Eye

四川大学组织学与胚胎学教研室

general compositions

tunica fibrosa

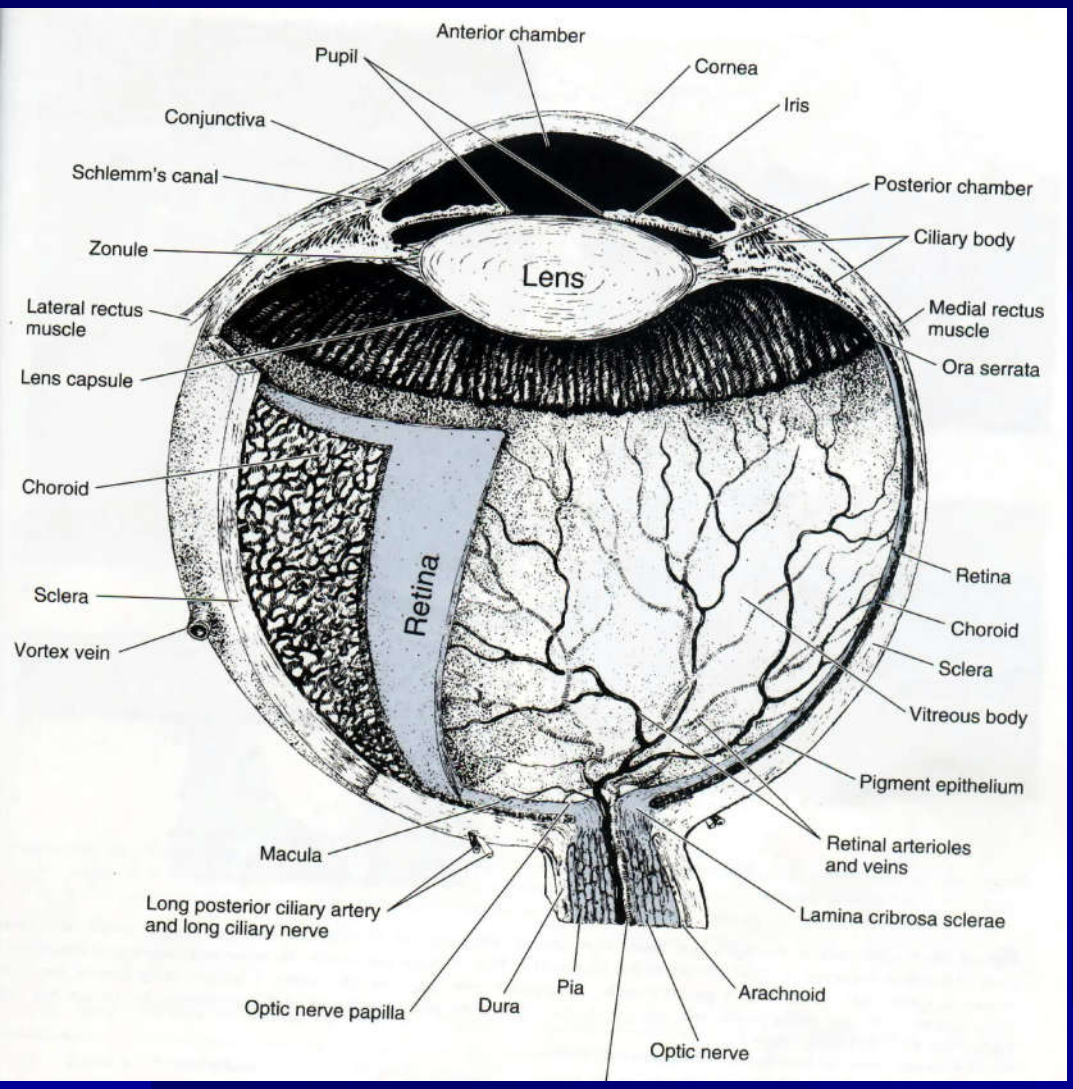
vascular layer

retina*

refracting media

I. General composition

eyeball
- outer tunics
- Enclosed composition （refracting media）



tunica fibrosa

sclera

iris

ciliary body

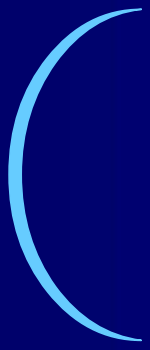
choroid

retina

Coats of eye: three layers

- **tunica fibrosa (DCT)**
  - cornea — anterior 1/6
  - sclera — posterior 5/6
- **vascular layer**
  - iris (LCT with blood v & pigment cells)
  - ciliary body
  - choroid
- **retina** (photosensitive)

Enclosed composition



lens

vitreous body

aqueous humor

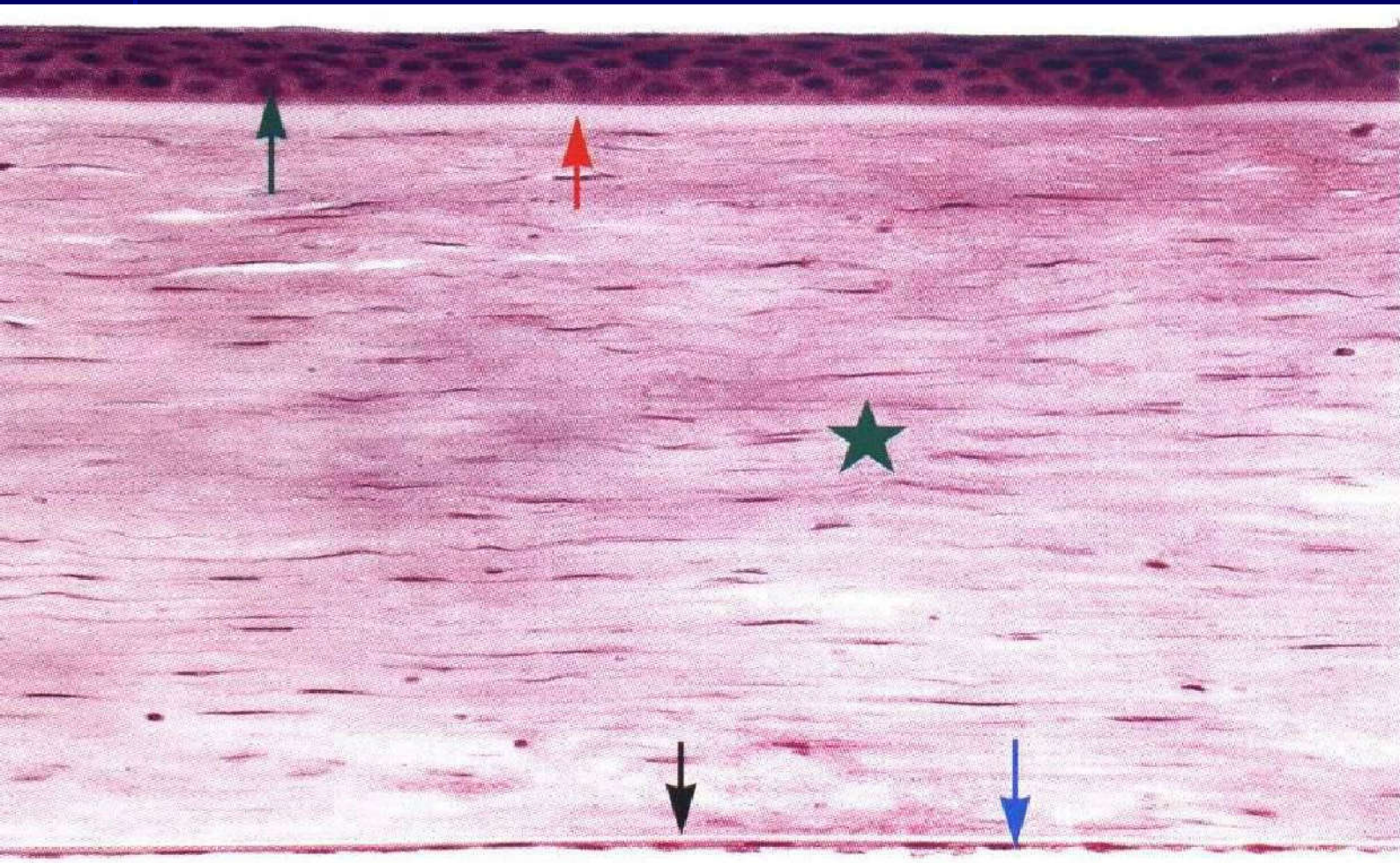
II. Tunica fibrosa

two parts: (cornea
sclera

- Cornea anterior 1/6

  colorless and transparent

five layers



- **corneal epithelium**

  * nonkeratinized stratified squamous epi
  * basal layer of epi are numerous mitotic figures
  * rich in nerve terminals

- **Bowman's membrane**

  (anterior limiting lamina)

