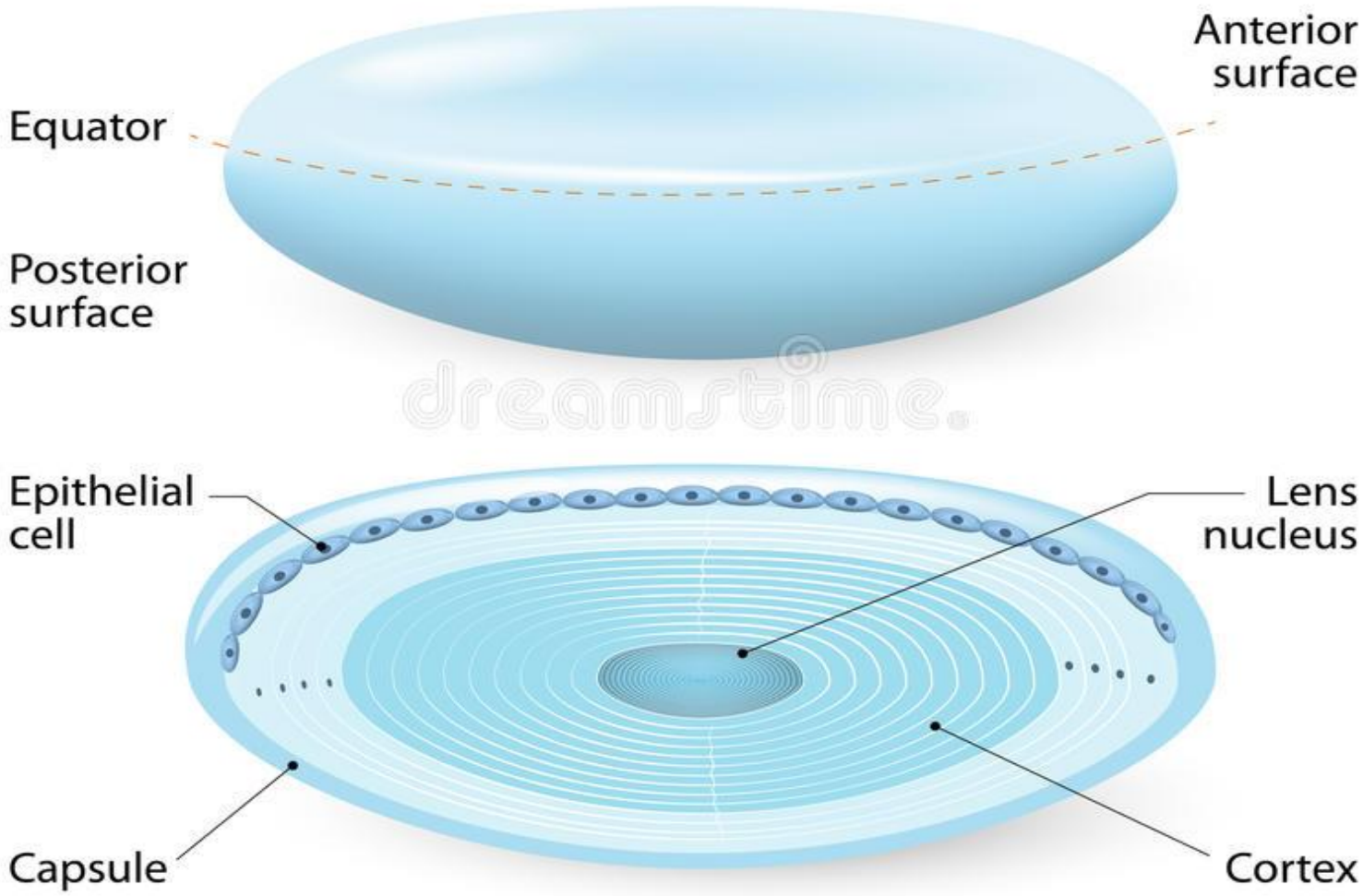
- **Most aqueous is drained from the eye through the trabecular meshwork into the canal of Schlemm from where it drains into episcleral veins.**

