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MIDLANDS SURGICAL  
ANATOMY TEACHING  
SERIES



MSATS  
HANDOUT  
2021/22

The background of the title text is a detailed anatomical illustration of a human torso, likely a male, showing the muscular system. The illustration is rendered in a dark blue-grey tone. Various muscles are labeled with numbers: 1 through 10. The muscles are arranged in layers, with the deltoids at the top, followed by the pectorals, and then various abdominal and back muscles. The numbers are placed near the corresponding muscle groups.

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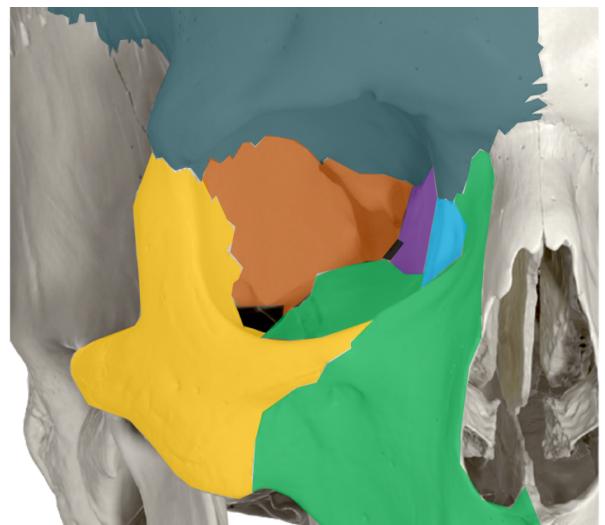
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# EYE & ORBIT ANATOMY

**Objectives:** Understand the gross anatomy of the eye, the function of extra-ocular muscles of the eye, the course of the optic nerve and the bony anatomy of the orbit. Apply anatomical knowledge in context of common procedures within ophthalmology surgery.

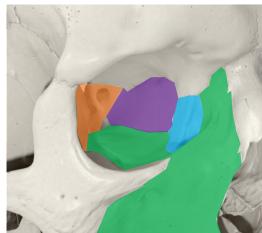
## Bony Orbit

- 7 bones:
  - Frontal bone
  - **Zygomatic bone**
  - **Maxilla**
  - **Sphenoid bone**
  - **Ethmoid bone**
  - **Lacrimal bone**
  - Palatine bone
- Forming a pyramid
  - Roof, lateral walls, medial walls, floor



### Medial wall

- 4 bones:
  - **Maxilla**
  - **Sphenoid bone**
  - **Ethmoid bone**
  - **Lacrimal bone**



