



# PNS module

## Lab. 1

## Vision

**Prof. Dr./ Sherif Wagih Mansour**

**Prof. of Physiology dpt.**

**2024**

# 1-Visual acuity

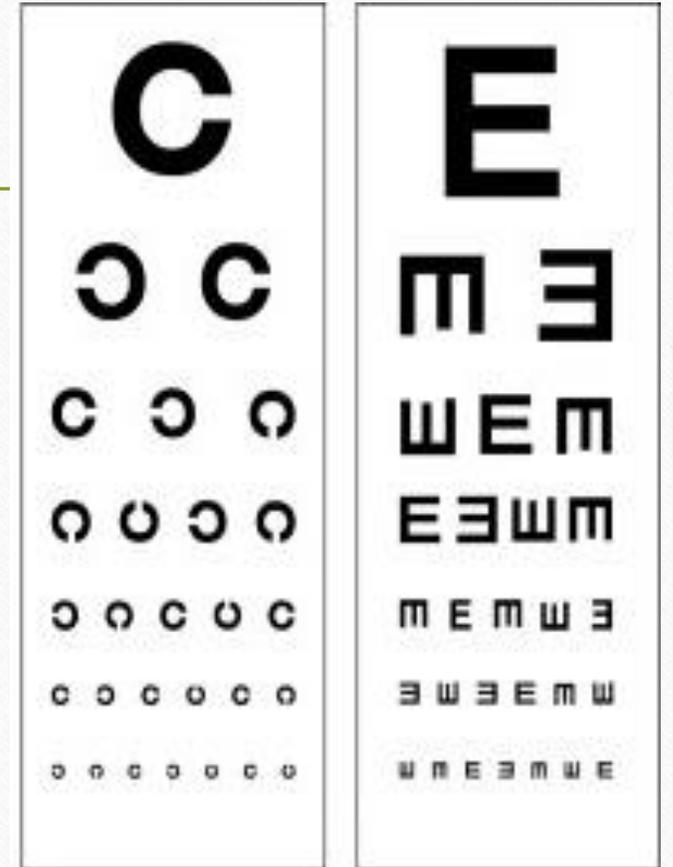
- **Definition:-**

It is the ability of the eye to see details. It depends on the ability of retina to perceive the separation between two points.

- **Procedure :-**

- **Landolt's broken rings:**

- is a white board containing **7 rows** of broken circles resemble letter (C)
- These 7 rows are graduated in **size** , so that each rows form angle of vision which can be differentiated by normal eye at particular distance e.g :-
- the **first** line (biggest circle) can be seen at a distance of **60** meter .
- the **second** line can be seen at **36** meter .
- the **third** line can be seen at **24** .
- the **forth** line can be seen at **18** .
- the **fifth** line can be seen at **12** .
- the **sixth** line can be seen at **9** .
- the **seventh** line can be seen at **6** .



- The subject must be at the **same** level with the charts, with a good source of **light**
- Each eye must be tested **separately**

