COLOUR VISION

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- Human eye is sensitive to the visible light , ie 400 nm to 750 nm.
- There are only 7 basic clours, but human eye can distinguish more than 200 shades of colours.

- **Qualities of colours**
- **Hue**- name of the colour itself.—red, green, blue etc –(depends upon wavelength)
- **Brightness**- depends on intensity of rays—different shades of same colour –bright red. Dull red etc
- **Saturation** – degree of dilution of a colour with white—red is more saturated than pink.(pink has more white mixed)

- **Primary colours-** **red, green and blue**.
- By mixing them in suitable proportion white or any desired colour can be obtained.

-- if they mix in equal proportion—**white colour**

- **complementary colour**
- When 2 colours are mixed in a particular proportion –give sensation of **white**
- Eg --**yellow & blue. Orange and cyan blue**

- **Mechanism of colour vision**
- There are 3 different types of cones in the retina and each cone contains different photopigments.
- In absorption spectra each cone shows peak sensitivity at a particular wavelength
- **Erythrolabe**– red sensitive (**L cone** –Long wavelength sensitivity cone)- shows maximum sensitivity at **570 nm**
- **Chlorolabe** –green sensitive (M cone-Medium wavelength)---**535 nm**
- **Cyanolabe** (short wavelength –S cone) –**445 nm**
- Each pigment is a combination of retinene & photopsin.
- Photopsin is different in different pigments, but retinene is same.

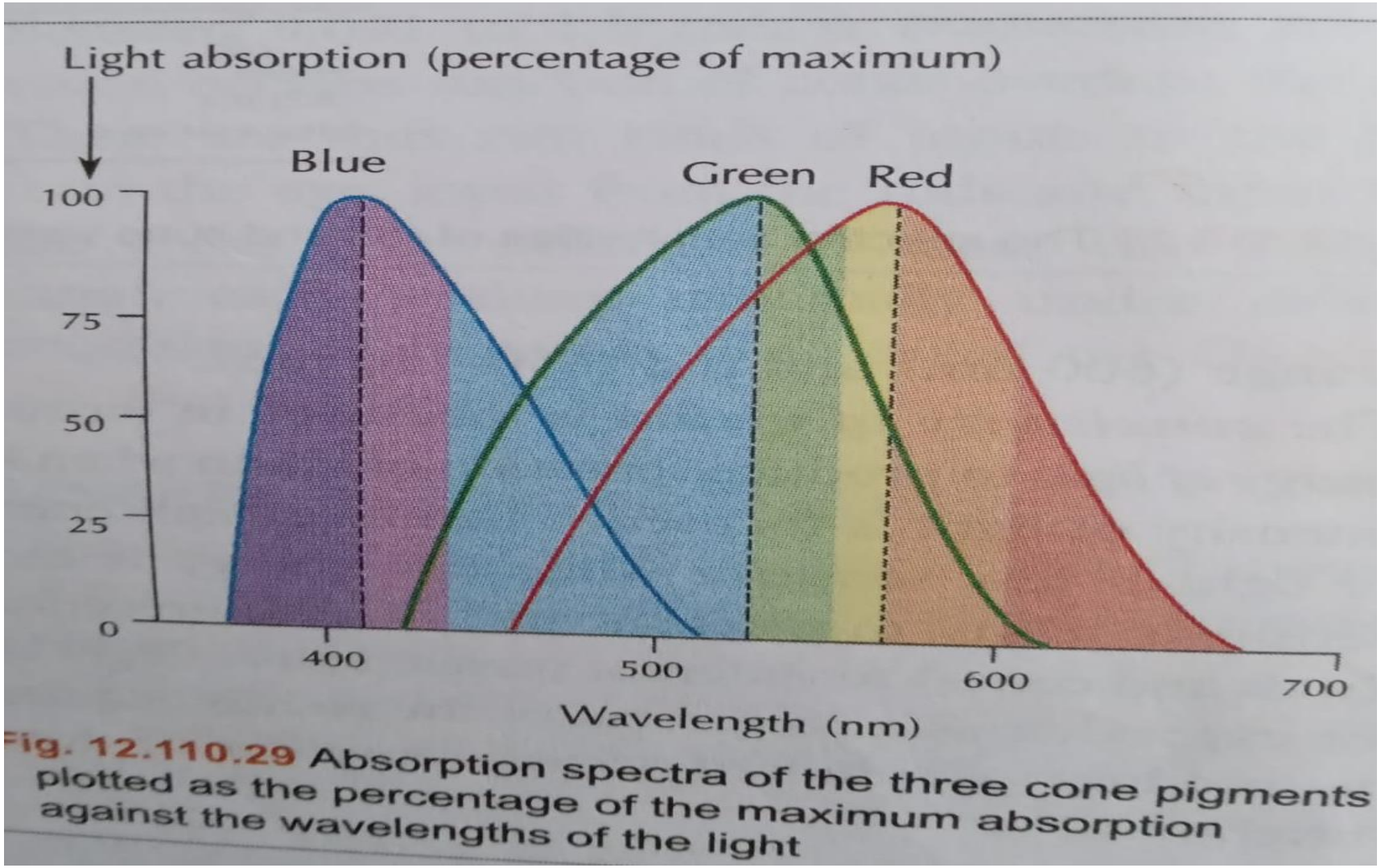

Fig. 12.110.29 Absorption spectra of the three cone pigments plotted as the percentage of the maximum absorption against the wavelengths of the light

