

Eyeball

Introduction

The eyeball is the **organ of sight**, structurally similar to a camera. It is **almost spherical**, measuring about **2.5 cm** in diameter. It has **three concentric coats**:

- **Outer (fibrous) coat:** Sclera + Cornea
- **Middle (vascular/uveal) coat:** Choroid, Ciliary body, Iris
- **Inner (nervous) coat:** Retina

Light enters through refracting media: **cornea ? aqueous humour ? lens ? vitreous.**

Outer Coat

The **outer coat** includes **sclera** (posterior 5/6) and **cornea** (anterior 1/6).

Sclera

- Opaque, tough, dense fibrous coat forming **posterior five-sixths** of eyeball.
- Thickest near optic nerve entry; thinnest **6 mm behind limbus** where recti insert; **weakest at optic nerve entrance.**
- Region at optic nerve perforations = **Lamina cribrosa.**

Surfaces

- **Outer surface:** smooth, white, covered by **Tenon's capsule**; anterior part visible as "white of eye".
- **Inner surface:** brown, grooved for ciliary vessels/nerves; separated from choroid by **perichoroidal space** with **lamina fusca**.

Continuity & Features

- Meets cornea at the **sclerocorneal junction/limbus**.
- Deep part contains **canal of Schlemm**, draining aqueous humour.

Pierced by (important exam point)

- Optic nerve (slightly inferomedial).
- Ciliary nerves & arteries.
- Anterior ciliary arteries.
- **4 vortex veins (vorticoses veins)**.

Vascularity

- Sclera is **almost avascular**.
- **Episclera** (loose connective tissue between conjunctiva and sclera) is **vascular**.

Muscle attachment

- Recti ? anterior to equator
- Obliques ? posterior to equator

Dissection (Sclera)

- Use a fresh **goat eyeball**.
- Remove fascial sheath, clean posterior ciliary nerves/vessels, identify vortex veins.
- Incise sclera at equator and strip it off from choroid.

Cornea

Features

- Transparent, forms **anterior one-sixth**.
- Junction with sclera = **limbus**.
- More **convex** than sclera.
- Separated from iris by **anterior chamber**.

Nutrition

- **Avascular**.
- Nourished by:
 - Lymph in corneal spaces
 - Lacrimal fluid

Nerve supply

- Branches of **ophthalmic nerve**
- **Short ciliary nerves** via ciliary ganglion
- **Pain is the only sensation** from cornea

Dissection (Cornea)

- Incise around limbus to remove cornea.
- Expose iris, ciliary body, choroid.
- Strip iris, remove lens (floats in water).
- Vitreous escapes on removing lens.

Clinical Anatomy (Cornea)

- Cornea can be **grafted** (avascular ? immune privilege).
- Injury causes **opacities ? visual disturbance**.
- Highly sensitive; even dust causes **pain**.
- Conjunctival inflammation ? **conjunctivitis**; palpebral conjunctiva used to assess **HB level**.
- Shape, curvature & AP diameter determine **refractive errors** (myopia, hypermetropia).

Middle Coat (Uveal Tract)

The middle coat consists of:

- **Choroid**
- **Ciliary body**
- **Iris**

Choroid

The choroid is a **thin, pigmented, vascular layer** lying between sclera and retina.

Key Features

- Separates posterior sclera from retina.
- **Anterior end:** merges with ciliary body at **ora serrata**.
- **Posterior end:** pierced by optic nerve and attached firmly to it.
- **Outer surface:** separated from sclera by **suprachoroidal lamina**, containing ciliary nerves and vessels.
- **Attachments:** loose to sclera; firm to retina.

Layers of Choroid

- Suprachoroid lamina
- Vascular lamina
- Choriocapillary lamina

- Bruch's membrane (basal lamina)

Ciliary Body

The ciliary body is a **thickened part of the uveal tract** posterior to the corneal limbus.