NOTE- Any interference with the drainage of aqueous into the canal of Schlemm increases intraocular pressure and leads to glaucoma

LENS

- **The lens is a transparent, encapsulated, biconvex body bathed in aqueous humour, which serves to adjust the focus of the eye.**
- **Posteriorly, it contacts the hyaloid fossa of the vitreous body. Anteriorly, it forms a ring of contact with the posterior border of the iris**
- **The lens is encircled by the ciliary processes, and is attached to them by the zonular fibres**

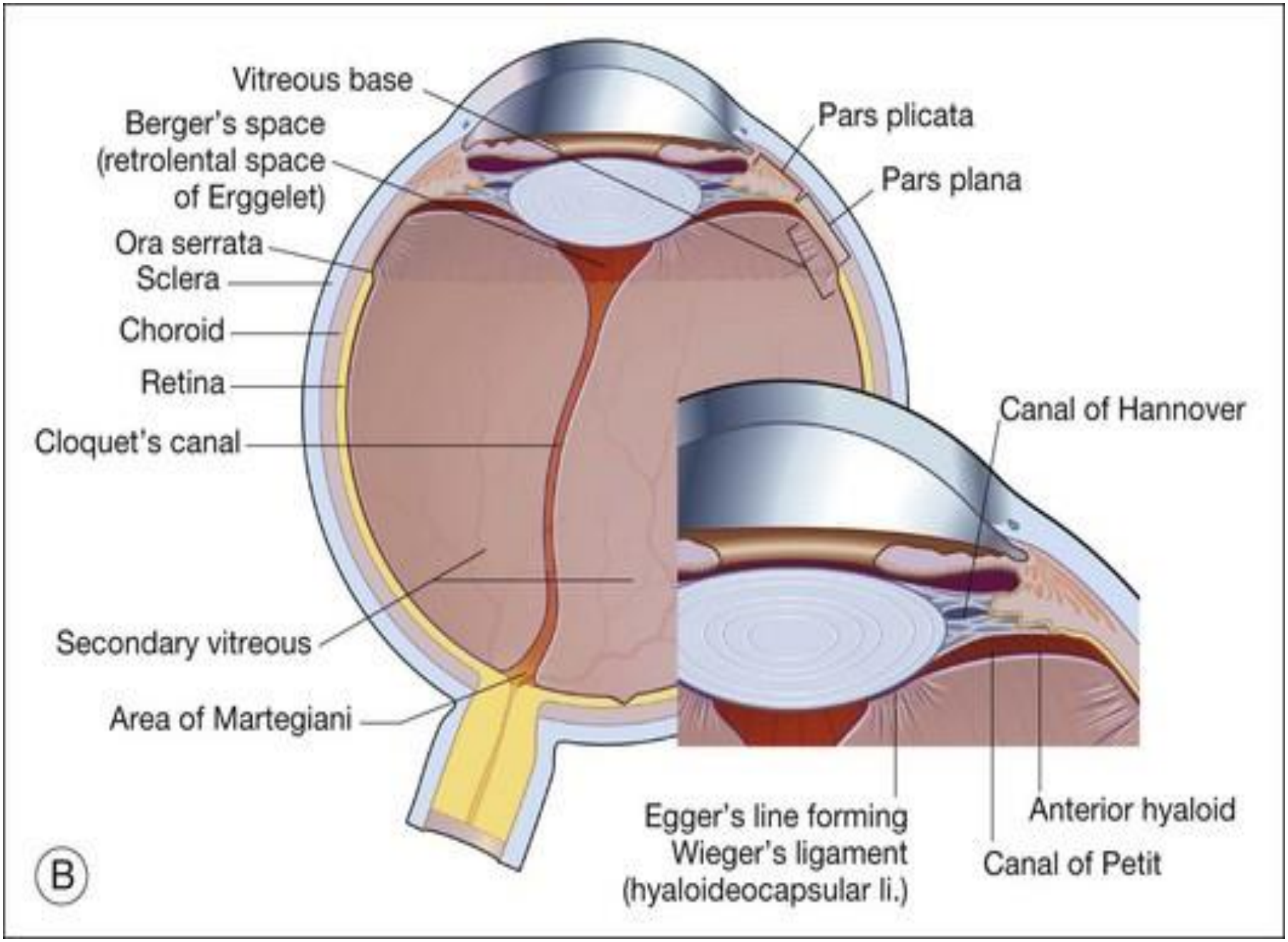
Crystalline lens



- **Lies behind the pupil and iris, within the cavity of the eyeball**
- **Arranged like the layers of an onion, make up the refractive media of the lens which normally is perfectly transparent and lacks blood vessels.**
- **The lens helps focus images on the retina to facilitate clear vision.**
- **The anterior convexity of the lens is less than that of the posterior surface.**