  * **collagen fibers without cells**

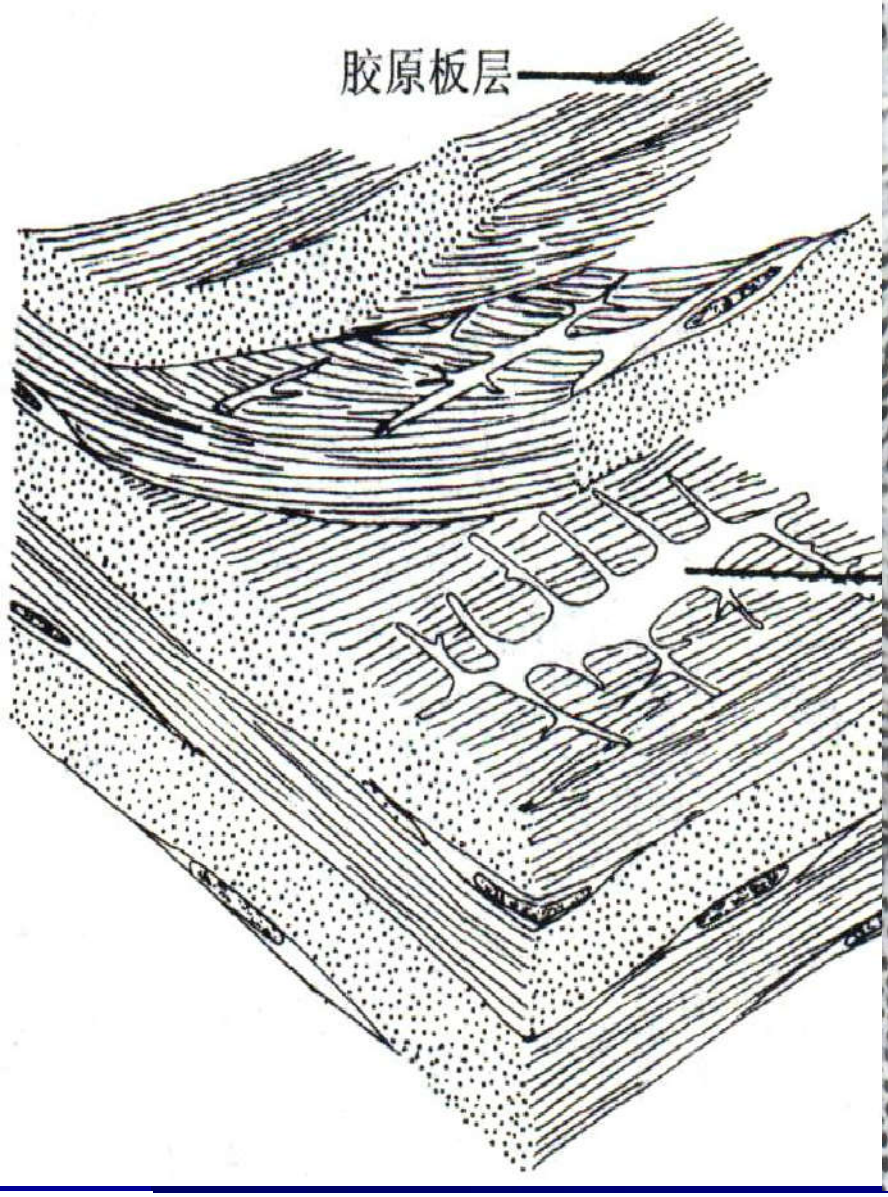
  * **can't regenerate**

- **stroma:**

* thick most layer of cornea
* many collagen lamellae

  (parallel to each other)
* avascular

  reason for transparence

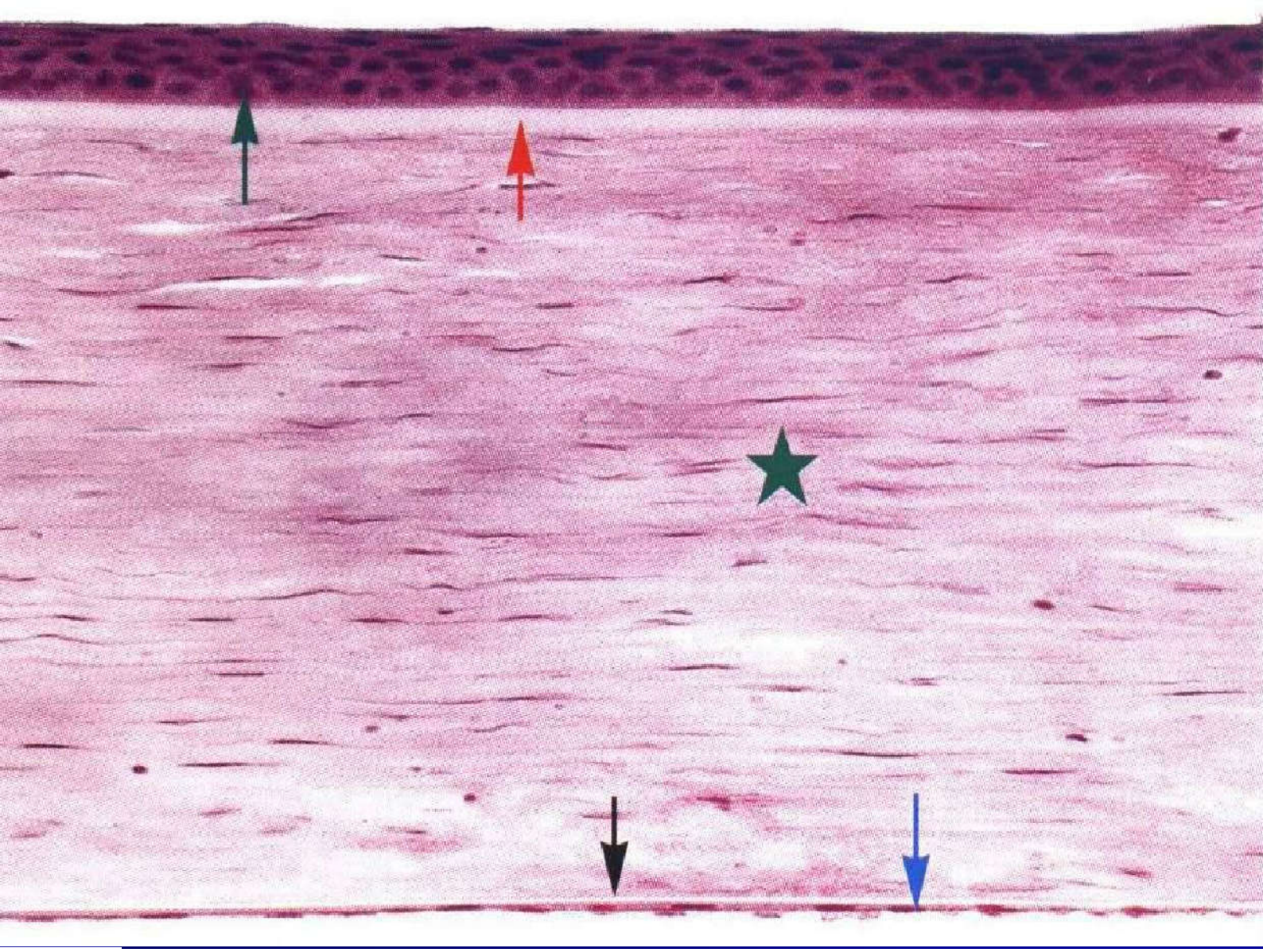

胶原板层

- **Descemet's membrane**

(posterior limiting lamina)

***thinner & homogeneous membrane**

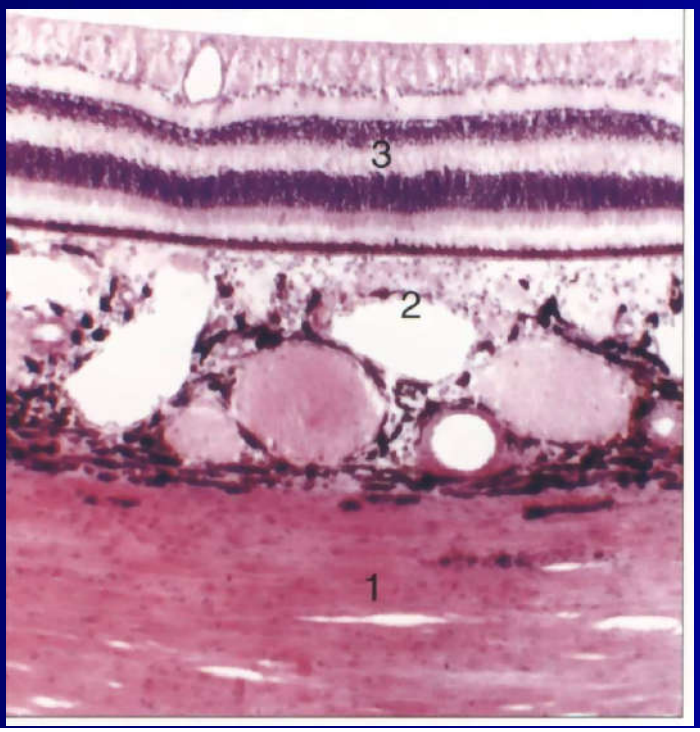
***composed of fine collagenous filaments**



