

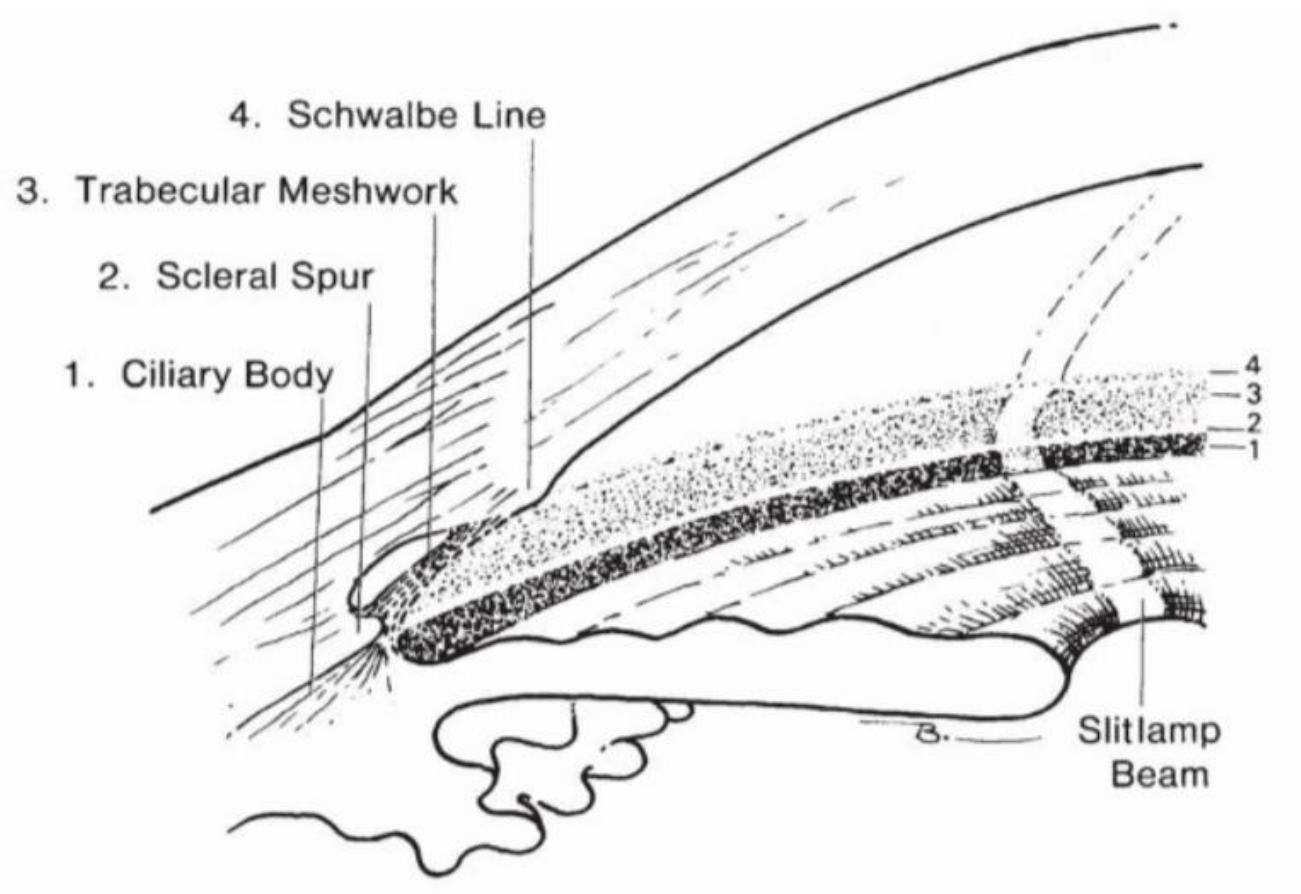
ANATOMY OF ANGLE OF ANTERIOR CHAMBER AND PHYSIOLOGY OF IOP MAINTENANCE

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Anterior Chamber Angle

- Structures forming angle recess
(from posterior to anterior)

- ❖ Ciliary Band
- ❖ Scleral Spur
- ❖ Trabecular meshwork
- ❖ Schwalbe's line



Ciliary Band

- Represents the anterior face of ciliary body including insertion of ciliary muscle into scleral spur.
- Most posterior landmark of the angle.
- Width depends on the level of iris insertion.
- Wide in myopes and narrow in hypermetropes
- It appears as a grey /dark brown band

Scleral Spur

- Wedge shaped circular ridge.
- Pale, translucent narrow strip of scleral tissue.
- Marks the posterior boundary of corneo-scleral meshwork.

