

Light in Medicine

Fall Semester

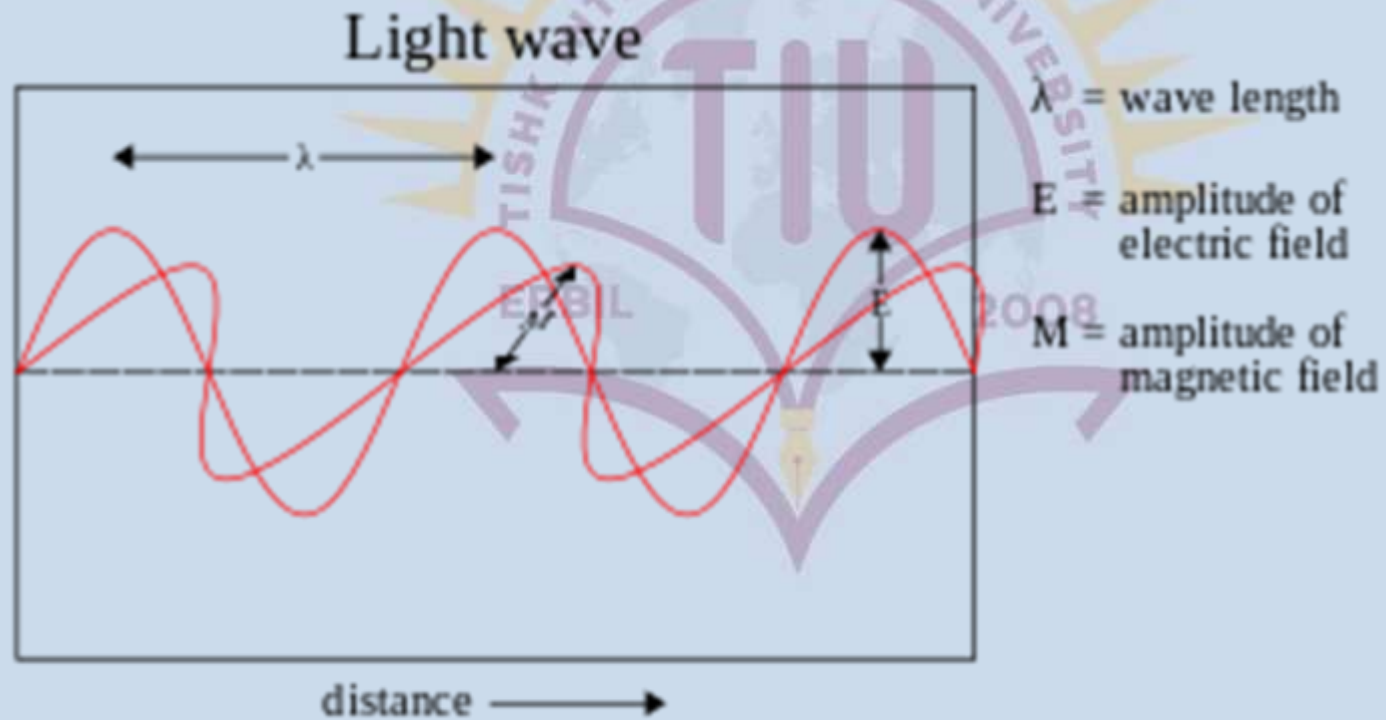
Course Name : Medical Physics

Stage : First

Lecture/Assistant Prof. Dr. Fatiheea F Hassan:



Light behaves both as a **wave** and as a **particle**. As a wave it produces interference and diffraction. As a **particle** it can be absorbed by a single molecule. When a light photon is absorbed its energy is used in various ways. It can cause a chemical change in the molecule that in turn can cause an electrical change.

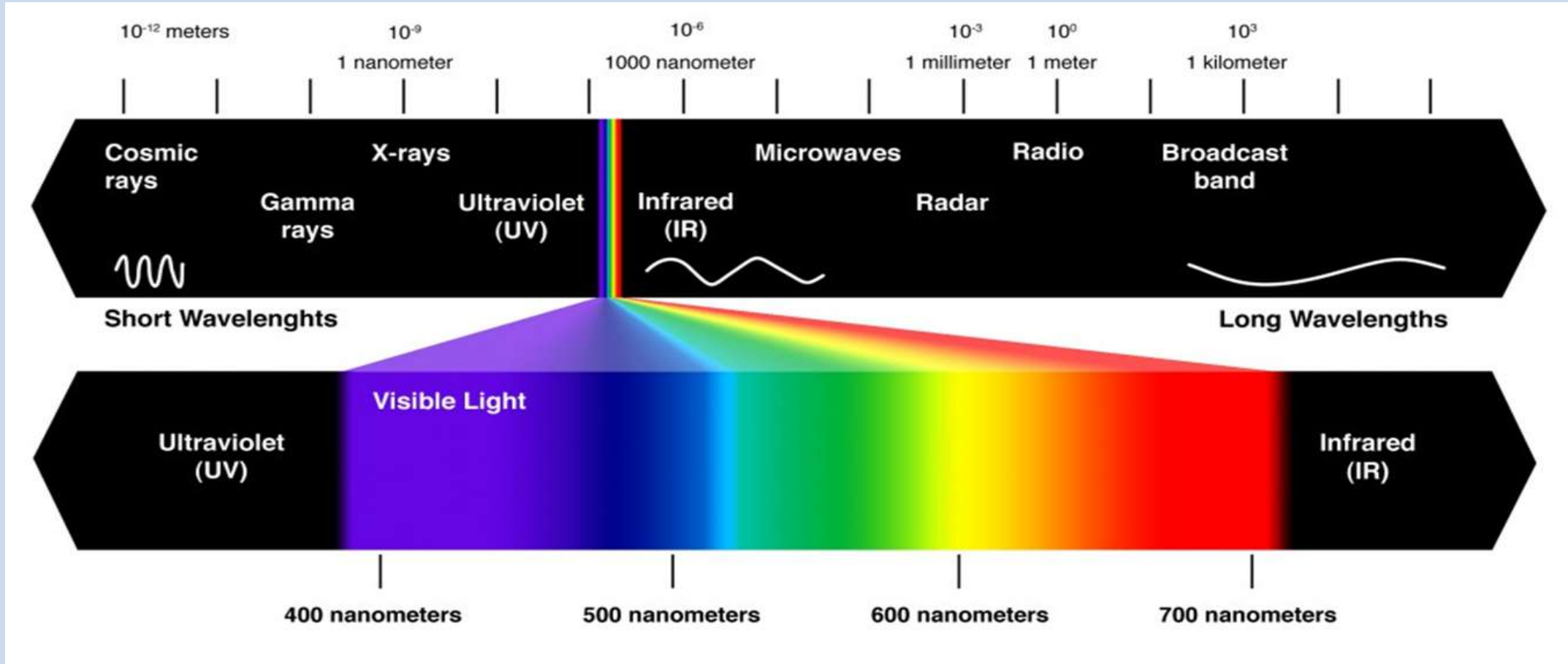


Light behaves both as a and as a.....