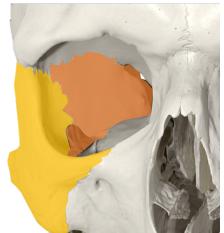
### Roof

- 2 bones:
  - **Frontal bone**
  - **Sphenoid bone**



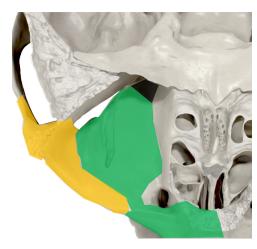
### Lateral wall

- 2 bones:
  - **Zygomatic bone**
  - **Sphenoid bone**



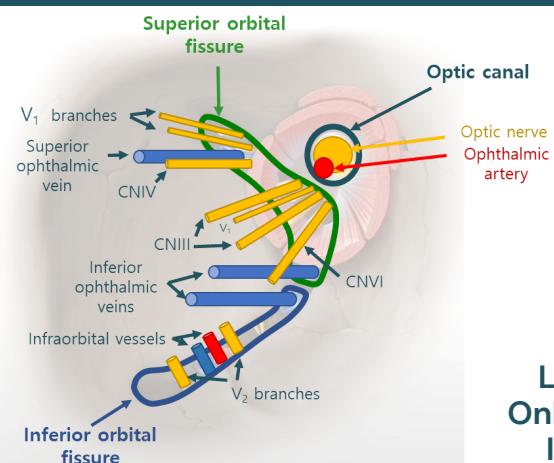
### Floor

- 3 bones:
  - **Zygomatic bone**
  - **Maxilla**
  - **Palatine bone**



## Fissures and Foramina

- **Optic canal**
  - Optic nerve
  - Ophthalmic artery
- **Superior orbital fissure**
  - Oculomotor nerve (CNIII)
  - Trochlear nerve (CNIV)
  - Ophthalmic nerve (CNV1)
  - Abducens nerve (CNVI)
  - Ophthalmic vein (superior & inferior)
- **Inferior orbital fissure**
  - CNV<sub>2</sub> branches
  - Inferior ophthalmic vein (inferior)
  - Infra-orbital vessels



Superior Orbital Fissure contents:

- L: lacrimal nerve (V<sub>1</sub> branch)
- F: frontal nerve
- S: superior ophthalmic vein
- T: trochlear nerve
- SO: superior division of oculomotor
- N: nasociliary nerve
- IO: inferior division of oculomotor
- A: abducens nerve
- IOV: inferior ophthalmic vein

**Long Fissures Seem To Store Only Nerves, Instead Of Arteries, Including Ophthalmic Vein**

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## Eye Anatomy

- **Function:**

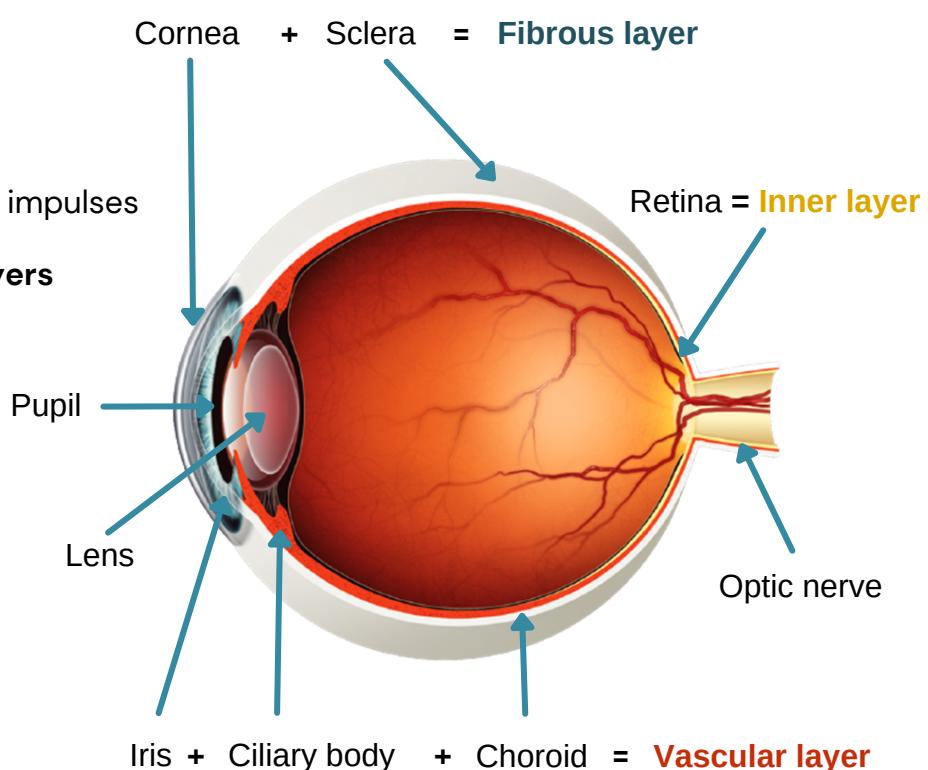
- Sensory organ
- Collects visible light
- Converts it into nerve impulses

- **Can be divided into 3 layers**

- **Fibrous**
- **Vascular**
- **Inner**

- **Visual system:**

- Eyes
- Optic nerves
- Optic chiasm
- Optic tracts
- Optic radiations
- Visual cortex



