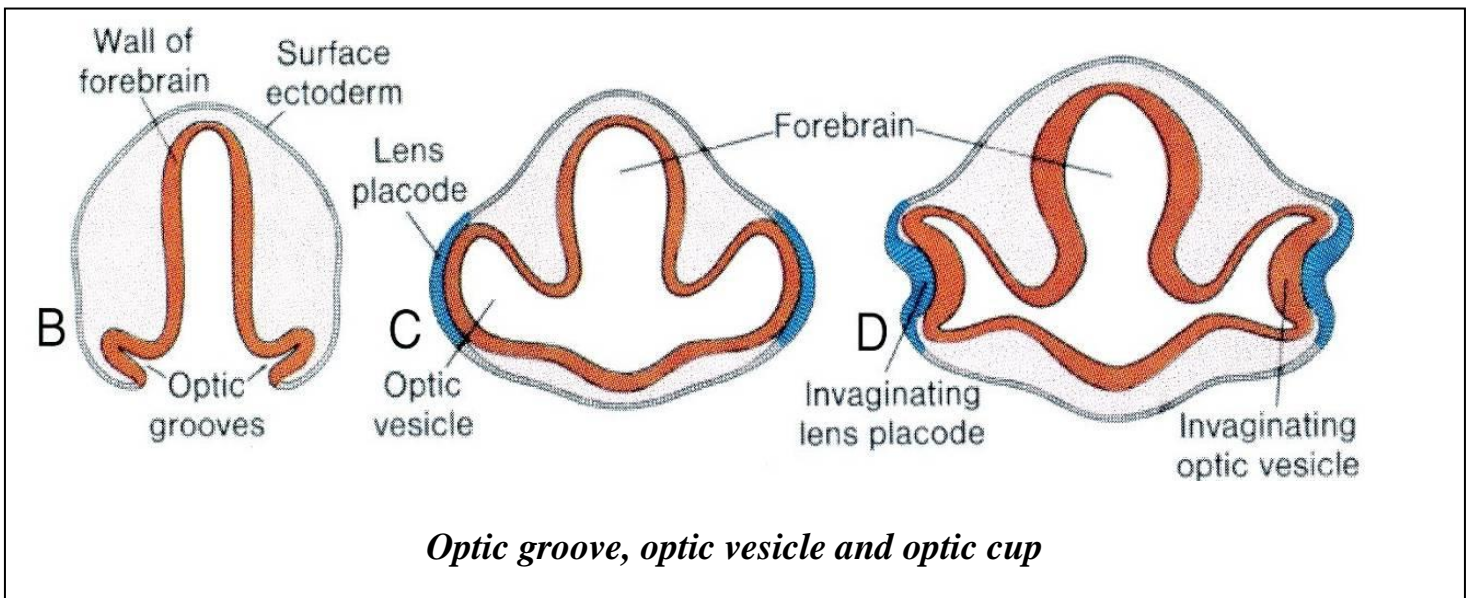
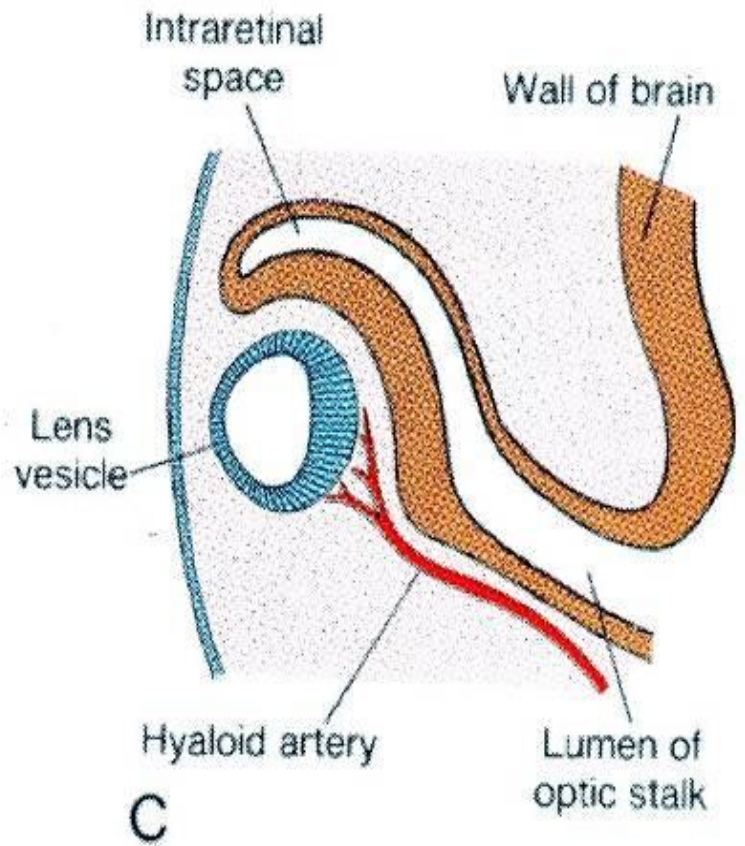