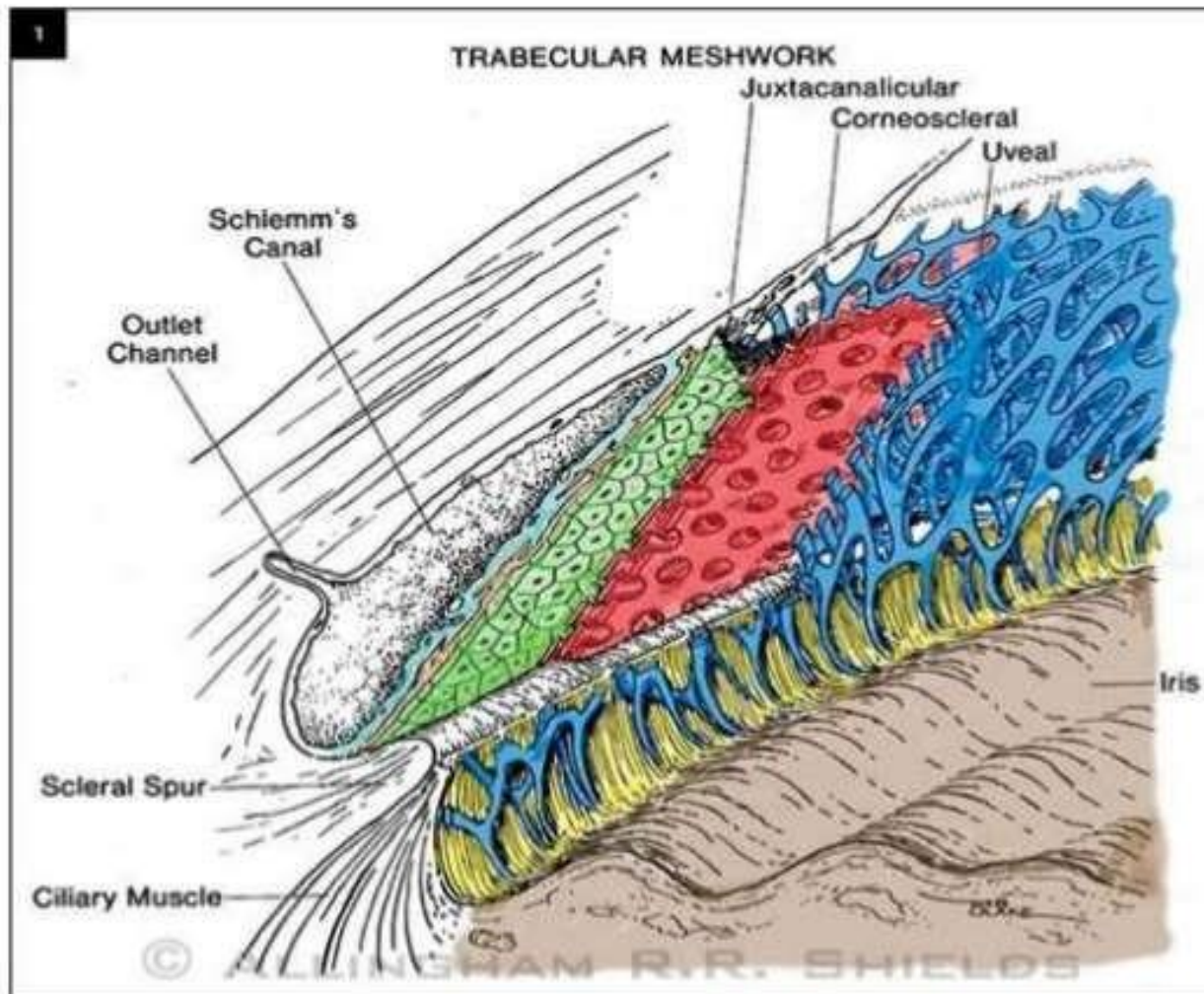
Trabecular Meshwork

- Broad band of tissue extending from Scleral Spur to Schwalbe's Line
- Color varies from faint tan to dark brown
- It is a sieve-like structure through which aqueous humour leaves the eye
- It consists of three portions
 - a) Uveal meshwork
 - b) Corneoscleral meshwork
 - c) Juxtacanalicular meshwork

Schwalbe's Line

- Anterior limit of the drainage angle
- Seen as fine scalloped border at the termination of Descemet's Membrane of cornea.
- Width:- 50-150 μm
- Clusters of secretory cells ,called schwalbe's line cells, produce a phospholipid material that facilitates aqueous humor flow through the canalicular system.

Trabecular meshwork



- Anterior chamber angle can be visualised clearly using gonioscope
- Based on the gonioscopic visualisation of anterior chamber angle structures, anterior chamber angle width can be graded
- There are various grading systems and most commonly used is Shaffer's system of grading.

SHAFFER'S SYSTEM OF GRADING

ANGLE WIDTH

GRADE	ANGLE WIDTH (in degrees)	CONFIGURATION	RISK OF CLOSURE	STRUCTURES VISIBLE ON GONIOSCOPY
4	40°	WIDE OPEN	CLOSURE IMPOSSIBLE	SL, TM, SS, CBB
3	30°	OPEN ANGLE	CLOSURE IMPOSSIBLE	SL, TM, SS
2	20°	MODERATELY NARROW	CLOSURE POSSIBLE	SL, TM
1	10°	VERY NARROW	HIGH RISK OF CLOSURE	SL ONLY
0	0°	CLOSED	CLOSED	NONE OF THE ANGLE STRUCTURES VISIBLE

