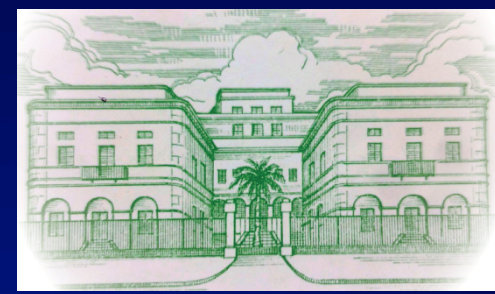


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Direttore: Prof. Leopoldo Spadea*



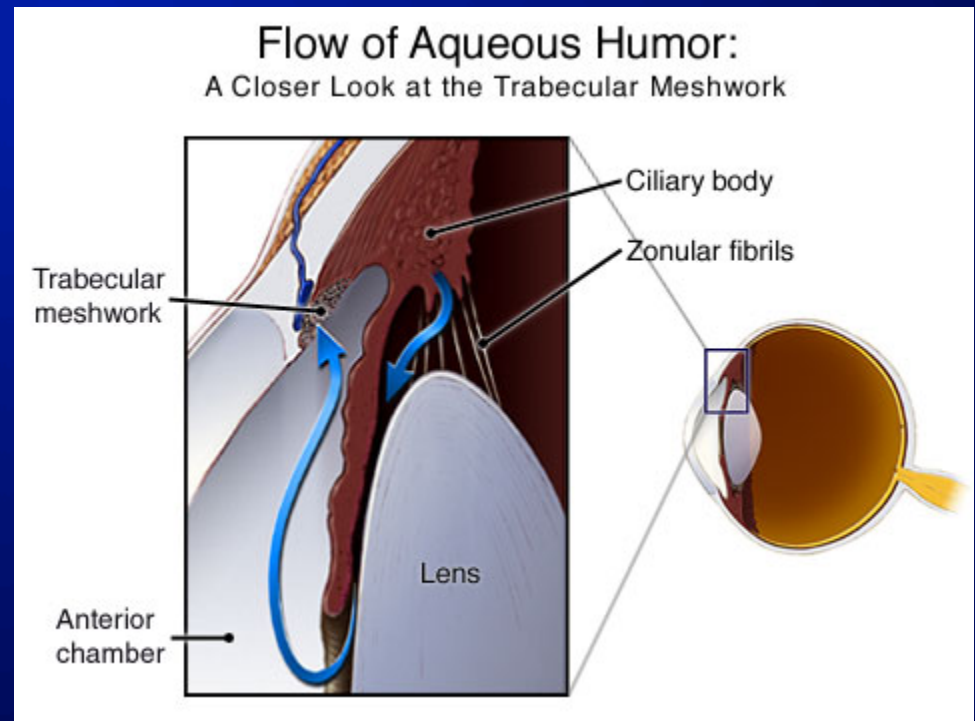
# *“Glaucoma”*

*Prof. Leopoldo Spadea*

# AQUEOUS CIRCULATION PATHWAYS ANATOMY

## Aqueous humor's Production area

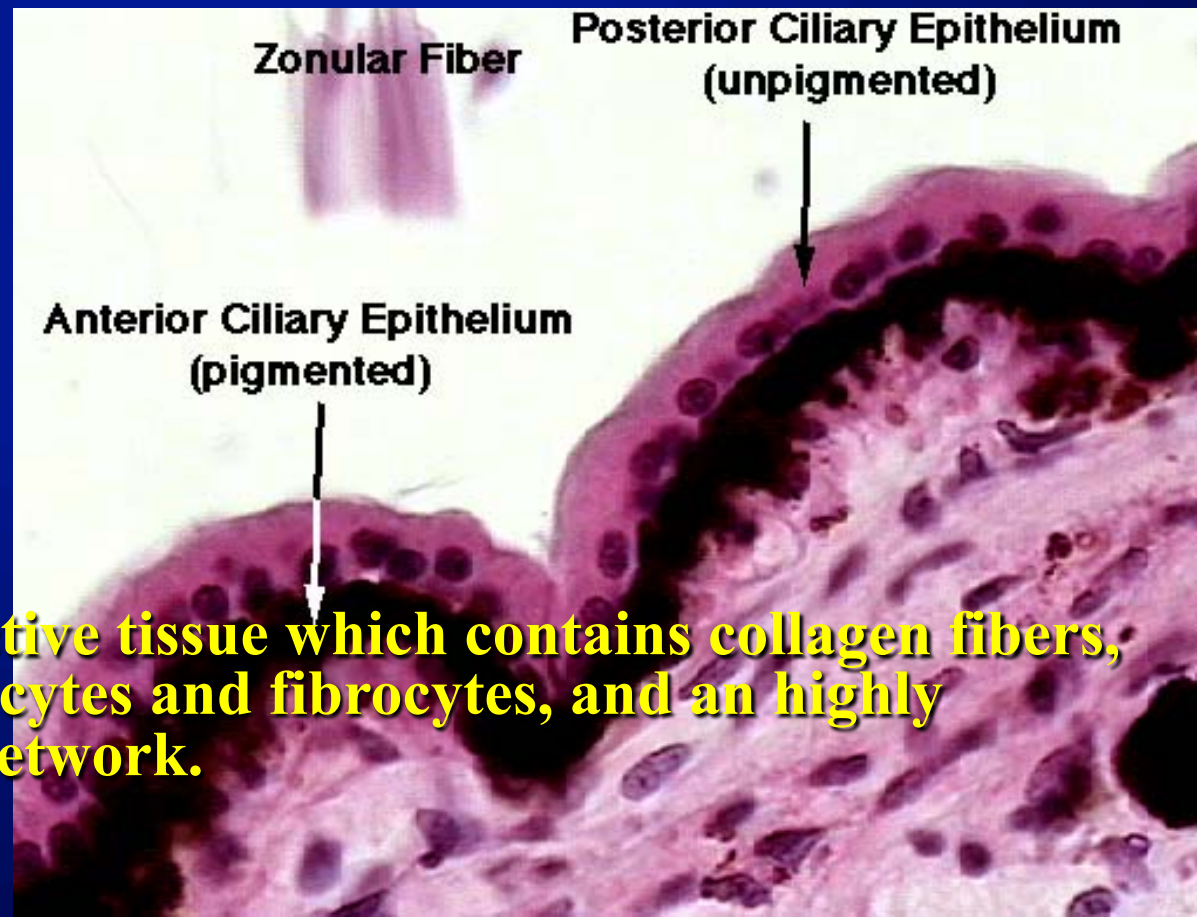
Constituted by the ciliary processes (CPs). CPs, about 70 per each eye, are combs inserted on the inner face of the ciliary body, composed by epithelium and stroma.



