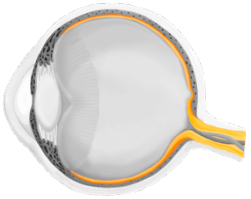
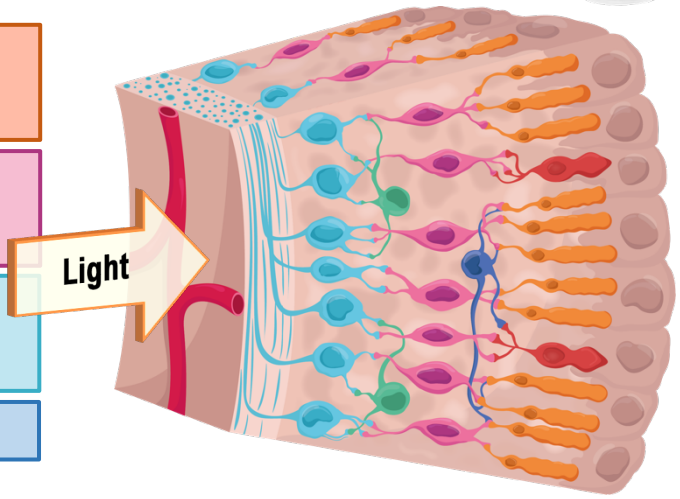
TOPIC: INNER LAYER

- *Recall*: Inner Layer is also known as the _____.
  - Functions for **phototransduction**: conversion of _____ energy to an _____ _____ response.
- 2 layers of the retina:
  1. **Pigmented Layer:** single cell layer; _____ photoreceptors & _____ light.
  2. **Neural Layer:** photoreceptors and _____:



- **Photoreceptors:** *Rods* and *Cones* excited by different _____ of light.
- **Bipolar Cells:** pass the signal from the photoreceptors to ganglion cells.
- **Ganglion Cells:** generate an _____ potential and form the _____ nerve.
- Amacrine cells.
- Horizontal cells.



EXAMPLE: The following list contains many of the structures that light must pass through to reach the rods and cones. Place the structures in the order that light would pass through them.

a) Aqueous humor
b) Bipolar cells
c) Cornea
d) Ganglion cells
e) Lens
f) Vitreous humor

Light → ____ → ____ → ____ → ____ → ____ → ____ → **Rods & Cones**

PRACTICE: True or False: if false, choose the answer that corrects the statement.

Waves of light must pass through both the ganglion and pigmented cells before reaching the photoreceptors.

a) True.
b) False, light reaches the photoreceptors first.
c) False, light must pass through the ganglion cells, but not the pigmented cells.
d) False, light must pass through the pigmented cells, but not the ganglion cells.

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PRACTICE: Once light is absorbed, what is the path of the nervous signal?

a) Rod or Cone → Bipolar Cell → Ganglion Cells.

b) Rod → Cone → Horizontal Cell → Ganglion Cell → Bipolar Cell.

c) Rods → Cones → Horizontal Cell → Amacrine Cells → Bipolar Cell → Ganglion Cells.

d) Pigmented Layer → Rod or Cone → Bipolar Cell → Ganglion Cells.

PRACTICE: Which part of the neural layer continues into and becomes the optic nerve?

a) Rods. b) Cones. c) Bipolar Cells. d) Ganglion Cells.

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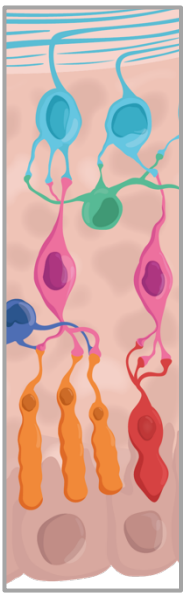
Comparing Rods and Cones

- 2 types of photoreceptors in the retina—named for their _____.

	Rods	Cones
Color	See in _____.	Provide _____ vision.
Sensitivity	High sensitivity. • Work in _____ light.	Low sensitivity. • Require _____ light.
Acuity	_____ to 1 ganglion. • _____ acuity.	_____ to 1 ganglion. • _____ acuity.
Location	Concentrated in the _____.	Concentrated in the _____.
Prevalence	~130 million per retina.	~6.5 million per retina.



- ***C**ones see in **C**olor, are in the **C**enter, and are s**C**ant.*

EXAMPLE: While walking through the woods at night, you realize that you can see things better if you don't look directly at them. In a single sentence, why might that be? (The table is provided as a reference.)