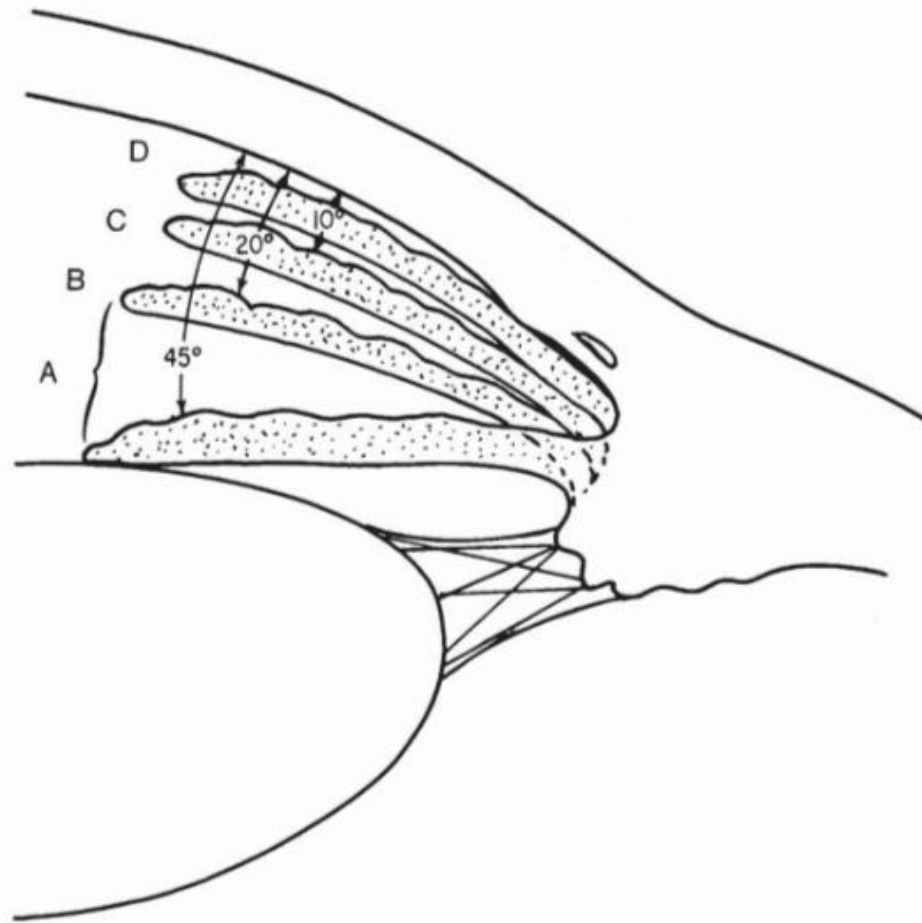


Figure 12.7 The Shaffer gonioscopic classification of the anterior chamber angle is based on the angular width of the angle recess (1). The angular width and clinical interpretation are given for each of the examples. A: Wide open (20 to 45 degrees); closure improbable. B: Moderately narrow (10 to 20 degrees); closure possible. C: Extremely narrow: closure possible. D: Partially or totally closed: closure present.

Aqueous outflow system

- It includes:-
 - a) The trabecular meshwork
 - b) Schlemm's canal
 - c) Collector channels
 - d) Aqueous veins and the episcleral veins

Trabecular meshwork

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graph LR; A[Trabecular meshwork] --- B[Uveal meshwork]; A --- C[Corneoscleral meshwork]; A --- D[Juxtacanalicular meshwork]
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Uveal meshwork