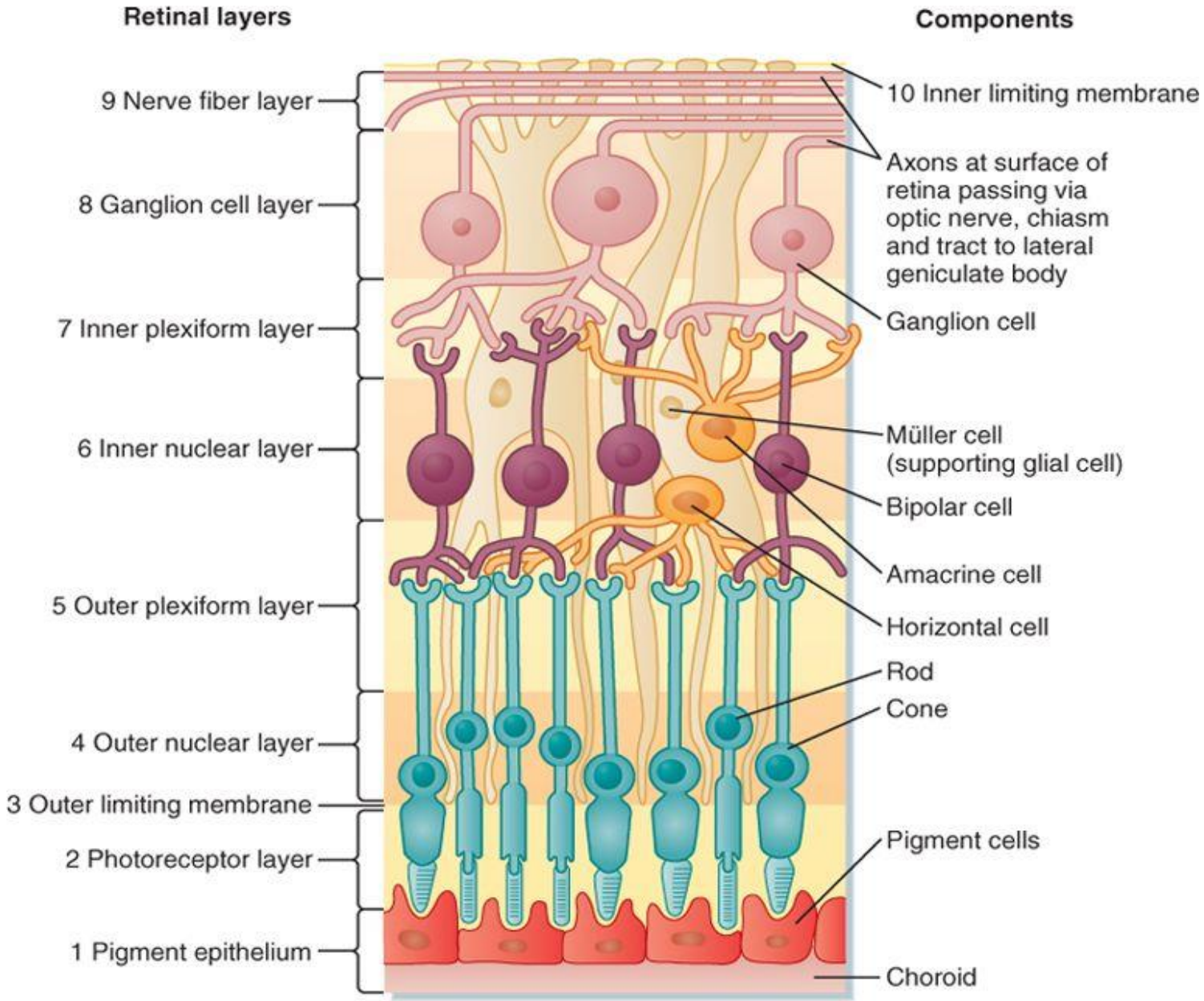
VITREOUS HUMOUR

- **The vitreous body occupies about four-fifths of the eyeball. Posteriorly it is in contact with the retina**
- **Its anterior surface is hollowed into a deep concavity, the hyaloid fossa, fitting the shape of lens**
- **It is colourless, consisting of approximately 99% water**
- **It has a gel-like consistency**
- **A narrow hyaloid canal runs from the optic nerve lead to the central posterior surface of the lens**


Vitreous base
Berger's space
(retrolental space
of Erggelet)
Ora serrata
Sclera
Choroid
Retina
Cloquet's canal
Secondary vitreous
Area of Martegiani
Pars plicata
Pars plana
Canal of Hannover
