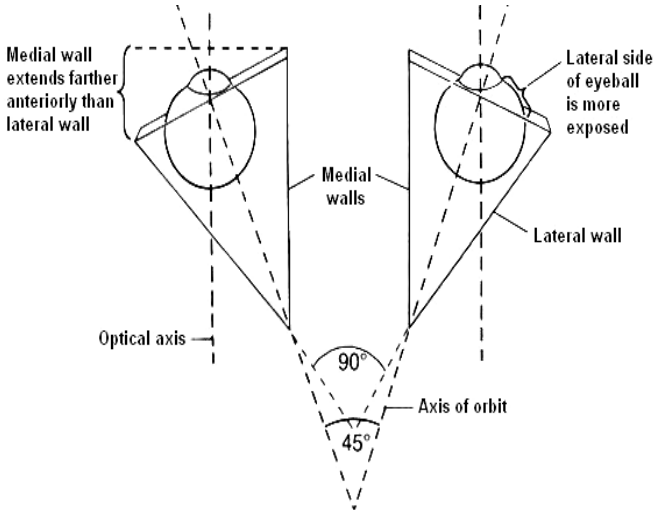
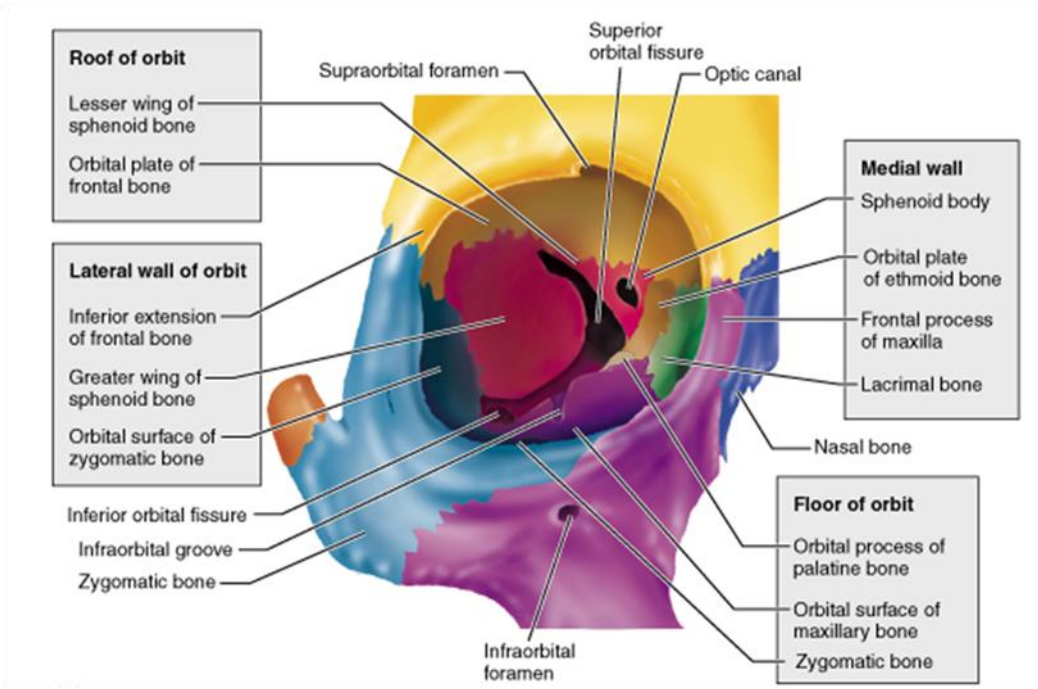
Unit VIII – Problem 8 – Anatomy: Orbit and Eyeball

- **The bony orbit**: it is protecting our eyeball and resembling a pyramid:
  - **With a base directed**: anterolaterally.
  - **And an apex directed**: posteromedially.

  Notes:
    - ✓ The medial wall of the pyramid is extending farther anteriorly than the lateral wall.
    - ✓ The orbital axes diverge at 45 degrees while the optical axes are parallel to each other.