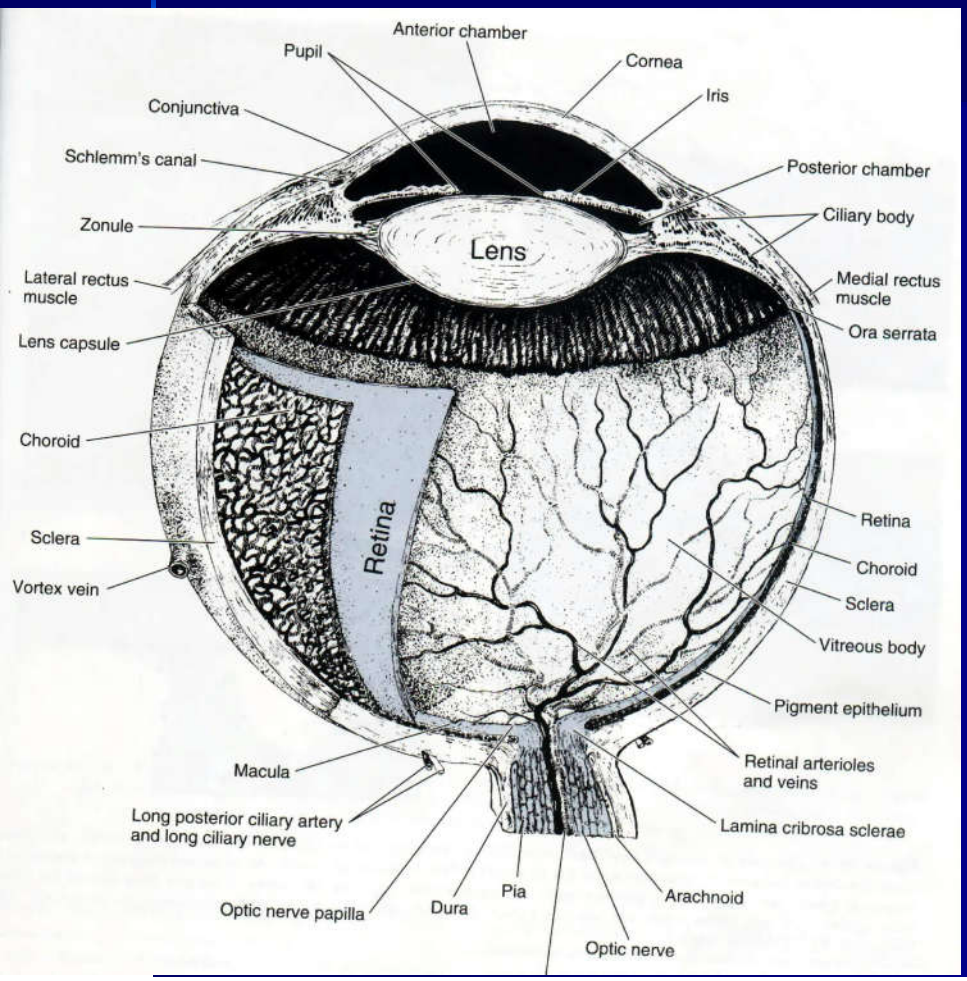
- **Sclera posterior 5/6**

  DCT: tough, dense connective tissue

  protective function



III. Vascular layer (middle layer)



three parts:

iris

ciliary body

choroid

- **Iris**

Location: between cornea & lens

partially covers the lens —— pupil

Structure: LCT with *blood vessels

and *pigment cells

two groups of muscle：

*sphincter pupillae muscle

- smooth m
- circular arranged
- parasympathetic innervation

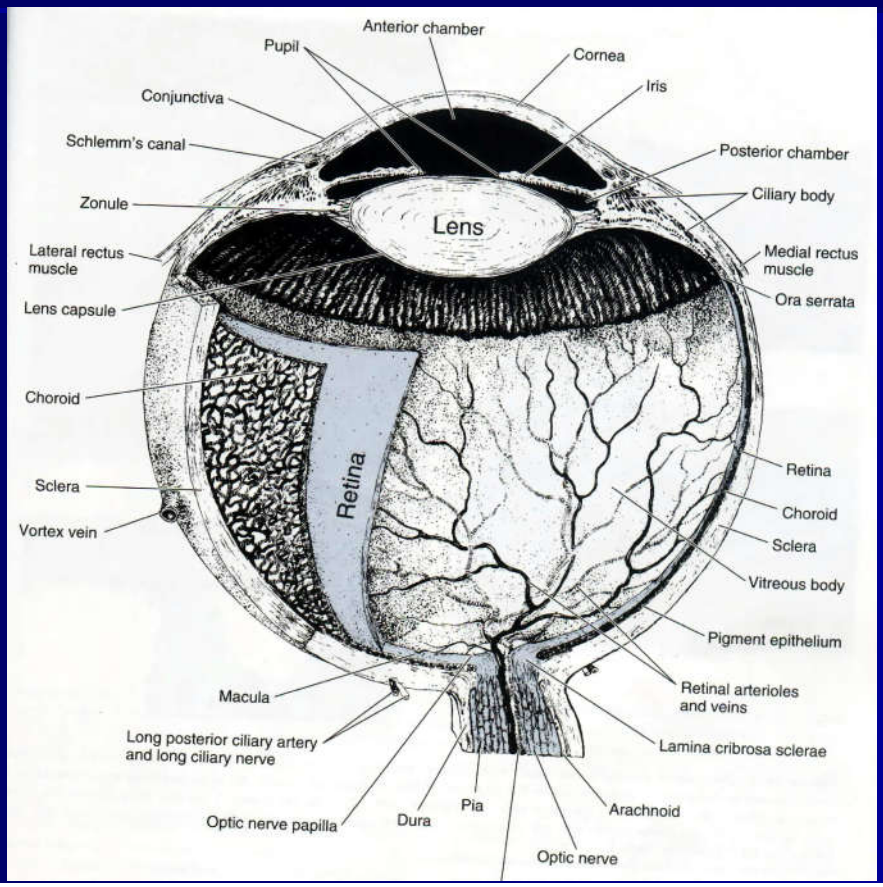
* dilator pupillae muscle

- smooth m
- radiately arranged
- sympathetic innervation

control the size of pupil

- **Ciliary body**

  iris —— ciliary body —— choroid



*continuous thickened ring

a triangle (in transverse section)

*structure

ciliary muscle

LCT (rich in elastic fibers, vessels and melanocytes)

ciliary zonule (connect with lens)

- Choroid

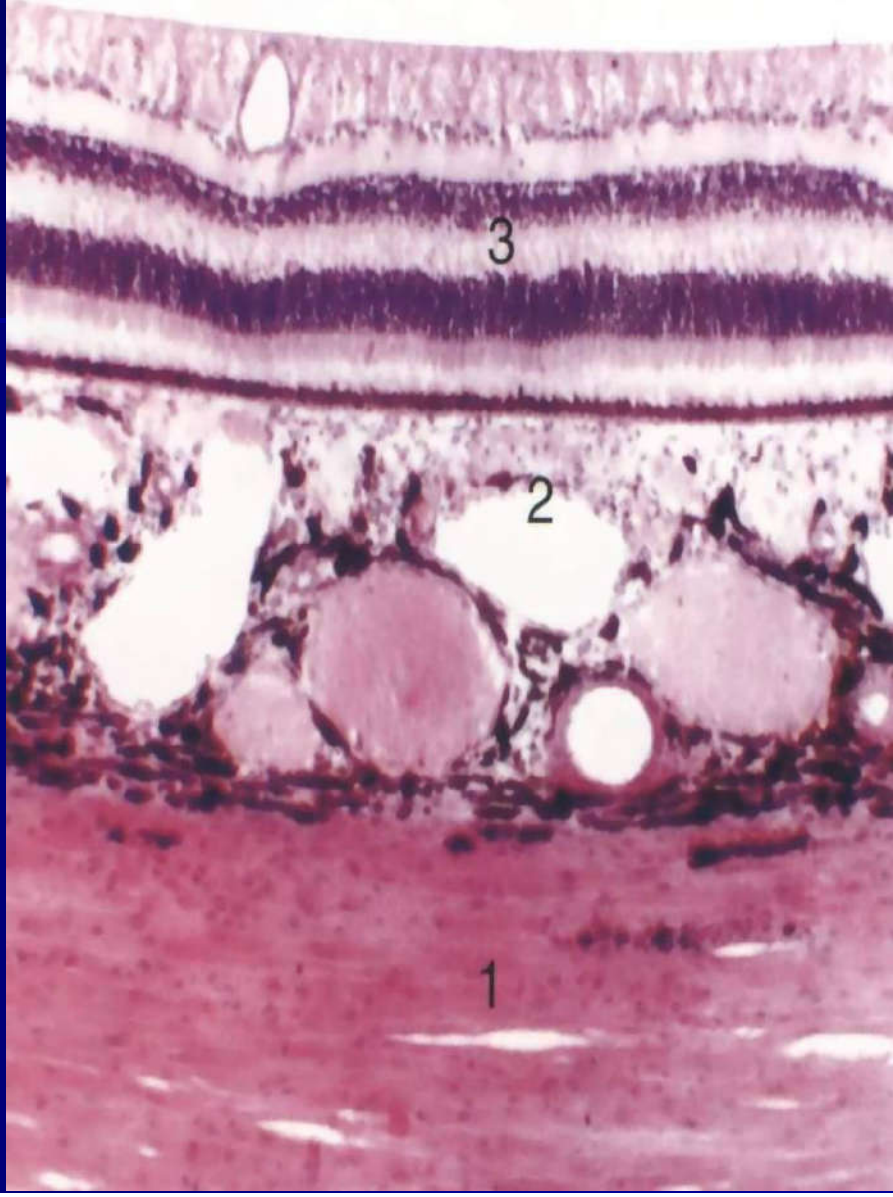
  LCT:

  blood vessels

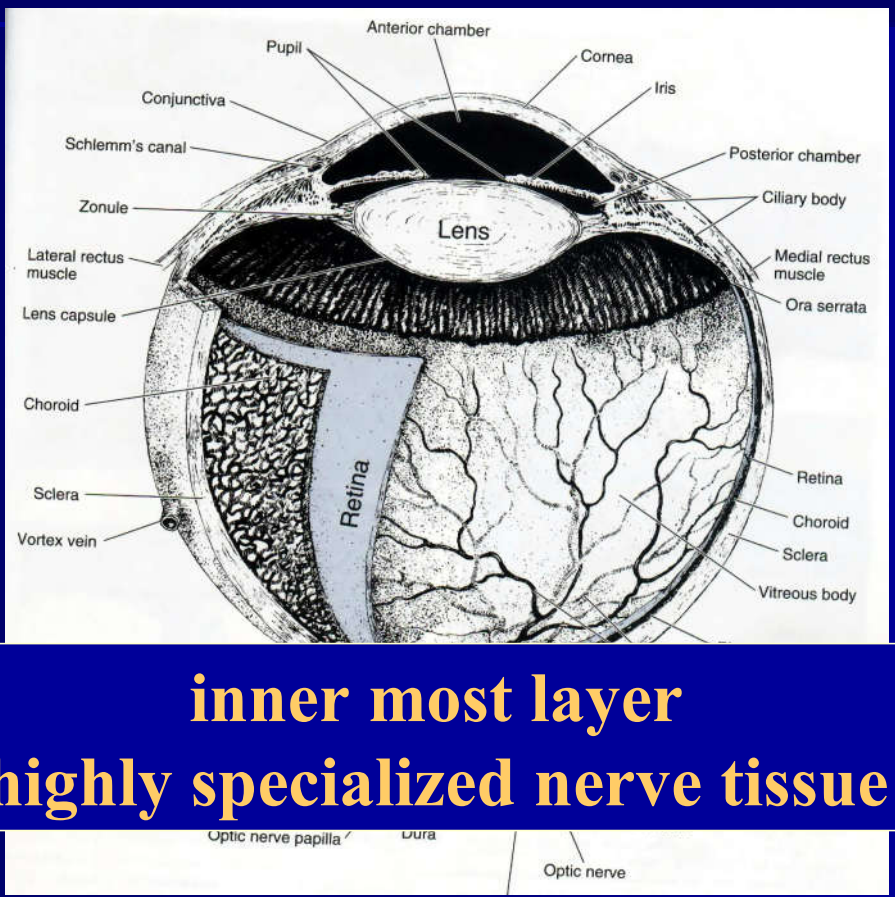
  melanocytes

  *nutrition

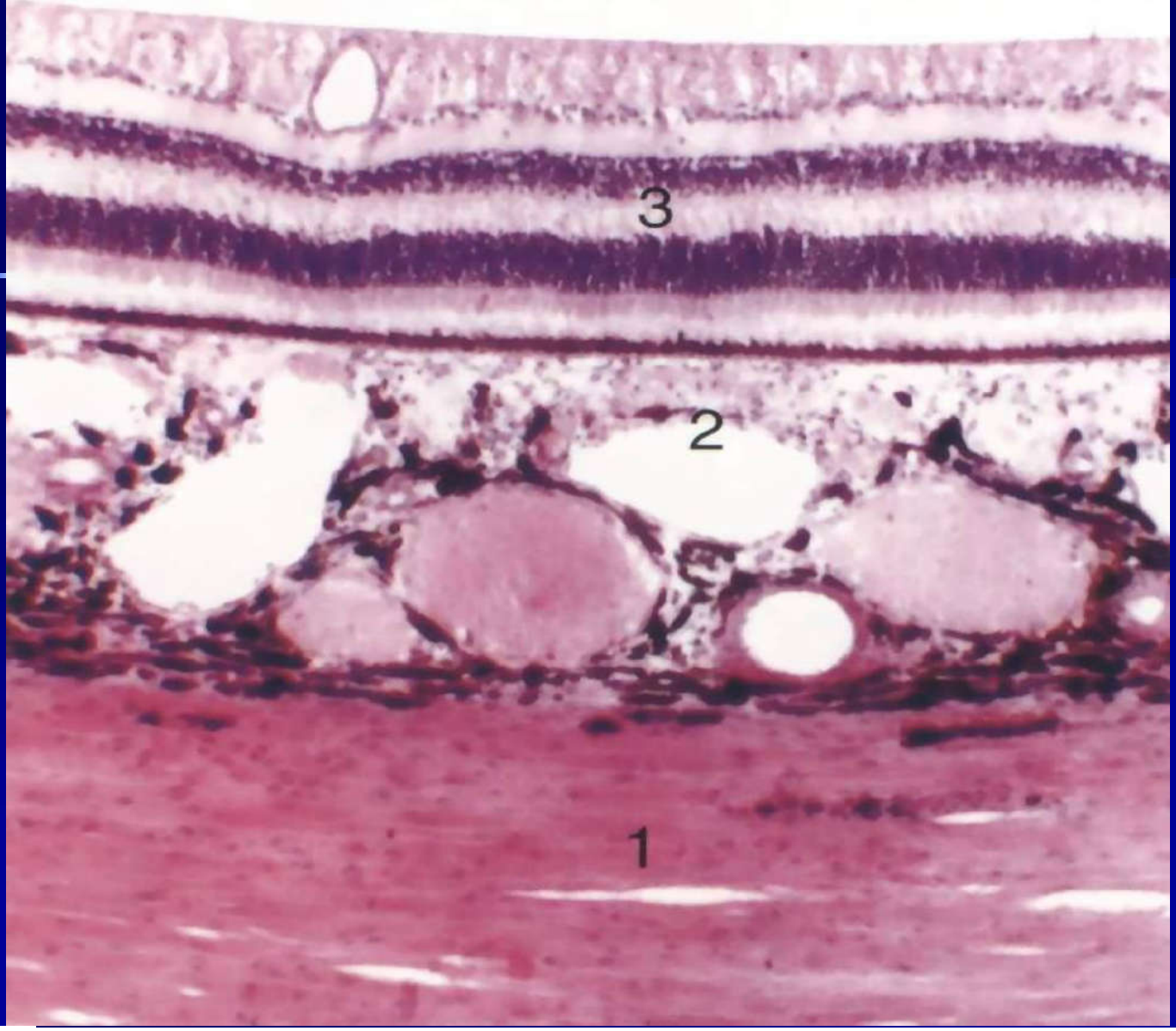
  *darkroom



IV. Retina



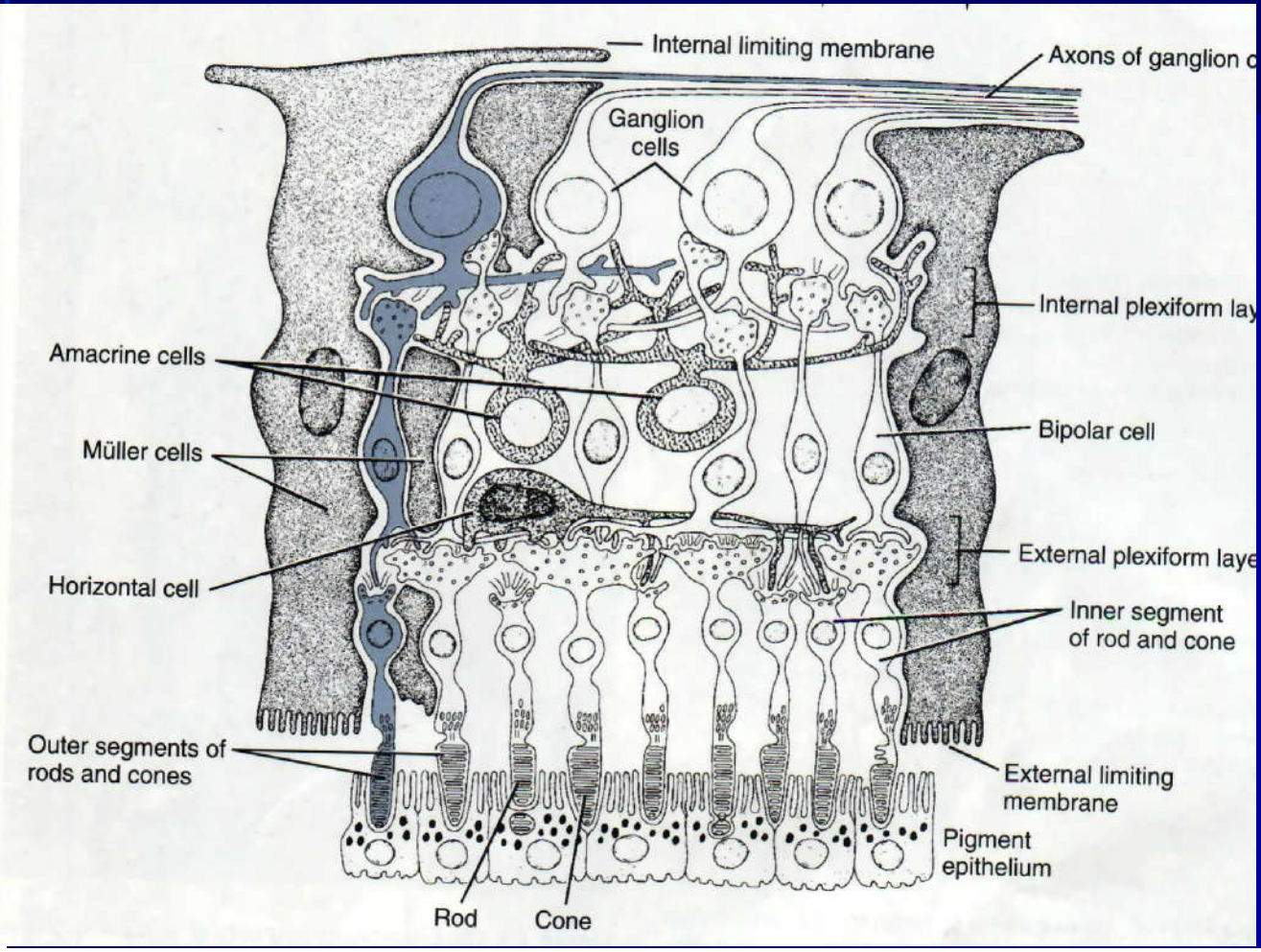
inner most layer
highly specialized nerve tissue