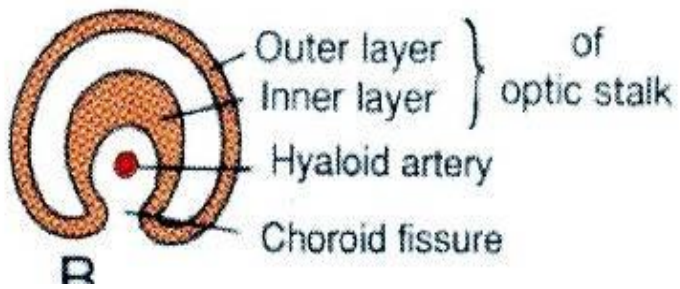
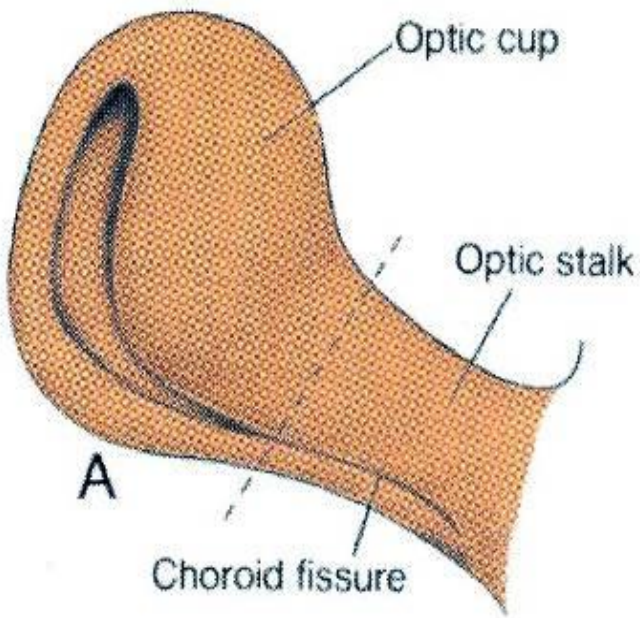