Egger's line forming
Wieger's ligament
(hyaloideocapsular li.)
Anterior hyaloid
Canal of Petit
B

RETINA

- **The retina is a thin sheet of cells**
- **It lines the inner posterior surface of the eyeball, sandwiched between the choroid externally and the vitreous body internally, and terminates anteriorly at the ora serrata**
- **The retina is composed of a variety of epithelial, neural and glial cell types whose distribution conventionally divides it into 10 layers.**



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

OPTIC DISC

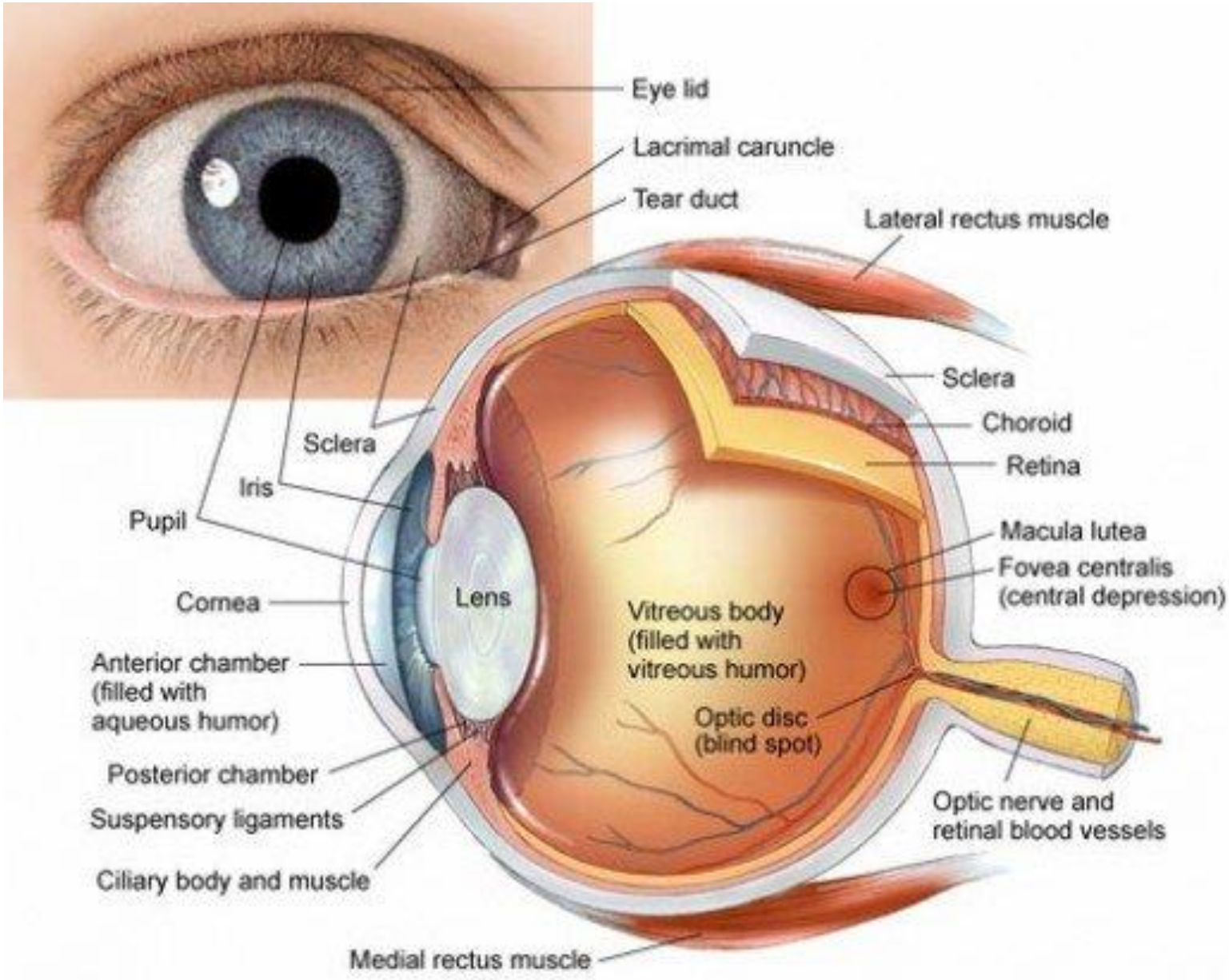
- **The optic disc is also called the blind spot. Because it contains no rods or cones**