Corneoscleral
meshwork

Juxtacanalicular
meshwork

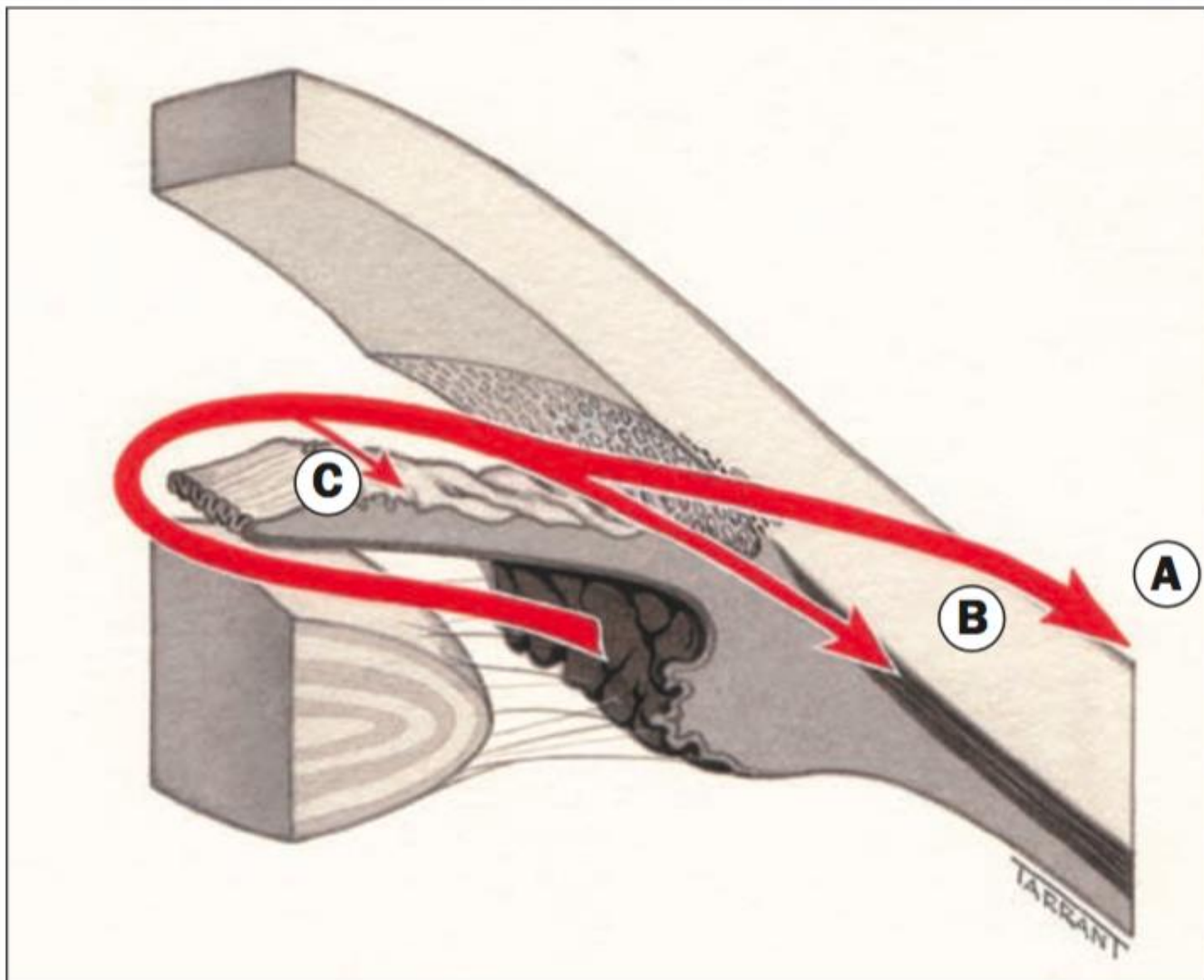
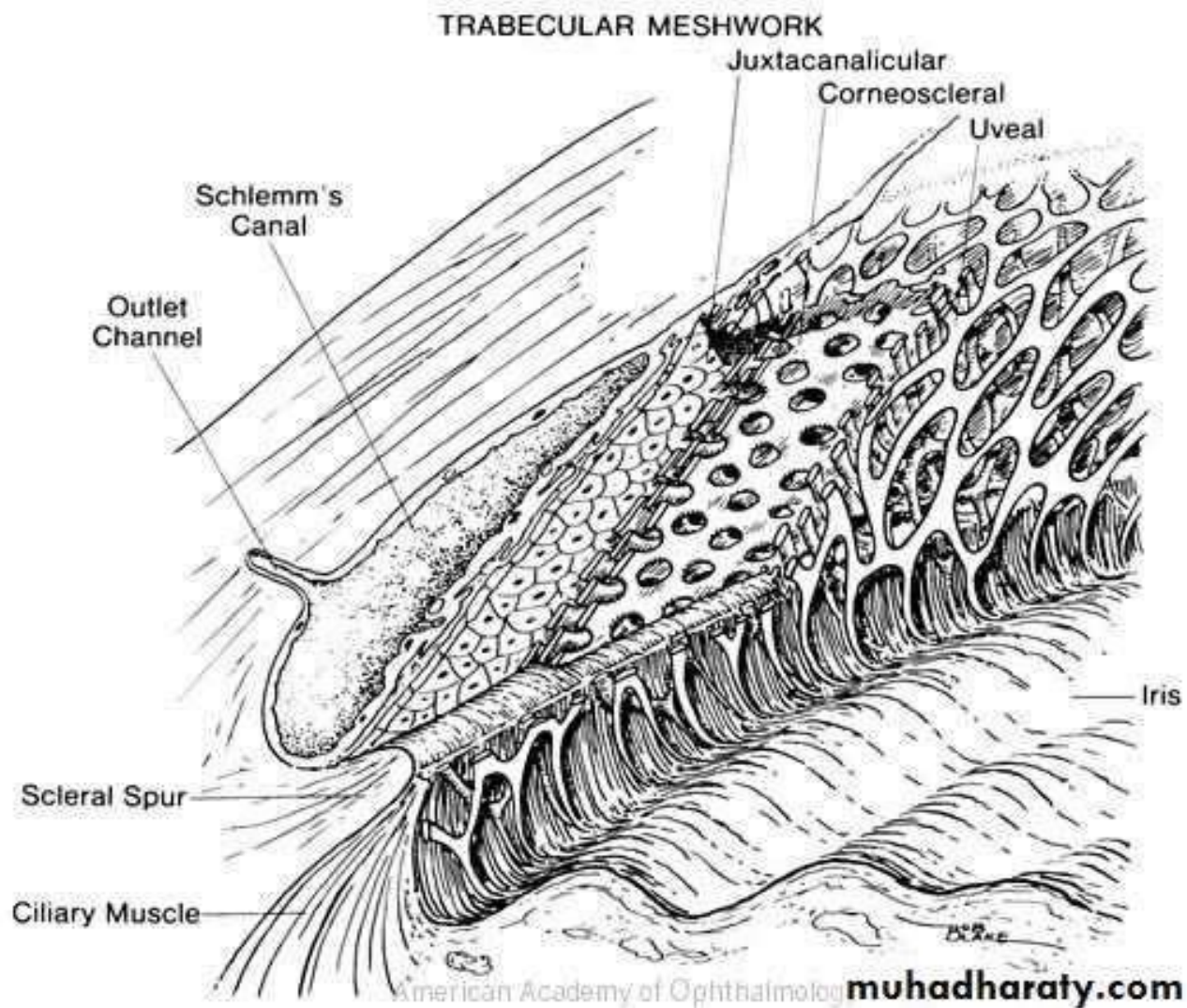


Fig. 10.3 Routes of aqueous outflow: A, trabecular; B, uveoscleral; C, iris



Uveal meshwork

- The uveal meshwork is the innermost portion, consisting of cord-like endothelial cell-covered strands arising from the iris and ciliary body stroma.
- The intertrabecular spaces are relatively large and offer little resistance to the passage of aqueous.

Corneoscleral meshwork

- It lies external to the uveal meshwork to form the thickest portion of the trabeculum.
- It is composed of layers of connective tissue strands with overlying endothelial-like cells.
- The intertrabecular spaces are smaller than those of the uveal meshwork, conferring greater resistance to flow.