DEVELOPMENT OF THE EYEBALL

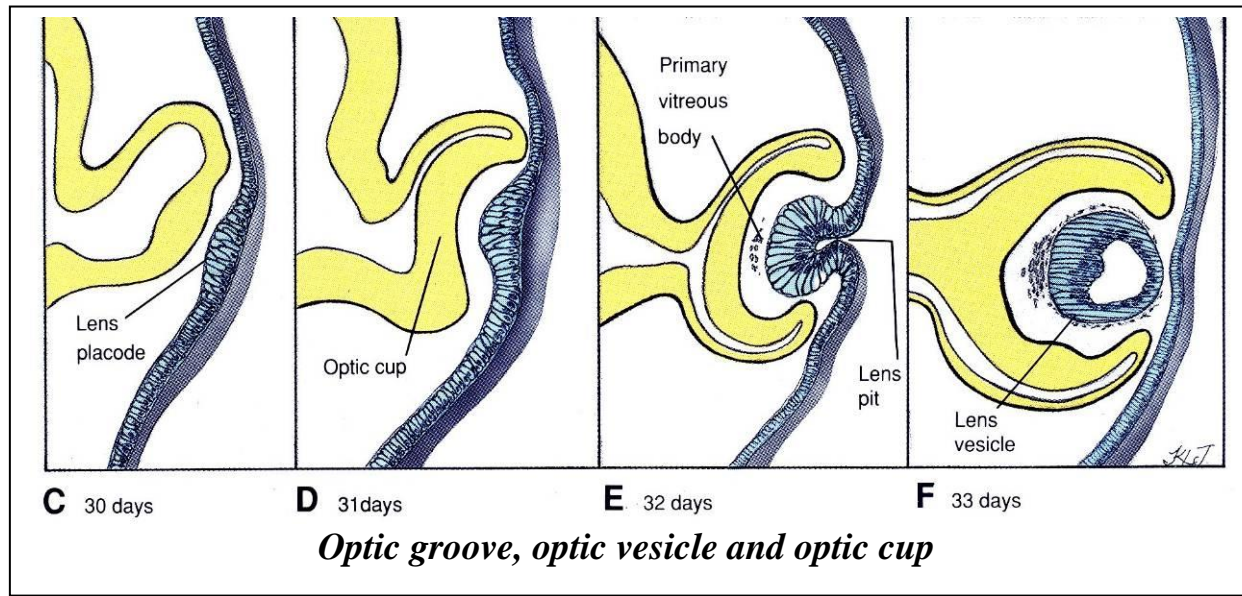
1- OPTIC VESICLE :

- The eyeball develops as a diverticulum called **optic vesicle** which arises from the ventrolateral part of the cranial part of the **prosencephalon**.
- The optic vesicle **elongates**:
 - **Its proximal** part remains narrow to form the **optic stalk**.
 - **Its distal** blind end **expands** and comes in contact with the **surface ectoderm**. It becomes **invaginated by** lens placode and is converted into the **optic cup**.
- The wall of the optic cup consists of **2 layers**: outer and inner **separated by the intra-retinal space**.
- The edge of the optic cup is deficient ventrally and this deficiency extends along the ventral aspect of the optic stalk to form a groove called the **choroidal fissure**.
 - Inside the choroidal fissure the **hyaloid artery** runs forwards as far as the concavity of the optic cup to end in the fetal lens.
 - The choroidal fissure becomes **closed** by approximation and fusion of its lips.
 - The **optic stalk** becomes the **optic nerve** while the proximal part of **hyaloid artery** becomes the **central artery of the retina**.



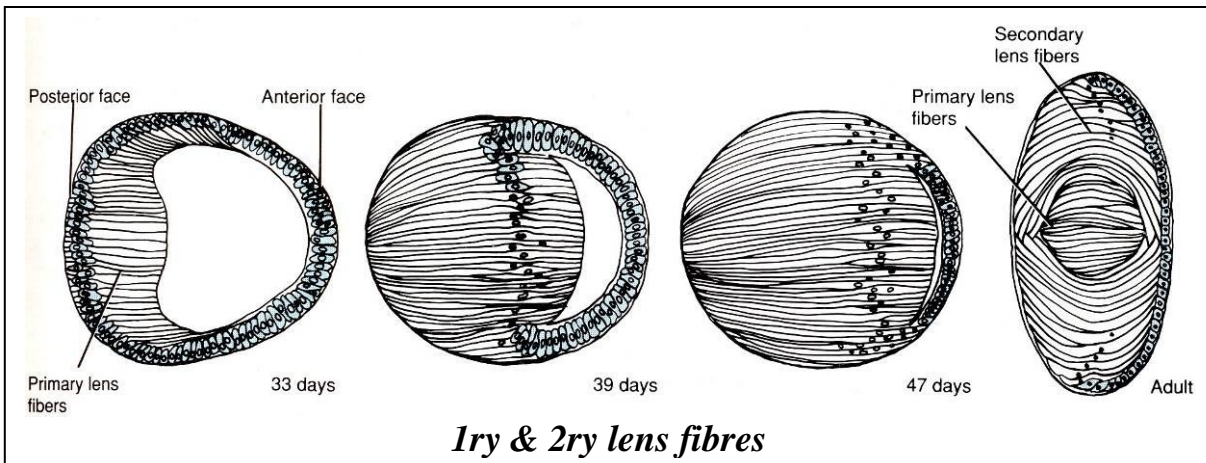


Choroid fissure and hyaloid artery



2- LENS :