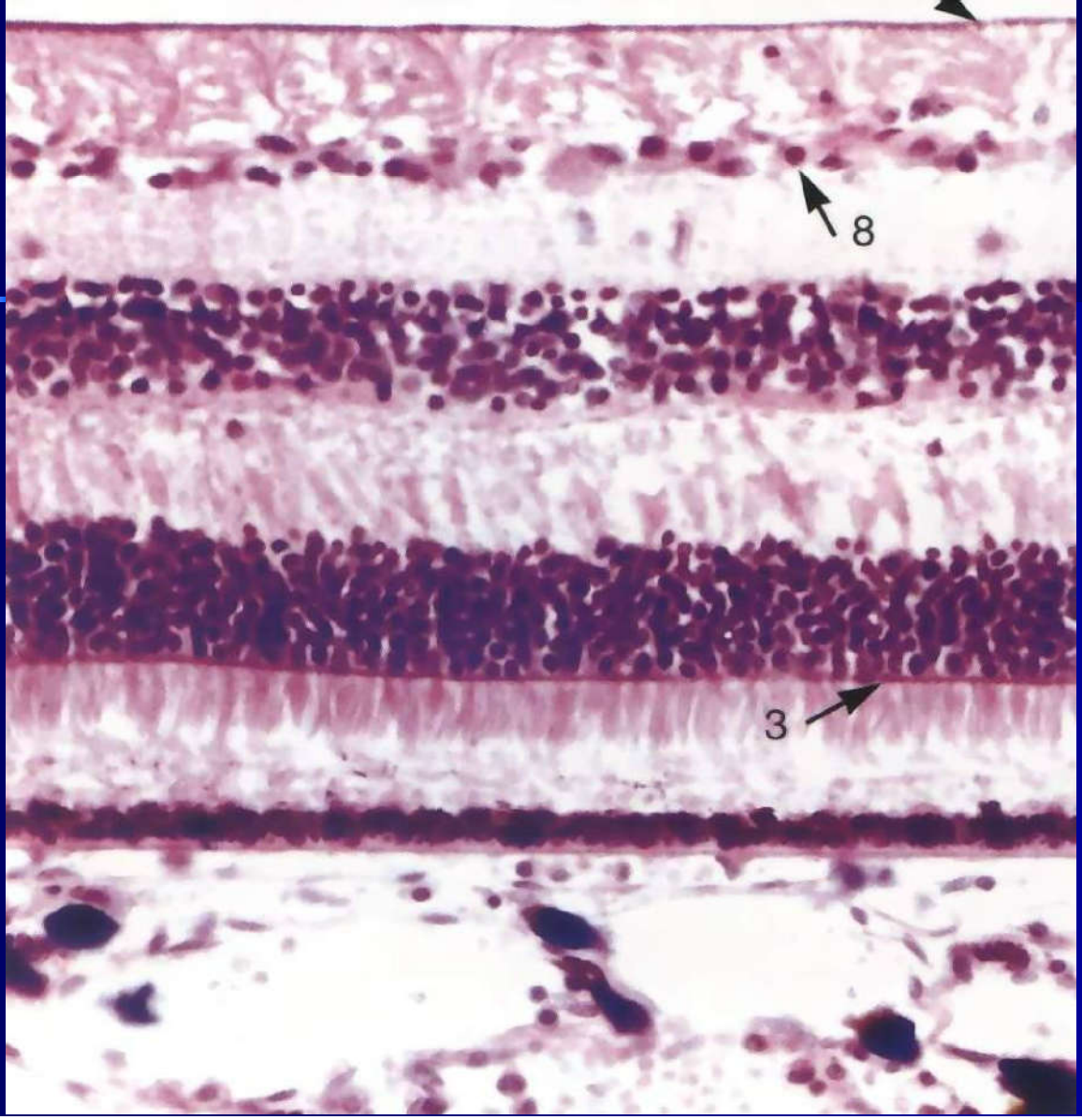

3
2
1

four layers of cells (from outer to inner)

- pigment epithelium
- visual cell (photoreceptor cell)
- bipolar cell
- ganglion cell

- **Pigment epithelium**




8
3

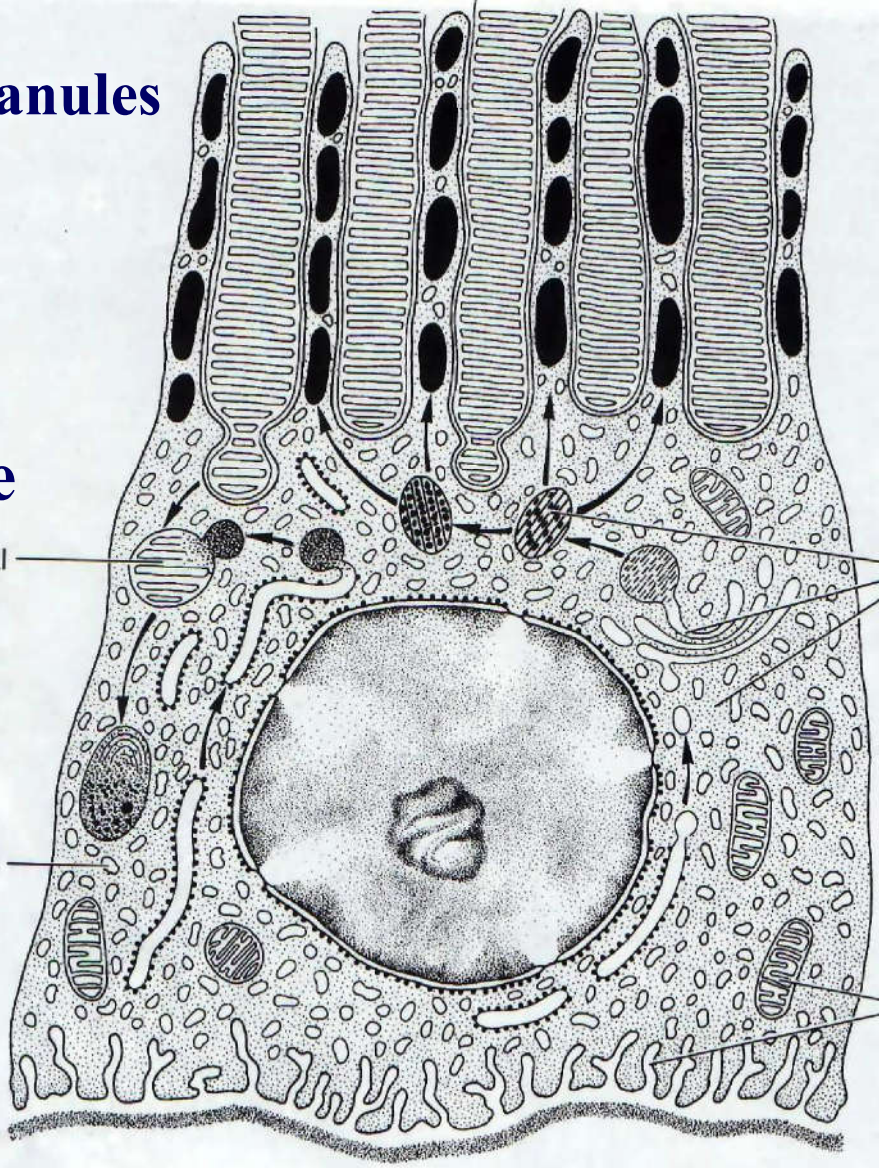
melanin granules

lysosome

Digestion, by lysosomal enzymes, of photo-receptor fragments phagocytized by pigment epithelial cells.

SER

Vitamin A transport and esterification in SER.



Synthesis of melanin by RER, Golgi apparatus and melanosomes. Melanin absorbs light after it has sensitized the receptor.

Ion transport by mito-chondria and membrane invaginations.

* single layer of short columnar cells
* melanin granules —— absorbing light
* SER —— esterify vitamin A
  —— photoreceptors
* lysosome, phagocytotic bodies
  ——renewal of membranous disks