# Ciliary Epithelium

Internal Layer or Anterior: adjacent to the posterior chamber, constituted by clear cells, provided with junctions with adjacent cells and of many **invaginations** that enhance their surface.

External layer or posterior: adjacent to the stroma, constituted by pigmented cells.



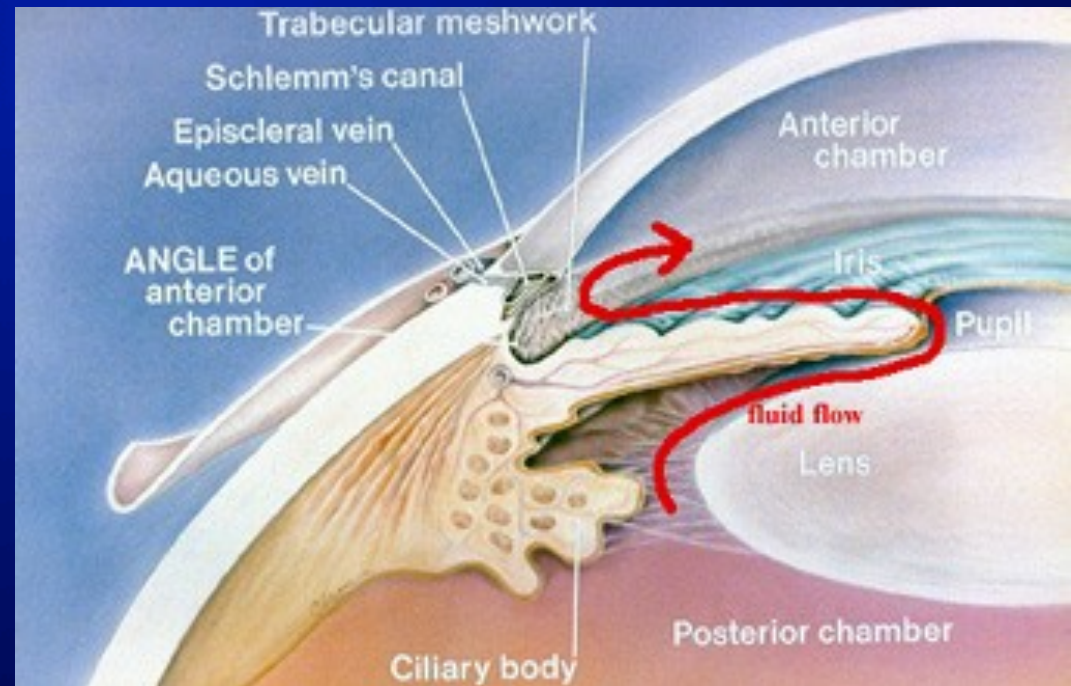
## Stroma Ciliary

Composed by connective tissue which contains collagen fibers, elastic fibers, melanocytes and fibrocytes, and an highly developed vascular network.

## Aqueous humor's discharge area

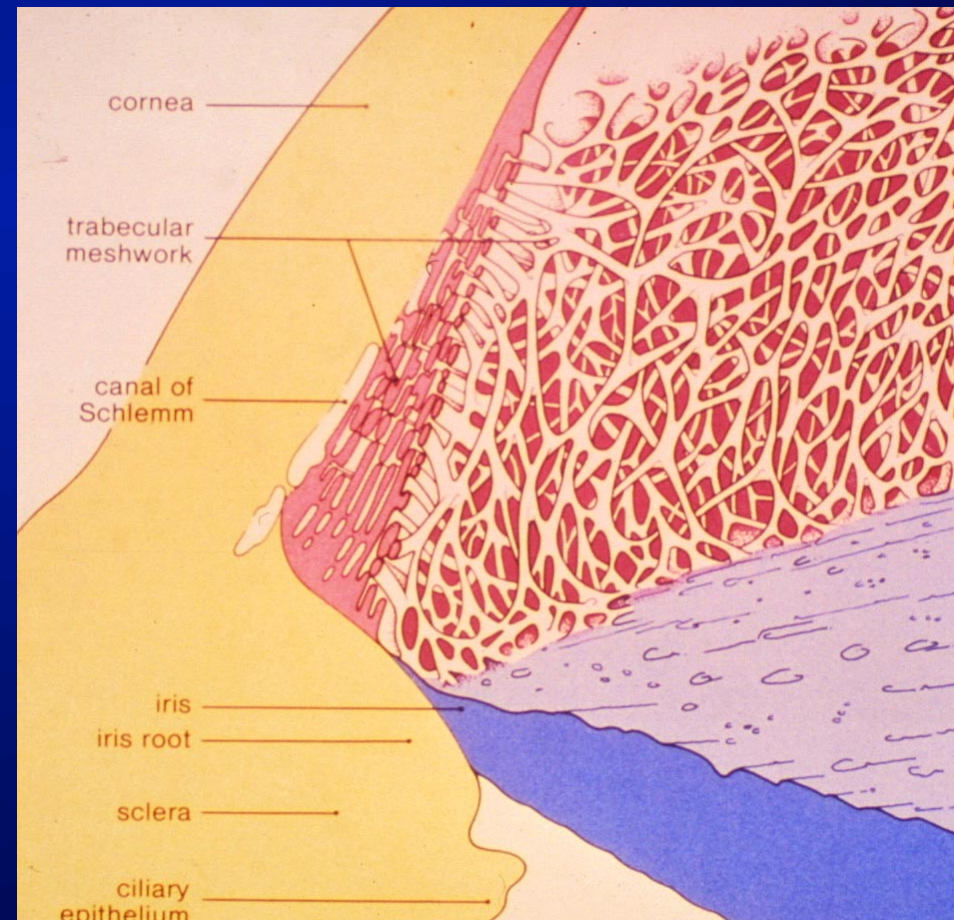
Is represented by the anterior chamber angle, peripheral part of the anterior chamber, which anterior wall is made by the Descemet's periphery and the posterior wall is made by the iris.