- The lens is formed on the surface as an **ectodermal thickening** called **lens placode**. Its formation is **induced by** the optic vesicle.
- The lens placode is then converted into a **lens vesicle**. This vesicle, then, **sinks** into the underlying **mesoderm** where it is **surrounded by** the margin of the **optic cup**.
- The cells of the posterior wall of the lens vesicle differentiate to form **primary lens fibers**. The elongation of these cells obliterating the cavity of the lens vesicle.
- The primary lens fibers are augmented by a new population of **secondary lens fibers** that arise from the simple epithelium that differentiates from cells of the **anterior wall** of the lens vesicle.
- The **mesoderm immediately adjacent** to the lens differentiate to become **lens capsule**.
- During **fetal life** the **capsule** of the lens is supplied by the **hyaloid artery**, but **before birth** the artery degenerates and the lens becomes **avascular**.



3- RETINA :

- The retina develops from the **2 layers of the optic cup** :
 - **Inner layer of optic cup:** is directed towards the concavity of the cup, and is much thickened to form the **nervous layer** of the retina (pars optica retinae). This part gives rise to the rods and cones, bipolar cells and ganglionic cells.
 - **Outer layer of optic cup:** is directed away from the concavity of the cup, and remains single-cell thick. It becomes pigmented and forms the **pigmented layer** of the retina.
 - The inner and outer layers of the optic cup are at **1st separated** from each other by a space called **intra-retinal space**. However, this space is rapidly **obliterated** by the **fusion of the 2 layers**.

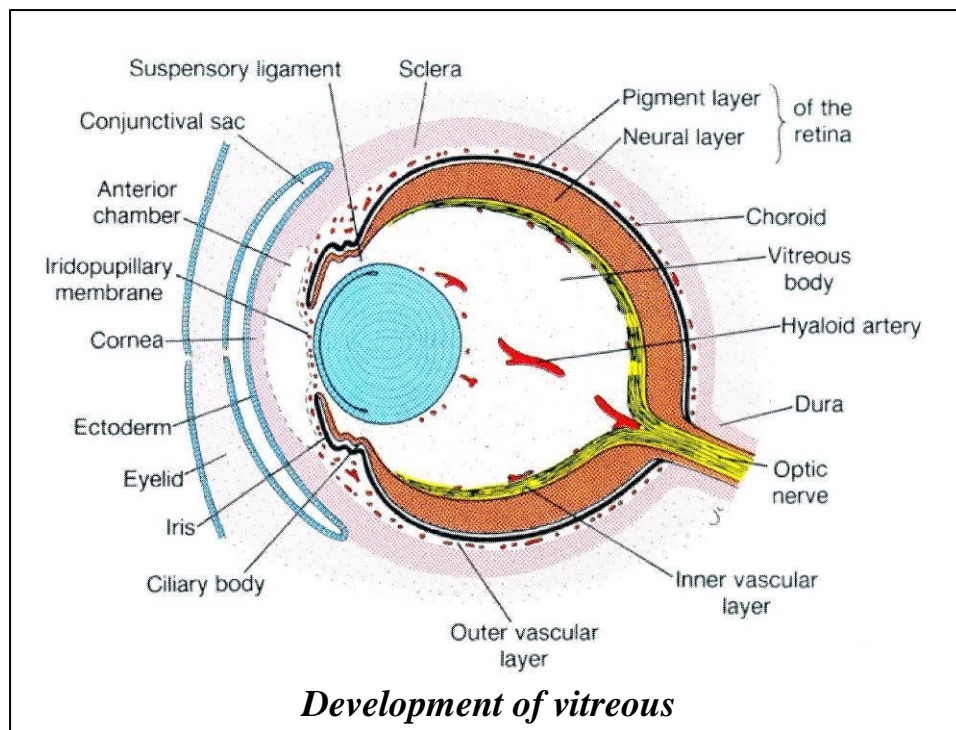
4- VITREOUS BODY:

- It is a mass of **mesoderm** (mainly) which **fills the concavity of the optic cup**.
- It is **traversed by hyaloid artery**. Normally, the **distal portion** of this vessel **degenerates**, leaving the **proximal part** to form the **central artery of the retina**.