---

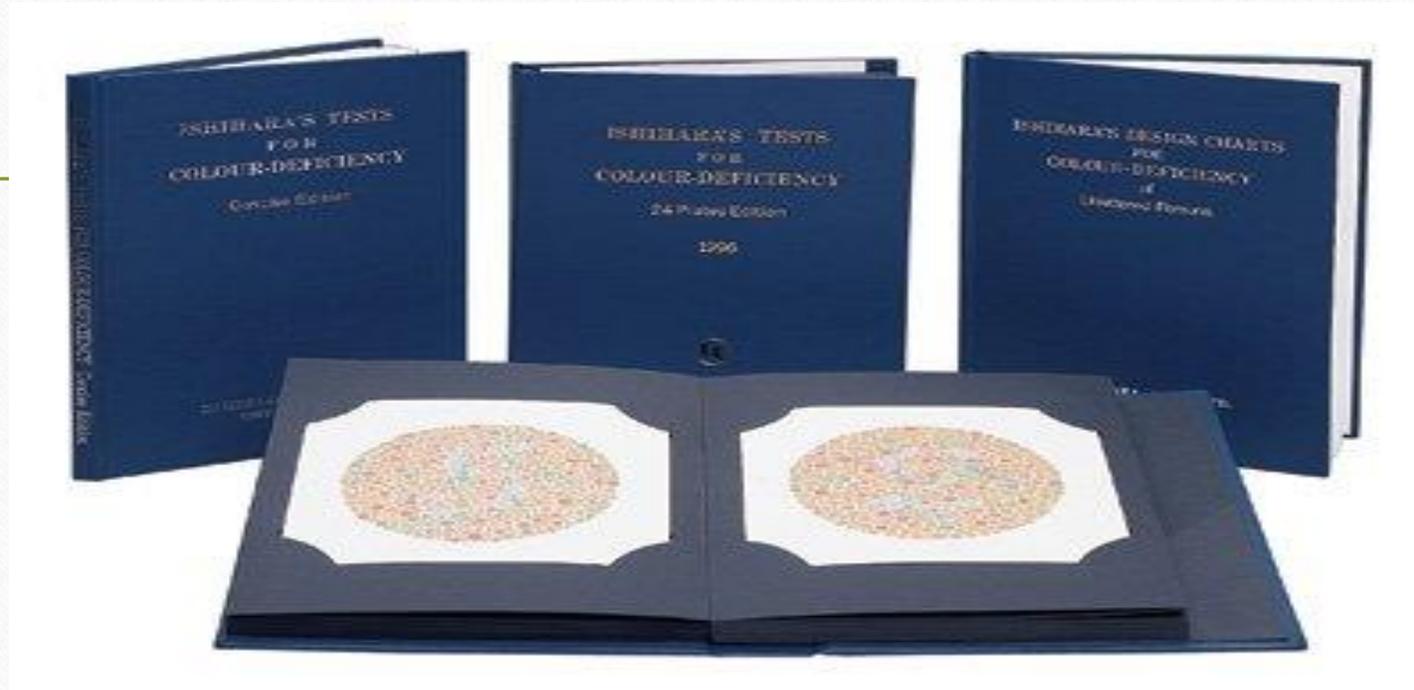
- The subject must be at a distance of **6 meter** to avoid accommodation . and is asked to identify the direction of the gap .
- **Snellen's letters** : Series of **letters** with varying sizes so constructed that the largest letter is visible by the normal eye at **60 meter** and the **smallest** at only **6 meter** .
- Examine the visual acuity of your partner by the use **landot's brocken rings** .

- In the **Emmetropic eye**, the brain can differentiate between two separate points if these two points stimulate **two separate cones** and in between them un-stimulated cone (which having a diameter of **4 Micron**).
- 

- This occurs when the two rays from the two separate points intersect with each other at **Nodal point of the lens (15 mm in front of the retina)** forming a **visual angle =1 minute**, thus the minimum separation between any two points that can be detected as separate is a **visual angle at nodal point = 1 minute**.
- Stimulation of two adjacent cones perceived by the visual cortex as one point.

- Each eye must be tested separately and the patient is tested from **above downward** at distance of **6 meter** to avoid any accommodation.
- The visual acuity is expressed as a fraction the **numerator** represents the **distance** between the **patient** and the **chart** while the **dominator** represents the maximum distance at which **normal** person can see the broken circles. The **normal** visual acuity is **6/6**. The visual acuity is maximal at the **fovea**.
- If the patient cannot see the largest row at 6 meters he is moved at 5 meters, then 4 meters till 1 meter.
- If patient is unable to see at 1 meter he is tested by **counting finger "CF"**. If he is unable to count finger he is tested by hand movement and lastly by perception of light "PL".

## 2- Color vision



Ishihara test Chart

- **I. The Ishihara test:** is a color perception test for red-green **color deficiencies**.
- The test consists of a number of colored plates, called **Ishihara plates**, each of which contains a circle of dots appearing randomized in color and size. Within the pattern are dots which form a number or shape clearly visible to those with normal color vision, and invisible, or difficult to see, to those with a red-green color vision defect, or the other way around. The full test consists of **38** plates. The plates make up several different test designs:
  - **1-Transformation plates:** individuals with color vision defect should see a different figure from individuals with normal color vision.
  - **2-Vanishing plates:** only individuals with normal color vision could recognize the figure.
  - **3-Hidden digit plates:** only individuals with color vision defect could recognize the figure.
  - **4-Diagnostic plates:** intended to determine the type of color vision defect and the severity of it.