Key Features

- Continuous with **iris anteriorly** and **choroid posteriorly**.
- Suspends the lens and helps in **accommodation**.

Structure

- **Triangular in cross section**.
- **Pars plana**: smooth posterior part.
- **Pars plicata**: anterior part with ~70 ciliary processes.

Iris

The iris is the **coloured diaphragm** of the eye forming the pupil.

Key Features

- Anteriorly covered by **mesothelium**, posteriorly by **deeply pigmented double-layered epithelium**.
- Iris stroma contains connective tissue, blood vessels, pigment cells.
- **Major arterial circle** at periphery; **minor arterial circle** near pupil.

- Eye colour depends on pigment density; fewer pigment cells ? blue iris.

Muscles

- **Sphincter pupillae** – parasympathetic supply
- **Dilator pupillae** – sympathetic supply

Clinical Anatomy (Middle Coat)

Accommodation Reflex

- Looking far ? ciliary muscle relaxed, suspensory ligament tense, lens flat.
- Near vision ? ciliary muscle contracts, ligament relaxed, lens becomes round.

Squint (Strabismus)

- Normal vision is binocular and 3D.
- Convergent squint: one eye turns inward.

Inner Coat / Retina

Basic Features

- Thin delicate inner layer, continuous with optic nerve.
- Outer retinal surface (pigment layer) attached to choroid.
- Inner surface contacts **hyaloid membrane** of vitreous.

- **Optic disc:** inferomedial to posterior pole, 1.5 mm diameter.

Parts

- **Optic part:** light-sensitive; extends from optic disc to ora serrata.
- **Ciliary and iridial parts:** thin, non-nervous layers anterior to ora serrata.

Specialized Areas

- **Physiological cup:** central depression of optic disc; no rods or cones ? blind spot.
- **Macula lutea:** lateral to optic disc, yellow, avascular.
- **Fovea centralis:** centre of macula; cones only; highest visual acuity; thinnest part of retina.

Clinical Anatomy (Retina)

(Directly covered under Clinical Anatomy section of middle coat; retina-specific clinical notes appear later in chapter.)

? Key points from retrieved content

- Accommodation defects ? myopia, hypermetropia
- Squint arises due to misalignment of visual axes

Aqueous Humour

The aqueous humour is a **clear fluid** filling the space **between cornea (in front) and lens (behind)** in the **anterior segment** of the eye.

The iris divides this segment into **anterior** and **posterior chambers**, which communicate **freely via the pupil**.

Formation & Drainage

- Secreted into the **posterior chamber** by **capillaries of ciliary processes**.
- Flows through pupil ? **anterior chamber**.
- Drains via:
 - **Iridocorneal angle** (spaces in ligamentum pectinatum)
 - **Canal of Schlemm**
 - ? Anterior ciliary veins

Functions

- Maintains **intraocular pressure** and thereby the **optical dimensions** of the eyeball.
- Rich in **ascorbic acid, glucose, amino acids** ? nourishes **avascular cornea and lens**.

Clinical Anatomy – Aqueous Humour

- Obstruction of outflow (or excess production) ? **raised intraocular pressure = glaucoma**.
- Glaucoma leads to:
 - **Cupping of optic disc**
 - **Pressure atrophy of retina**

- **Blindness**

- Glaucoma must be treated **urgently**.

Lens

Features

- Transparent, **biconvex** structure between anterior and posterior segments.
- Diameter ? **1 cm**.
- **Poles**: central points of anterior and posterior surfaces.
- **Axis**: line joining the poles.
- **Equator**: marginal circumference.
- Contributes **15 dioptres** to the total ~58 D of the eye.

Curvature

- **Posterior surface** is more convex than anterior.
- Anterior surface kept **flattened** by tension of suspensory ligament.
- When ligament relaxes (ciliary muscle contracts), lens becomes **more convex**.

Capsule & Epithelium

- Enclosed in thick elastic capsule (thickest anteriorly).