5- COATS OF EYEBALL :

a- OUTER FIBROUS COAT :

- It is derived from **mesoderm around the optic cup** , and is **continuous** with the dura mater which surrounds the optic nerve.
- It gives rise to the **sclera and cornea**.



b- INNER VASCULAR COAT :

- It is derived from **mesoderm** in contact with the outer layer of optic cup.
- This vascular coat consists of the **choroid** .

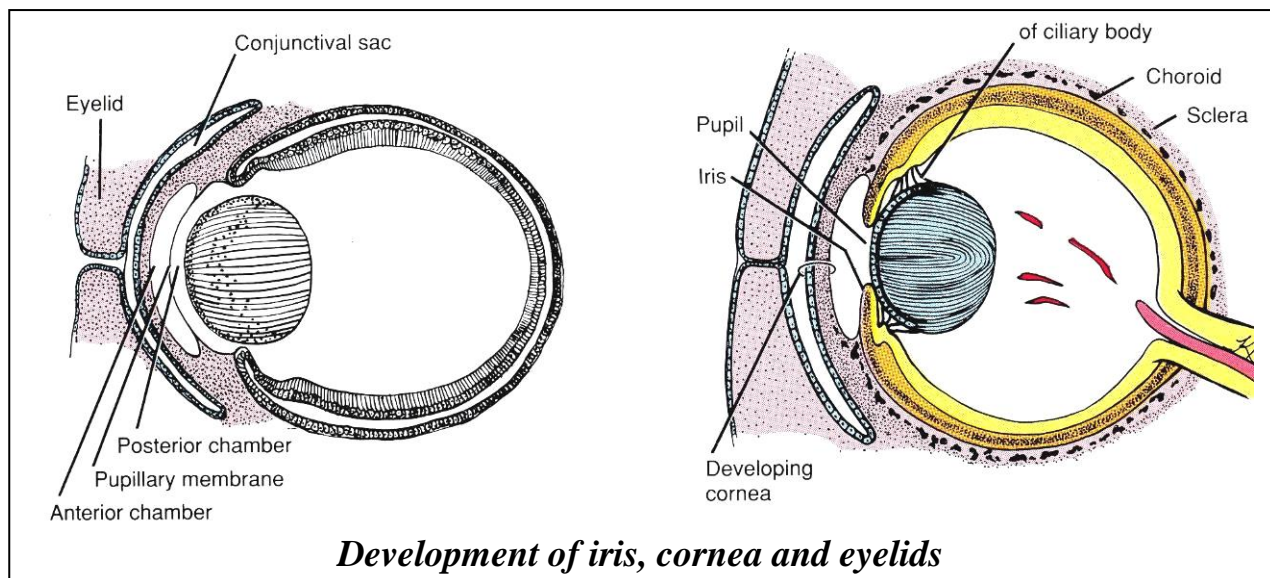
6- IRIS and CILIARY BODY :

- The mesoderm anterior to the optic cup form **iridopupillary membrane** which cover the iris superficially.
- The **2 ectodermal layers** forming the edge of the optic cup extends anterior on the deep surface of iridopupillary membrane to form the **iris and ciliary body** .

- This membrane is at **1st a continuous** sheet, but later on it becomes **perforated** in its centre to form the **pupil** of the eye.
- The **ciliary muscle , dilator and sphincter pupillae** develops from the mesoderm in contact with the developing iris & ciliary body .