Juxtacanalicular meshwork

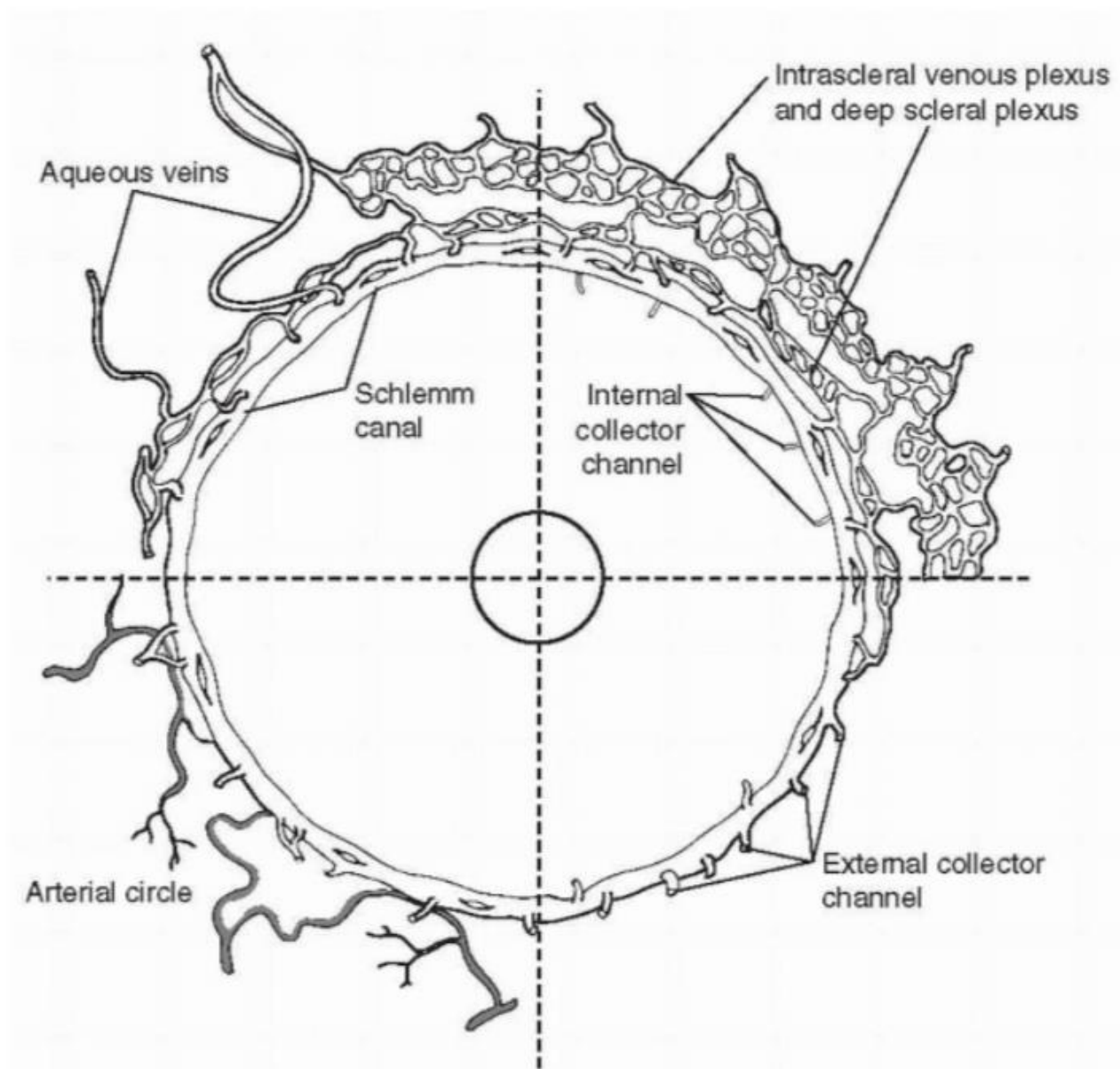
- It is the outer part of the trabeculum, and links the corneoscleral meshwork with the endothelium of the inner wall of the canal of Schlemm.
- It consists of cells embedded in a dense extracellular matrix with narrow intercellular spaces.
- Offers the major proportion of normal resistance to aqueous outflow.

Schlemm's canal

- It is a circumferential channel within the perilimbal sclera.
- The inner wall is lined by irregular spindle-shaped endothelial cells containing infoldings (giant vacuoles) that are thought to convey aqueous via the formation of transcellular pores.
- The outer wall is lined by smooth cells and contains the openings of collector channels, which leave the canal at oblique angles and connect directly or indirectly with episcleral veins.
- Septa commonly divide the lumen into 2–4 channels.

Collector channels

- These, also called intrascleral aqueous vessels, are about 25-35 in number and leave the Schlemm's canal at oblique angles to terminate into episcleral veins in a laminated fashion.
- These intrascleral aqueous vessels can be divided into two systems.
 - The larger vessels (aqueous veins) run a short intrascleral course and terminate directly into episcleral veins (direct system).
 - Many smaller collector channels form an intrascleral plexus before eventually going into episcleral veins (indirect system).