- Anterior surface has **cubical epithelium** centrally; at periphery, cells elongate ? **lens fibres**.

Lens Substance

- **Nucleus**: central, oldest, firm fibres.
- **Cortex**: peripheral, softer, newer fibres.

Suspensory Ligament (Zonule of Zinn)

- Attaches to:
 - Ciliary processes
 - Furrows between processes
 - Ora serrata
- Fibres attach to lens mostly **in front of equator**, some behind.

Dissection – Lens

- Make an incision on **anterior surface**.
- Apply gentle pressure to **express the lens from its capsule**.

Clinical Anatomy – Lens

- Lens becomes **opaque with age ? cataract**, requiring replacement.

- **Central retinal artery** is an end artery; blockage ? **sudden blindness**.
- **Third nerve paralysis** ? partial ptosis, dilated pupil, eye deviated down and out.
- **Horner's syndrome** ? partial ptosis + miosis.
- **Brainstem death** ? pupils fixed and dilated.
- Ophthalmoscopy allows observation of:
 - Diabetic/hypertensive retinal changes
 - Papilloedema (raised intracranial pressure)

Vitreous Body

The vitreous body is the **transparent, gel-like substance** that fills the posterior four-fifths of the eyeball.

It lies behind the lens and ciliary processes, which **indent the vitreous anteriorly**.

Key Features (from the document's visible sections)

- Occupies the **vitreous chamber**.
- Maintains the **shape of the eyeball**.
- Supports the retina by pressing it against the choroid.
- Composed of:
 - Water
 - Hyaluronic acid

- Collagen fibrils
- Enclosed by a thin membrane called the **hyaloid membrane** (not directly in this snippet but referenced in adjacent retina content).

Development of Eye Structures

The development information appears as a consolidated section under “DEVELOPMENT,” which applies to **lens, retina, vitreous region, sclera, choroid, cornea**, and related structures.

Development Summary

- **Optic vesicle** ? forms **optic cup**, an outpouching from forebrain.
- **Lens** ? develops from the **lens placode (ectodermal)**.
- **Retina:**
 - Pigmented layer ? from **outer layer** of optic cup
 - Nervous layers ? from **inner layer** of optic cup
- **Choroid & sclera** ? from **mesoderm**
- **Cornea:**
 - Epithelium ? **surface ectoderm**
 - Remaining layers ? **mesoderm**

(The vitreous body itself forms largely from secondary mesenchyme surrounding the optic cup; although this specific line is not fully visible in the retrieved page, the adjoining description confirms the region.)

Molecular Regulation

The molecular signals controlling eye development are clearly described:

Key Molecular Regulators

- **WNT, BMP, TGF- β , FGF** ? regulate **optic vesicle** formation
- **PAX6** ? essential for **lens vesicle differentiation**
- **Sonic hedgehog (SHH)** has two critical roles:
 - **Inhibition of SHH** + expansion of **PAX2** ? **failure of eye separation** ? **cyclopia**
 - **Overexpression of SHH** ? **loss of eye structures**
- **Vitamin A deficiency** in pregnancy ? **anterior segment defects** (cornea, eyelids)

Clinical Problems — Solutions & Reasoning (Full Eyeball Chapter)

1. Retinal Detachment

Clinical Problem

A patient reports sudden flashes of light, floaters, and a curtain-like shadow descending over the visual field.

Reasoning

- The retina has **two layers** with different embryological origins.

- The **outer pigmented layer** adheres firmly to the choroid.
- The **inner nine nervous layers** are loosely attached and can separate.
- When the inner layers pull away, photoreceptors lose blood supply from choroid and central retinal artery branches.
- This produces visual field defects.

Solution

Immediate ophthalmologic evaluation with **urgent retinal reattachment**, such as pneumatic retinopexy, scleral buckle, or vitrectomy, to prevent permanent loss of photoreceptor function.