Mechanism of colour vision

- **Each cone pigment can absorb a wide range of wavelengths**
- **One wavelength may stimulate more than one type of cone.**
- Due to differential stimulation of these 3 types of cones we can perceive all the colours.

- Eg a monochromatic light of wavelength **580 nm** stimulates red cones **99%,** green cones **42%** and does not stimulate blue cones.
- The ratio of stimulation of the 3 types of cones is

  red : green: blue = **99:42:0**

Nervous system interprets this ratio as the sensation of **orange**.

- Light of 580 nm ----stimulus ratio is 99: 42: 0 --- orange
- Light of 550 nm ---- “ - 83:83:0--- yellow
- Light of 490 nm --- “ --31:67:36—green
- Light of 450nm -- “ 0:0:97 ------blue
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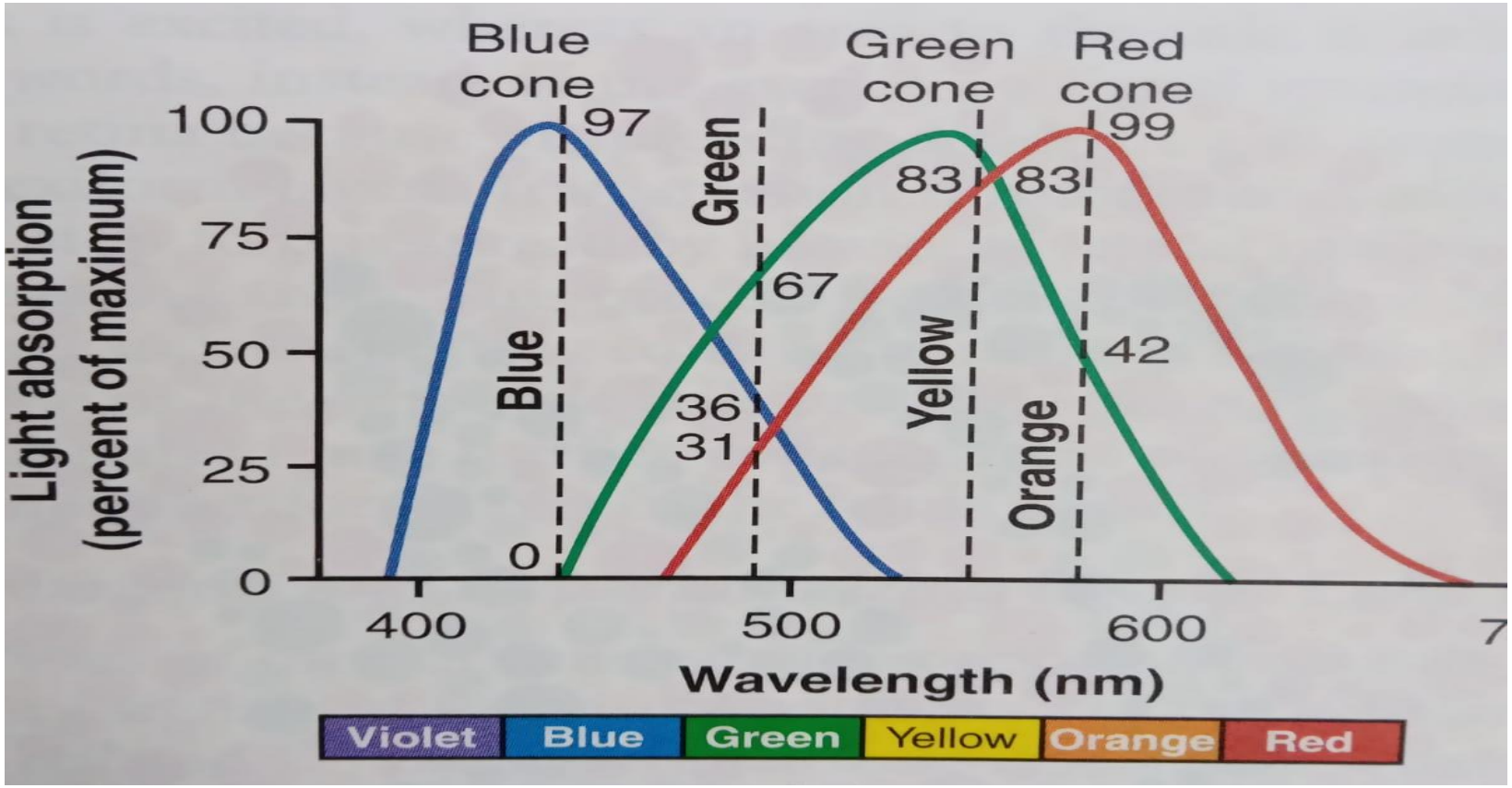