- a. Photon, particle
- b. Wave, sound
- c. Wave, particle
- d. Particle, sound



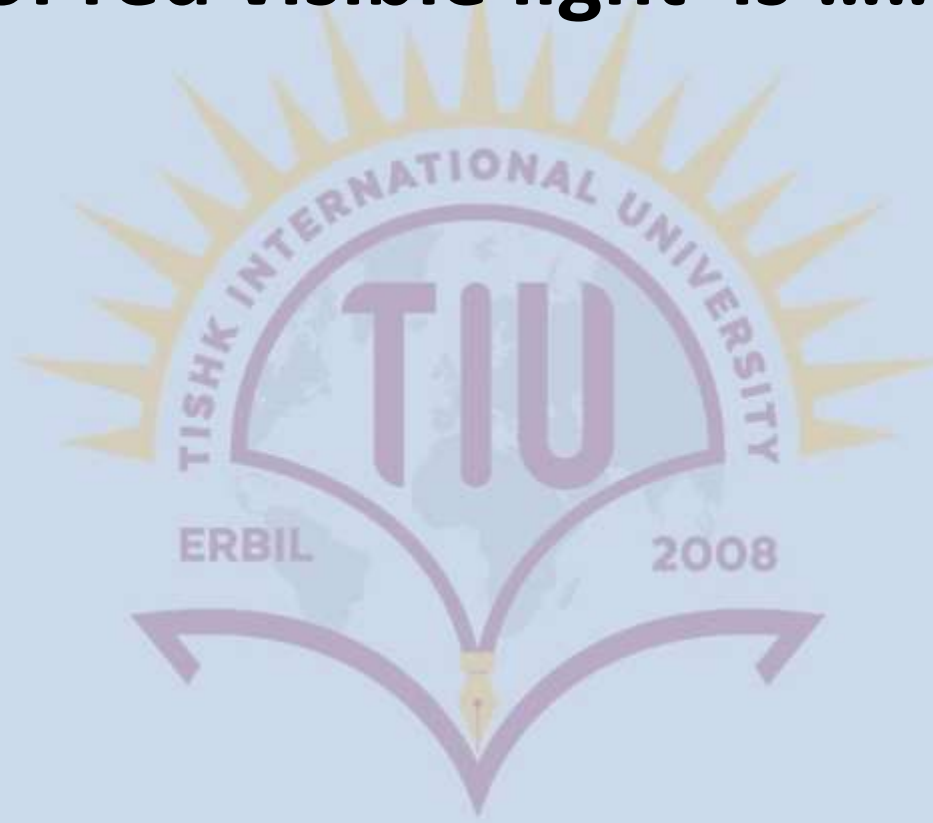
Spectrum of light



- Even though man is now very efficient at making artificial light, the sun is still the major source of light in the world.
- The sun is both beneficial and hazardous to our health.

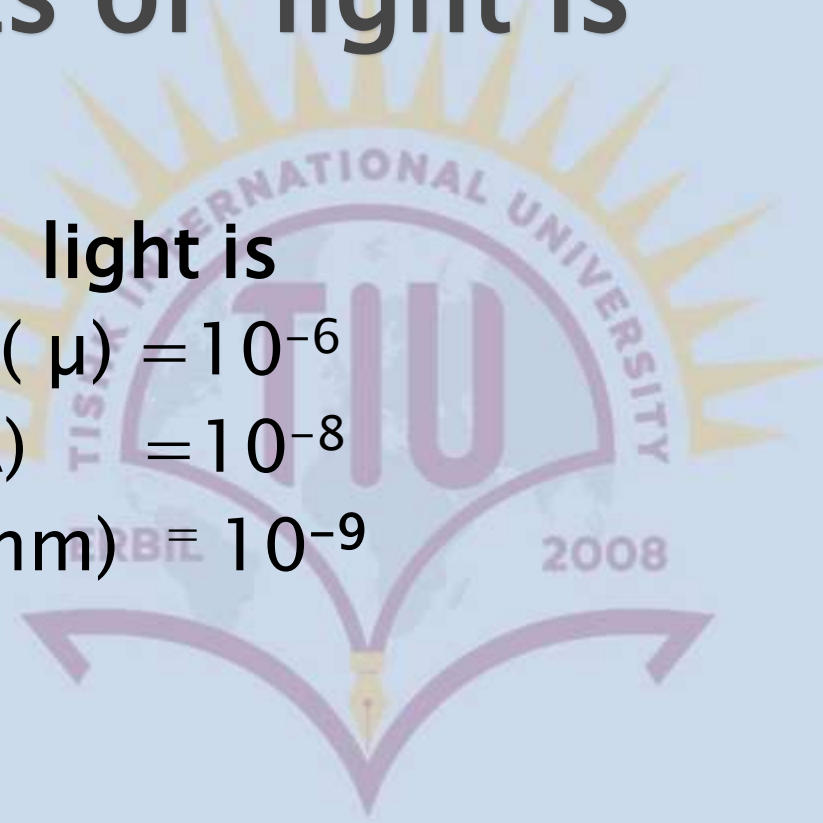
The wave length of red visible light is nanometers

- a. 600
- b. 700
- c. 400
- d. 300
- e. 100



The units of light is

- ▶ The units of light is
- ▶ micrometer(μ) = 10^{-6}
- ▶ angstrom (\AA) = 10^{-8}
- ▶ Nanometer(nm) = 10^{-9}



The properties of light are:

Light has some interesting properties, many of which are used in medicine: -

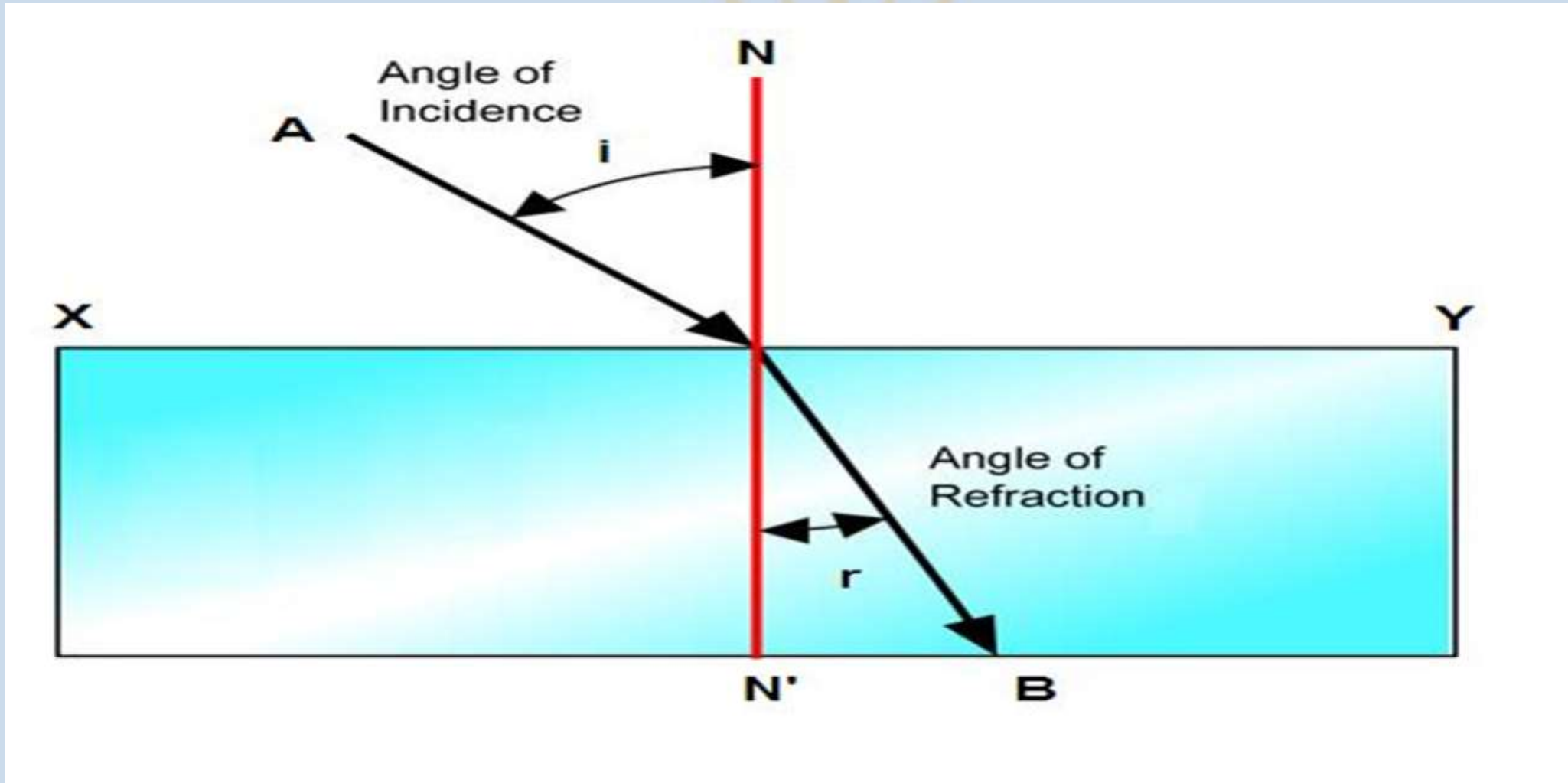
The speed of light changes when it goes from material into another.

The ratio of the speed of light in a vacuum to its speed in a given material is called **the index of refraction**

= (the speed of light in a vacuum / the speed of light in a given material).

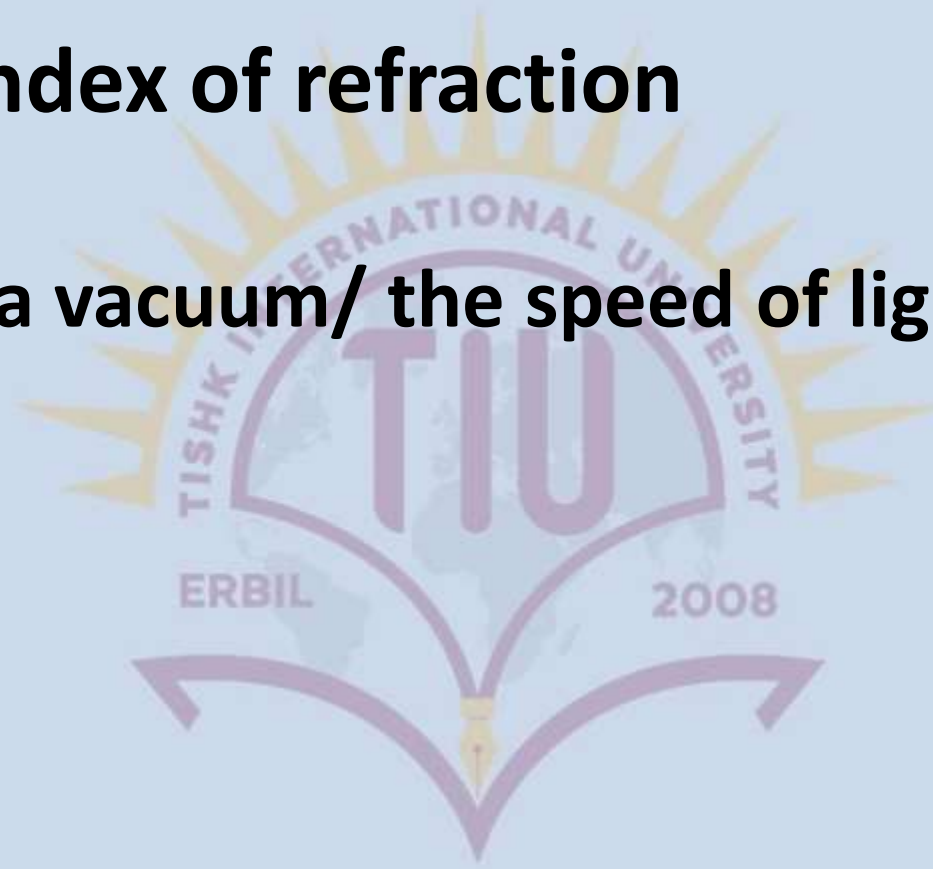
At which function index of refraction is applied in medicine?

IF a light beam meets a new material at an angle other than perpendicular. It bends, or refracted .