AQUEOUS HUMOUR DRAINAGE

POSTERIOR CHAMBER

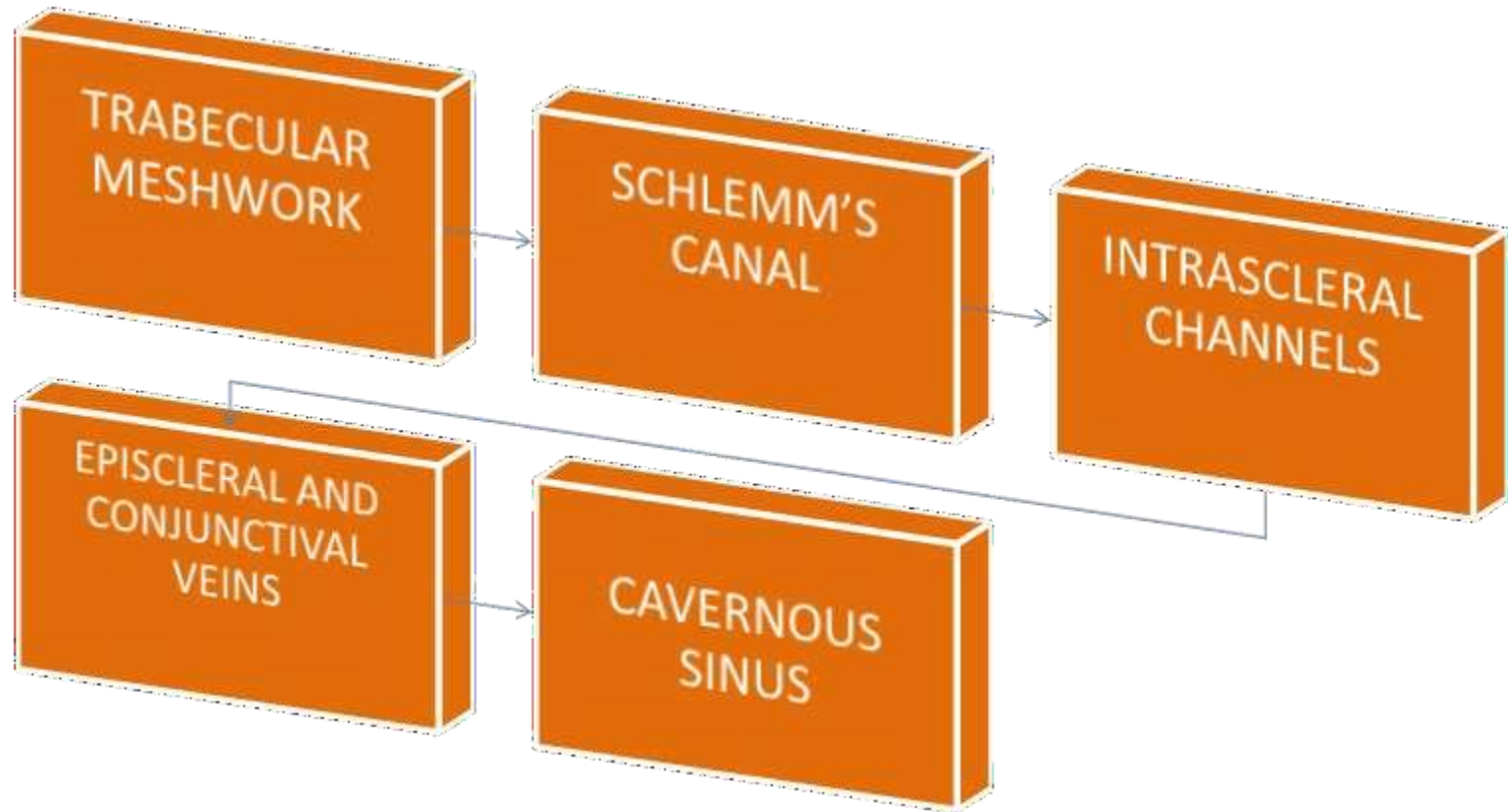


ANTERIOR CHAMBER

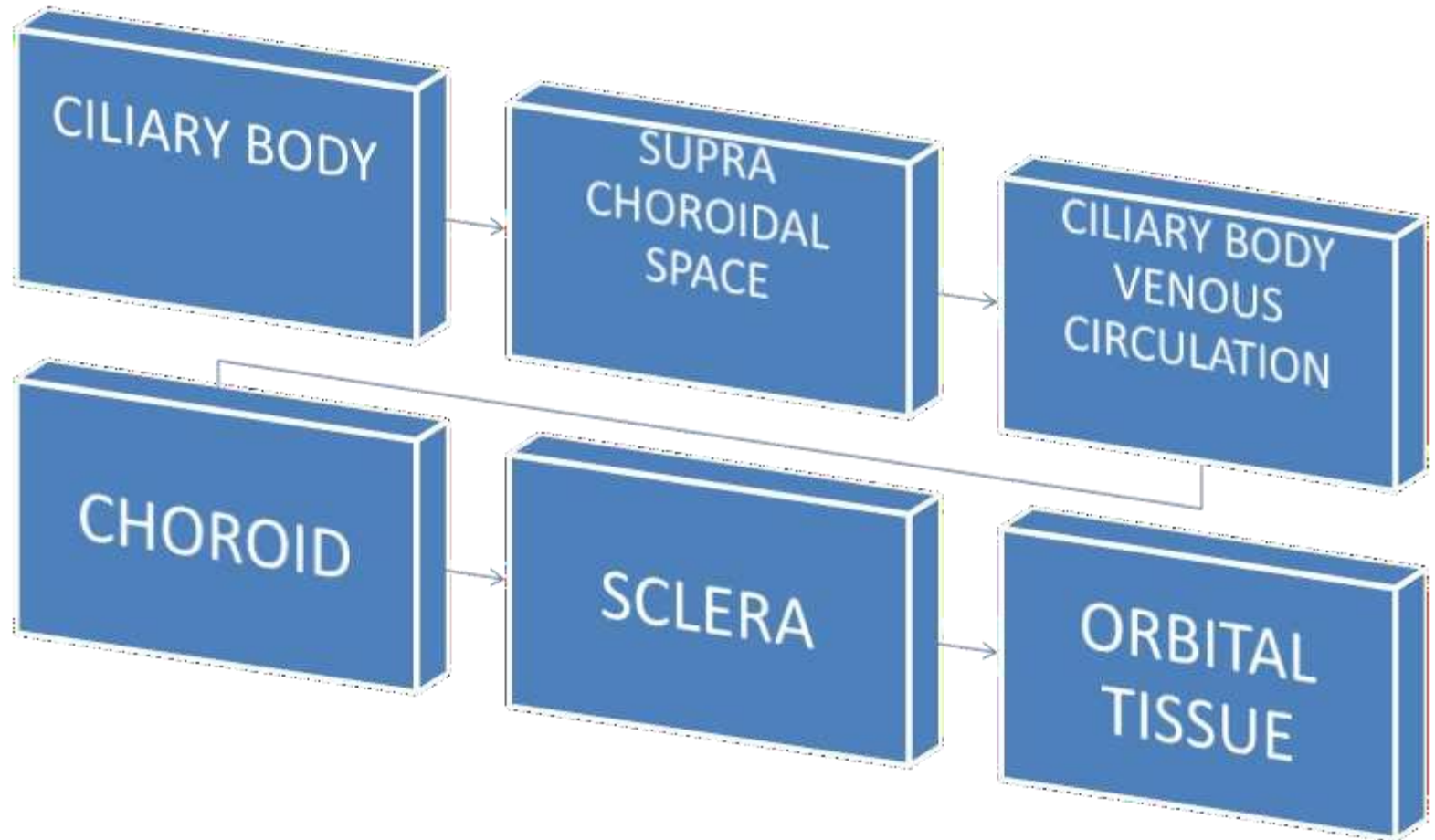
TRABECULAR OUTFLOW
(Conventional)