7- EYELIDS :

- The upper and lower **eyelids** develop as **2 folds of ectoderm filled with mesoderm.**
- The margins of the 2 lids are at 1st **fuse** together but later on they are **separated.**



Development of eyelids, conjunctival sac, and lacrimal gland.

8- LACRIMAL APPARTUS :

a- LACRIMAL GLAND :

- It arises as a group of **ectodermal buds** which develop from the upper lateral angle of the conjunctival sac.
- These buds sink into the underlying mesoderm and become **canalized** to form the **ducts and acini** of the gland.
- The **surrounding mesoderm** gives the fibrous stroma , smooth muscles and the capsule of the gland .

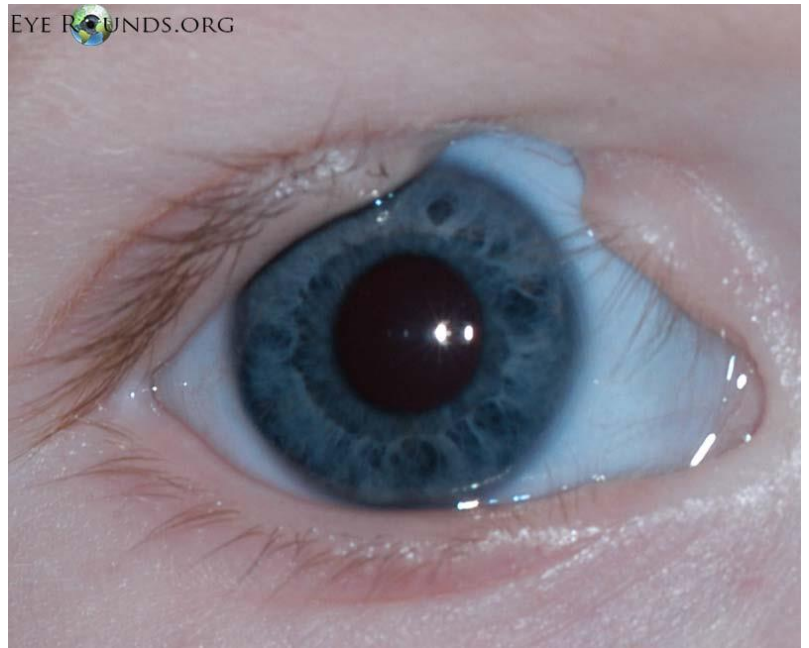
b- LACRIMAL SAC :

- The **nasolacrimal duct** develops at the line of **junction** between the maxillary prominence and the frontonasal prominence.
- The **upper end** of the nasolacrimal duct **dilates** to form the **lacrimal sac**.
- The **lacrimal canaliculi** arise as 2 solid **ectodermal cords** from the medial ends of the margins of the 2 lids. They become **canalized** and **join** the lacrimal sac.

★ **ABNORMALITIES :**

1. **Coloboma** may occur if the choroid fissure fails to close.
2. **The iridopupillary membrane:** may persist.
3. **Congenital cataract:** the lens becomes opaque during intrauterine life.
4. **The hyaloid artery may persist to form a cord or cyst.**
5. **Fusion of eyelids** due to their failure of separation
6. **Microphthalmia** the eye is too small; the eyeball is only 2/3 of its normal volume.
7. **Anophthalmia** is absence of the eye.
8. **Congenital aphakia** (absence of the lens) **and aniridia** (absence of the iris).
9. **Cyclopia** (single eye) and **synophthalmia** (fusion of the eyes).

