



كلية المستقبل الجامعة
قسم الفيزياء الطبية
المرحلة الثالثة

Medical Physics

Lecture 8

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Light in Medicine :

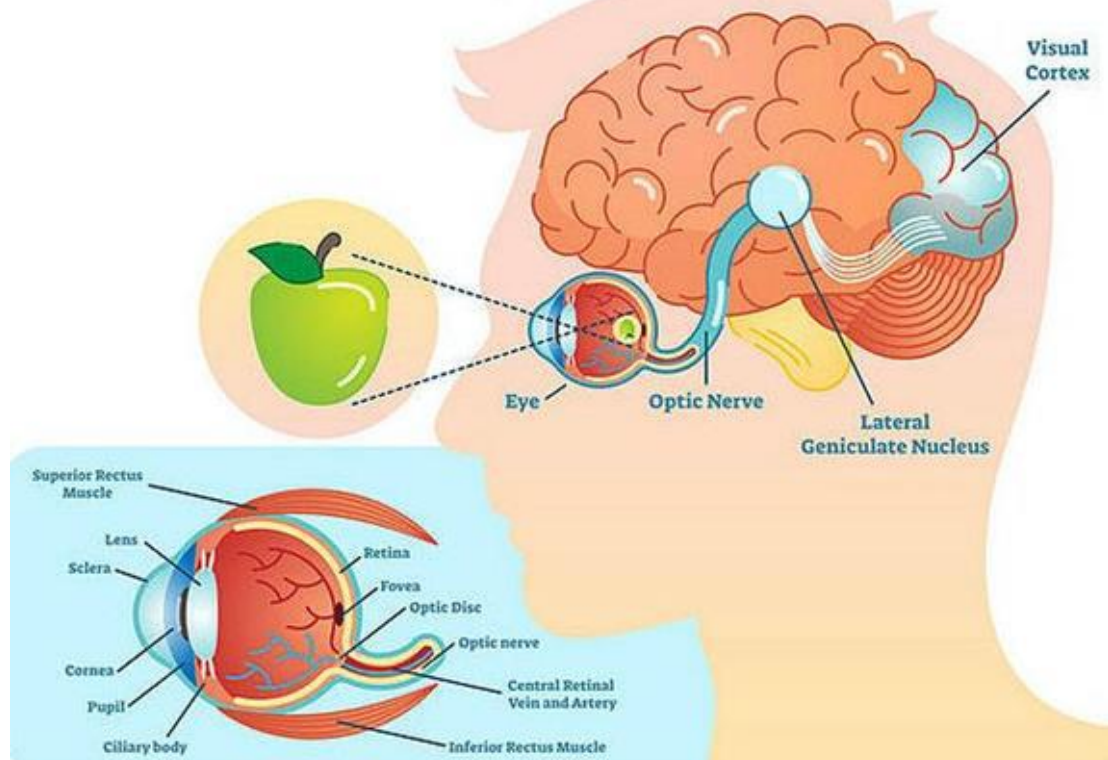
Even though man is now very efficient at making artificial light, the sun is still the major source of light in the world. The sun is both beneficial and hazardous to our health .

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. If a light beam meets a new material at an angle other than perpendicular, it bends, or is refracted. This property permits light to be focused and is the reason we can read and see objects clearly .

How Visual System Organized

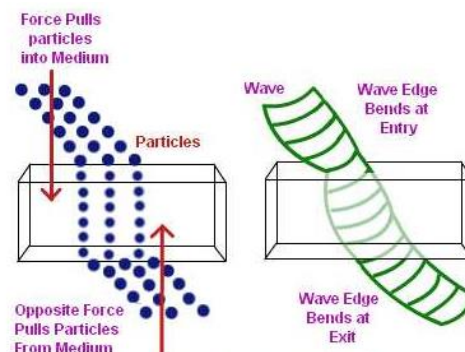


Light Behavior :

Light behaves both as a wave and as a particle :

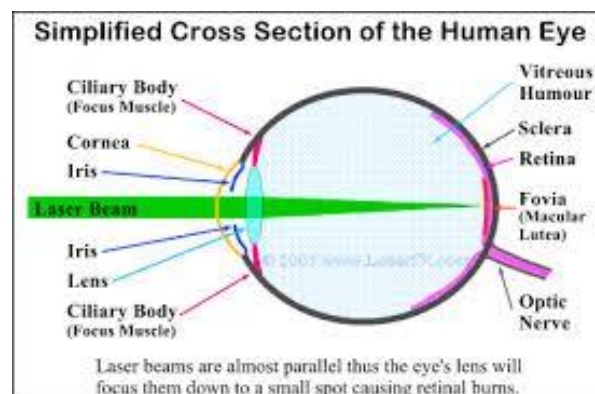
- 1- As a wave it produces interference and diffraction, which are of minor importance in medicine.
- 2- As a particle it can be absorbed by a single molecule. When a light photon is absorbed its energy is used in various ways. It can cause a chemical change in the molecule that in turn can cause an electrical change.

This is basically what happens when a light photon is absorbed in one of the sensitive cells of the retina (the light-sensitive part of the eye). The chemical change in a particular point of the retina triggers an electrical signal to the brain to inform it that a light photon has been absorbed at that point .



- 3- 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 .