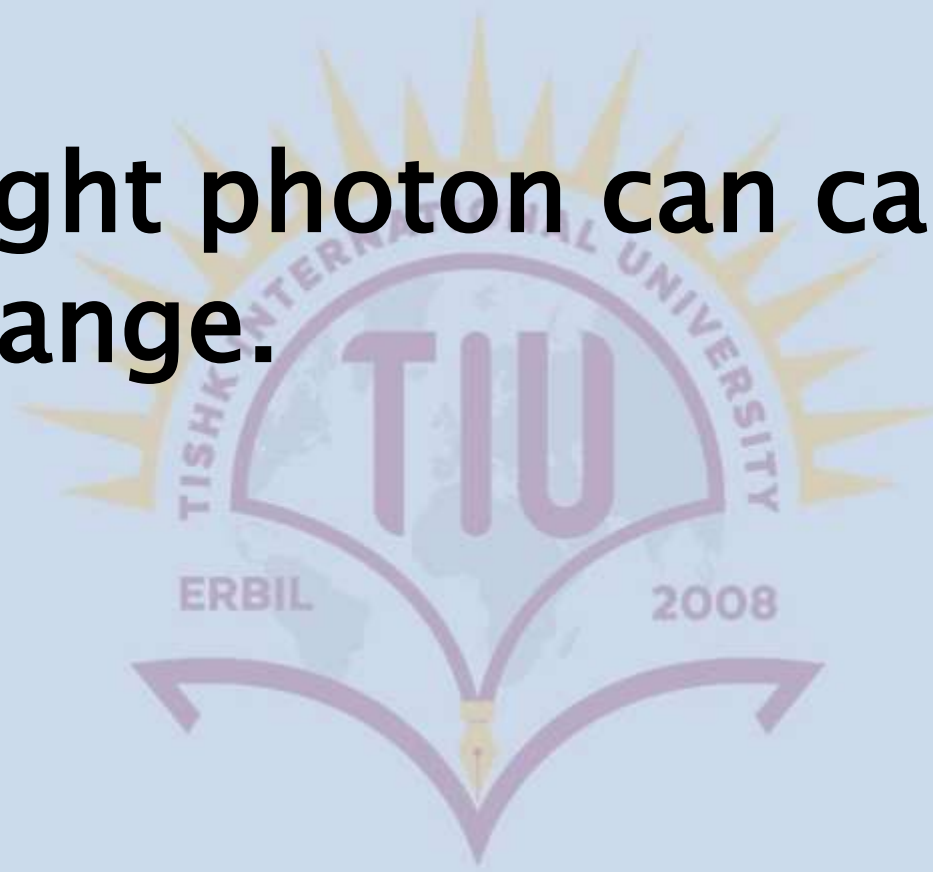


Define the index of refraction

(the speed of light in a vacuum/ the speed of light in a given material)

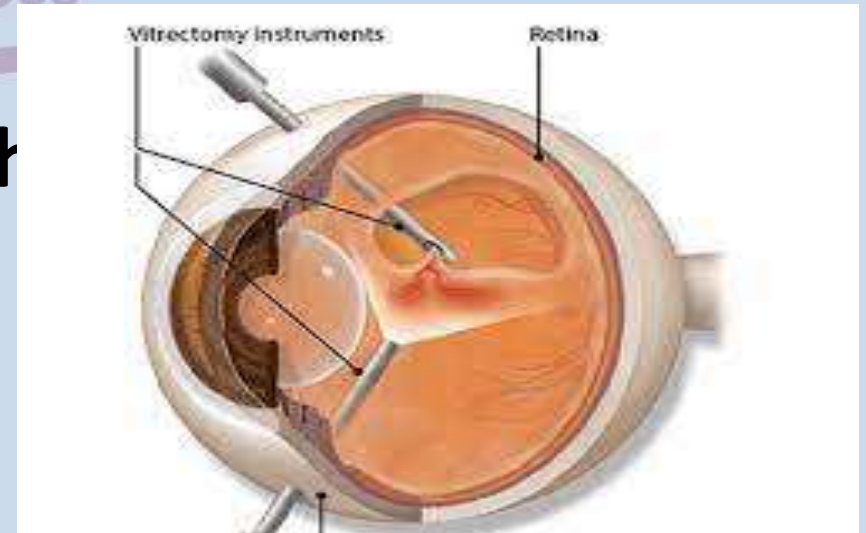


Explain: A light photon can cause an electrical change.



When light is absorbed, its energy generally appears as heat

When light is absorbed, its energy generally appears as heat. This property is the basic for the use in medicine of IR light to heat tissues. Also, the heat produced by laser beams is used to "weld" a detached retina to the back of the eyeball and to coagulate small blood vessels in the retina.