VEOSCLERAL
OUTFLOW
(Uncoventional)

TRABECULAR OUTFLOW (70-80%)

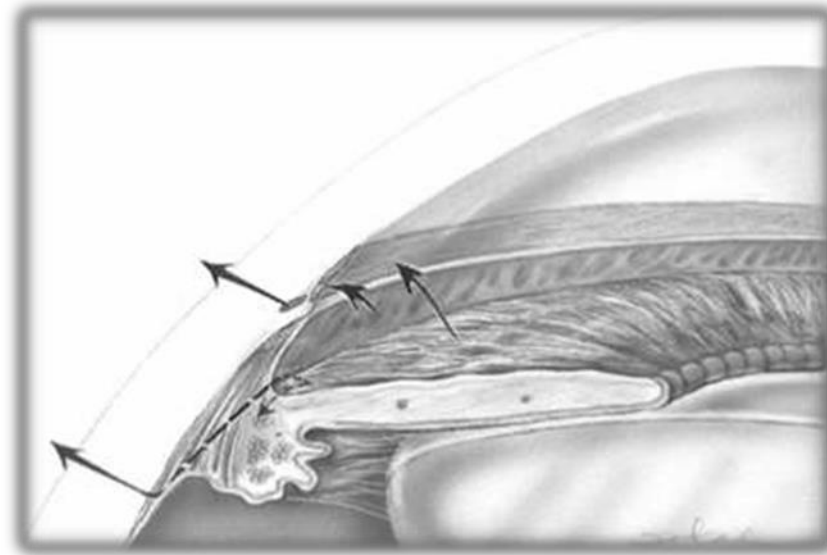


UVEOSCLERAL OUTFLOW (10-20%)



PHYSIOLOGY OF DRAINAGE OF AQUEOUS HUMOUR

- Exits the eye at anterior chamber angle via two pathways:
 - Conventional Trabecular Pathway
 - Unconventional Uveo-scleral Pathway



- IOP is determined primarily by the resistance to aqueous humor outflow.
- Factors influencing IOP may be extrinsic or intrinsic to the aqueous humor outflow pathways.
- Extrinsic factors include IOP and ciliary muscle contraction.
- Intrinsic factors include both the direct activity of trabecular meshwork cells and the indirect effects of cellular activity, such as in maintaining the ECM of both the trabecular meshwork and the ciliary body, which then provides resistance to outflow.

I. CONVENTIONAL TRABECULAR PATHWAY

- About 75 to 90% of aqueous is drained via this route into episcleral veins.
- This is a bulk flow pressure-sensitive route so that increase in IOP will increase outflow.

II. UNCONVENTIONAL UVEOSCLERAL OUTFLOW

- Approximately 10 to 25% of total aqueous drained via this pathway.
- The main resistance to uveoscleral flow is by tone of the ciliary muscle.
- Factors like Pilocarpine that contracts ciliary muscle lower the uveoscleral outflow.
- Whereas, the factors such as atropine that relax ciliary muscle raise the uveoscleral flow.

CILIARY MUSCLE TONE

- Contraction of the ciliary muscle influences aqueous humor outflow through conformation effects on the trabecular meshwork.
- Pharmacological cycloplegia may reverse this effect, increasing aqueous humor resistance within the conventional outflow pathway and increasing IOP.
- Pharmacological manipulation of ciliary muscle contraction has the opposite effect on uveoscleral outflow.
- Contraction of the ciliary muscle through the use of cholinergic agonists diminishes uveoscleral outflow whereas cycloplegia improves outflow through this pathway.

EXTRACELLULAR MATRIX

- The ECM appears to play a role in modifying aqueous humor outflow through the unconventional pathway.
- Proteoglycans in ECM, with its large and numerous negatively charged glycosaminoglycan side- chains, are thus a likely source of at least a portion of the outflow resistance.

TRANSPORT THROUGH THE JUXTACANALICULAR MESHWORK

- Major site of aqueous humor outflow resistance.
- The presence of pores and giant vacuoles within the endothelial cells of the inner wall of Schlemm's canal represent a transcellular pathway of fluid movement which offer resistance to outflow.
- It is an active metabolic process.