2. Cataract (Lens Opacity)

Clinical Problem

An elderly patient has painless progressive blurring of vision and difficulty seeing at night.

Reasoning

- The lens grows throughout life.
- Aging causes **lens fibres to lose transparency**, especially in the nucleus.
- The lens becomes denser and scatters light, producing glare and blurred vision.

Solution

Surgical removal of the opaque lens and implantation of an **intraocular lens**, restoring transparency and focusing capacity.

3. Acute Angle-Closure Glaucoma

Clinical Problem

A patient presents with severe eye pain, headache, halos around lights, red eye, and a mid-dilated pupil.

Reasoning

- Aqueous humour is produced in the posterior chamber and drains through the **iridocorneal angle** into the canal of Schlemm.
- Blockage at this angle rapidly increases intraocular pressure.
- Rising pressure compresses the optic nerve and retinal blood flow.

Solution

Immediate reduction of intraocular pressure using medications (acetazolamide, β -blockers) followed by definitive procedures like **laser peripheral iridotomy**.

4. Central Retinal Artery Occlusion

Clinical Problem

A patient develops sudden, painless, complete vision loss in one eye.

Reasoning

- The **central retinal artery** is an **end artery** supplying the inner retinal layers.
- Occlusion stops blood flow $\rightarrow$ ischemia $\rightarrow$ sudden blindness.

- The outer retina may still receive minimal diffusion from choroidal vessels, but this is insufficient.

Solution

Urgent ocular massage, lowering intraocular pressure, and rapid management of embolic risk—but prognosis is usually poor due to irreversible ischemia within minutes.

5. Third Nerve Palsy

Clinical Problem

A patient has ptosis, a dilated pupil, and an eye deviated “down and out.”

Reasoning

- Third nerve supplies:
 - **Levator palpebrae (ptosis)**
 - **Sphincter pupillae (pupil dilatation)**
 - **Most extraocular muscles** except lateral rectus and superior oblique.
- Paralysis leaves the unopposed lateral rectus and superior oblique, pulling the eye downwards and laterally.

Solution

Identify the cause—aneurysm, diabetes, trauma—and provide targeted treatment; pupil involvement suggests compression (often life-threatening).

6. Horner Syndrome

Clinical Problem

A patient has ptosis, miosis, and facial anhidrosis.

Reasoning

- Caused by interruption of sympathetic fibres.
- The **dilator pupillae** loses input ? constricted pupil.
- **Superior tarsal muscle** loses tone ? mild ptosis.
- Sweat glands lose sympathetic supply ? anhidrosis.

Solution

Treat underlying cause such as tumour, carotid dissection, or spinal lesion.

7. Myopia and Hypermetropia

Clinical Problem

A young adult has difficulty seeing distant objects (or near objects).

Reasoning

- **Myopia:** Eyeball too long / lens too strong ? image focuses **in front of retina**.
- **Hypermetropia:** Eyeball too short / lens too weak ? image focuses **behind retina**.

Solution

- Myopia: **Concave lenses**
 - Hypermetropia: **Convex lenses**
 - Refractive surgery when indicated.
-

8. Loss of Accommodation (Presbyopia)

Clinical Problem

A middle-aged patient cannot focus on near objects.

Reasoning

- Ciliary muscle contraction normally relaxes zonular fibres ? lens becomes convex.
- With age, lens loses elasticity ? cannot increase curvature.

Solution

Reading glasses with **convex lenses** to augment near focus.

9. Corneal Ulcer Causing Severe Photophobia

Clinical Problem

A patient with a corneal ulcer experiences intense photophobia and reflex tearing.

Reasoning

- Cornea is **highly innervated** (ophthalmic division of trigeminal nerve).

- Damage ? severe pain + reflex blepharospasm.
- Iris shares common pathways and becomes inflamed, adding photophobia.

Solution

Topical antimicrobials, cycloplegics, and urgent ophthalmology follow-up.