- **Broadly speaking:**

- Fibrous layer
- Vascular layer
- Inner layer

→ Provides shape and supports deeper structures

→ Blood vessels + connective tissue

→ Retina – light detection

## Eye Chambers

- **3 chambers:**

- Anterior chamber
- Posterior chamber
- Vitreous chamber

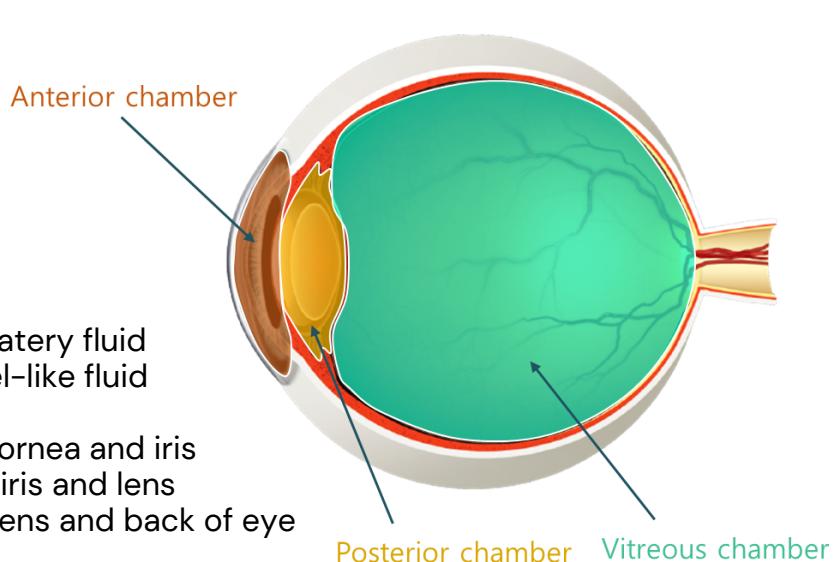
- **Two types of fluid:**

- **Aqueous humour** – clear, watery fluid
- **Vitreous humour** – thick, gel-like fluid

- **Anterior chamber** = between cornea and iris

- **Posterior chamber** = between iris and lens

- **Vitreous chamber** = between lens and back of eye

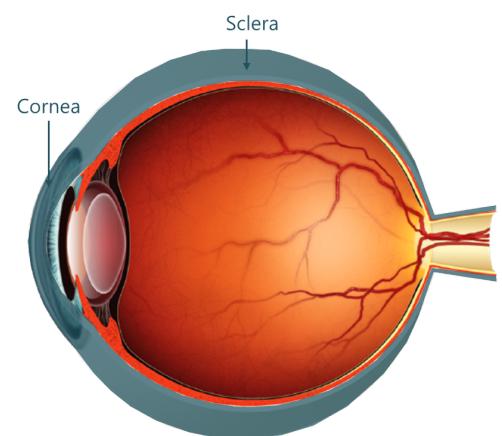


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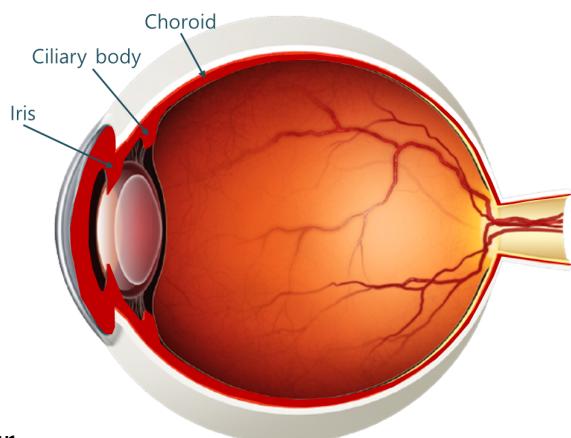
## Fibrous Layer

