

Phototransduction and retinal adaptation

Retina

Retina: photosensitive innermost of the eye

Retina has 10 layers (histology)
But only 4 are special (physiology)

1) Pigmented epithelium layer

2) Rs&Cs (Rods & cones layer)

3) Bipolar cells layer

4) Ganglion cells layer

1) pigmented epithelium layer

- **Monolayer** of cells with same name
- Outer side contacts **Choroid**
- Inner side contacts Rs&Cs (**rods & cones**)

Function:

- Contain light absorbing melanin. pigment
Thus preventing internal light reflection
(Prevent glare)
- Produces stick EC matrix to keep outer segments of Rs&Cs straight & aligned
- Helps in breakdown & resynthesis of photopigments (photopigment recycle)
- Helps outer segments renewal by ingesting old outer tips of Rs&Cs
- Stores vitamin A for photopigments recycle

2) Rs&Cs (photoreceptors) layer

Structure of Rs&Cs:

- **Outer segment containing**
 - 1) Modified cilia
(long cylindrical in rods)
(Short conical in cones).
 - 2) Disc shaped shelves
(folds of inner cell membrane)
 - 3) greater/outer disc membrane
Contain:
(photosensitive pigment **rhodopsin**)
(G-Protein **transducin**)
(c-GMP **phosphodiesterase, PDE**)
(c-GMP gated ion channels for alkalis)

• Inner segment containing

- 1) nucleus & mitochondria
- 2) their inner membrane contain:
(**Na/K Pump & K channels**)
- 3) Synapsing body with bipolar cells
(Contains **glutamate** transmitter)

	Rods	Cones
Number	120 M	6~7 M
Shape	Cylindrical	Conical
Photosense pigment	Rhodopsin (purple)	Iodopsin (3 types)

2) Rs&Cs (photoreceptors) layer

	Rods	Cones
Location	Mainly peripheral retina & less in middle part <i>(Absent in fovea & disc)</i>	Mainly in fovea & less in middle part
Connection	Many rods Connect to one bipolar cell ----- Many bipolar cells (300) Connect to one ganglion (1)	One cone To one bipolar cell To one ganglion
Function	- more light sensitivity - Less detail vision - Can't identify colors - Night vision	<i>[حرفياً العكس بالضبط]</i> - Less light sensitive - More detailed vision - Identify colors - Day vision

3) bipolar cells & 4) ganglion cells

They make
1st & 2nd order neurons
 in visual pathway

Function:

Bipolar cells transmit signals
 From Rs&Cs to **ganglion cells**
Which transmit signals to brain
 Using optic nerve