In the inner part of the anterior chamber angle there are the **trabecular meshwork**, the **Schlemm's canal**, the **aqueous veins**.



# Trabecular meshwork

A meshwork made of connectival lamellae, separated by empty spaces (trabecular pores). Each lamella is covered by a single layer of endothelial cells.

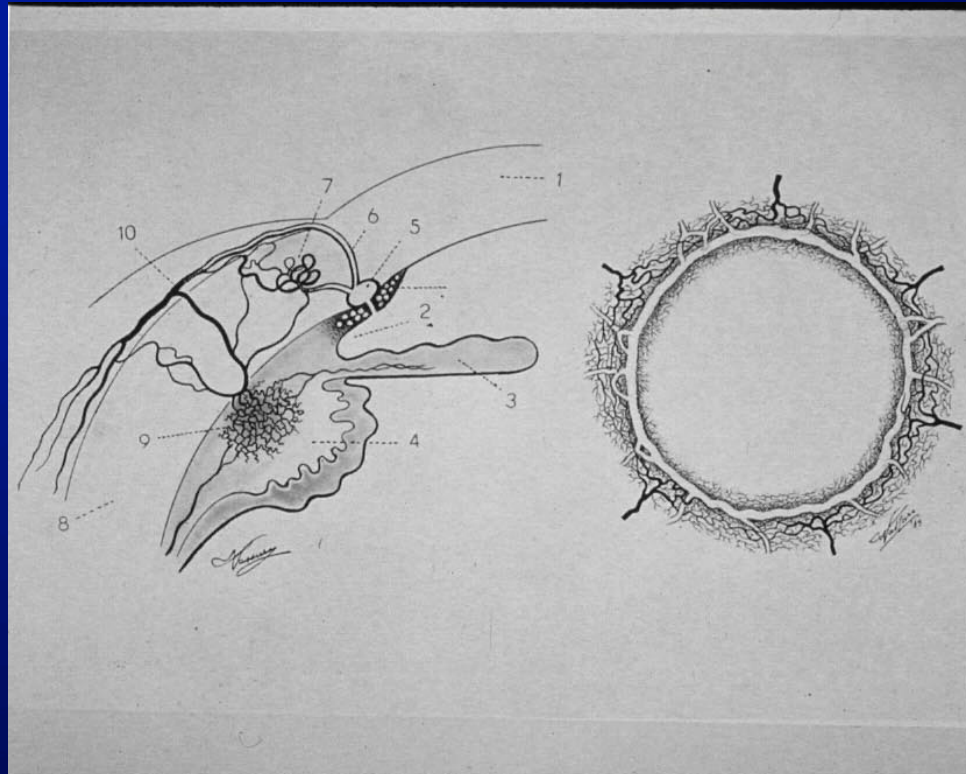


# Schlemm's Canal

Tubular structure placed around the limbus, covered by endothelial cells.

## Aqueous Veins

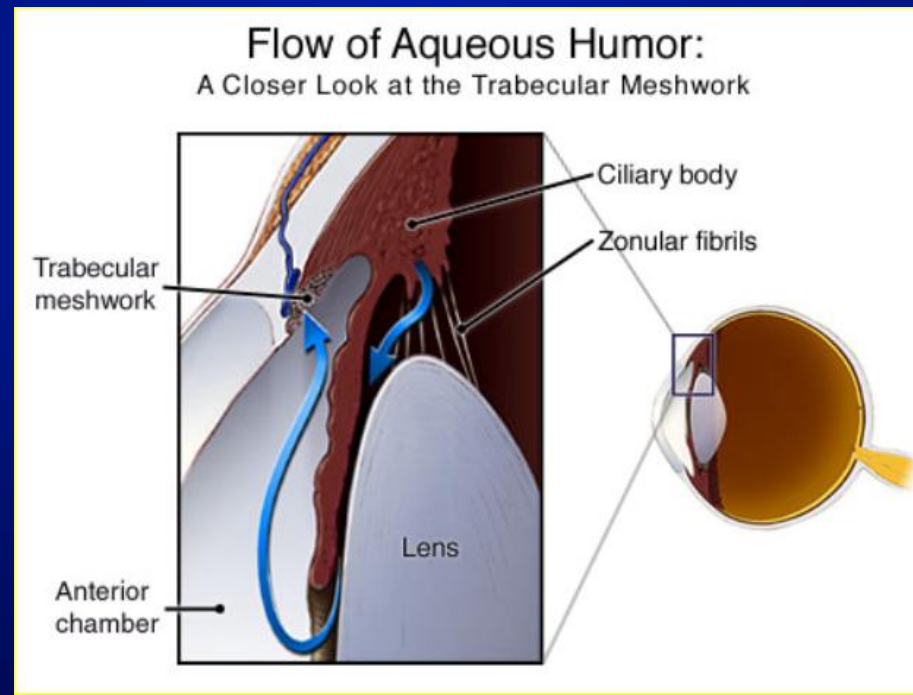
Input pathway of the aqueous into the blood stream. 30-40 canaliculi that, from the Schlemm's canal wall, go to the episcleral veins