- **Sclera:**
  - Opaque layer of dense connective tissue
  - 'White of the eye'
  - Pierced by numerous vessels and nerves
  - Provides attachment for extra-ocular muscles
- **Cornea:**
  - Continuous with the sclera
  - Transparent
  - Allows light to enter the globe



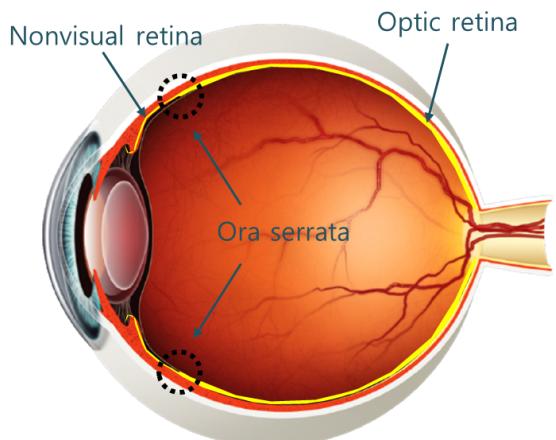
## Vascular Layer

- **Choroid:**
  - Thin, highly vascular layer
  - Attached to the retina
- **Ciliary body:**
  - Ring-shaped structure around the lens
  - **Ciliary muscle + ciliary processes**
- **Iris:**
  - Projects from ciliary body
  - Central opening = pupil
  - Contains smooth muscle fibres
  - Pigmented epithelial cells and stroma = eye colour
  - **Circular fibres** (sphincter pupillae muscle)
  - **Radial fibres** (dilator pupillae muscle)



## Inner Layer

- **Retina:**
  - Optic part
  - Nonvisual part
  - Junction = **Ora serrata**
- **Optic retina:**
  - Neural layer
  - Pigmented layer – firmly attached to choroid
- **Nonvisual retina:**
  - Covers ciliary body + iris

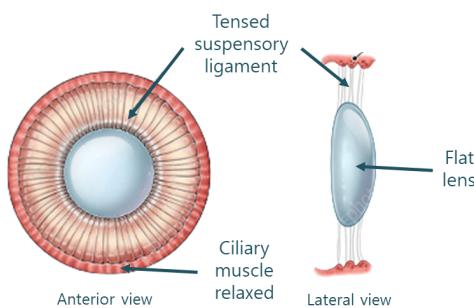


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## Accommodation Reflex

- **Ciliary body**
  - Alters lens shape
  - Produces humour
- **Ciliary muscle**
  - Contains smooth muscle fibres
  - Arranged longitudinally, circularly, radially
- **Ciliary processes**
  - Longitudinal ridges projecting from ciliary muscle
  - **Zonular fibres** (suspensory ligament)
  - Attach ciliary processes to lens

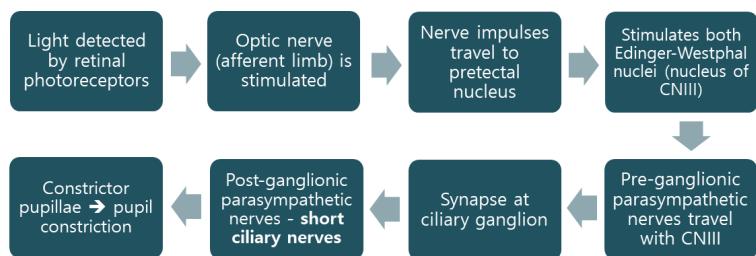


### Distant object:

- Ciliary muscle relaxed
- Suspensory ligament tensed
- Lens flattened

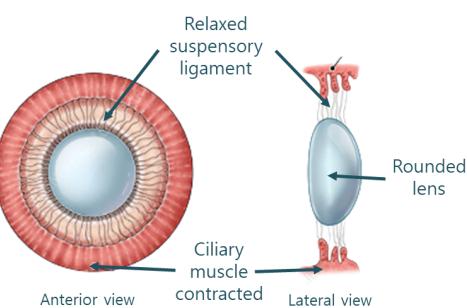
## Pupillary Reflex

- **Function**
  - Constriction of pupil in response to light
  - 1 afferent limb + 2 efferent limbs
    - Afferent: Optic nerve (CNII)
    - Efferent: Oculomotor nerve (CNIII)