Coloboma of eyelid



Coloboma of iris

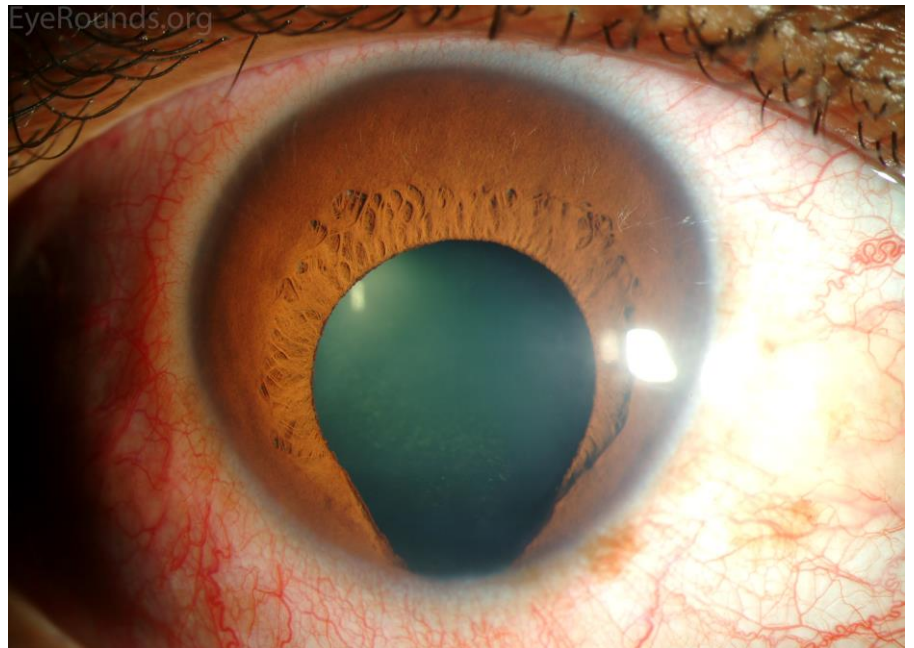




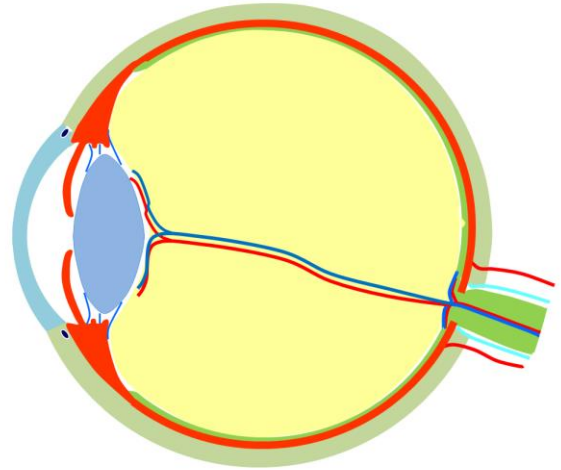
Fig. 1 Aniridia means an absence of the iris or colored part of the eye.



Persistence of iridopupillary membrane

The Hyaloid Blood Vessels

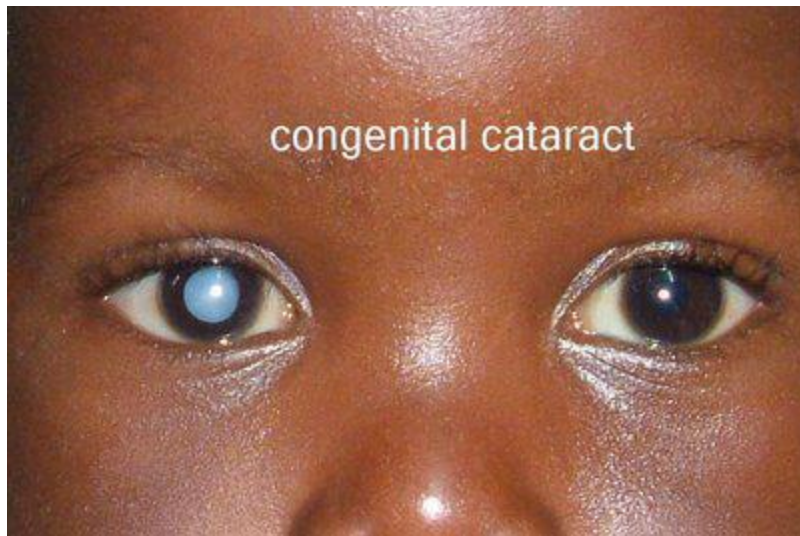
Persistence of hyaloid artery



©Dr. Tarek Mamoun

Microphthalmia





Congenital cataract



Cyclopia



synophthalmia