10. Optic Disc Swelling (Papilledema)

Clinical Problem

A patient with chronic headache shows bilateral swollen optic discs on fundus exam.

Reasoning

- Raised intracranial pressure is transmitted along the optic nerve sheath.
- This compresses the optic nerve head and retinal venous return ? disc edema.
- Vision may initially remain normal before late deterioration.

Solution

Treat underlying raised intracranial pressure (tumour, hydrocephalus, infection).

? Frequently Asked Questions (FAQs) — Eyeball

1. What are the three coats of the eyeball?

- **Outer coat:** Sclera + Cornea

- **Middle coat (Uveal tract):** Choroid + Ciliary body + Iris
 - **Inner coat:** Retina
-

2. Why is the cornea transparent?

Because it is **avascular**, has **regularly arranged collagen fibres**, and maintains **constant hydration**.

3. Why can the cornea be transplanted easily?

It is **avascular**, so the risk of immune rejection is extremely low.

4. What is the sclera made of and why does it appear white?

Dense, irregular collagen fibres that scatter light ? **white opacity**.

5. What is the lamina cribrosa?

The perforated region of sclera through which the **optic nerve fibres** exit.

6. What is the function of the choroid?

Provides **nutrients** to the outer retina, especially rods and cones via choriocapillaris.

7. What are the parts of the ciliary body?

- **Pars plana** (smooth)
 - **Pars plicata** with ciliary processes
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8. What is the role of the ciliary muscle?

Controls accommodation by changing **lens curvature**.

9. Which muscle constricts the pupil?

Sphincter pupillae (parasympathetic supply).

10. Which muscle dilates the pupil?

Dilator pupillae (sympathetic supply).

11. What determines eye colour?

The **amount of pigment** in iris stroma.

Less pigment ? blue; more ? brown/black.

12. What is the optic disc?

The area where optic nerve fibres exit; contains **no photoreceptors** ? called the **blind spot**.

13. What is the macula lutea?

A yellow, cone-rich region responsible for **sharp vision**.

14. What is the fovea centralis?

Center of macula; **only cones**, thinnest retina, highest visual acuity.

15. What fluid fills the anterior chamber?

Aqueous humour.

16. Where is aqueous humour produced?

Capillaries of **ciliary processes**.

17. How does aqueous humour drain?

Iridocorneal angle ? **canal of Schlemm** ? anterior ciliary veins.

18. What causes glaucoma?

Blocked outflow of aqueous humour ? **raised intraocular pressure** ? optic nerve damage.

19. What are the functions of aqueous humour?

- Maintains intraocular pressure
 - Nourishes cornea and lens
 - Removes metabolites
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20. What is the structure of the lens?

- Biconvex
 - Surrounded by capsule
 - Has nucleus and cortex
 - Suspended by **zonular fibres**
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21. Why does the lens become more convex during near vision?

Ciliary muscle **contracts** ? zonular fibres **relax** ? lens bulges.

22. What is cataract?

Opacity of the lens, commonly due to aging.

23. What fills the vitreous chamber?

Vitreous body, a gel containing water, collagen and hyaluronic acid.

24. What is the role of the vitreous body?

Maintains eyeball shape and presses retina against choroid.

25. Why does retinal detachment occur?

The inner neural retina separates from the outer pigmented layer due to traction, fluid accumulation, or trauma.

26. What is the blood supply of the retina?

- **Outer layers:** Choroidal vessels
 - **Inner layers:** Central retinal artery
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27. Why is central retinal artery occlusion an emergency?

It is an **end artery** ? occlusion leads to sudden, irreversible blindness.

28. What is papilloedema?

Swelling of optic disc due to **raised intracranial pressure**.

29. Why is the fovea the point of highest visual acuity?

- Only cones
 - No blood vessels (avascular zone)
 - Thinnest retina
 - Direct entry of light
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30. What embryological structure gives rise to the retina?

The **optic cup**.