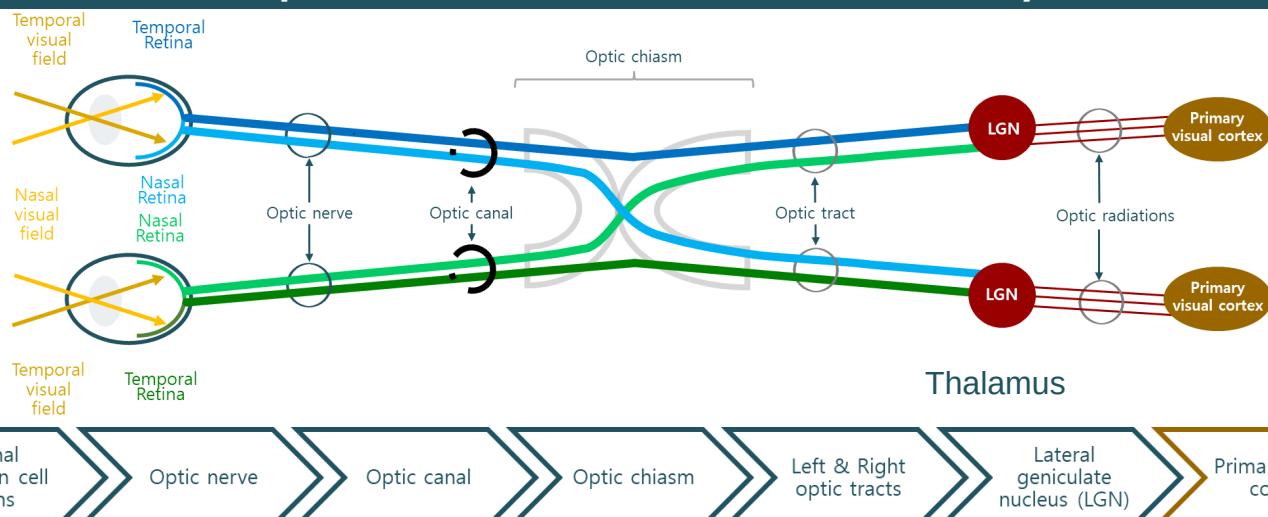


### Close object:

- Ciliary muscle contracted
- Suspensory ligament relaxed
- Lens relaxed = more rounded



## Optic Nerve Course & Visual Pathway



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## Eye Blood Supply

### • A: Ophthalmic artery

- Branch of internal carotid artery
- Gives off:
  - Central retinal artery**
  - Short posterior ciliary arteries
  - Long posterior ciliary arteries
  - Anterior ciliary complex

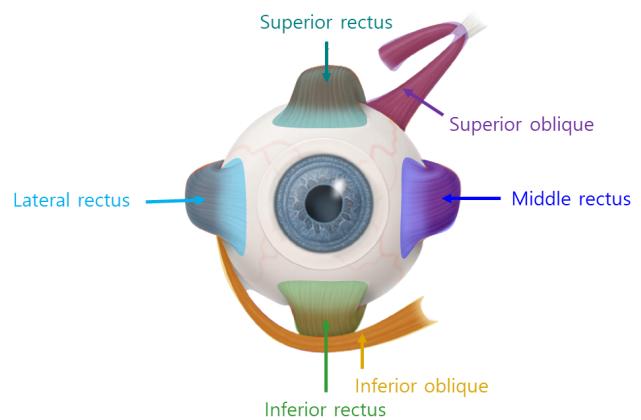
### • V:

- Superior ophthalmic vein
- Inferior ophthalmic vein

## Extra-Ocular Muscles of the Eye

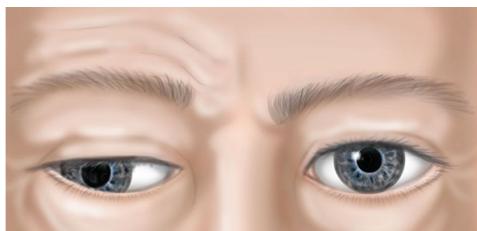
**LR6, SO4, R3**

Muscle	Function	Right eye
Lateral rectus	Look laterally	
Medial rectus	Look medially	
Superior rectus	Up & in	
Inferior rectus	Down & in	
Superior oblique	Down & out	
Inferior oblique	Up & out	



## Cranial Palsies

CNIII palsy



Affected eye

Normal eye

CNIV palsy



Affected eye

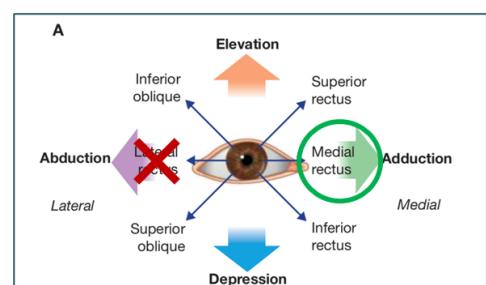
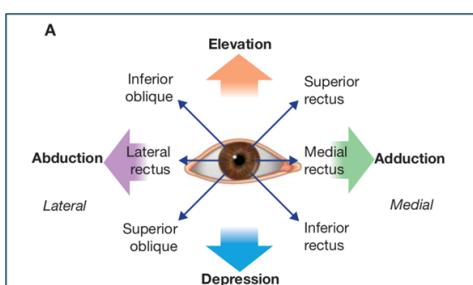
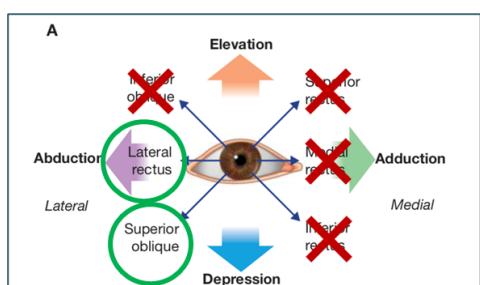
Normal eye