## Theories of color vision:-

- **A-Trichromatic theory or young - Helmholtz theory** which suggests the presence of **3 types of cones** each one is maximally stimulated or maximally sensitive to one of the primary color.

---

- **First** cone contains pigment that is maximally sensitive to **blue** part of the spectrum
- **Second** cone contains pigment that is maximally sensitive to **green** part of spectrum,
- **Third** cone contains pigment that is maximally sensitive to the **red** part of the spectrum.
- Any different colored object stimulates the 3 cones but in an **unequal** manner and thus number of impulses that are emitted from these cone to the visual cortex differ in frequency and number and this difference gives the specific sensation by that color.
- On the other hand **equal** stimulation of all the three cones gives the sensation of **white** color.

## **B-Neural theory of color vision:**

- There are **3 types** of the ganglion cells:
- **W cells (40%)**: these cells are **small**.

---

- **X cells (55%)**: these cells have a **medium** diameter. Also called the **P cells**.
- **Y cells (5%)**: these cells are **large** also they are also called **M cells**.
- Then from these **X** ganglion cells to another group of cells in the **lateral geniculate body in the thalamus** . Finally impulses reach color sensitive neurons in **visual cortex** called neurons of "**blobs**" to relay in lingual and fusiform gyri of the **occipital** cortex which were proved to be concerned with **color vision**.

# Color Blindness

- Color blindness is most commonly **hereditary** disorder (recessive sex - linked trait) and very rarely acquired affecting **males** (8%) more than females (0.4 %).