# AQUEOUS CIRCULATION PHYSIOLOGY

## Aqueous Production

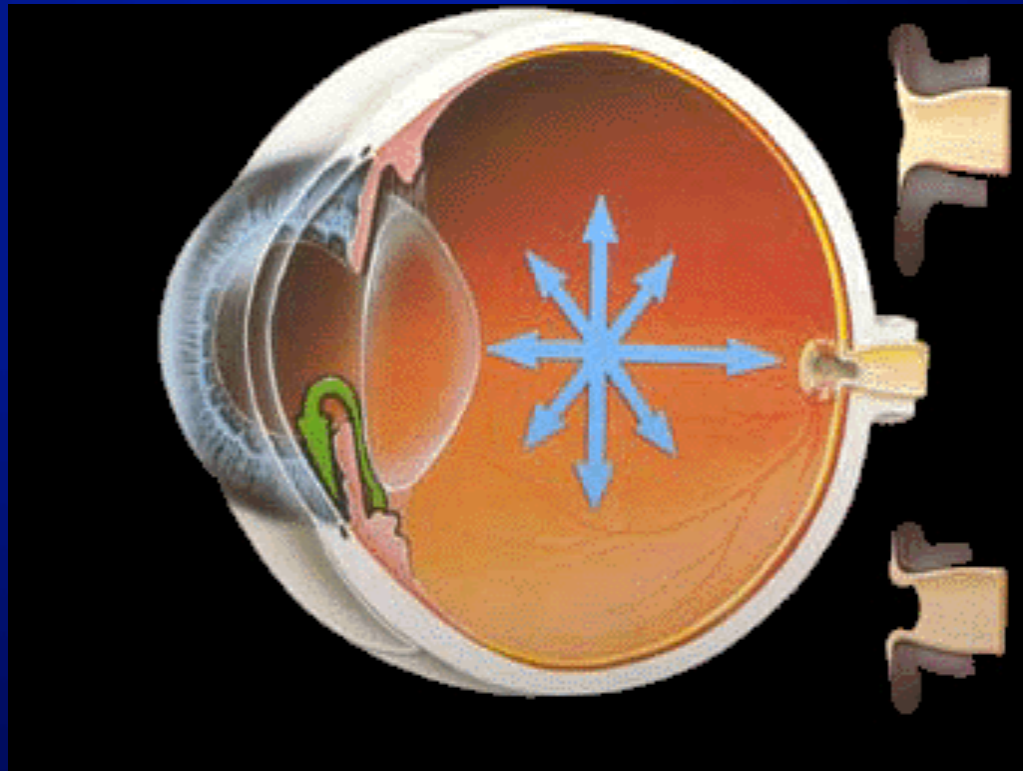
Plasma derived fluid that moves through 2 barriers, the vessel wall and the CPs's epithelial layer, to which production contribute passive mechanisms (25-30%), by diffusion and ultrafiltration, and active mechanisms (70-75%).



## **Aqueous humor characteristics**

**Physical characteristics**: transparent fluid, colorless, pH more alkaline and a higher osmotic pressure than blood's one.

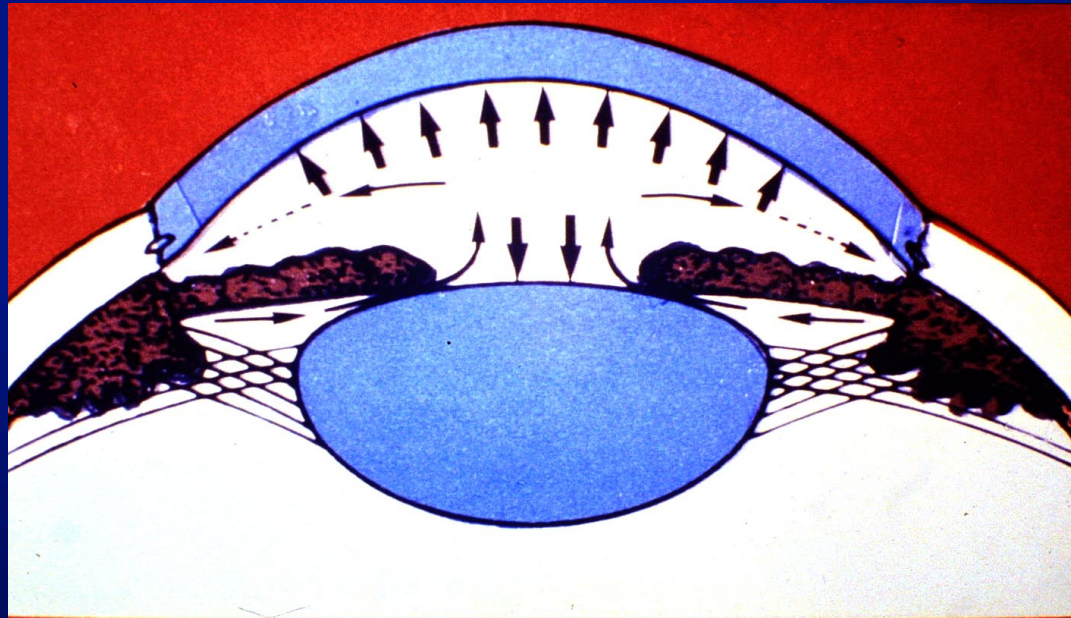
**Chemical characteristics**: compared to blood: poor in proteins, less glucose. Contains hyaluronic acid.