CNVI palsy



Affected eye

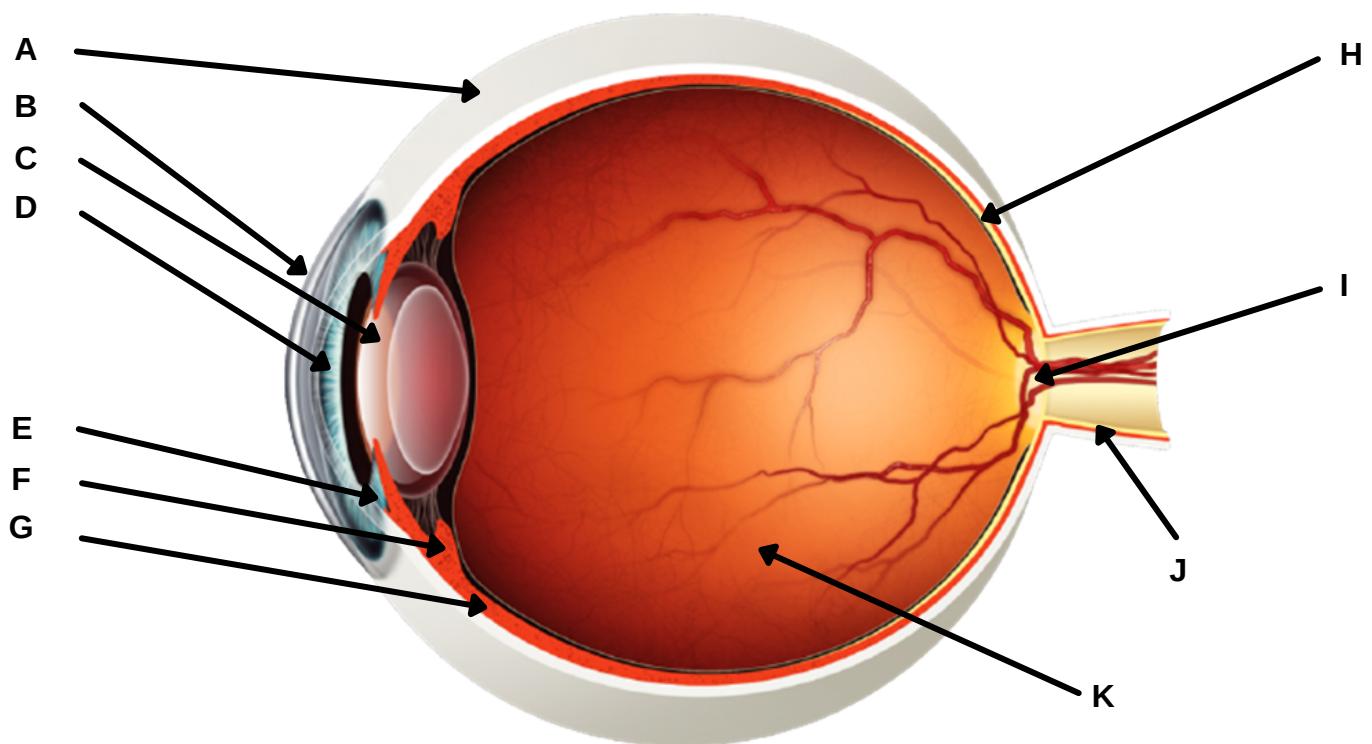
Normal eye



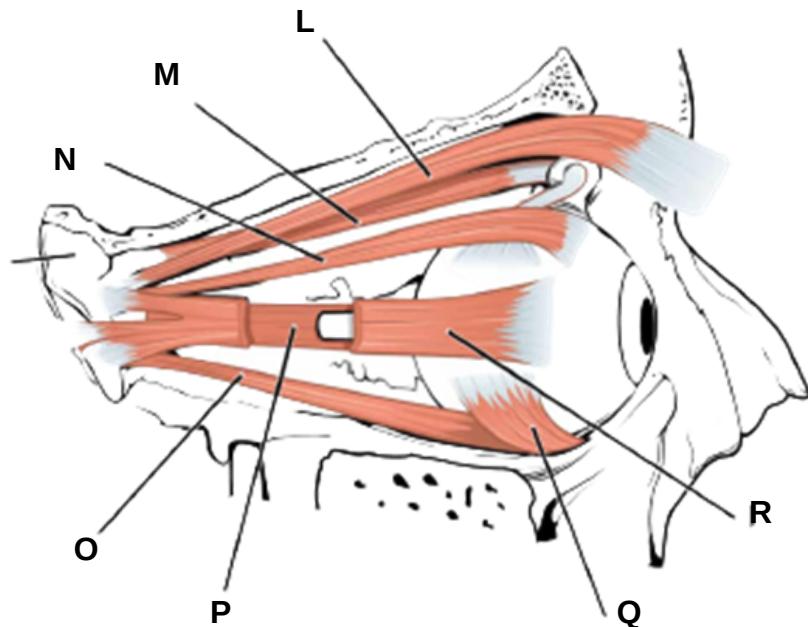
# EYE & ORBIT ANATOMY

*Test yourself...*

**1) Label the structures of the eye**



**2) Label the extra-ocular muscles**



# EYE & ORBIT ANATOMY

*Test yourself...*

## MCQ 1

Which is the correct course of the visual pathway?

- A. Optic nerve, optic chiasm, optic radiations, lateral geniculate nucleus, primary visual cortex
- B. Optic canal, optic nerve, optic chiasm, optic tracts, optic radiations, lateral geniculate nucleus, primary visual cortex
- C. Optic nerve, optic chiasm, optic tracts, lateral geniculate nucleus, optic radiations, primary visual cortex
- D. Optic nerve, optic tracts, optic radiations, primary visual cortex
- E. Optic nerve, optic chiasm, optic tracts, optic radiations, lateral geniculate nucleus, primary visual cortex

## MCQ 2

Where is the lateral geniculate nucleus located?