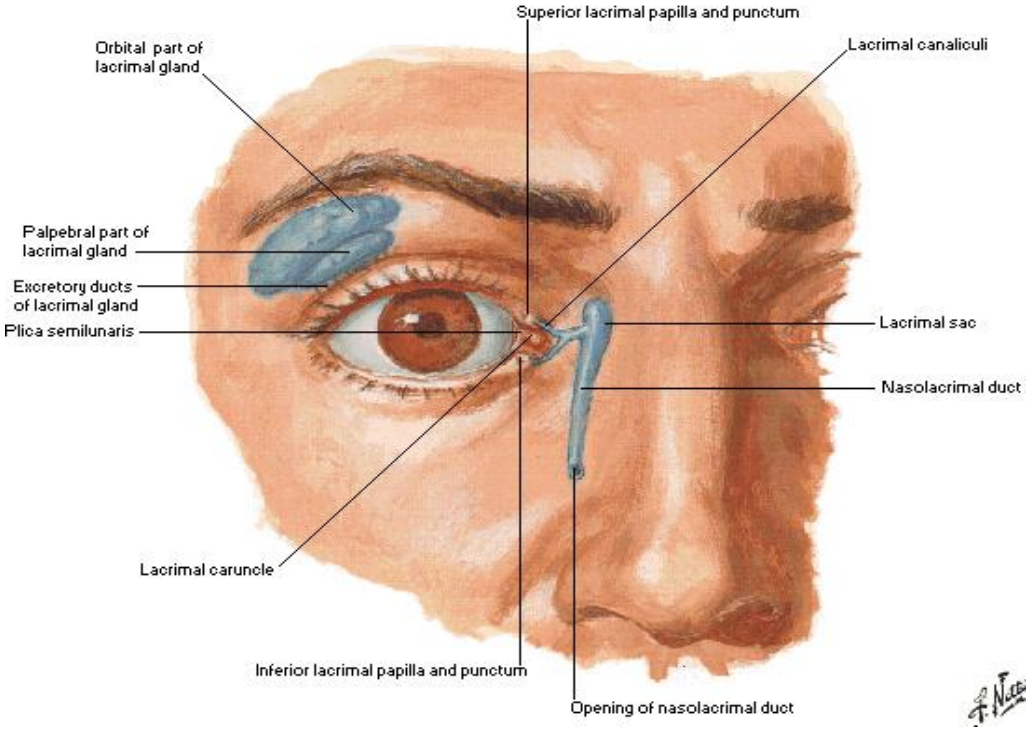
- **The walls of the orbit are formed by the following bones:**
  - **Roof of the orbit**: frontal bone + lesser wing of sphenoid bone.
  - **Floor of the orbit**: maxillary bone + zygomatic bone.
  - **Lateral wall of the orbit**: frontal bone + zygomatic bone + greater wing of sphenoid bone.
  - **Medial wall of the orbit**: sphenoid body + ethmoid bone + lacrimal bone + maxillary bone.



- **Anatomy of the eyelid:**
  - Eyelids are movable folds which cover the eyeball anteriorly.
  - It is covered externally by skin and internally by a mucous membrane called conjunctiva (notice that conjunctiva does not cover the cornea).
  - The structures which are strengthening the eyelid superiorly and inferiorly are known as superior and inferior tarsi.
  - Eye lashes are attached to the margins of the eyelid and they are connected with sebaceous glands.
  - **Tarsal glands**: they secrete lipids which lubricate edges of the eyelids and prevent them from sticking when they are closed.
- **Lacrimal gland:**
  - **It is divided by levator palpebrae muscle into:**
    - ✓ Deep orbital lobe.

- ✓ Superficial palpebral lobe.

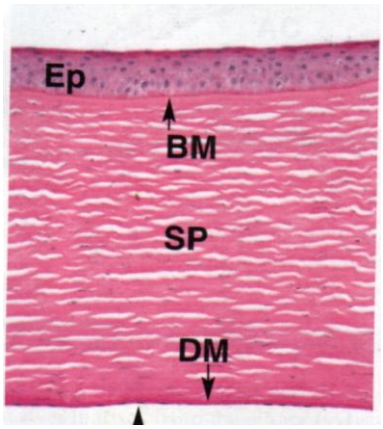
- **Tears produced by lacrimal gland are drained medially through**: lacrimal puncta → lacrimal canaliculi → lacrimal sac → nasolacrimal duct → terminating in the nasal cavity through inferior nasal meatus.



- **Innervation of lacrimal gland:**
  - ✓ Parasympathetic: from facial nerve.
  - ✓ Sympathetic: from superior cervical ganglia.