## Aqueous flow and discharge

After being produced by CPs's epithelium, goes into the posterior chamber, through the space between the iris and the lens (pupil), passes into the anterior chamber , undergoes movements inside the anterior chamber and then reaches the angle. Goes through the trabecular meshwork, reaches the canal of Schlemm and then leaves it through the aqueous veins and finally reaches the venous circulation (episcleral veins).



# Intraocular Pressure (IOP)

Very important to maintain the correct position of refractive structures indispensable for vision.

## Goldman Equation:

$$P_{oc} = (F \times R) + P_v$$

Mean normal **IOP** is  $15 \pm 6$  mmHg, is higher in the newborns and undergoes physiological variations:

- **Systolic variation:** little elevation with each systole; poor periodicity;
- **Nychthemeral variation:** nychthemeral variations (3-4 mmHg) with maximum peaks in the morning.

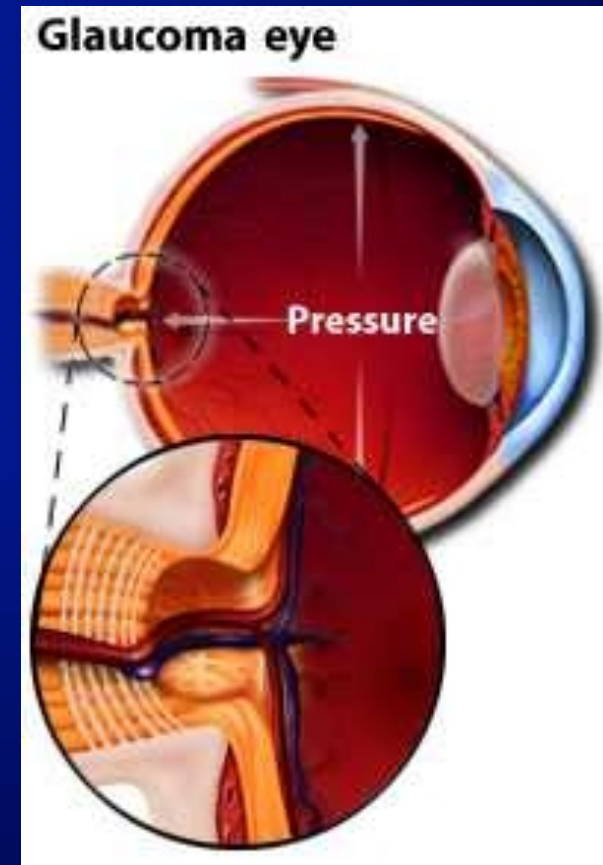
# GLAUCOMA

**Disease caused by alterations in the aqueous circulation, with**

**1)IOP values higher than normal**

**2)degenerative phenomena into the optic disc**

**3)perimetric visual field loss**

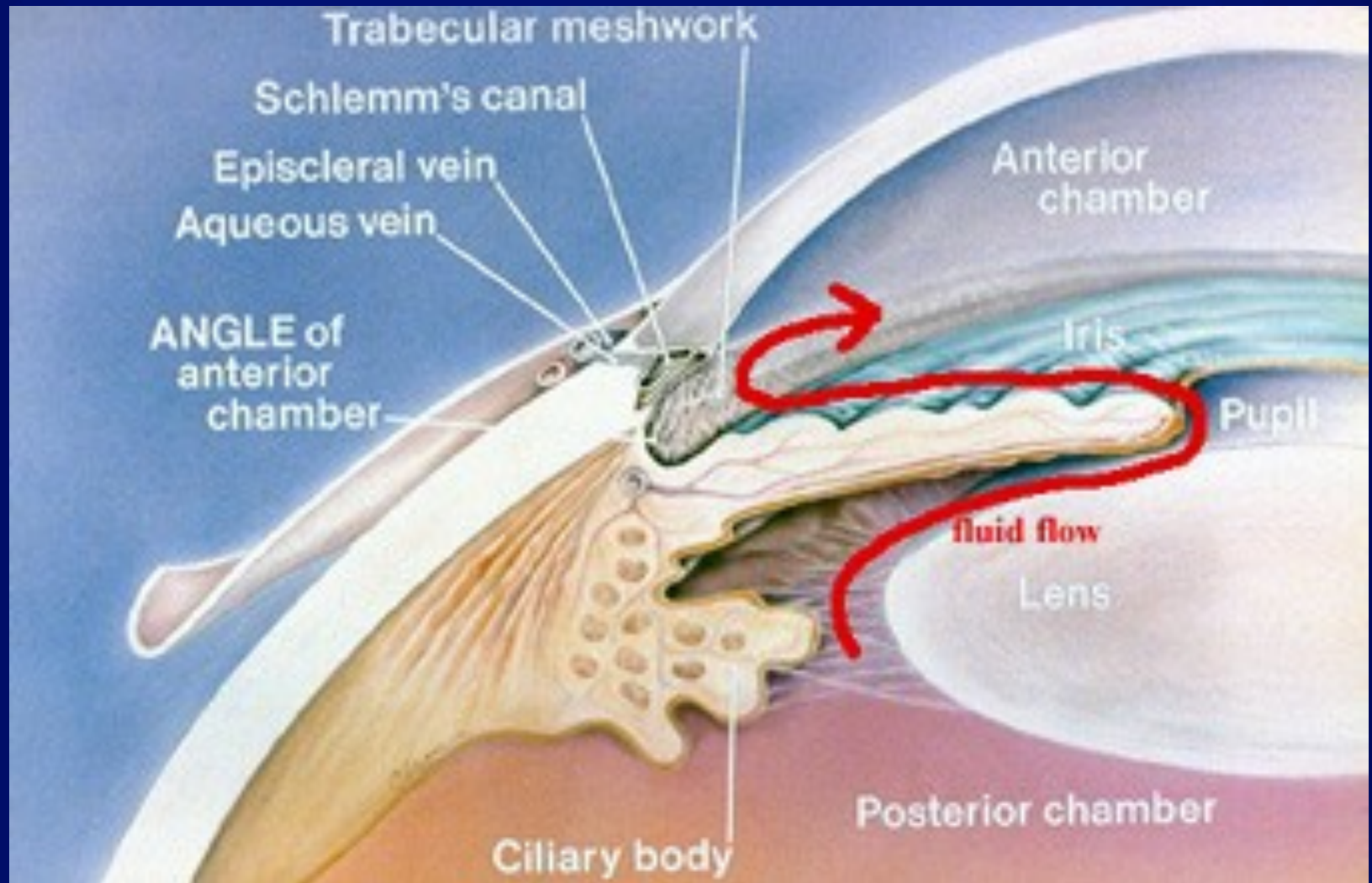


# Classification

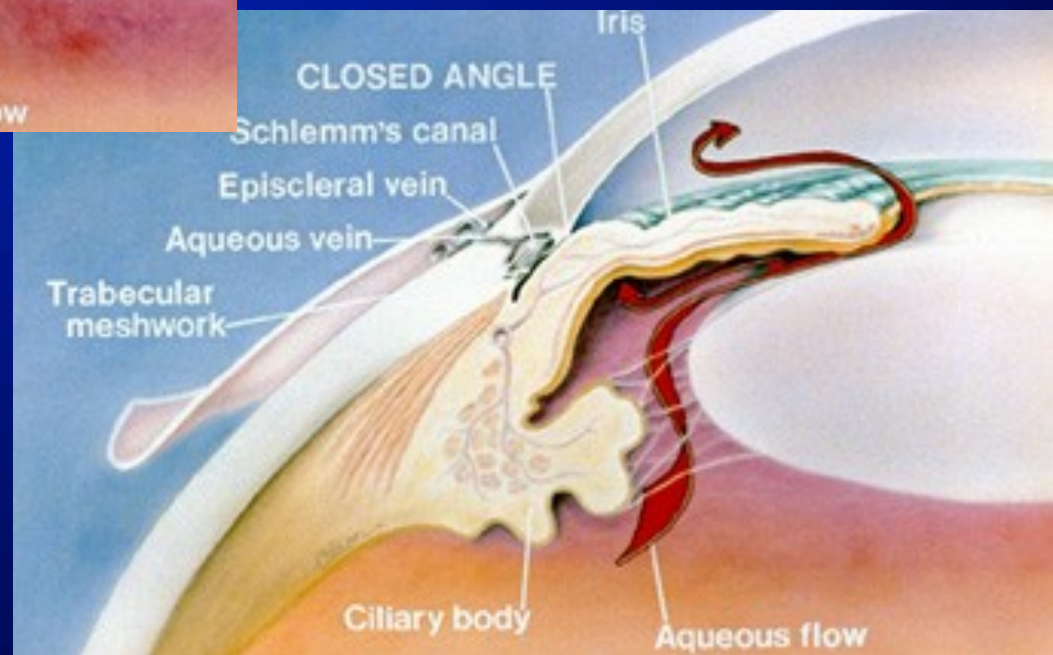
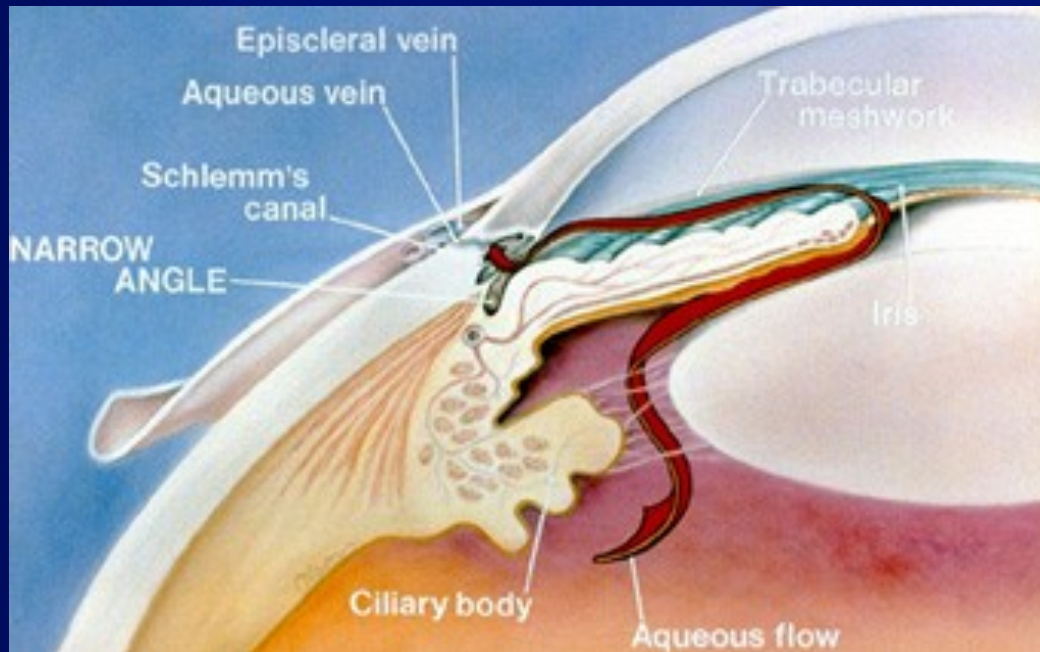
**Primary Glaucoma : 1)PAOG** (primary open angle glaucoma)  
2) closed angle glaucoma