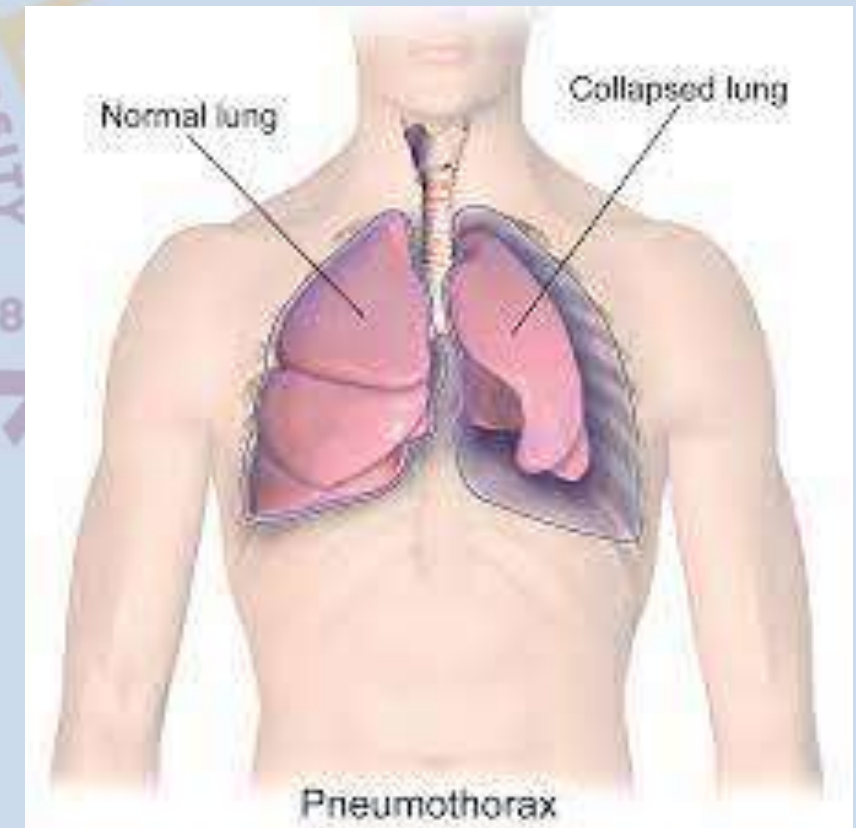
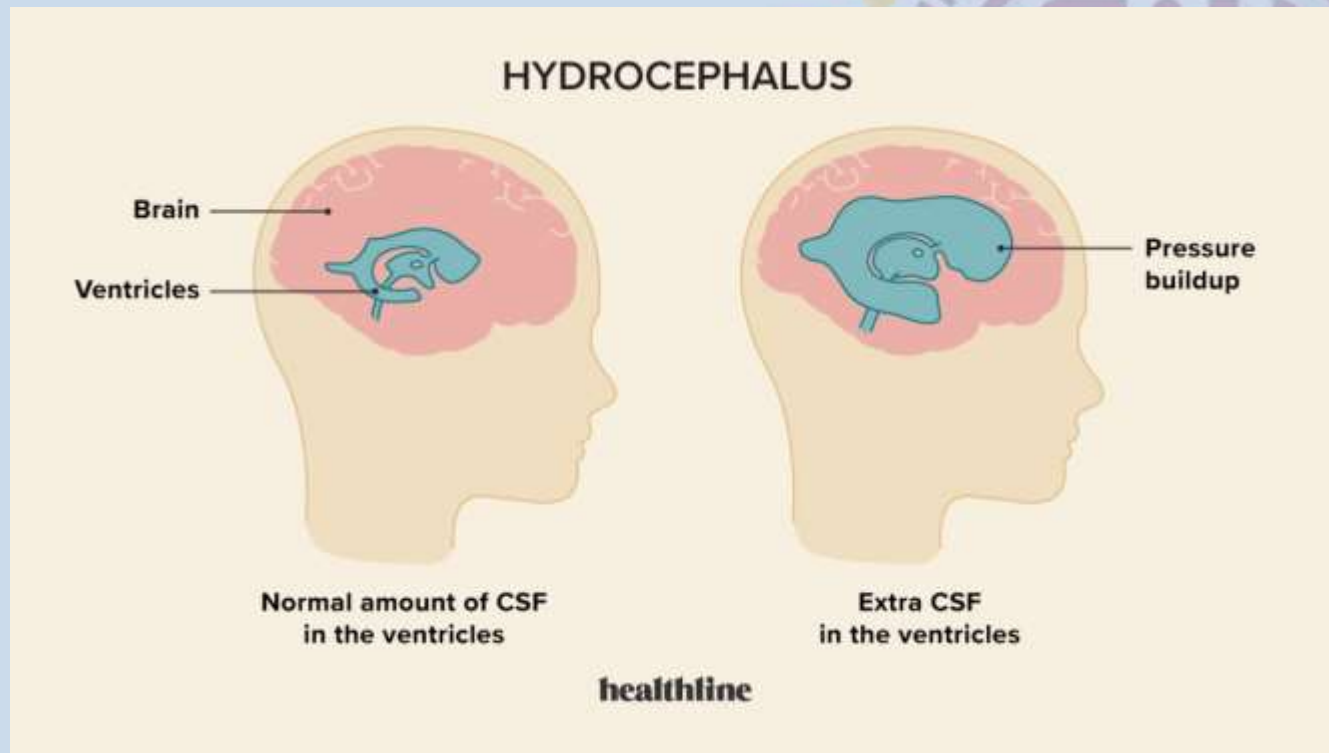


Give example about a light photon appears as heat in human body



Medical uses of visible light

- ▶ Pediatricians use a shine light into the bodies of infants and observe the amount of scattered light produced in order to detect water – head or collapsed lung.



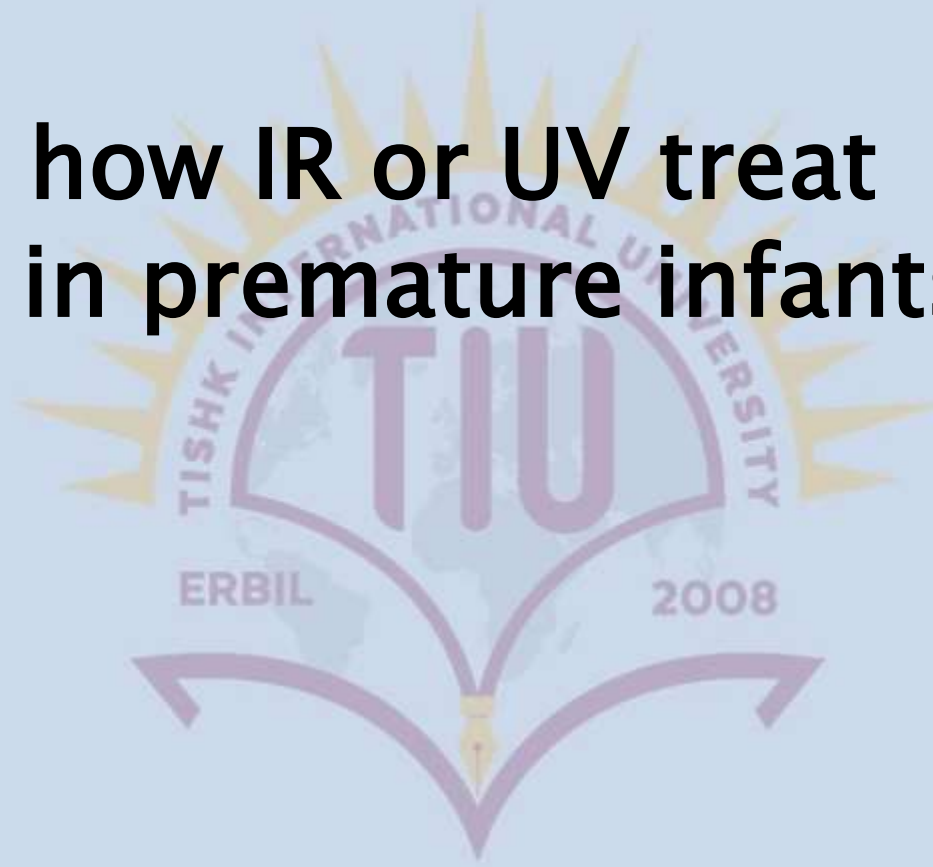
Pediatricians use a shine light to detect and