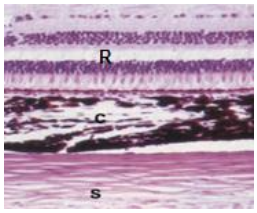
- **Anatomy of the eyeball:**

- **It is formed by 3 layers:**
  - ✓ 1st layer: outer fibrous coat (composed of type-I collagen):
    - ❖ This layer is composed of the sclera and cornea (both of them are composed of type-I collagen).
    - ❖ The collagen in the cornea is arranged in a very regular manner.
    - ❖ There are 5 histological layers of the cornea:
      - *Epithelium*: stratified squamous non-keratinized epithelium.
      - *Bowman's membrane*: thin layers of collagen fibers providing strength and stability.
      - *Stroma*: parallel type-1 collagen bundles.
      - *Descemet's membrane*: thick homogenous structure of fine collagen filaments.
      - *Endothelium*: simple squamous maintaining the transparency.

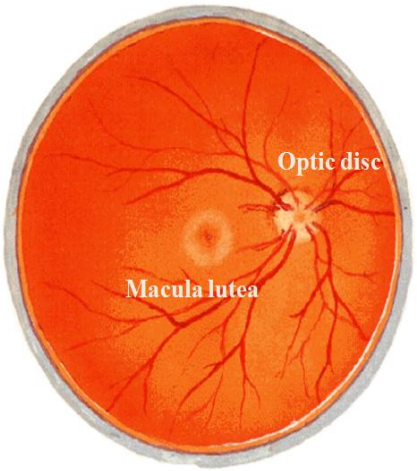


    - ❖ The sclera is relatively avascular while the cornea is completely avascular. Therefore, the cornea receives nutrition from peripheral capillaries and 2 fluids:
      - Tears from lacrimal gland.
      - Aqueous humor.
    - ❖ The cornea is innervated by ophthalmic division of trigeminal nerve.
    - ❖ The angle between intersecting sclera and cornea is known as corneoscleral junction.

- ✓ 2nd layer (uvea): it is composed of blood vessels and pigmented cells. This layer is formed by:
  - ❖ *Iris (diaphragm-like structure):*
    - It is the colored part of the surrounding the pupil.
    - It has 2 types of muscles:
      - ➢ Circular muscles: under the control of parasympathetic system and causing constriction of the pupil (miosis).
      - ➢ Radial muscles: under the control of sympathetic system and causing dilation of the pupil.
  - ❖ *Ciliary body:*
    - It is connecting iris to choroid and providing attachment to the lens through zonular fibers (suspensory ligaments).
    - It is producing the fluid of the anterior segment of the eye (aqueous humor).
  - ❖ *Choroid:*
    - It is a dark reddish-brown layer between sclera and retina.
    - It has 2 types of blood vessels:
      - ➢ Large vessels located externally.
      - ➢ Fine capillaries (choriocapillaries) located internally.



- ✓ 3rd layer (retina): has the neural elements of the eye:
  - ❖ *The retina is divided into:*
    - Visual retina: which has a neural layer (light receptive) and a pigmented layer (reducing scattering of light).
    - Non-visual retina: which has a pigmented layer and a supporting layer.
  - ❖ *Fundus*: it is the interior aspect of the posterior part of the eyeball. It has the optic disc (for entry of optic nerve and accompanying vessels) and the macula (which is lateral to the optic disc and functioning in visual acuity mostly in fovea centralis).



  - ❖ *Histology of the retina:*
    - Important cells of the retina are:
      - ➢ Pigmented epithelium.
      - ➢ Photoreceptors which include both rods and cones.
      - ➢ Bipolar cells.
      - ➢ Ganglion cells: the fibers of which will continue as the optic nerve.
      - ➢ Horizontal cells.
      - ➢ Amacrine cells.

- **Refractory media of the eyeball:**
  - **Definition**: it is the media through which light passes on its way to the retina:
    - ✓ Cornea: primary refractive media of the eyeball.
    - ✓ Aqueous humor: watery fluid which is produced and reabsorbed by ciliary body and filling the anterior segment of the eyeball (interior of the eyeball anterior to the lens, suspensory ligament and ciliary body).
      - ❖ *What are the anterior and posterior chambers?*

- Anterior chamber: it is the space between the cornea and iris/pupil.
- Posterior chamber: it is the space between iris/pupil and lens and ciliary body.

