Vision3

Color Vision

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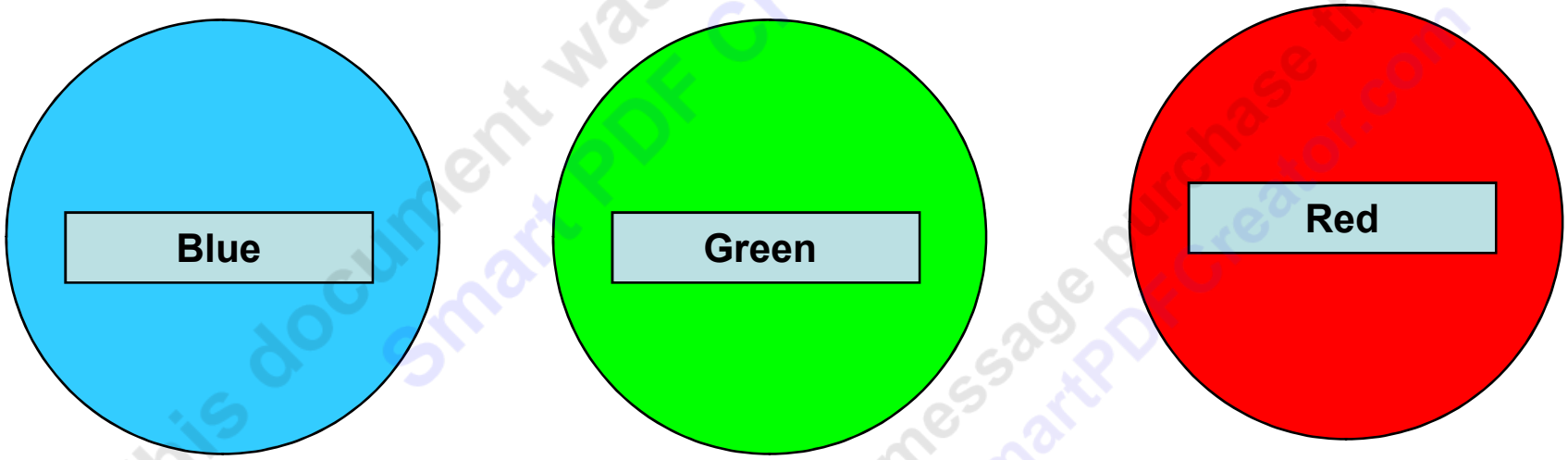
There are 3 primary colors :



When mixed → white or any other color

(Thomas Young 1807)

Mixing colors

✓ Color vision is subserved by 3 types of cones

Containing a photoreceptor pigment most sensitive to one of the 3 primary colors :

Blue-sensitive cones → contain blue-sensitive pigment

Green-sensitive cones → contain green-sensitive pigment

Red-sensitive cones → contain red-sensitive pigment

✓ The technical names for these receptors are :

(1) S-cones (Blue cones) → sensitive maximally to Short wavelengths (hence called S cones).

- Peak sensitivity in the blue spectrum .

(2) M-cones (Green cones) → sensitive maximally to Medium (Middle) wavelengths (hence called M cones)..

- Its peak sensitivity is in the yellowish-green spectrum .

(3) L-cones, (Red cones) → sensitive maximally to Long wavelengths (hence called L cones).

- Its peak sensitivity is in the yellow regions of the spectrum.

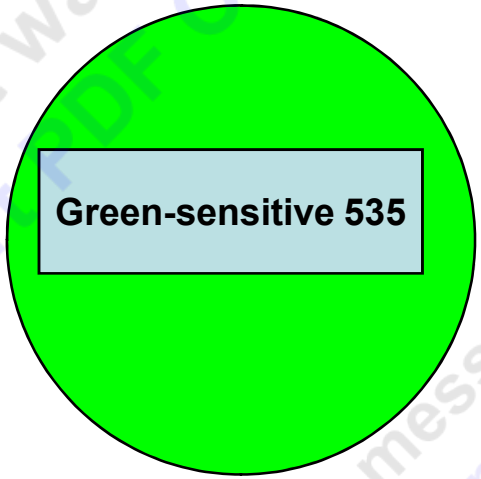
✓ Color vision is subserved by 3 types of cones containing a photoreceptor pigment most sensitive to oneof the 3 primary colors :

Blue-sensitive cones → contain blue-sensitive pigment

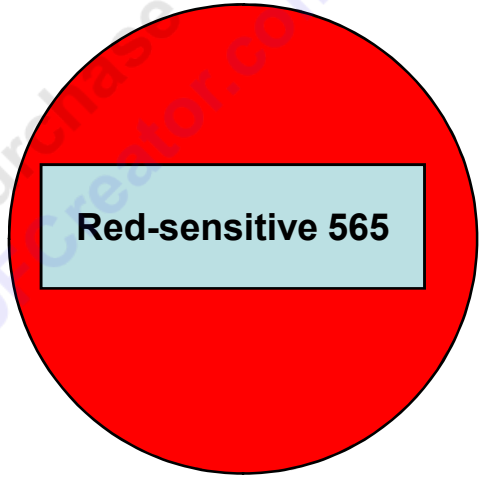
Green-sensitive cones → contain green-sensitive pigment