- A. Midbrain
- B. Thalamus
- C. Hypothalamus
- D. Optic chiasm
- E. Secondary visual cortex

## MCQ 3

What is the name of the fluid located in the anterior chamber of the eye?

- A. Aqueous humour
- B. Vitreous humour
- C. Liquid humour
- D. Anterior humour
- E. Dark humour

## MCQ 4

Which two parts of the orbits are structurally the weakest?

- A. Lateral wall & medial wall
- B. Roof & floor
- C. Medial wall & roof
- D. Floor & lateral wall
- E. Medial wall & floor

## MCQ 5

Which structure passes through the optic canal alongside the optic nerve?

- A. Oculomotor nerve (CNIII)
- B. Superior ophthalmic vein
- C. Inferior ophthalmic vein
- D. Ophthalmic artery
- E. Infra-orbital vein

## MCQ 6

Which cranial nerve palsy leads to subtle but characteristic head-tilt away from the site of the lesion?  
(Hint: which cranial nerve palsies have the most obvious signs?)

- A. CNII palsy
- B. CNIII palsy
- C. CNIV palsy
- D. CNV palsy
- E. CNVI palsy

# EYE & ORBIT ANATOMY

*Test yourself...*

## OSCE Station – Case Based Discussion

While working in A&E you see a 50 year-old male with a one hour history of painless, sudden vision loss in his left eye. He has a history of hypertension, diabetes, and hypercholesterolaemia. He is a regular smoker and occasionally uses cocaine. On examination you notice a relative afferent pupillary defect and reduced visual acuity. On fundoscopy, you see a characteristic appearance (see image ->)



**Q1. Describe the presented image**

**Q2. What is your differential diagnosis? Is this an emergency or can the patient be followed up in the community?**

**Q3. What laboratory investigations would you include to help determine the aetiology of this condition?**

**Q4. What additional imaging investigations would you consider and why?**

**Q5. What are the treatment options? What condition needs to be ruled out? What advise do you need to give the patient about driving?**

OSCEs: 1) Fundoscopy of the left retina, revealing a pale optic disc and cherry-red spot. Multiple partially occluded vessels. 2) Central retinal artery occlusion. MEDICAL EMERGENCY!!! 3) FBC, ESR & CRP (exclude giant cell arteritis), coagulation screen, glucose, lipid profile 4) Carotid artery doppler - check for carotid stenosis, CXR - sarcoidosis / TB, Echo - PMG of rheumatic fever or valvular disease 5) If patient present within 90 minutes = dislodge the embolus: ocular massage, re-breathing into a bag, IV acetazolamide, anterior chamber paracentesis. Retinal artery occlusion should be managed as a stroke - refer to stroke team! Start on aspirin. Rule out giant cell arteritis. Patient not allowed to drive for at least a month

MCQs: 1 = C, 2 = B, 3 = A, 4 = E, 5 = D, 6 = C

Answers: 1 & 2: A = sclera, B = cornea, C = lens, D = iris / anterior chamber, E = iris, F = ciliary body, G = choroid, H = retina, I = optic disc, J = optic nerve, K = vitreous chamber, L = levator palpebrae superioris, M = superior oblique, N = superior rectus, O = inferior rectus, P = medial rectus, Q = inferior oblique, R = lateral rectus  
Labels 1 & 2: A = sclera, B = cornea, C = lens, D = iris / anterior chamber, E = iris, F = ciliary body, G = choroid, H = retina, I = optic disc, J = optic nerve, K = vitreous chamber, L = levator palpebrae superioris, M = superior oblique, N = superior rectus, O = inferior rectus, P = medial rectus, Q = inferior oblique, R = lateral rectus