



Al- mustaqbal University College
Anesthesia Techniques Department
First stage /medical physics
five lecture by Asst. Lecturer Fatema Sattar

Lecture 5:

Physics of eyes and vision

-The sense of vision consists of three major components

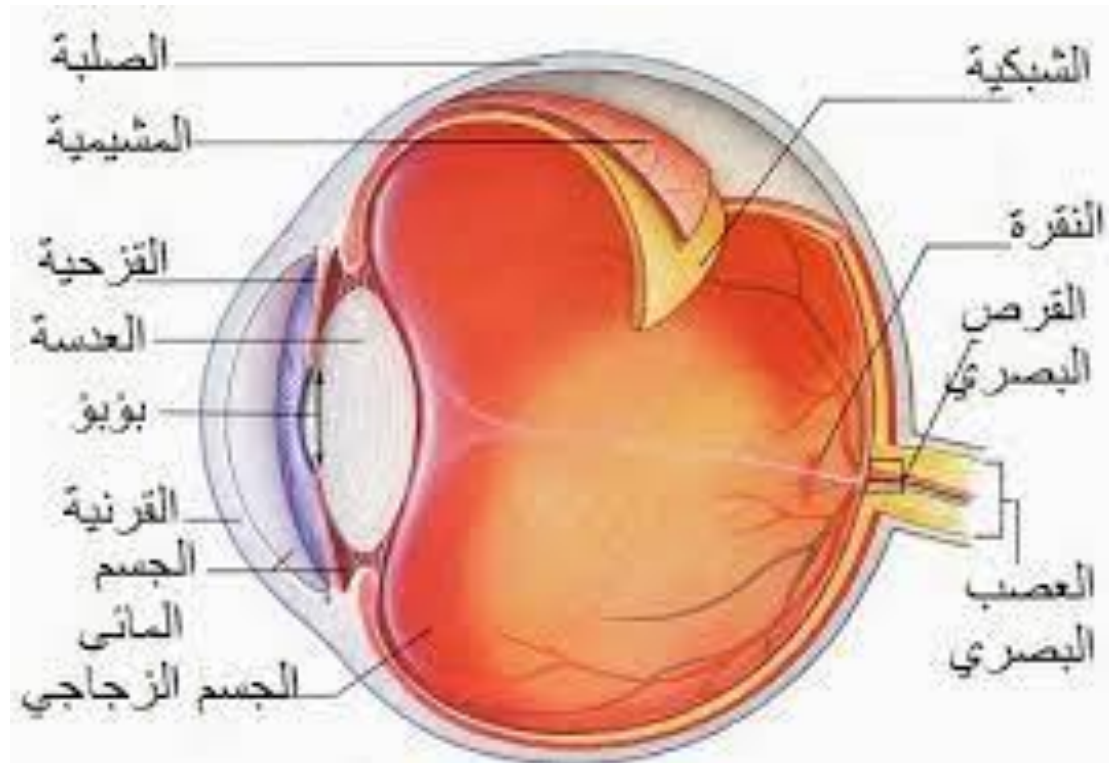
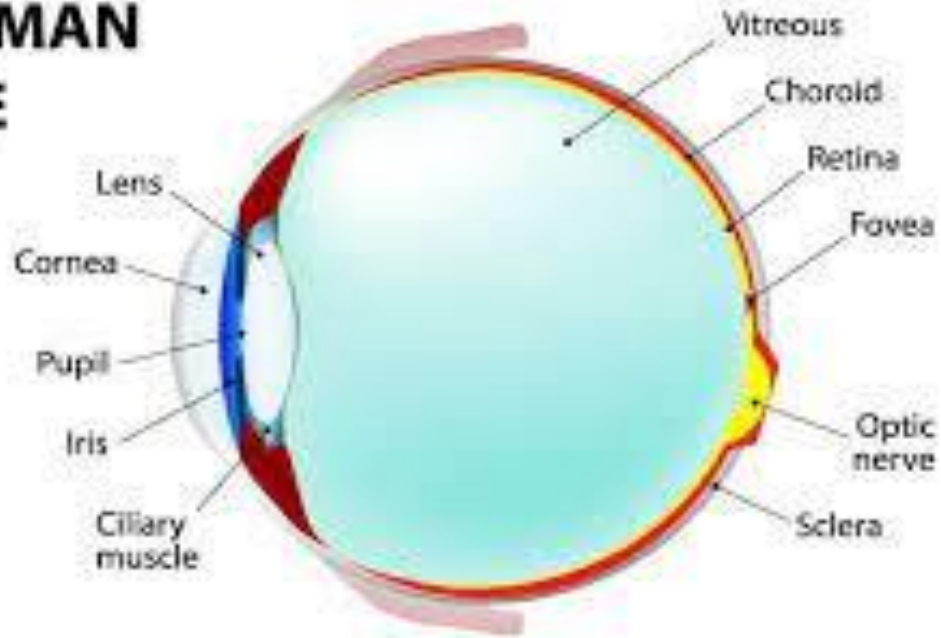
- 1- The eye that focus image from outside world on the retina.
- 2- The system of millions of nerves that carries information deep into the brain.
- 3- The visual cortex part of brain

Blindness results if anyone of parts does not function.

Vision Elements of the Eye

1. **The cornea:** It is the clear transparent bump on the front of the eye.
2. **The Iris:** It is the colored part of the front eye. The function of iris is adaptation Of vision from light to dark and vice versa.
3. **The Pupil:** It is the small opening in the center of iris where light enters the lens. Under average light condition the opening is about 4 mm in diameter. It can change from about 3 mm in diameter in bright light to about 8 mm in diameter in dim light about 300 sec are needed for it to fully open and about 5 sec required for close as much as possible.
4. **The lens:** It is variable in shape and has the ability to focus objects at various distances.
5. **The aqueous humor:** It fills the space between the lens and the cornea.
6. **The Vitreous humor:** Is a clear jelly-like substance that fills the large space between the lens and the retina.
7. **The sclera:** this part covering over all of the eye except the cornea.
8. **The Retina:** The light sensitive part of the eye. It converts the light image into Electrical nerve impulses that one sent to the brain.

HUMAN EYE



-Retina the light detector of eye

Retina the light sensitive part of eyes, converts the light images into electrical nerve impulses that are sent to the brain. The photon must be above minimum energy to cause the reaction. Infrared photons have insufficient energy and are not seen.

Ultraviolet photons have sufficient energy but they are absorbed before they reach the retina and also are not seen.

-Diopter strength of the Eye

There is a simple relationship between the focal length F , the object distance P , and the image distance Q of a thin lens.

If F measured in meters, then $1/F$ is the lens strength in diopters (D).

That is, a positive (converging) lens with focal length of 1 m has strength of 1 D. the focal length F of a negative (diverging) lens is considered to be negative. A negative lens with a focal length of -0.5 m has strength of -2 D.

The focal length F of a combination of two lenses with focal lengths

$$1/F = 1/F_1 + 1/F_2 + 1/F_n$$

Example:

Assume lens A with focal length $F_A = 0.33$ m is combined with lens B with focal length $F_B = 0.25$ m what is the dioptric strength and the focal length of combination?

Sol:

$$1/F = 1/F_A + 1/F_B$$

$$= 1/0.33 + 1/0.25$$

$$= 3 + 4 = 7 \text{ D}$$

$$D = 1/F$$

$$\text{So } F = 1/D$$

$$= 1/7$$

$$= 0.14 \text{ m}$$