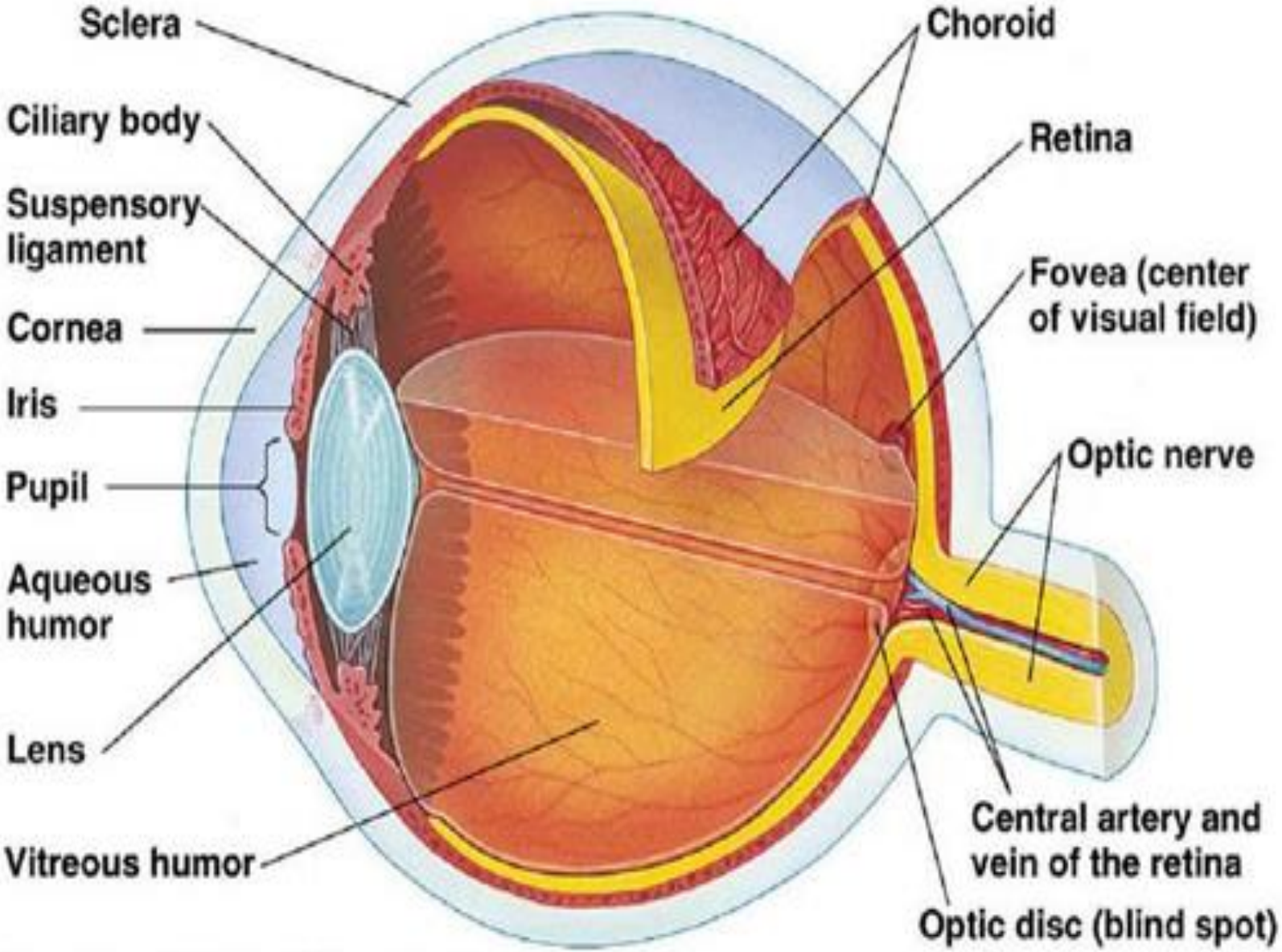
- **The optic disc is the site where the optic (II) nerve exits the eyeball. Bundled together with the optic nerve are the central retinal artery, a branch of the ophthalmic artery, and the central retinal vein.**

