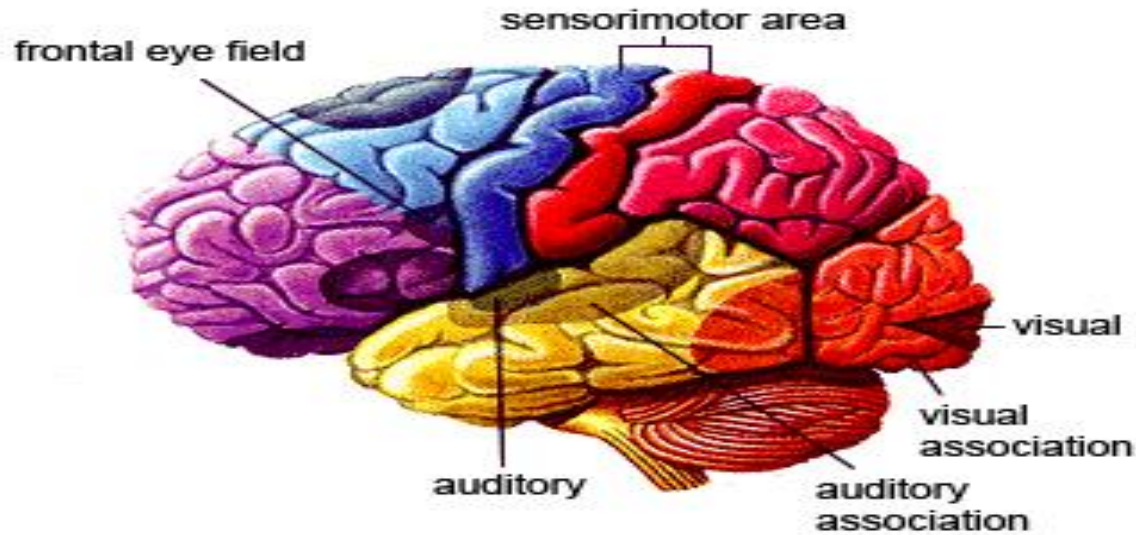


PHYSIOLOGY TEAM



Amna Baljoun

Ahlam Al Maawi
Bodoor Al Tayeb

Areej Al Kahtani
Asmaa` Bedawi

(these notes are combination of female and male slides + our notes)