- **Perception of white**

--Equal stimulation of three cones gives sensation of white

- Stimulation of only one type of cone do not encode any colour.
- At least 2 types of cones are required for colour vision.

- **Theories of colour vision**
- 1) **Young Helmholtz Trichromatic theory**

  --colour vision is a function of cones.
- 3 types of cones for 3 primary colours, and each contain different photochemical pigments.

They are **erythrolabe,chlorolabe & cyanolabe** each absorb maximally at different wavelengths.

- Ability to appreciate a colour depends upon the particular wavelength stimulating the cone.
- Red light stimulates red cones maximally and other cones feebly.

-Similarly others.

- By mixing 3 primary colours in different proportions, any type of colour sensation can be produced

2) Herrings theory of opposite colours.

3) Granites dominator and modulator theory

Colour bllindness

- -is the failure to appreciate one or more of the three primary colours.

Colour blindness may be congenital or acquired

--It is inherited through X-linked recessive gene.

-Acquired colour blindness may be due to **damage of macula or optic nerve**

- **Trichromats**—individuals with normal colour vision have 3 types of cones.
- **In anomalous trichromats-**--people have 3 types of cones, but 1 cone is weak. (anomaly—weak)
- Protanomaly— red weak
- Deuteranomaly- green weak
- Tritanomaly – blue weak

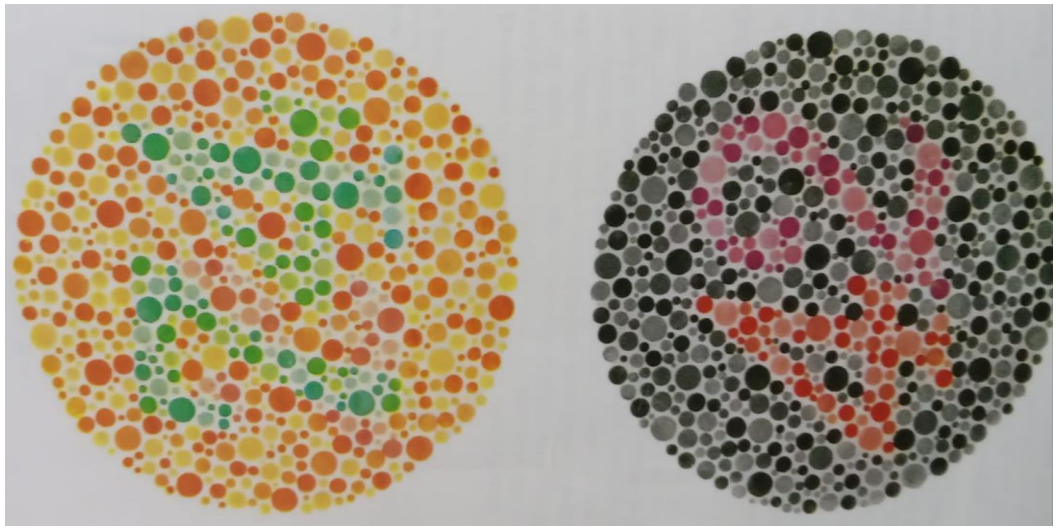
- **Dichromats**- **one cone is absent**, only 2 cones are present.
- protanopia—red absent—red blind
- Deuteranopia—green absent
- Tritanopia ---blue absent
- Dichromats can match their colour spectrum by mixing only 2 primary colours.

- **Monochromats** –have only one cone & cannot appreciate any colour.

(minimum 2 cones are required to appreciate any colour)

They have only **black and white vision**

- **Tests for colour vision.**
- Ishihara charts---- are plates printed with numbers or designs in coloured circles on a background of similarly shaped colour circles. The figures are intentionally made of colours that are likely to look the same as the backgound to an individual who is colour blind.
- A colour blind person reads them differently.



- **Importance of colour vision-**
- 1) pilots, navigators,vehicle drivers, and railway employers require normal colour vision as they deal with colours for running their machines.
- 2) workers in textile industry where dyeing cloth requires high degree of colour vision
- 3) persons working in paint and printing industries. Etc

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