Color Vision

by

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COLOR VISION

- It the ability to discriminate between different colors.

1- there are 3 primary colors(blue- red- green) sensed by cones in fovea & appreciated within photopic vision.

2- sensation of extraspectral colors as white, yellow, orange, purple, can be produced by mixing properties of the blue &red & green in different combinations.

3- black means absence of light (not darkness because in dark we do not see black

- **Color vision theory : (Young- Helmholtz theory)**
- **1- we have 3 kindes of cones each has a specific photopigment (rhodopsin)& is sensitive to one of the 3 primary colors**
- **a- Blue cone system:- has S pigment (blue sensation pigment) which respond to short wave length (440 nm senses the blue color)**
- **b- Green cone system:- has M pigment (green sensation pigment) which respond to middle wave length (535 nm senses the green color & less to yellow) & absorb light at the green portion.**

c- Red cone system:- has L pigment (red sensation pigment) which respond to large wave length at or > 535 nm so senses the red & yellow color & absorb light at the red portion.

- 2- <u>sensation of any color determined by:</u>
- 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.

3- 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)

5- perception of white is due to equal stimulation of blue & red & green cones.There is no wave length corresponds to white, white is a combination of all wave lengths

- #- <u>color vision is coded by :-</u> 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.

- 6-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)
- 7--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)
- 8-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 BLINDNESS:-**
- **- There is gene for rhodopsin on chromosome(3)**
- **- 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**

- **- red – green blindness:-**
- **-Green & red cones see different colors between wave length 525-675 nm & distinguish them.**
- **-If either of these cones are absent, the person can not distinguish 4 colors (red – green- yellow- orange)& he can not distinguish red from green (primary colours) so called**
- **(red – green blindness).**

-It is x- linked disease transmitted from females to their male sons, never occure in females as they have 2 x chromosomes

- Males have one x & one y chromosome so if this one x chromosome miss the gene for color vision , he will get red-green color blindness.

-Females show the disease only if both x chromosomes lack the gene

- Females from color blind fathers are carriers transmit the disease to ½ of their sons.

- **Trichromats** :- have 3 cone pigments(normal or have slight weakness in detecting red or green or blue color
- **Dichromats:-** have only 2 cone pigments systems only so he is completely blind to red or green or blue (so they may have protanopia, deuteranopia,or tritanopia) they get color by mixing only 2 of the primary colors.

Monochromats :- have only one cone system or loss of all so see only white or black or grey or have no color perception.

- Nopia = blindness, nomaly =weakness

- 1-Protanopia(red- blindness) :- no red cones system so person has shortened spectrum wave length,
- if only weakness in red color vision is called protanomaly.

2-Deutranopia (green - blindness) :-
no green cones system
-so person see only long & short wave length)
- if only weakness in green color vision is called deutranomaly.
- has normal spectral width because green cones operates in the middle

3-Tritanopia (blue - blindness) :- no blue cones system , if only weakness in blue color vision is called tritanomaly.