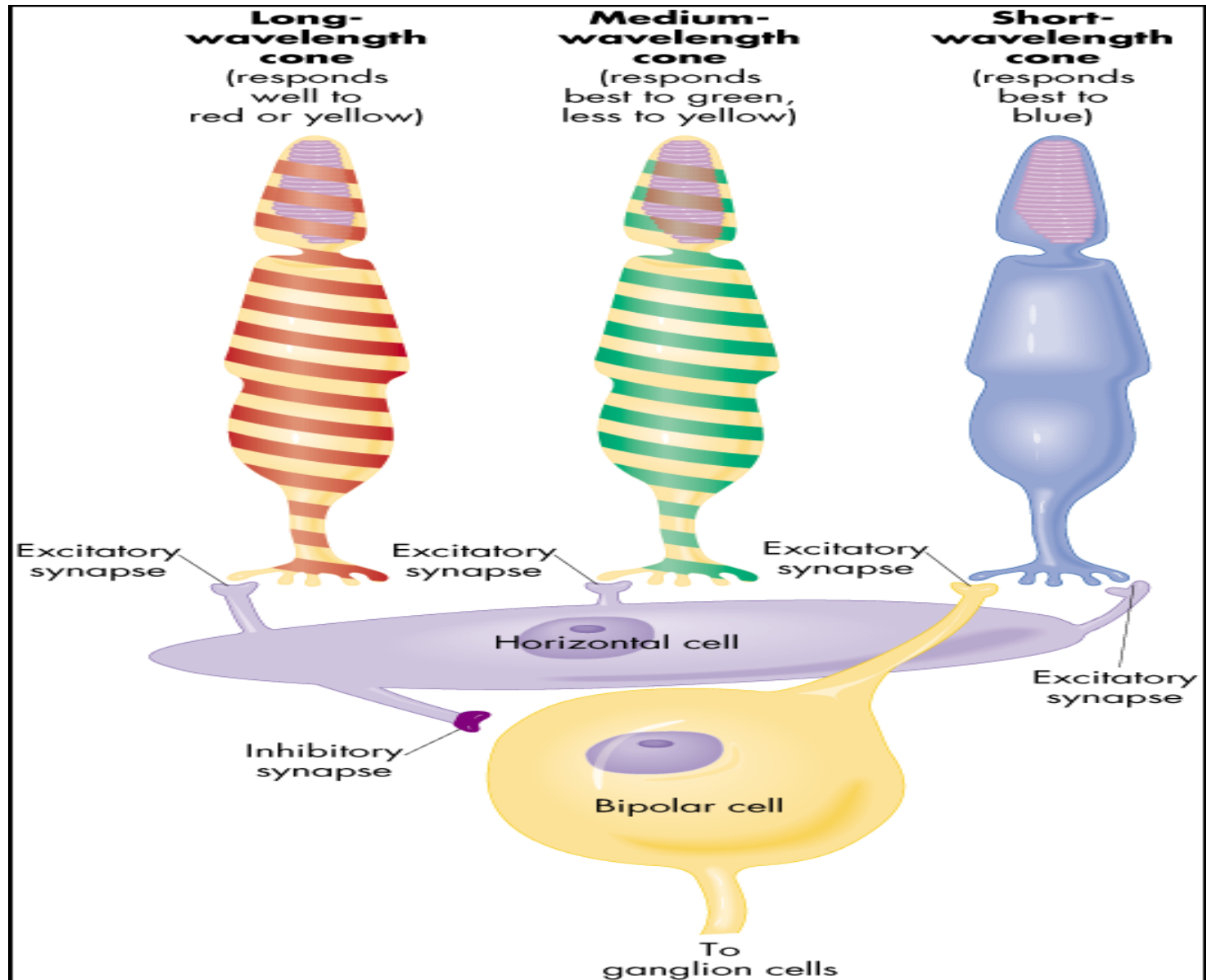
COLOR VISION



COLOR VISION

- It is the ability to discriminate between different colors and it is important to distinguish an object from its background
- there are 3 primary colors(blue- red- green) sensed by cones in fovea & appreciated within photopic vision.
- sensation of extraspectral colors as white, yellow, orange, purple, can be produced by mixing properties of the blue & red & green in different combinations.
- black means absence of light (not darkness) because in dark we do not see black
 - (there are no black waves because the black color does not reflect light)





Color vision theory : (Young- Helmholtz theory)

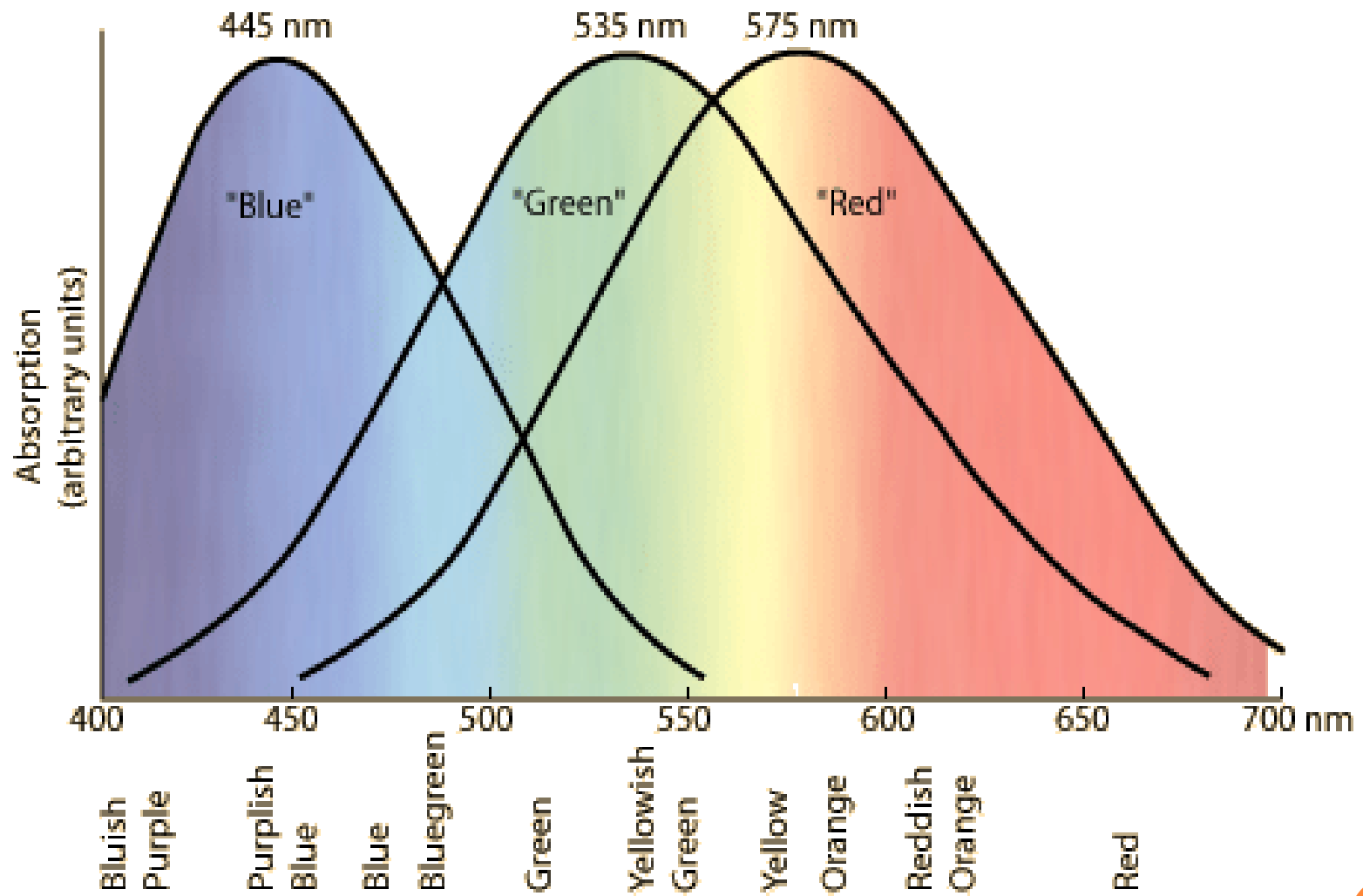
- we have 3 kinds of cones each has a specific photopigment & is sensitive to one of the 3 primary colors