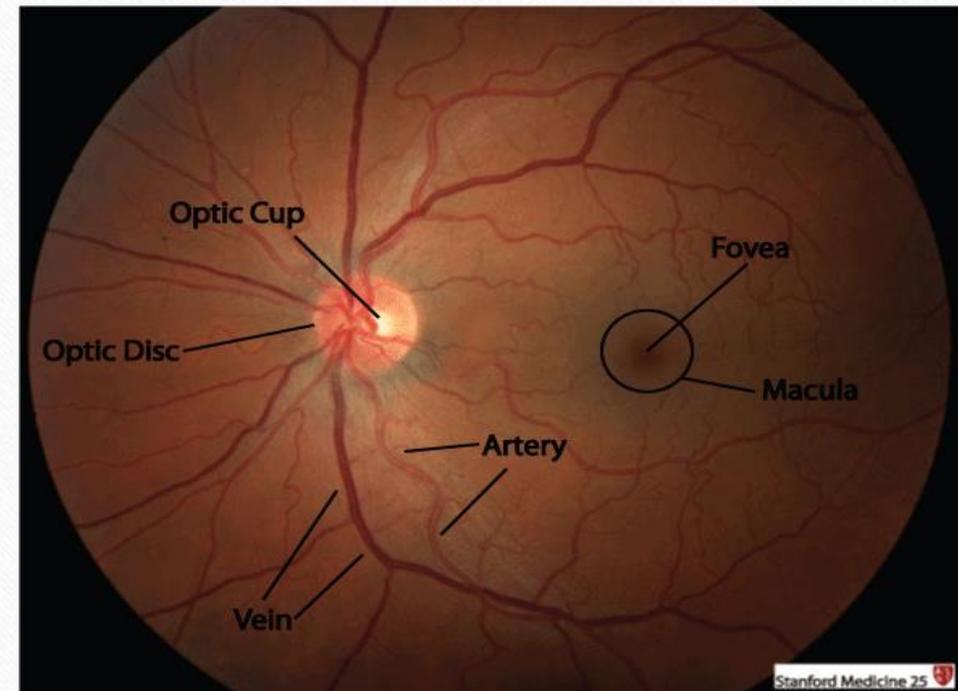
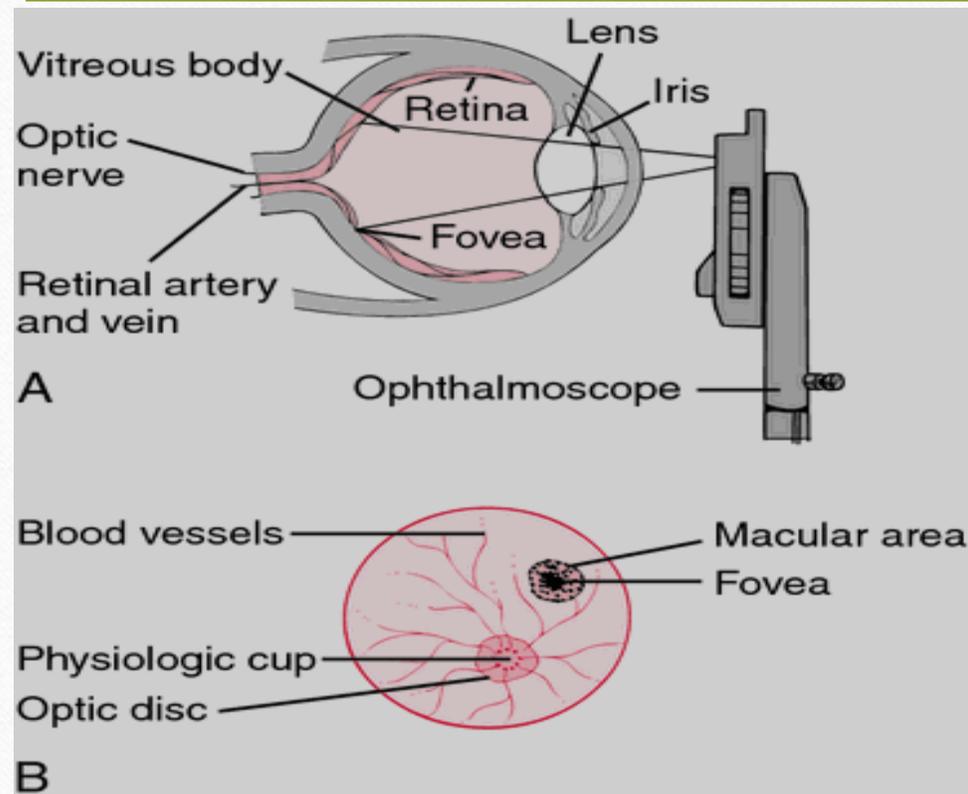
---

- According to **Young - Helmholtz theory** Color blindness is classified to: -
- **A- Trichromate:-** in this condition the patient has the **3 cones** but **one of them is weak**.
- **B- Dichromate :-** in this condition **one cone is totally absent** and the **other two are present**. Thus patient cannot perceive a certain color.
- **C- Monchromate :-** here the patient have **only one cone** system and matches the different colors as various degrees of grey color.

# 3- Ophthalmoscopy



- **Ophthalmoscopy**, also called **funduscopy**, is a test that allows a health professional to see inside the **fundus** of the eye and other structures using an **ophthalmoscope** . It is done as part of an eye examination . It is crucial in determining the health of the retina, optic disc and vitreous humor.



# Medical uses

- **Ophthalmoscopy** is done as part of a routine physical or complete eye examination.
- It is used to detect and evaluate symptoms of various **retinal vascular diseases** or eye diseases such as **glucoma** .
- In patients with **headaches**, the finding of **swollen optic disc**, or **papilledema**, on ophthalmoscopy is a key sign, as this indicates raised intra-cranial pressure (ICP) which could be due to hydrocephalus or brain tumour, amongst other conditions.
- Cupped optic discs are seen in **glucoma**..
- In patients with **diabetes mellitus**, regular ophthalmoscopic eye examinations (once every 6 months to 1 year) are important to screen for diabetic retinopathy.
- In **arterial hypertension**, hypertensive changes of the retina closely mimic those in the brain and may predict **cerebro-vascular accidents (strokes)**.

# *Thank You*

---