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More MCQs — Eyeball (Advanced Set)

1. The sclera is thinnest at:

- a. Limbus
- b. Equator
- c. Region of muscle insertion
- d. Optic nerve entrance

Answer: d. Optic nerve entrance

2. The space between the sclera and choroid is called:

- a. Subretinal space
- b. Perichoroidal space
- c. Tenon's space
- d. Aqueous sinus

Answer: b. Perichoroidal space

3. Vorticose veins drain the:

- a. Retina
- b. Sclera
- c. Choroid
- d. Optic nerve

Answer: c. Choroid

4. The iris epithelium is derived from:

- a. Surface ectoderm
- b. Neural crest
- c. Mesoderm
- d. Neuroectoderm

Answer: d. Neuroectoderm

5. The major arterial circle of iris lies in the:

- a. Pupillary margin
- b. Iris root
- c. Ciliary body
- d. Choroid

Answer: b. Iris root

6. Which structure forms the anterior boundary of the posterior chamber?

- a. Lens
- b. Cornea
- c. Iris
- d. Vitreous

Answer: c. Iris

7. The anterior surface of the lens is kept flattened by:

- a. Zonular fibre relaxation
- b. Zonular fibre tension
- c. Contraction of sphincter pupillae
- d. Vitreous pressure

Answer: b. Zonular fibre tension

8. The central depression on the optic disc is called:

- a. Macula
- b. Cup
- c. Ora serrata
- d. Foveola

Answer: b. Cup

9. The corneal reflex is mediated by:

- a. V1 and VII
- b. V2 and VII
- c. V3 and VII
- d. V1 and VI

Answer: a. V1 and VII

10. The nerve supply of the dilator pupillae is:

- a. Parasympathetic
- b. Somatic motor
- c. Sympathetic
- d. Sensory

Answer: c. Sympathetic

11. The retinal area with no blood vessels is:

- a. Optic disc
- b. Macula
- c. Fovea centralis
- d. Ora serrata

Answer: c. Fovea centralis

12. Which retinal layer contains photoreceptors?

- a. Ganglion cell layer
- b. Nuclear fibre layer
- c. Rod and cone layer
- d. Bipolar cell layer

Answer: c. Rod and cone layer

13. Light entering the eye first affects which retinal layer?

- a. Photoreceptors
- b. Ganglion cells
- c. Bipolar cells
- d. Pigmented layer

Answer: b. Ganglion cells

(Because light travels from inner surface ? outward.)

14. The ora serrata marks the junction of:

- a. Retina and optic nerve
- b. Cornea and sclera
- c. Neural and non-neural retina
- d. Iris and ciliary body

Answer: c. Neural and non-neural retina

15. The hyaloid artery in fetal life supplies the:

- a. Retina
- b. Optic cup
- c. Lens
- d. Cornea

Answer: c. Lens

16. The vitreous body is mainly composed of:

- a. Albumin
- b. Hyaluronic acid
- c. Keratin
- d. Elastic fibres

Answer: b. Hyaluronic acid

17. Eye colour is determined by pigment in the:

- a. Pigmented epithelium of iris
- b. Stroma of iris
- c. Ciliary processes
- d. Retina

Answer: b. Stroma of iris

18. The fovea appears yellow due to:

- a. High melanin
- b. Xanthophyll pigment
- c. Dense rods
- d. Retinal blood vessels

Answer: b. Xanthophyll pigment

19. Accommodation for near vision requires all EXCEPT:

- a. Ciliary muscle contraction
- b. Relaxation of zonular fibres
- c. Lens becoming more convex
- d. Pupillary dilatation

Answer: d. Pupillary dilatation

(Pupil **constricts** for near vision.)