Blue cone system: has S pigment (blue sensation pigment) which respond to short wave length (440 nm sense blue color)

Green cone system: has M pigment (green sensation pigment) which respond to middle wave length (535 nm senses the green color & less to yellow)

Red cone system: has L pigment (red sensation pigment) which respond to large wave length (> 535 nm so senses the red & less to yellow color





- Sensation of any color is determined by:
 - a- wave length of light
 - b- amount of light absorbed by each type of cones
 - c- frequency of impulses from each cone system to ganglion cells which is determined by wave length of light.
- Each cone system respond to its color at a lower threshold than needed to sense other colors (red cones respond to red or yellow color at a lower threshold than to green color)
- There is no wave length corresponds to white, white is a combination of all wave lengths.
Perception of white is due to equal stimulation of blue & red & green



- Perception of orange

is due to stimulation of 99% of red cones & 42% of green cones & 0% of blue cones(so ratio is 99:42: 0)

- Perception of yellow

is due to stimulation of 50% of red cones & 50% of green cones & 0% of blue cones(so ratio is 50:50: 0)

- Perception of blue

is due to stimulation of 0% of red cones & 0% of green cones & 97% of blue cones(so ratio is 0:0: 97)



Color vision is coded by :-

- Different responses in ganglion cells that depends upon → the wave length of stimulus which determine frequency of impulses in ganglion cells
- The color perception in the brain depends on → the amount of activity in each of the 3 cone systems as mentioned above.



CLASSIFICATION OF HUMANS WITH RESPECT TO COLOR PERCEPTION

There are 3 types

- **Trichromats** : have 3 cone pigments or have slight weakness in one of the cons
- **Dichromats** : they are blind to one of the 3 primary colors .
They get their color sense by mixing 2 primary colors .
- **Monochromats** :
 - have only 1 cone system → match their color spectrum by varying the intensity of only one color.
 - loss of all cone systems → see only white , black , grey
(because the rods take place of cones)
rods see → white , black and grey



COLOR BLINDNESS:-

- There is gene for **rhodopsin** on chromosome(3)
(any mutation in this gene → blindness)
- There is gene for **blue** sensitive (S) cone pigment on chromosome(7)
- There is gene for **red** & **green** sensitive cone pigment on x chromosome.

* when a single group of color receptive cones is absent (due to absence of there gene) the person can not see or distinguish some colors from others

- Prevalence of color blindness:

males 8%

females 0.4%



○ Dichromats & Trichromats are color blind :

Why ?

Because color blindness is defined as “ inability to perceive differences between some of the colors that other people can



Red – Green blindness

- Because green & red cones see different colors between wave length 525 - 675 nm and distinguish them.
- If either of these cones are absent, the person can not distinguish 4 colors (red – green- yellow- orange) and he can not distinguish red from green so called
- It is x- linked disease transmitted from females to their male sons, never occure in females as they have 2 x chromosomes,.
- but males have one x & one y chromosome so if this one x chromosome miss the gene for color vision , he will get color blindness.



ANOPIAS

- most severe forms, color blindness is caused by the absence of one of the cone visual pigments.
- Red-green color blindness is common , about 4-5% of the population
- Deutanopes Patients missing (Green) pigments (Green-blind)
- Protanopes Patients missing (Red) pigments (Red- blind)
- Tritanopes Patients missing (Blue) pigments (blue – blind)



ANOMALIES

- Patients with mild or moderate color blindness are called Anomalous Trichromats;
- Deuteranomaly = Weak M (Green) pigments
- Protanomaly = Weak L (Red) pigments
- Tritanomaly = Weak S (Blue) pigments