- **Visual cell**

outer and inner segments

nuclear region

synapses region

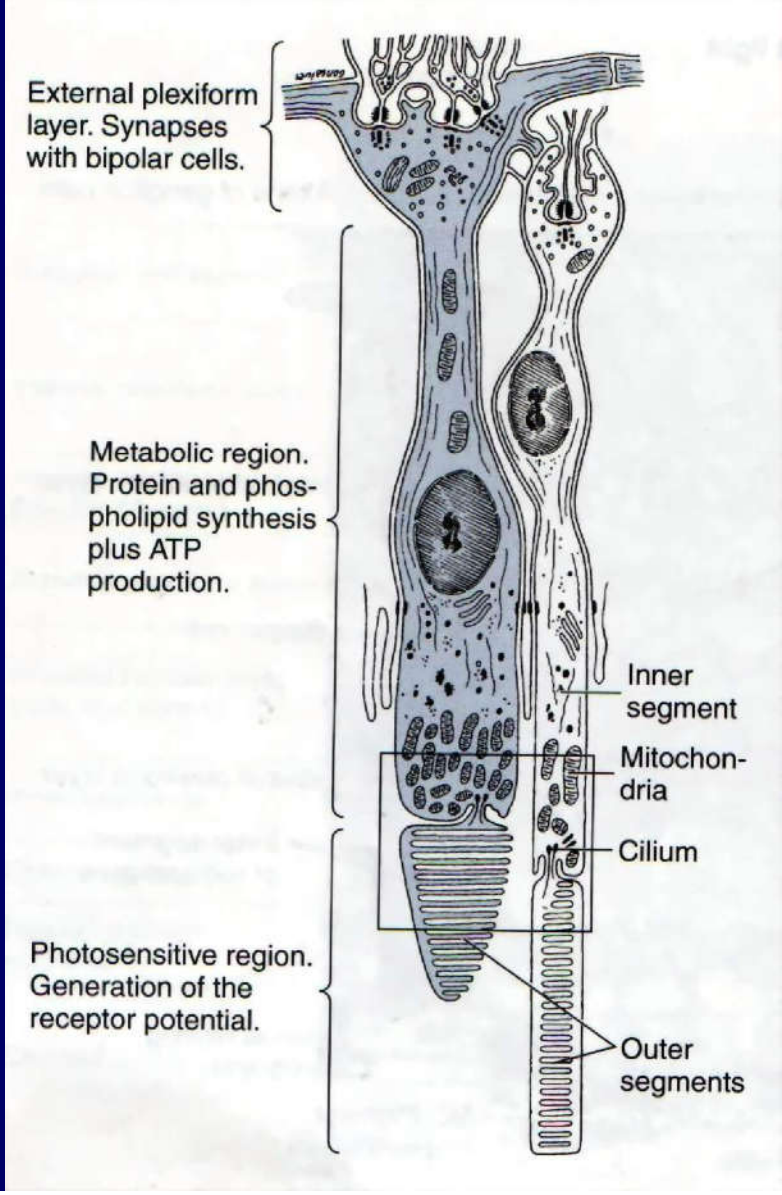
dendrite (photosensitive)

sensory neuron

axon — bipolar cells

Rod cell:

thin, elongated cells with a rod shaped outer segment



*membranous disks

independent disks

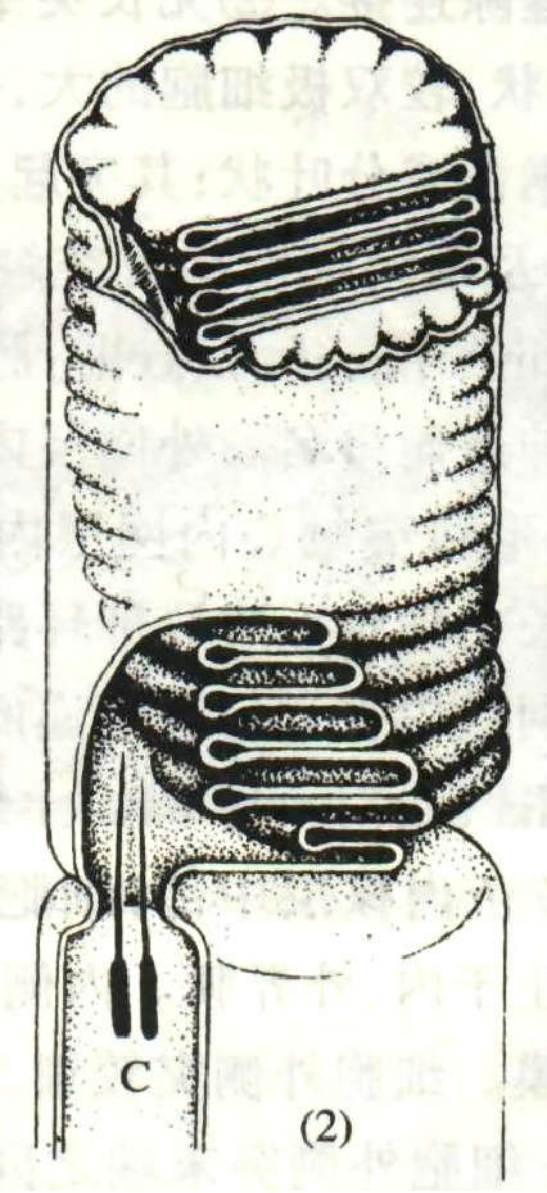
stack up like coins

pigment visual purple (rhodopsin)

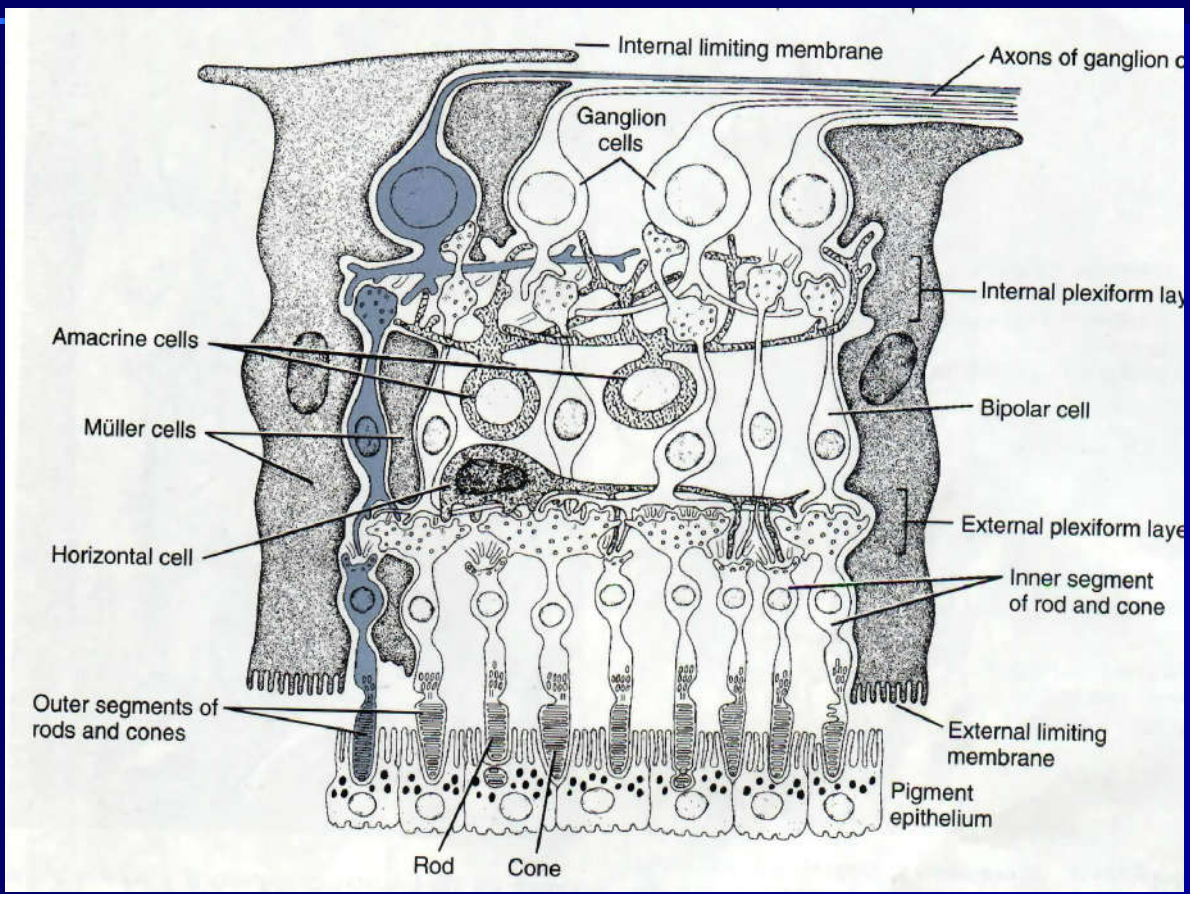
low levels of light ;