- a. Hydrocephalus , collapsed liver
- b. Water lung, collapsed liver
- c. Water head, collapsed liver
- d. Hydrocephalus, collapsed lung

- ▶ Pediatricians use IR and UV for treating jaundice in premature infants. However, because of their higher energies, UV photons are more useful than IR photons



**Explain , how IR or UV treat
jaundice in premature infants**

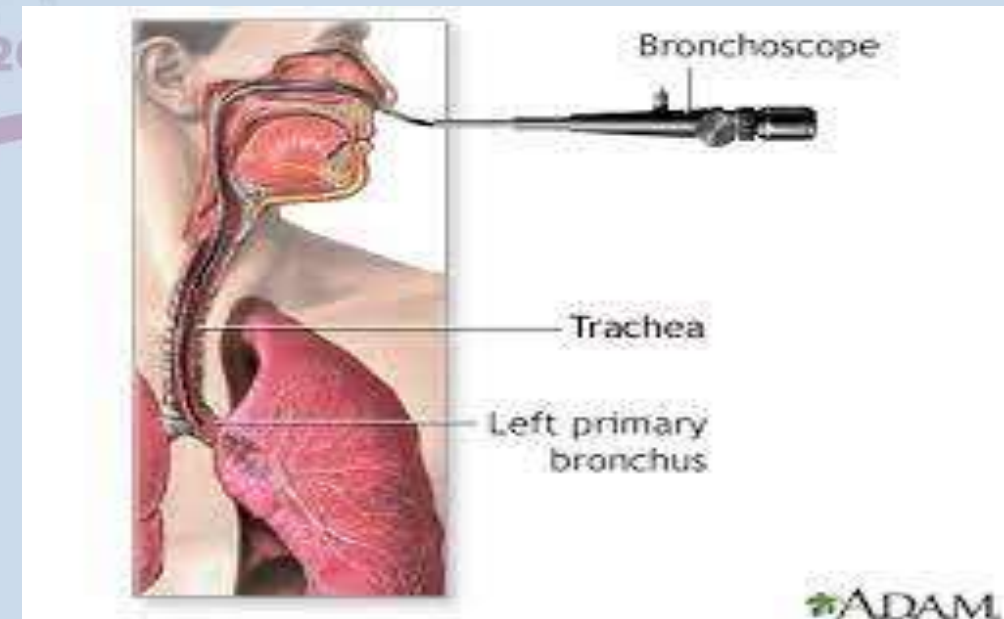
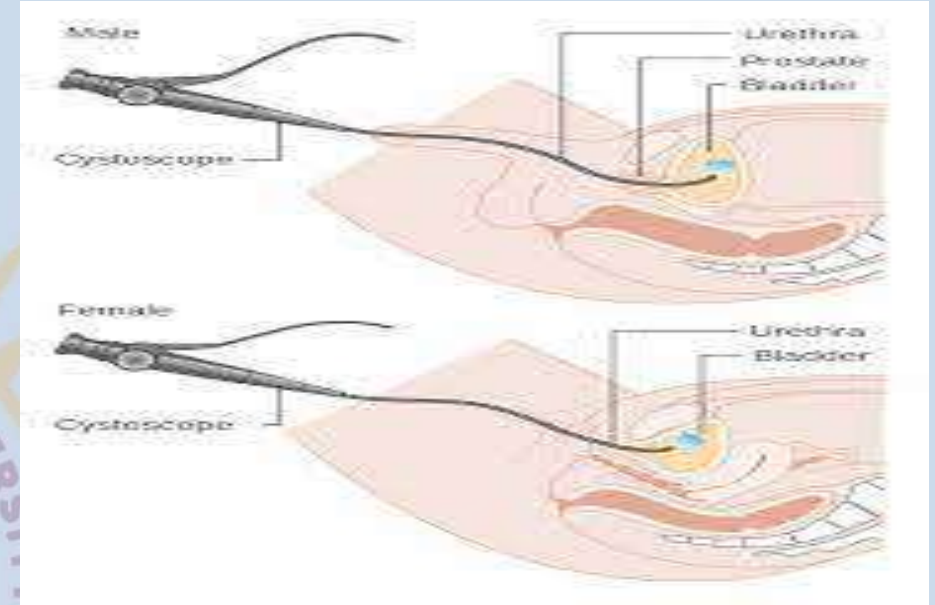


▶ **Light source in endoscope uses to see inside the body.**

A number of instruments, called **endoscopes**, are used for viewing internal body cavities. Special purpose endoscopes are often given names indicating their purpose.

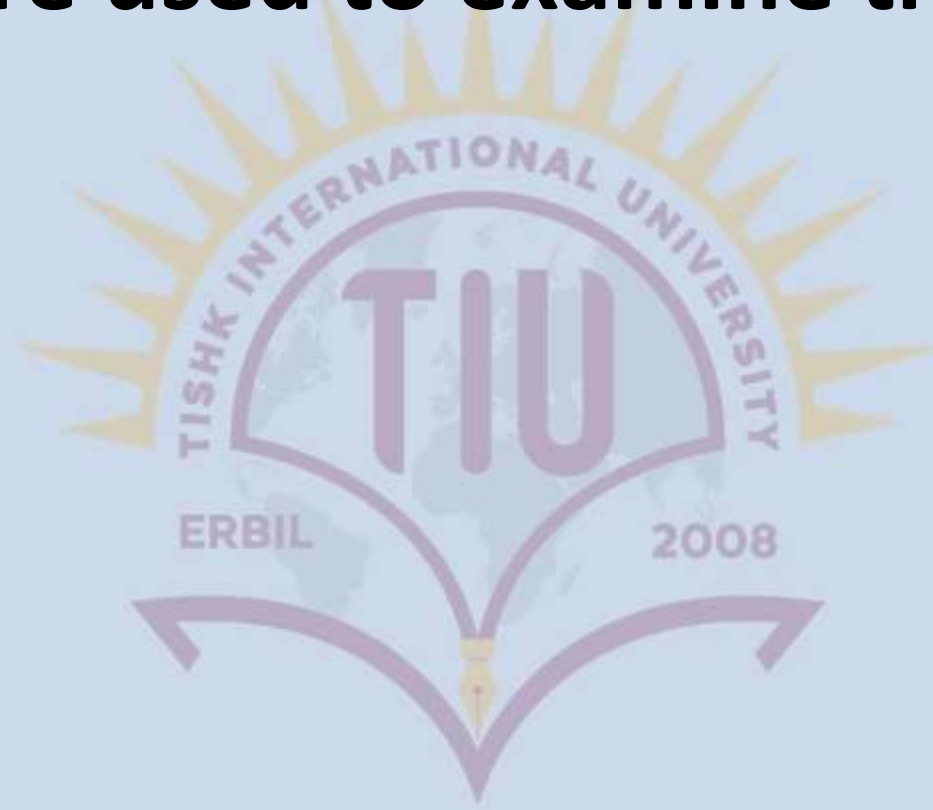
For example, **cystoscopes** are used to examine the bladder, **proctoscopes** are used for examining the rectum, and **bronchoscope** are used for examining the air passages into the lungs.