Red-sensitive cones → contain red-sensitive pigment

Blue-sensitive pigment absorbs Blue color waves, which are Short (S) waves

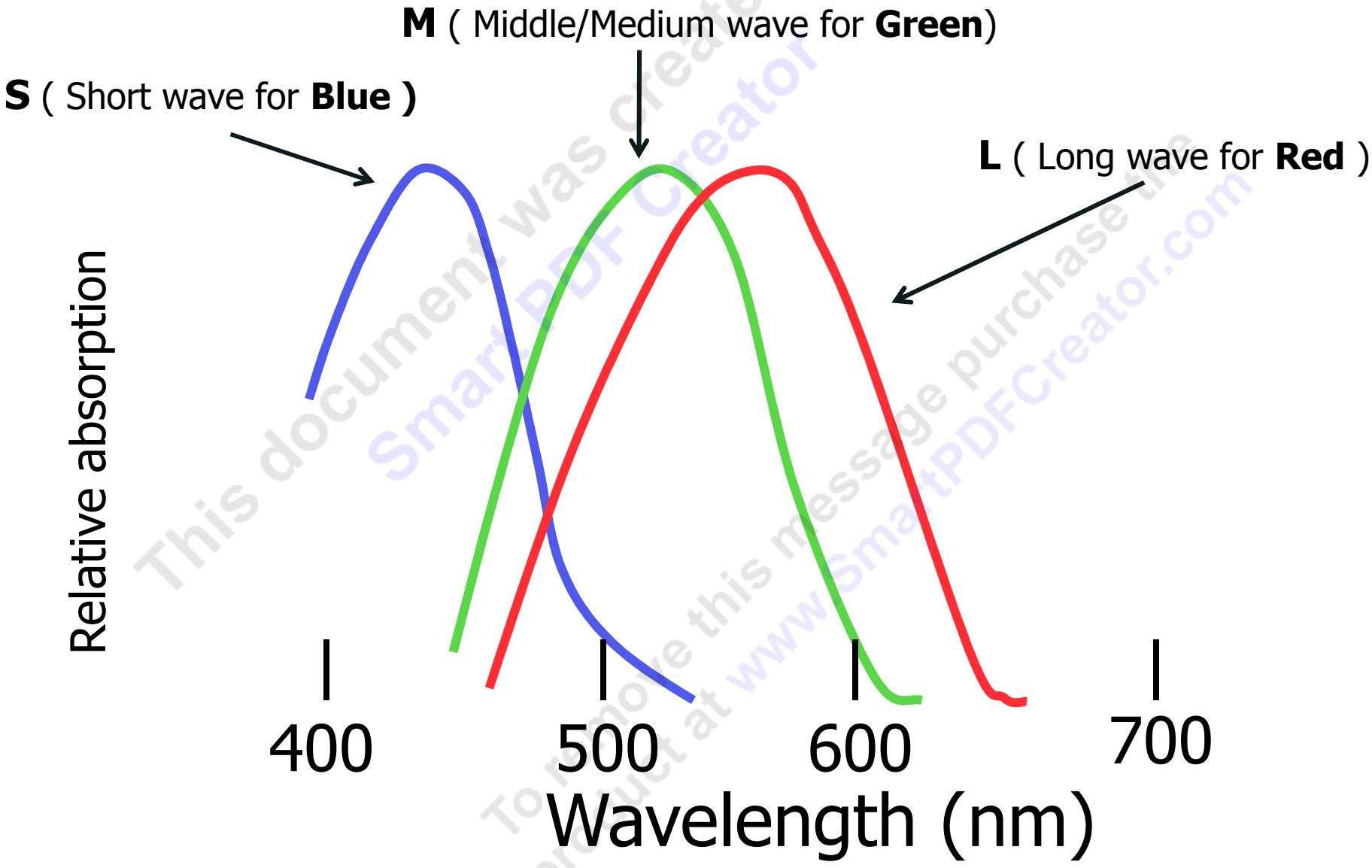


Green-sensitive pigment absorbs Green color waves , which are Middle (M) waves



Red-sensitive pigment absorbs Red color waves, which are Long (L) waves

Cone Wavelength Ranges



- Sensation of color depends upon :
- (1) Wavelength of light
- (2) Amount of light absorbed by each type of cones .
- (3) Frequency of impulses from each cone system .

• Inheritance

1. **red-sensitive pigment (Long wave) → X-linked inheritance (Gene in X chromosome)**
2. **green-senstive pigment (Middle wave)→ X-linked inheritance (Gene in X chromosome).**
3. **blue-sensitive pigment (Short wave).. Gene in chromosome 7 (autosomal)**

Classification of Humans with respect to Color Perception

- ✓ With respect to color perception , human beings are 3 types →

1. Trichromats : see the 3 primary colors
2. Dichromats : they are blind to one of the 3 primary colors .

- ✓ They get their color sense by mixing 2 primary colors .

3. Monochromats : do not perceive color (have only one color)

- ✓ 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 distinguish "

- Prevalence of color blindness:

  males ……..8%

  females …. 0.4%

- More commonly affects males but is transmitted by females , because red-sensitive pigment (in L cones) and green-senstive pigment (in M ones) are carried by Genes in the X chromosome →

  i.e., have X-linked inheritance

Color Blindness

✓ This disability can be mild (anomaly) , or can be severe (anopia)

Anopias

- In its most severe forms, color blindness is caused by the absence (anopia) of one of the cone visual pigments.
- Red-green color blindness is common , about 4-5% of the population (8-10% men red-green color blind).
- Patients missing M(Green) pigments are called Deuteranopes →i.e., Green-blind
- Patients missing L(Red) pigments are called Protanopes → i.e., Red- blind
- Patients missing S(Blue) pigments are called Tritanopes → i.e., Red- blind
- Monochromats → are patients missing two groups of photopigments

• Anomalies

- Patients with mild or moderate color blindness → are called → Anomolous Trichromats;
- Weak M (Green) pigments = Deuteranomalous .
- Weak L (Red) pigments type pigments = Protanomalous
- The M- and L-cone photopigment genes lie in X-chromosome .

- Thanks