**Secondary Glaucoma : open angle,  
closed angle**

# Open angle Glaucoma



# Narrow and Closed angle Glaucoma



# GLAUCOMA

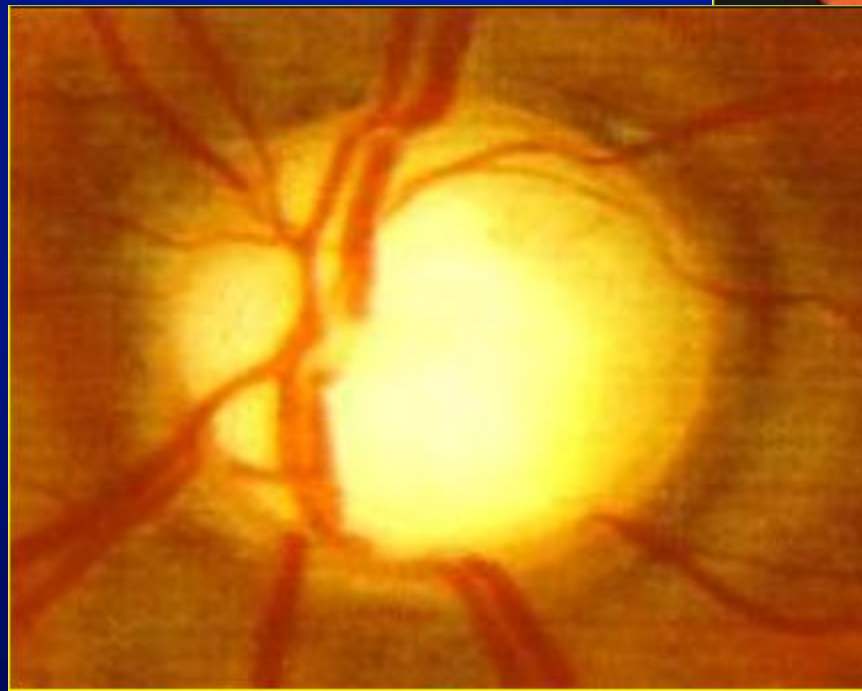
## Ocular Hypertension



# GLAUCOMA

## Degeneration of the optic nerve

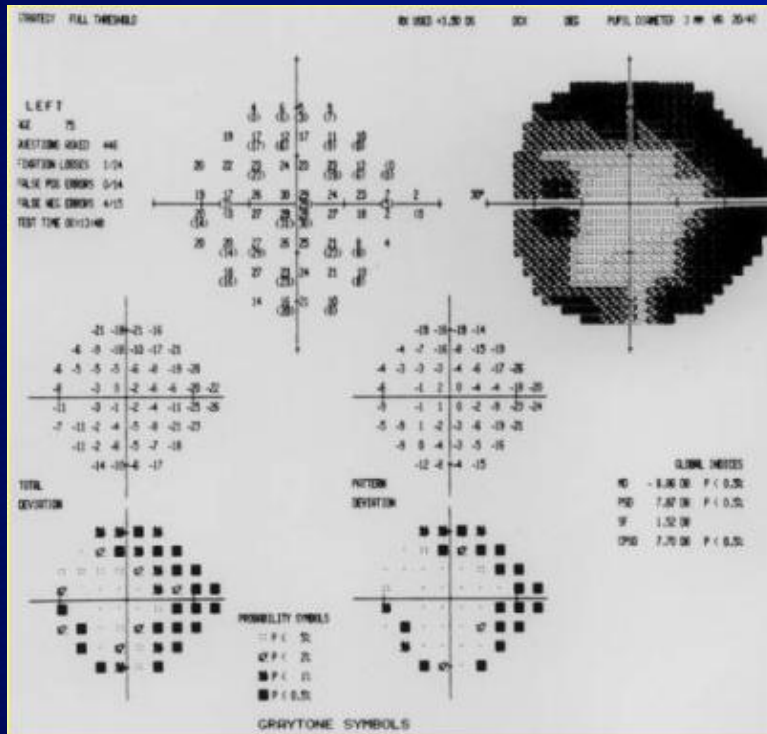
Increase of the excavation  
neural rim decrease,  
pallor





# GLAUCOMA

## Visual field loss



# Primary Open Angle Glaucoma

**POAG represents more than a half of the cases of glaucoma. It is a disease of the adult age, constantly bilateral, hereditarily transmitted.**

**It is caused by a progressive obstruction to the aqueous outflow, because of a reduction of the trabecular meshwork function, resulting in the increase of the IOP, optic disc alterations and visual field loss.**

# Primary Open Angle Glaucoma

## Subjective Symptoms:

poor and not defined or absent

## Objective Symptoms:

increased IOP, optic disc excavation and pallor,  
visual field loss

## Evolution

very slow

## Prognosis

bad for visual function (blindness).