Some endoscopes are **rigid tubes** with a light source to illuminate the area of interest. Many of them are equipped with **optical attachments** to magnify the tissues being studied.



cystoscopes are used to examine the.....

- a.Lungs
- b.Rectum
- c.Bladder
- d.head



proctoscopes are used for examining the

- a.Lungs
- b.Rectum
- c.Bladder
- d.head

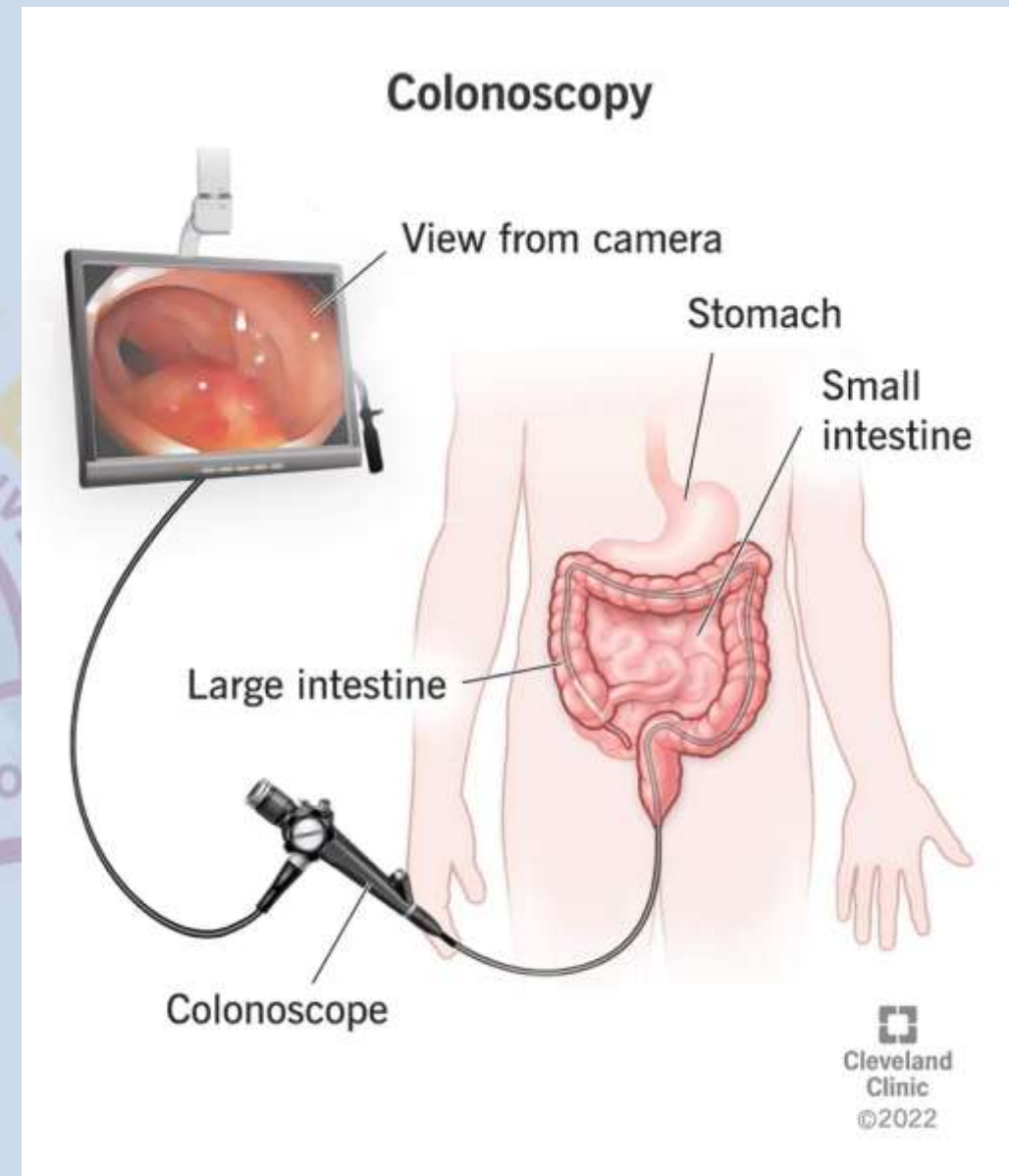


**bronchoscope are used for examining the air passages
into the**

- a.Lungs
- b.Rectum
- c.Bladder
- d.head



Colonoscopy is a procedure in which a doctor uses a colonoscopy, to look inside rectum and colon. Colonoscopy can show irritated and swollen tissue, ulcers, polyps, and cancer.