V_A — night blindness

nyctalopia

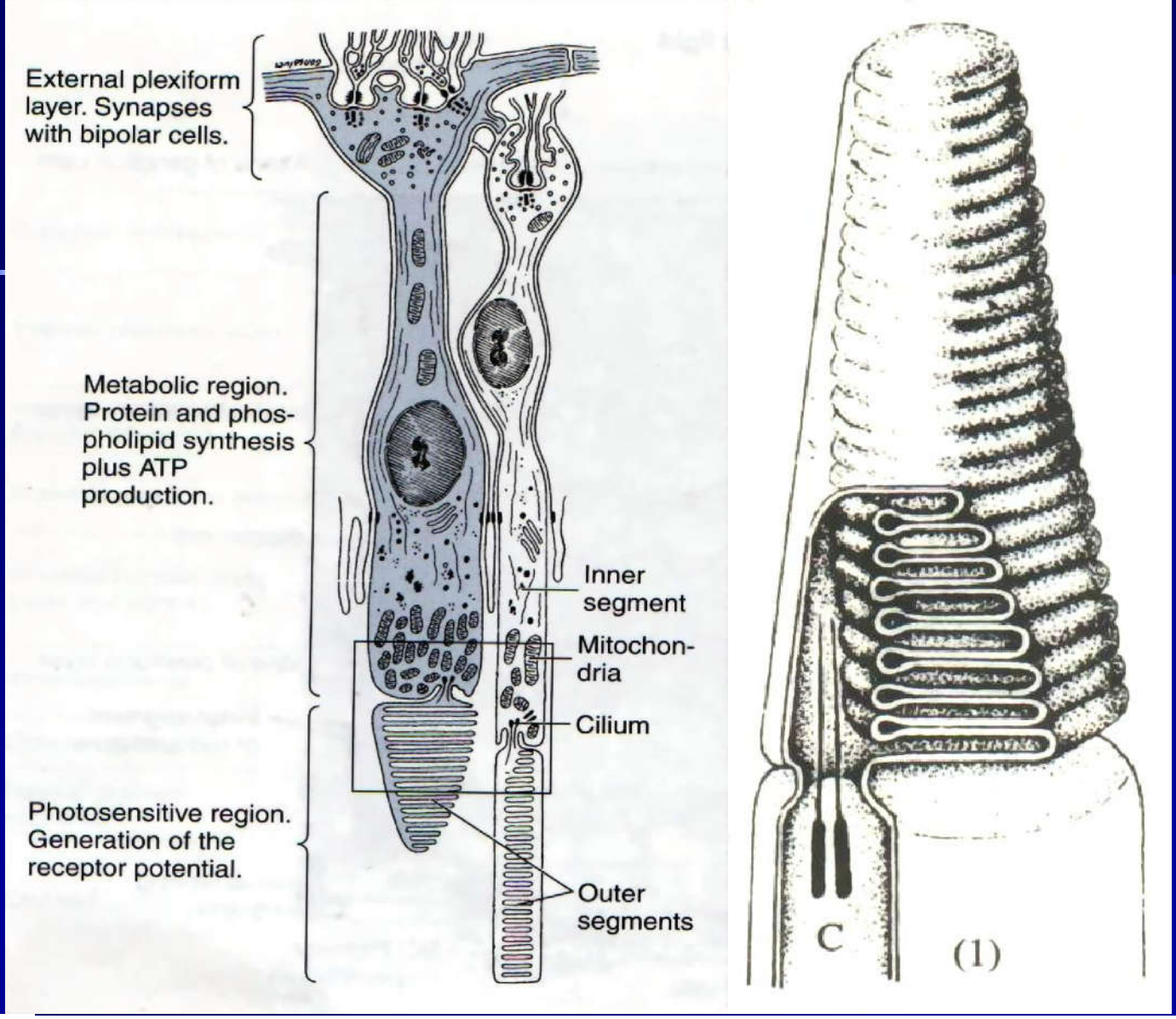


* **hereditary retinal dystrophy**
  dysfunction of the pigment epithelium



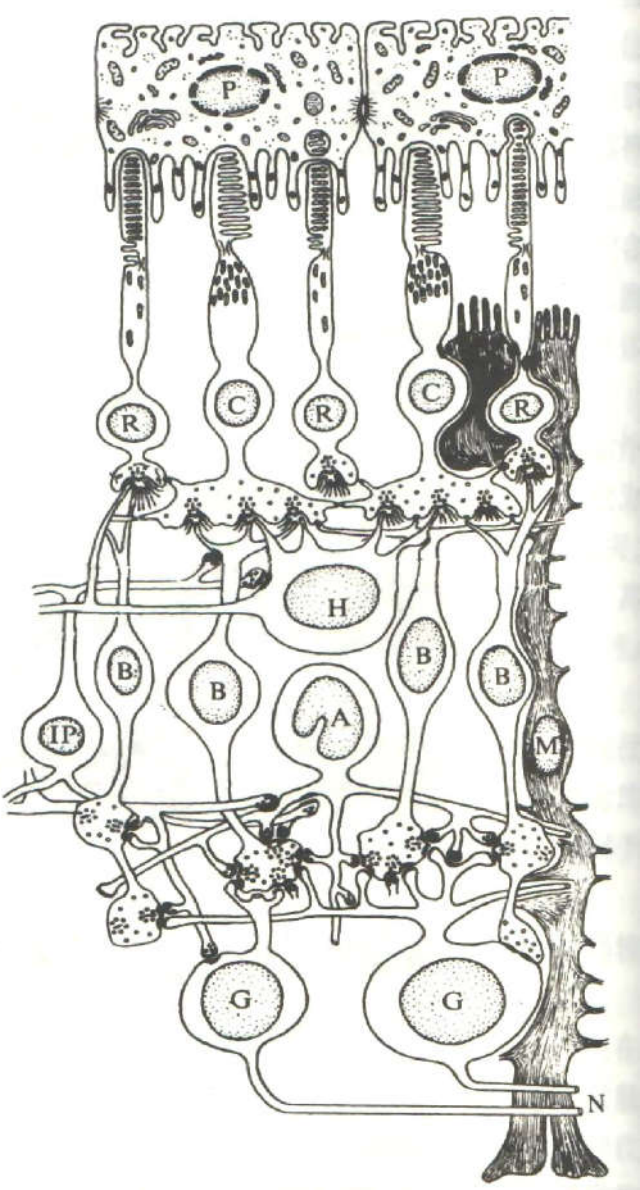
Cone cell —— elongated neuron

* outer segments are cone-shape
* disks are not independent of the outer plasma membrane
* iodopsin: sensitive to light of a higher intensity & colors (red, green & blue)


External plexiform layer. Synapses with bipolar cells.
Metabolic region. Protein and phospholipid synthesis plus ATP production.
Photosensitive region. Generation of the receptor potential.
Inner segment
Mitochondria
Cilium
Outer segments
C
(1)

- Bipolar cell

* connect with axon of visual cells
* diffuse bipolar cells
* monosynaptic bipolar cells



- Ganglion cell

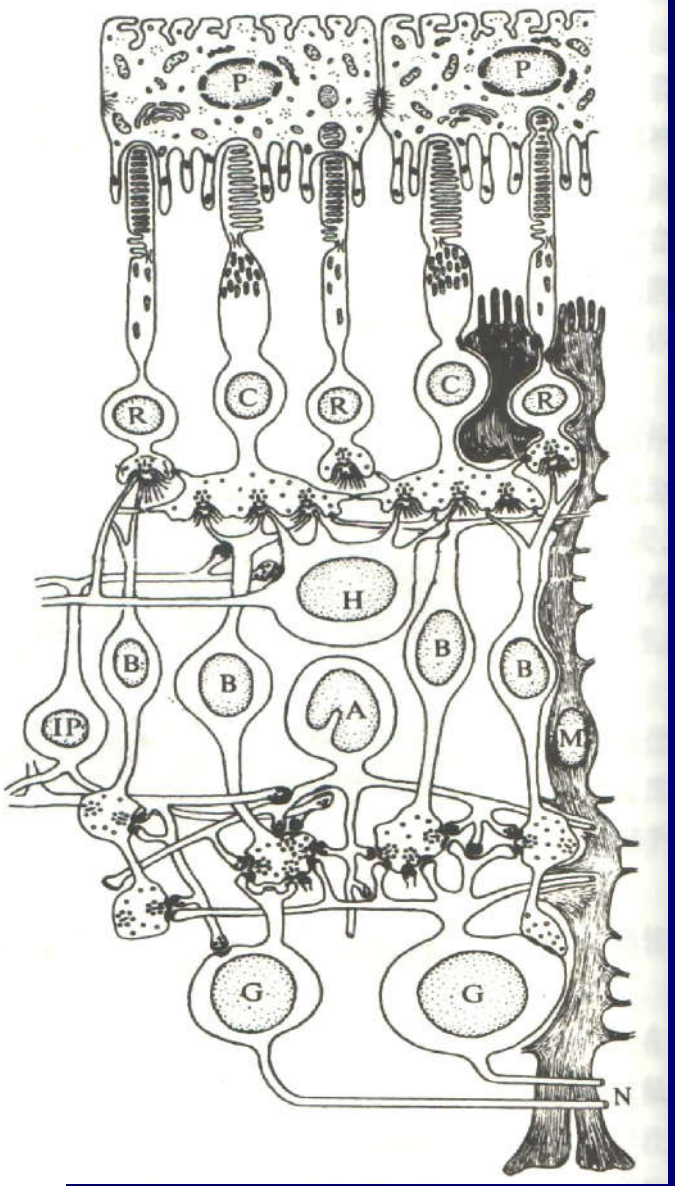
  multipolar neuron with long axon

  (diffuse ganglion cells

  monosynaptic ganglion cells

* dendrites —— bipolar cells

* axons —— optic nerve (papilla of optic nerve—blind spot)



diffuse ganglion cell

monosynaptic ganglion cell

- radial neuroglia cell (Müller cell)