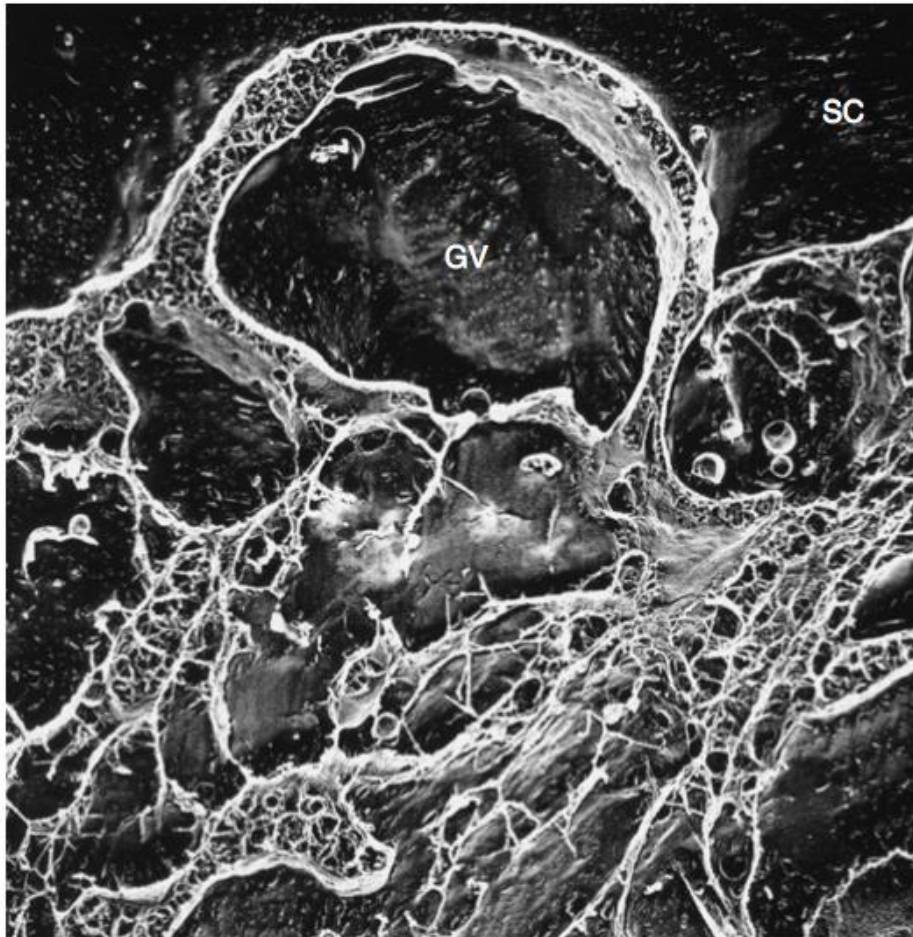


FIGURE 4-4 Electron micrograph of juxtacanalicular meshwork, viewed after quick-freeze, deep-etch preparation, which avoids standard histologic dehydration. Note giant vacuole (GV) projecting into Schlemm's canal (SC). Cellular and intercellular tissues that may contribute to aqueous outflow resistance are better preserved with this type of preparation. (Courtesy of H. Gong, M.D., Ph.D., and T. Freddo, O.D., Ph.D.)

Drugs Affecting Outflow and Production of Aqueous humour

Uveoscleral outflow

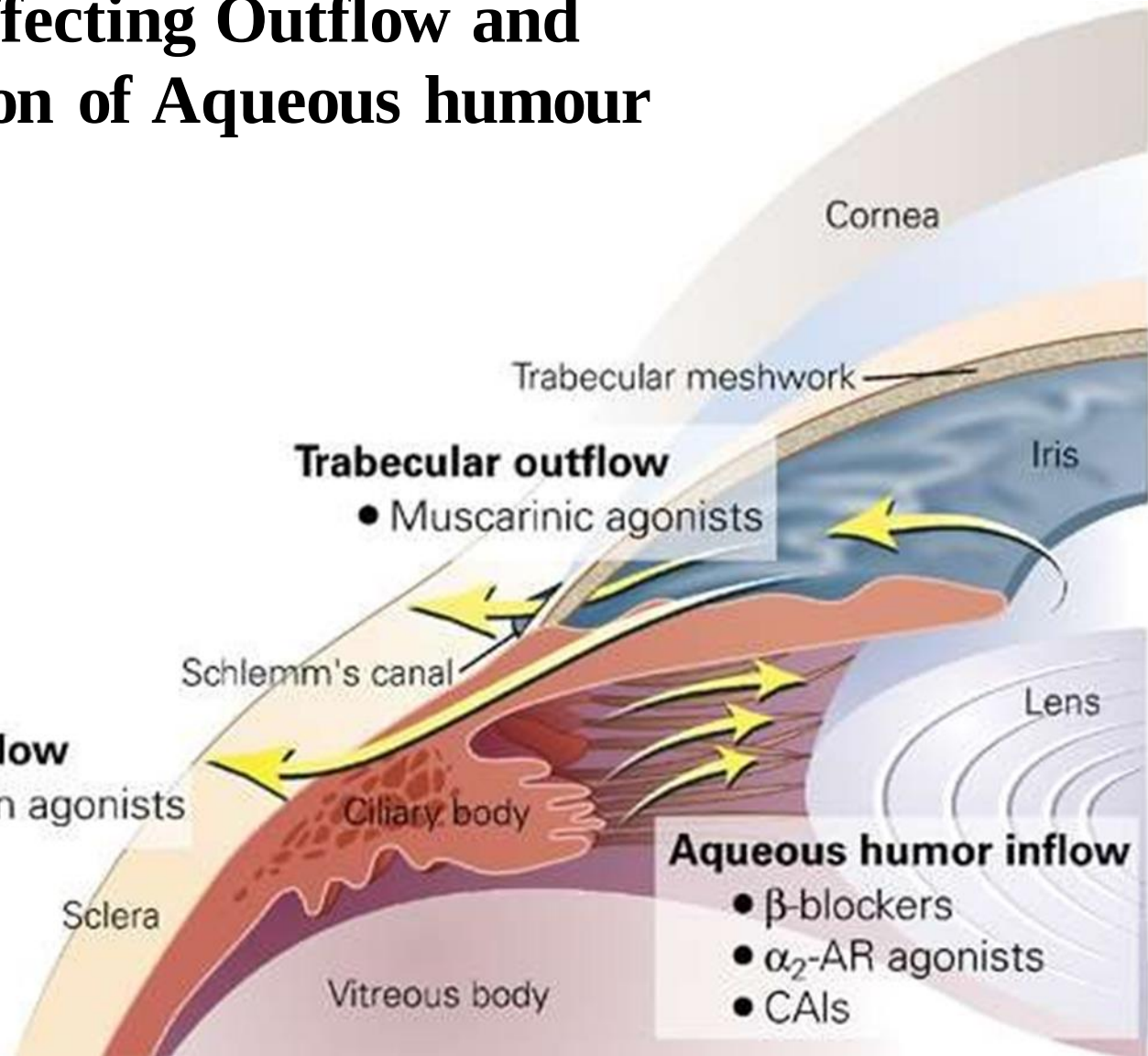
- Prostaglandin agonists

Trabecular outflow

- Muscarinic agonists

Aqueous humor inflow

- β -blockers
- α_2 -AR agonists
- CAls



THANK YOU