MACULA LUTEA AND FOVEA CENTRALIS

- **The macula lutea (macula a small, flat spot; lute- yellowish) is in the exact center of the posterior portion of the retina, at the visual axis of the eye .**

- **The fovea centralis , a small depression in the center of the macula lutea, contains only cones., the fovea centralis is the area of highest visual acuity (sharpness of vision).**

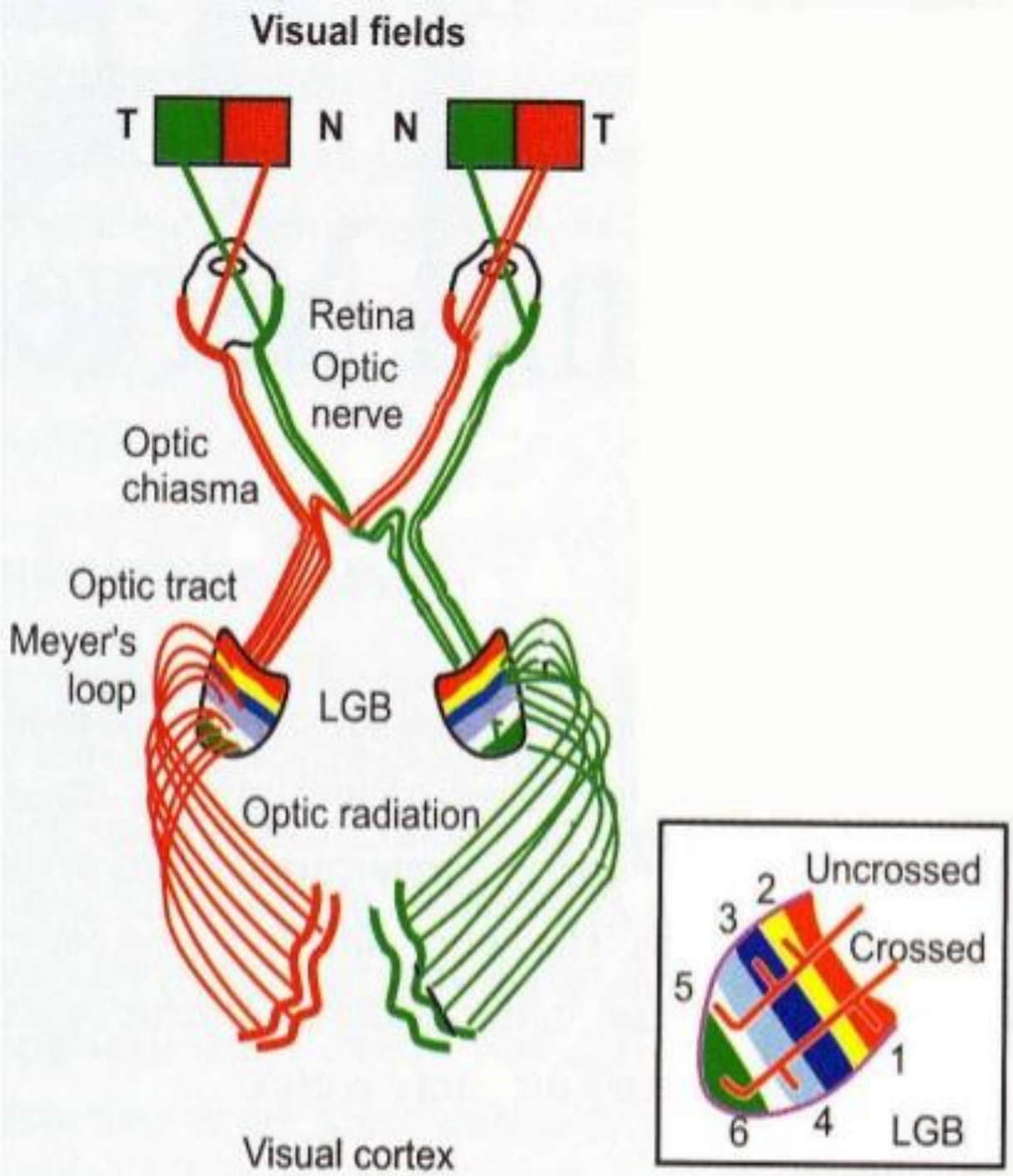

Eye lid
Lacrimal caruncle
Tear duct
Lateral rectus muscle
Sclera
Choroid
Retina
Macula lutea
Fovea centralis
(central depression)
Sclera
Iris
Pupil
Cornea
Lens
Vitreous body
(filled with
vitreous humor)
Anterior chamber
(filled with
aqueous humor)
Optic disc
(blind spot)
Posterior chamber
Suspensory ligaments
Ciliary body and muscle
Optic nerve and
retinal blood vessels
Medial rectus muscle


Sclera
Ciliary body
Suspensory ligament
Cornea
Iris
Pupil
Aqueous humor
Lens
Vitreous humor
Choroid
Retina
Fovea (center of visual field)
Optic nerve
Central artery and vein of the retina
Optic disc (blind spot)

VISUAL PATHWAY