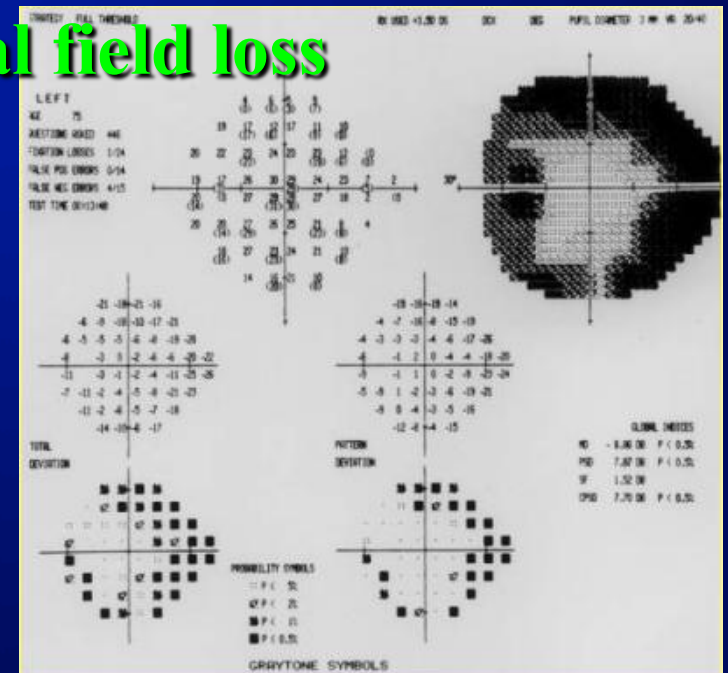
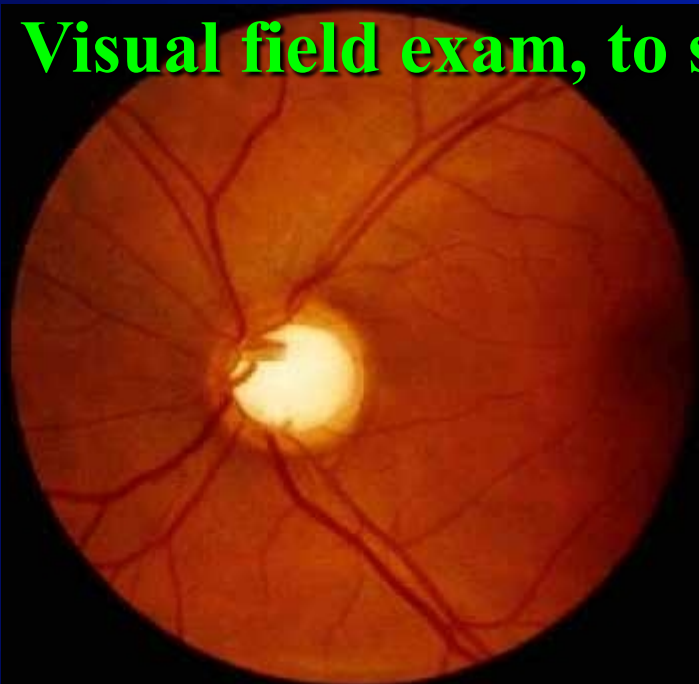
# Diagnosis

Tonometry, IOP must not be greater than 20-21 mmHg

Gonioscopy, with Goldman lens, for the angle evaluation

Optic disc exam, which shows excavation, pallor and neuroretinal rim

Visual field exam, to show visual field loss



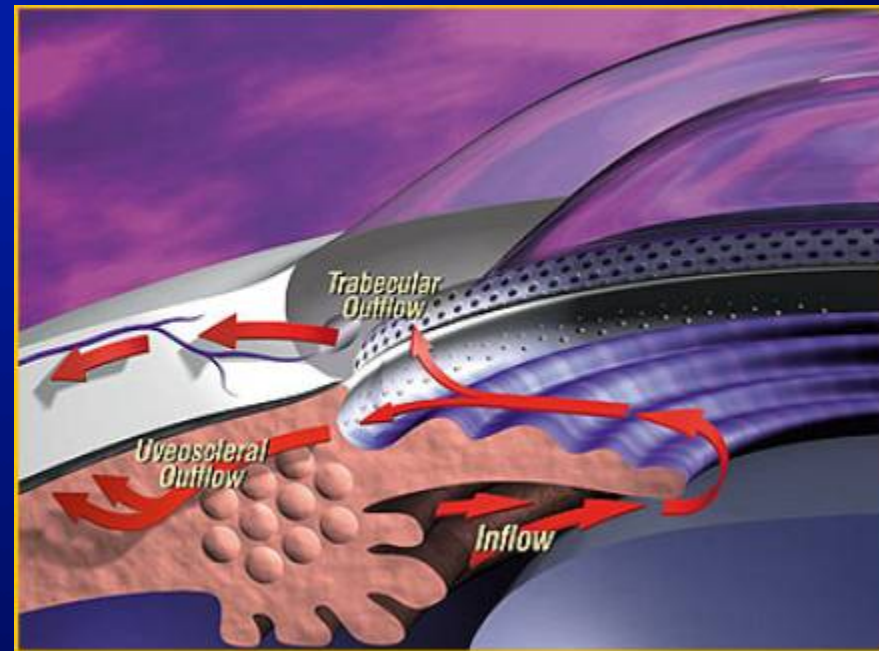
# GLAUCOMA

## Therapy

**Aim: to stabilize and prevent the progression of the perimetric defect, reducing IOP.**

### Pharmacological therapy

- beta-blockers,
- adrenergic agonists (alpha),
- cholinergic agonists,
- carbonic anhydrase inhibitors,
- prostaglandin analogues



# GLAUCOMA

**Laser Therapy** (in pharmacological therapy non-responders eyes)

Trabeculoplasty (thermal burns in the trabecular meshwork), increases the aqueous outflow, causing in a contraction of the trabecular meshwork and a biological response of its cells.

**Surgical Therapy** (in eyes not responders to previously exposed therapies)

Trabeculectomy, removal of a portion of the trabecular meshwork.