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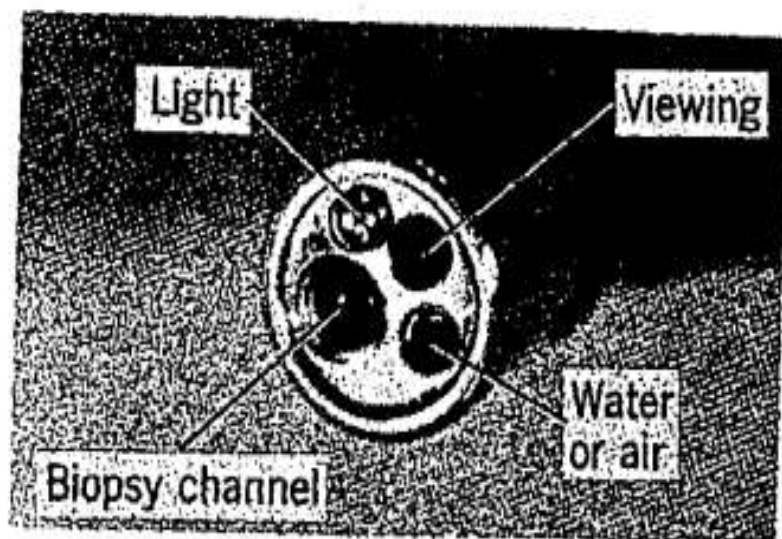
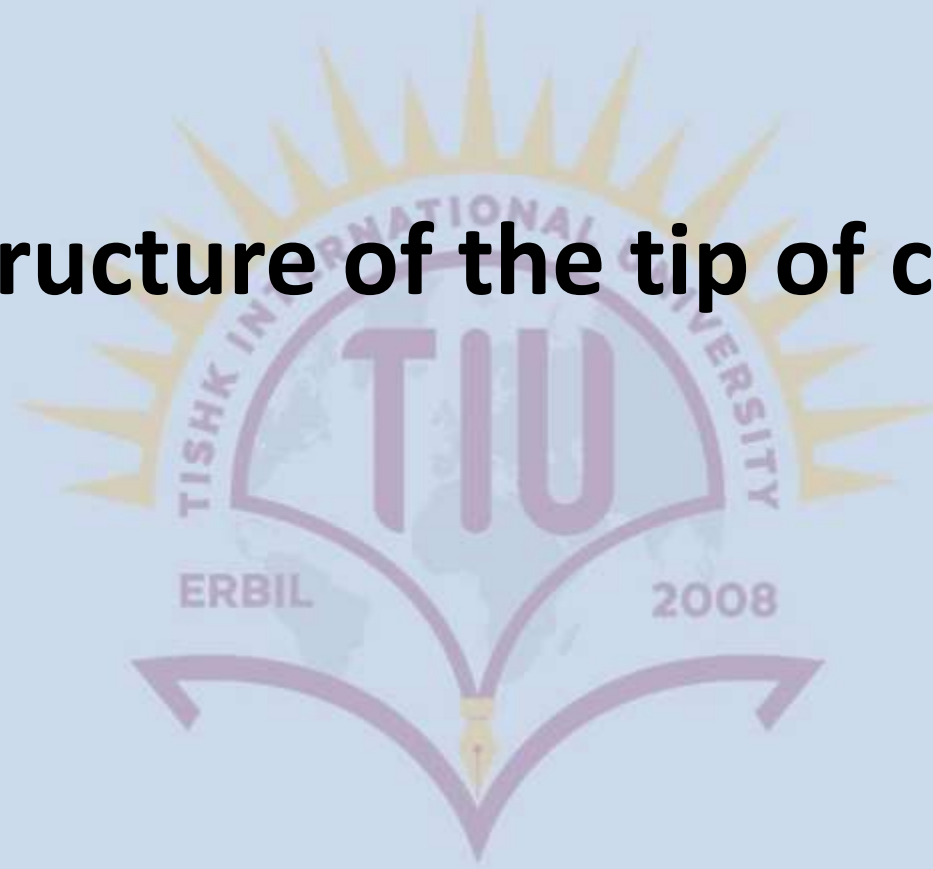
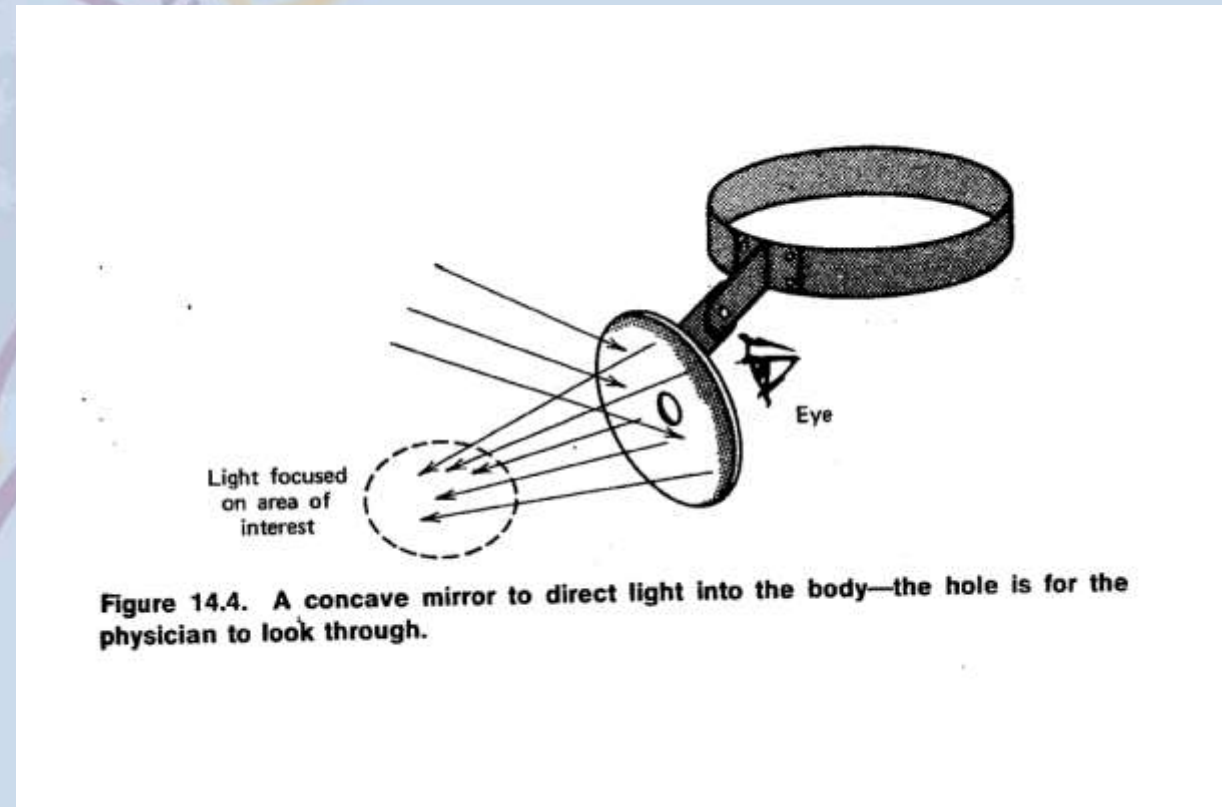


Figure 14.6. The tip of a colonoscope shows the fiberoptic light channel and viewing channel, the water or air channel, and a biopsy channel that permits passage of a device to take tissue samples. (Courtesy of John F. Morrissey, M.D., University of Wisconsin, Madison, Wisc.)

Explain the structure of the tip of colonoscope



The visible light used in the ophthalmoscope for looking into eyes, and in **the otoscope** for looking into ears by using a concave mirror to direct light in the body and a hole in the middle of it for the physician to look through



Thank you