- **The visual pathway includes the interneurones of the retina, retinal ganglion cells whose axons project via the optic nerve, chiasma, and optic tract to the lateral geniculate nucleus**

- **Neurones within the LGN which project via the optic radiation to the primary visual cortex**


Visual fields
T
N
N
T
Retina
Optic nerve
Optic chiasma
Optic tract
Meyer's loop
LGB
Optic radiation
Visual cortex
Uncrossed
Crossed
1
2
3
4
5
6
LGB

BLOOD SUPPLY

- OPTHALMIC ARTERY

VEINS DRAINAGE

- OPTHALMIC VEIN, CENTRAL RETINAL VEIN ,CHOROIDAL VEINS

NERVE SUPPLY

- 3, 4, 6, CRANIAL NERVE

Clinical condition

Myopia or nearsightedness

- **Myopic individuals can see close objects clearly, but not distant objects**

Hyperopia or farsightedness

- **Also known as hypermetropia , the eyeball length is short relative to Hyperopic individuals can see distant objects clearly, but not close ones**

ASTIGMATISM

- Refraction abnormality is astigmatism in which either the cornea or the lens has an irregular curvature.

PREBYOPIS

- This is a condition caused by decreased elasticity of the lens in person over 40 years old
- Focussing power of the lens is lost

CATARACT

- Opacity in the lens of the eyeball is called cataract