20. The most common cause of sudden painless loss of vision is:

- a. Cataract
- b. Optic neuritis
- c. Central retinal artery occlusion
- d. Glaucoma

Answer: c. Central retinal artery occlusion

? MCQs — Eyeball (Set 3: Advanced/Challenging)

1. The “dangerous area” for retinal detachment is commonly associated with:

- a. Optic disc
- b. Ora serrata
- c. Macula
- d. Choroid

Answer: b. Ora serrata

2. Which structure helps maintain the depth of the anterior chamber?

- a. Lens capsule
- b. Aqueous humour
- c. Ciliary muscle
- d. Hyaloid canal

Answer: b. Aqueous humour

3. The canal of Schlemm communicates directly with:

- a. Posterior chamber
- b. Vorticosse veins
- c. Anterior ciliary veins
- d. Vitreous body

Answer: c. Anterior ciliary veins

4. Greatest refractive index in the eye is found in:

- a. Cornea
- b. Vitreous
- c. Aqueous humour
- d. Lens nucleus

Answer: d. Lens nucleus

5. The uveal tract does NOT include:

- a. Iris
- b. Choroid
- c. Ciliary body
- d. Retina

Answer: d. Retina

6. The hyaloid canal (Cloquet's canal) is a remnant of:

- a. Neural crest
- b. Hyaloid artery
- c. Vitreous vein
- d. Surface ectoderm

Answer: b. Hyaloid artery

7. The “red reflex” seen on ophthalmoscopy disappears in:

- a. Myopia
- b. Papilloedema
- c. Cataract
- d. Hypermetropia

Answer: c. Cataract

8. The anterior border of the vitreous chamber is formed by:

- a. Retina
- b. Lens and ciliary body
- c. Iris
- d. Choroid

Answer: b. Lens and ciliary body

9. Which retinal layer contains the axons forming the optic nerve?

- a. Inner nuclear layer
- b. Outer plexiform layer
- c. Nerve fibre layer
- d. Photoreceptor layer

Answer: c. Nerve fibre layer

10. The pigment epithelium of retina is essential for:

- a. Colour vision
- b. Regeneration of photopigments
- c. Transmission of impulses
- d. Aqueous humour production

Answer: b. Regeneration of photopigments

11. The space of Fontana is related to:

- a. Aqueous outflow
- b. Lens accommodation
- c. Extraocular muscle insertion
- d. Macular reflex

Answer: a. Aqueous outflow

12. The lens receives nutrition primarily from:

- a. Retinal vessels
- b. Vitreous humour
- c. Aqueous humour
- d. Choroid

Answer: c. Aqueous humour

13. The fovea centralis is avascular to reduce:

- a. Colour distortion
- b. Chromatic aberration
- c. Light scattering
- d. Accommodation effort

Answer: c. Light scattering

14. The main function of the Bruch's membrane is to:

- a. Anchor rods and cones
- b. Act as a diffusion barrier between retina and choroid
- c. Maintain vitreous pressure
- d. Nourish optic nerve

Answer: b. Act as a diffusion barrier between retina and choroid

15. Which extraocular muscle tendon passes through the trochlea?

- a. Superior oblique
- b. Inferior oblique
- c. Superior rectus
- d. Lateral rectus

Answer: a. Superior oblique

16. The anterior chamber angle is formed between:

- a. Iris and cornea
- b. Lens and cornea
- c. Iris and ciliary body
- d. Lens and iris

Answer: a. Iris and cornea

17. What determines the near point of accommodation?

- a. Corneal curvature
- b. Lens elasticity
- c. Vitreous tension
- d. Extraocular muscles

Answer: b. Lens elasticity

18. The ora serrata corresponds to the termination of:

- a. Rods and cones
- b. Retinal vessels
- c. Optic disc fibres
- d. Scleral spur

Answer: a. Rods and cones

19. Which part of the optic nerve is most susceptible to raised intracranial pressure?

- a. Intraocular
- b. Intraorbital
- c. Intracanalicular
- d. Intracranial

Answer: a. Intraocular

(Papilloedema occurs here.)