Rods	Cones
Many	Few
Periphery	Center
Low light	Bright light
Low acuity	High acuity
Grayscale	Color

_____

_____

PRACTICE: Which of the following statements is true for cones.

a) There are more cones than rods in the retina.

b) They are specialized for low light vision.

c) They are concentrated in the center of the retina (fovea centralis).

d) They are named for their long cylindrical shape.

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PRACTICE: Different animal species differ in the relative number of rods and cones that are present in their eyes. Which of the following statements would you expect to be true about these differences?

a) Species that require greater visual acuity will have relatively more rods in their eyes; species that require greater peripheral vision will have more cones.

b) Nocturnal (active at night) species will have relatively more rods in their eyes; diurnal (active in the day) species will have relatively more cones.

c) Species that require better depth perception will have relatively more cones in their eyes; species that require greater field of vision will have more rods.

d) Nocturnal (active at night) species will have relatively more cones in their eyes; diurnal (active in the day) species will have relatively more rods.

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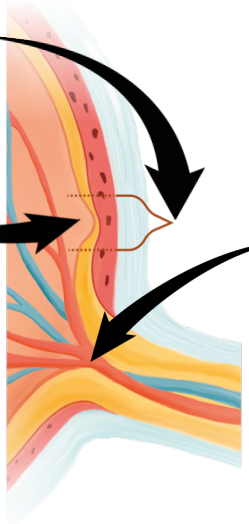
Structures of the Retina

- The distribution of photoreceptors and neurons in the retina gives rise to distinct structures:

Macula Lutea: area at _____ of vision.

- Contains mostly cones.
- **Fovea Centralis:** center of the macula lutea; contains **only** _____.
  - Highest visual _____.
  - Inner retinal structures go _____ fovea—creates pit.



Optic Disc: Location where the optic nerve and blood vessels leave the eye.

- _____ rods or cones.
- Creates a _____ spot.

EXAMPLE: Find your blindspot! Close or cover your left eye. Look at the "**X**" with your right eye. With the "●" kept horizontally to the right of the "X" move your head closer or further from the screen until you can no longer see the "●".

X ●

Why do you have a blind spot? _____

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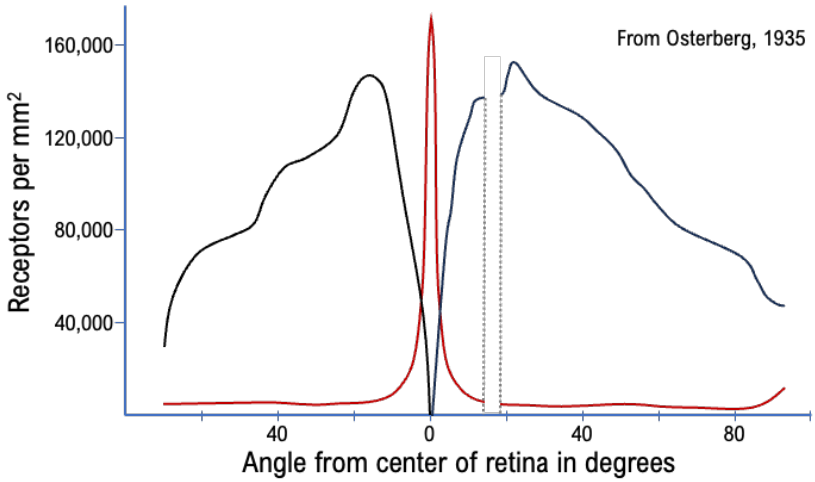
EXAMPLE: The graph below shows the density of rods and cones in the retina relative to their distance from the center of vision in angular degrees. One type of receptor (either rods or cones) is represented by the red line. One type (either rods or cones) is represented by the black line. Based about what you know about rods and cones in the retina:

a) Label the line for “cones”.

b) Label the line for “rods”.

c) Identify and label the structure between 15º and 20º marked by the dotted lines.

d) Circle the area that represents the fovea centralis.



PRACTICE: On the image of the retina below, identify the stuctures located in each circle.

a) Structure 1 is the optic disc, structure 2 is the macula lutea.

b) Structure 1 is the fovea centralis, structure 2 is the macula lutea.

c) Structure 1 is the optic disc, structure 2 is the fovea centralis.

d) Structure 1 is the macula lutea, structue 2 is the optic disc.