*long cells like fibers

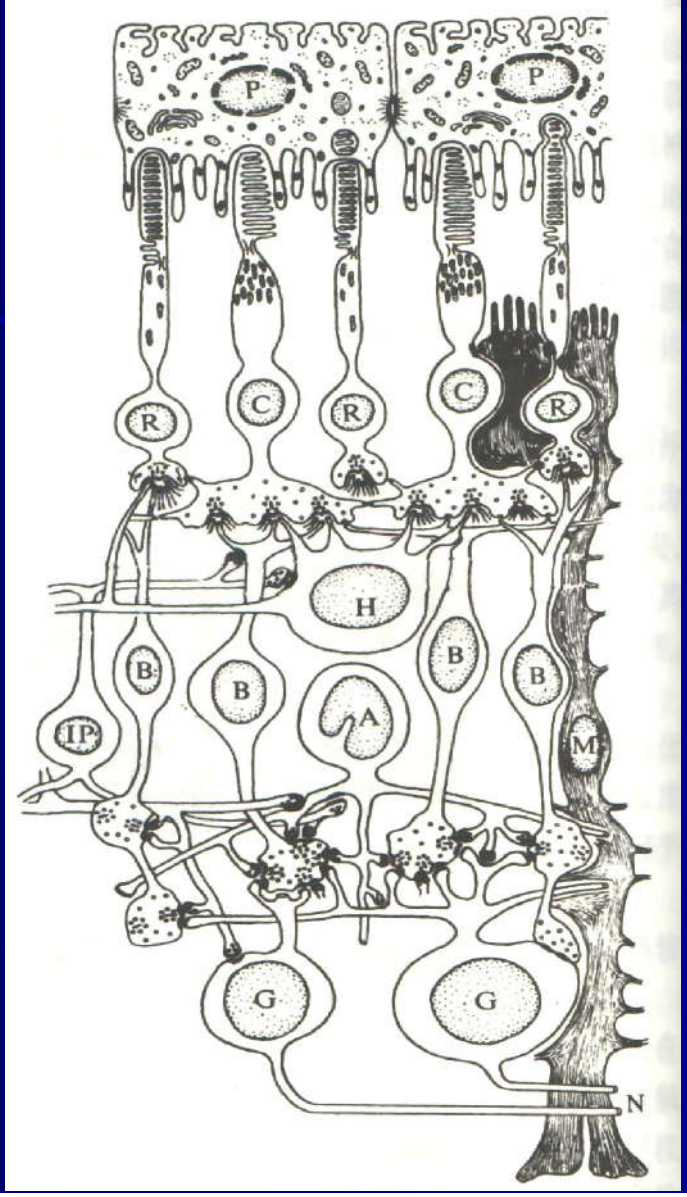
*soma —— inner nuclear layer

*process —— extend toward outer & inner

outer limiting membrane

inner limiting membrane

*function: support, insulate, nourish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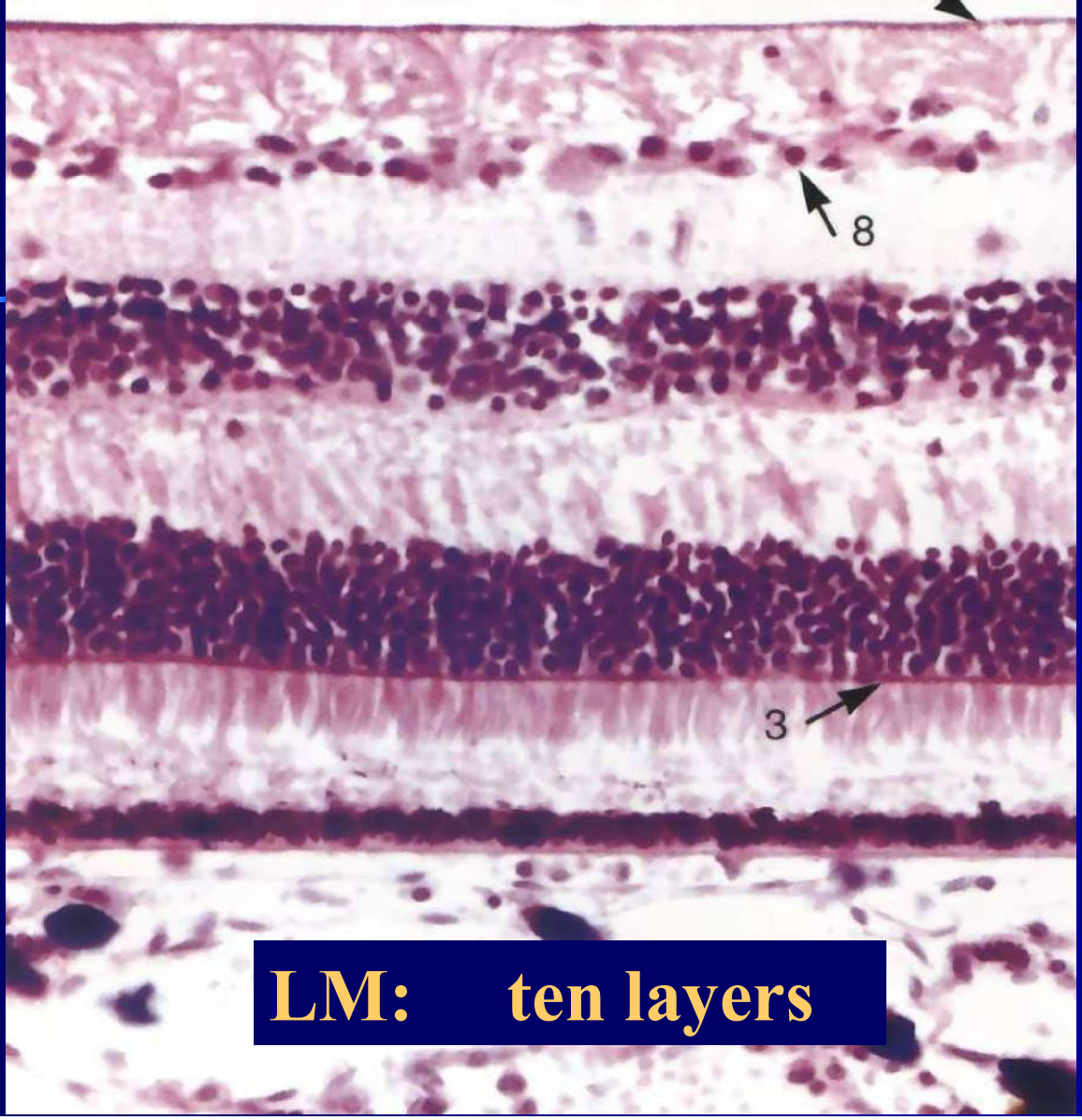


LM: ten layers

- **Macula lutea**

  in posterior pole of retina (Φ 3mm)

- **Central fovea**

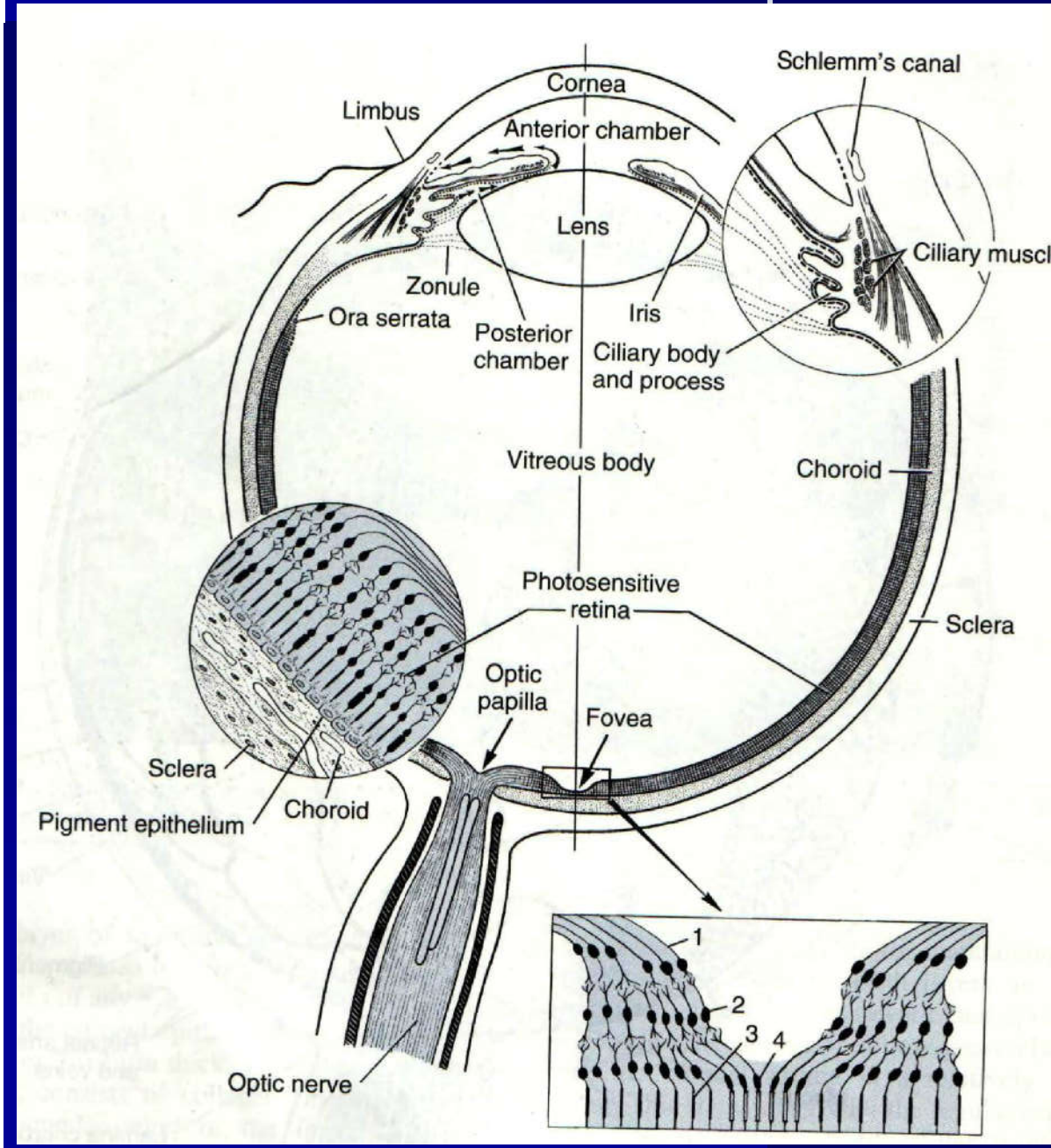
  located in the center of macula lutea (Φ 1.5mm) , where the retina is very thin, consists only of cone cells ("1-to-1" connection)

macula lutea & central fovea

papilla of optic nerve

V. Refracting media

- cornea
- lens
- vitreous body
- aqueous humor


Schlemm's canal
Cornea
Limbus
Anterior chamber
Lens
Ciliary muscl
Zonule
Ora serrata
Posterior chamber
Iris
Ciliary body and process
Vitreous body
Choroid
Photosensitive retina
Sclera
Optic papilla
Fovea
Sclera
Choroid
Pigment epithelium
Optic nerve
1
2
3
4

?

What is the pathway of light in the retina?