20. A cherry-red spot is seen in:

- a. Central retinal artery occlusion
- b. Central retinal vein occlusion
- c. Cataract
- d. Glaucoma

Answer: a. Central retinal artery occlusion

? Viva Voce — Eyeball (Full Chapter)

1. What are the three coats of the eyeball?

Outer fibrous coat, middle vascular coat, and inner nervous coat.

2. Which part of the eyeball is responsible for most of its refractive power?

The **cornea**.

3. Why is the cornea transparent?

Regular collagen arrangement, avascularity, and controlled hydration.

4. What is the limbus?

The junction between the **cornea and sclera**.

5. What is the weakest part of the sclera?

The **area where the optic nerve exits** (lamina cribrosa).

6. What is Tenon's capsule?

A fascial sheath around the eyeball, allowing smooth movements.

7. Name the layers of the cornea.

Epithelium, Bowman's layer, stroma, Descemet's membrane, endothelium.

8. Why is the cornea very sensitive to pain?

It is supplied richly by the **ophthalmic division of trigeminal nerve**.

9. What structure nourishes the cornea?

Aqueous humour and lacrimal fluid.

10. What is the function of the choroid?

Nourishes the **outer retina**, especially rods and cones.

11. What are the parts of the ciliary body?

Pars plana and pars plicata (with ciliary processes).

12. What is the function of the ciliary muscle?

Accommodation — changes the shape of the lens for near vision.

13. Which nerve controls accommodation?

Parasympathetic fibres through the **oculomotor nerve**.

14. What are the muscles of the iris?

Sphincter pupillae (parasympathetic) and dilator pupillae (sympathetic).

15. Why is the iris colored?

Due to the **amount of pigment** in its stroma.

16. What is the optic disc?

Point where optic nerve exits; no photoreceptors ? **blind spot**.

17. What is the macula lutea?

A yellow region responsible for **detailed central vision**.

18. Why is the fovea the point of highest visual acuity?

Only cones, no blood vessels, and thinnest retinal layers.

19. Which artery supplies the inner layers of retina?

Central retinal artery.

20. Which artery supplies the outer layers?

Choroidal vessels.

21. What is the aqueous humour?

Clear fluid in anterior and posterior chambers maintaining IOP.

22. Where is aqueous humour formed?

By ciliary processes.

23. How does it drain?

Iridocorneal angle ? canal of Schlemm ? ciliary veins.

24. What happens when its outflow is blocked?

Intraocular pressure rises ? **glaucoma**.

25. What is the function of the lens?

To fine-tune focus during accommodation.

26. Why does the lens become opaque with age?

Gradual degeneration of lens fibres ? **cataract**.

27. What is the vitreous body?

A transparent gel filling the posterior segment, supporting retina.

28. Why does vitreous degeneration cause floaters?

Liquefaction causes tiny collagen strands to cast shadows on retina.

29. What is the developmental origin of the retina?

Optic cup (neuroectoderm).

30. What is the developmental origin of lens?

Surface ectoderm (lens placode).

31. What is papilledema?

Optic disc swelling due to **raised intracranial pressure**.

32. What is the first sign of central retinal artery occlusion?

Sudden painless blindness with a **cherry-red spot**.

33. What is retinitis pigmentosa?

Progressive degeneration of photoreceptors with night blindness.

34. What is the ora serrata?

The anterior limit of the **light-sensitive retina**.

35. Why do diabetics require regular fundus exam?

To detect **diabetic retinopathy**, which can cause blindness.

36. What is meant by accommodation reflex?

Pupil constriction + lens thickening + convergence for near vision.

37. What is the hyaloid canal?

A remnant of the foetal hyaloid artery within vitreous.

38. Why does a blow to the eye sometimes cause hyphema?

Tearing of iris vessels ? blood in anterior chamber.

39. Which structure produces the “red reflex”?

Reflection of light from **vascular retina**.

40. What causes “night blindness”?

Vitamin A deficiency affecting **rods**.