❖ *Flow of aqueous humor (how it is reabsorbed?):*
- Produced by ciliary process.
- To posterior chamber.
- And then through the pupil.
- To the anterior chamber.
- To iridocorneal angle.
- To meshlike spaces (Fontana).
- Eventually to canal of Schlemm.

✓ Lens:

❖ It is a transparent biconvex structure enclosed in a capsule and anchored to ciliary processes through zonular fibers (suspensory ligament of the lens).

❖ With increased age, the lens becomes more fibrous with less ability to accommodate (cannot change its shape depending if the object is far or near):
- Normally when there is a far object → ciliary muscle is relaxed → thus zonula fibers will be stretched → and the lens will get more flattened.
- When there is a near object → ciliary muscle is contracted → thus zonula fibers are relaxed → and the lens will become more biconvex.

✓ Vitreous humor:

❖ It is the gelatinous material in the posterior 4/5 of the eyeball (posterior to the lens) which acting as a shock absorber. It also transmits light, supports the lens and holds the retina in place.

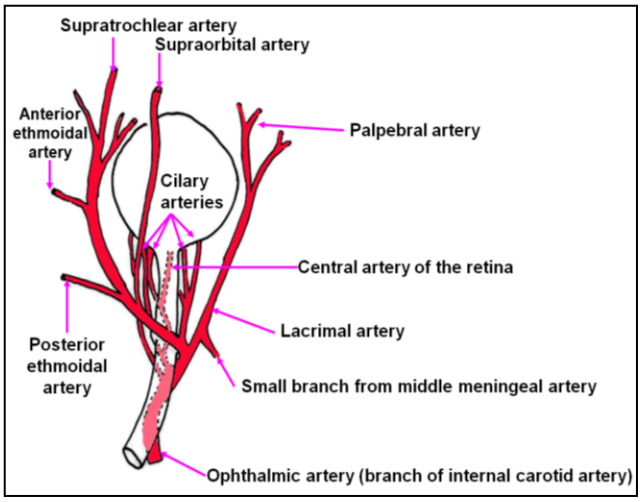
- **Intrinsic arteries and veins of the eye:**
  - The central retinal artery is a branch from the ophthalmic artery and is considered as the sole supply with no significant collaterals. Obstruction of this artery will result in blindness and retinal atrophy.
- **Extraoccular muscles:**

MUSCLE	ACTIONS
SR	Elevation, adduction, medial rotation
IR	Depression, adduction, lateral rotation
SO	Abduction, depression, medial rotation
IO	Abduction, elevation, lateral rotation
MR	Adduction
LR	Abduction
Levator Palpebrae Superioris: elevation of upper eyelid	

  - Notice that all extraoccular muscles are innervated by oculomotor nerve except lateral rectus (which is innervated by the abducens nerve) and superior oblique (which is innervated by the trochlear nerve).
  - **Actions of extraoccular muscles:**
    - ✓ At the vertical access: abduction and adduction.

- ✓ At the transverse axis: elevation and depression.
- ✓ At the antero-posterior axis: medial and lateral rotations (also known as intorsion and extorsion respectively).

- **Blood supply:**
  - **Ophthalmic artery:**
    - ✓ It is a branch of the internal carotid artery.
    - ✓ Ocular vessels are:
      - ❖ Central artery of the retina.
      - ❖ Ciliary arteries.
    - ✓ Orbital vessels are:
      - ❖ Lacrima.
      - ❖ Supratrochlear.
      - ❖ Dorsal nasal.
      - ❖ Ethmodial.
      - ❖ Muscular.
      - ❖ Palpebral.



- **Nerves of the orbit:**
  - **Optic nerve**: entering the orbit from middle cranial fossa through the optic canal (accompanied by ophthalmic artery).
  - **Lacrimal nerve**: arising from ophthalmic division of trigeminal nerve and entering the orbit through the superior orbital fissure.
  - **Frontal nerve**: arising from ophthalmic division of trigeminal nerve and dividing into supratrochlear and supraprbital nerves.
  - **Nasociliary**: arising from ophthalmic division of trigeminal nerve.
  - **Trochlear nerve**: entering the orbit through superior orbital fissure.
  - **Oculomotor nerve**: entering the orbit through superior orbital fissure.
  - **Abducens nerve**: entering the orbit through the superior orbital fissure.
  - **Ciliary ganglion**: parasympathetic ganglion in the posterior part of the orbit between the optic nerve and lateral rectus.