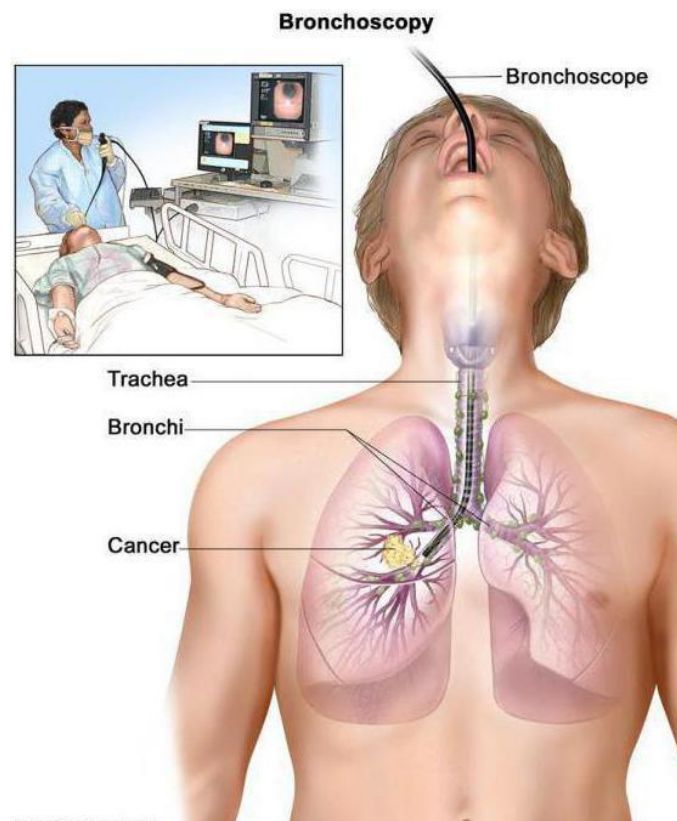


Application of Visible Light in Medicine :

Endoscopy Devise :

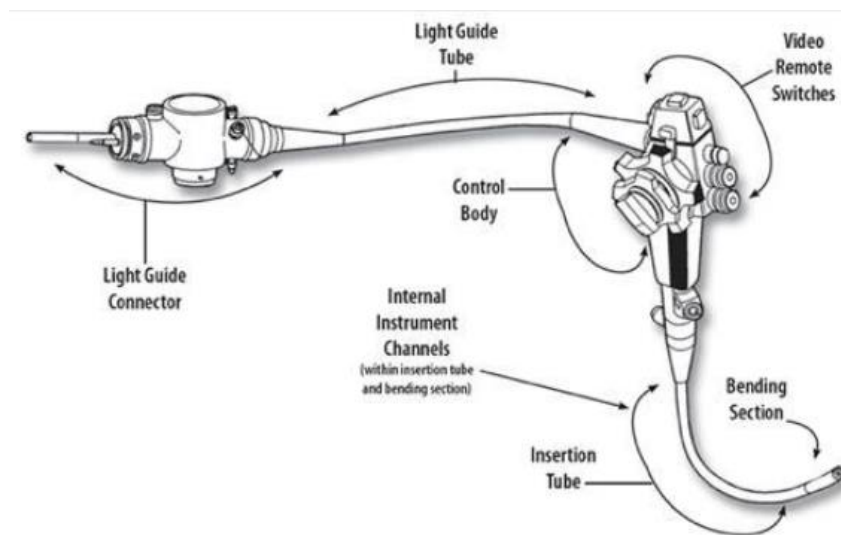
Endoscopy is the insertion of a long, thin tube directly into the body to observe an internal organ or tissue in detail. It can also be used to carry out other tasks including imaging and minor surgery. Endoscopy can be useful in a wide array of medical situations .

Endoscopes are minimally invasive and can be inserted into the openings of the body such as the mouth . Alternatively, they can be inserted into small incisions, for instance, in the knee or abdomen. Surgery completed through a small incision and assisted with special instruments, such as the endoscope, is called keyhole surgery



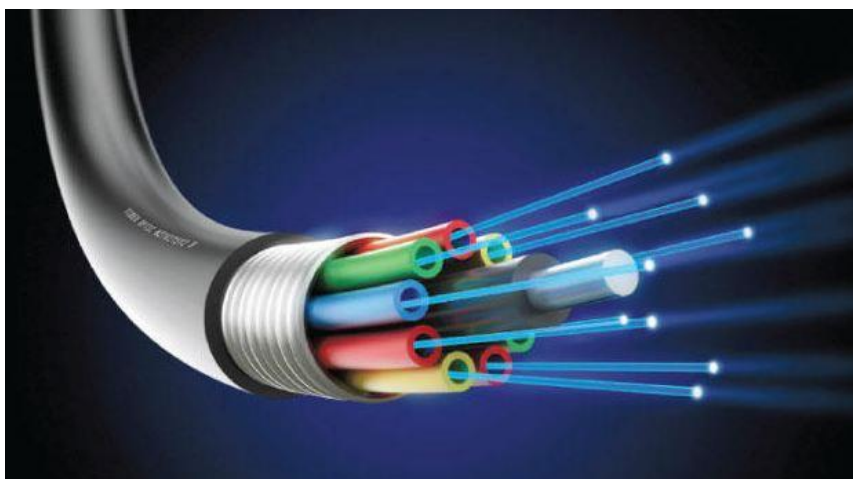
Components of Endoscopy Device :

- 1- A thin, long flexible tube .
- 2- A lens or lens system .
- 3- A light transmitting system (Optical Fiber) .
- 4- The eyepiece .
- 5- Control system .



Optical Fiber :

The most notable application of the phenomenon of perfect reflection is optical fibers. Where a beam of light loaded with data is transmitted through the optical fiber at an angle greater than its critical angle .

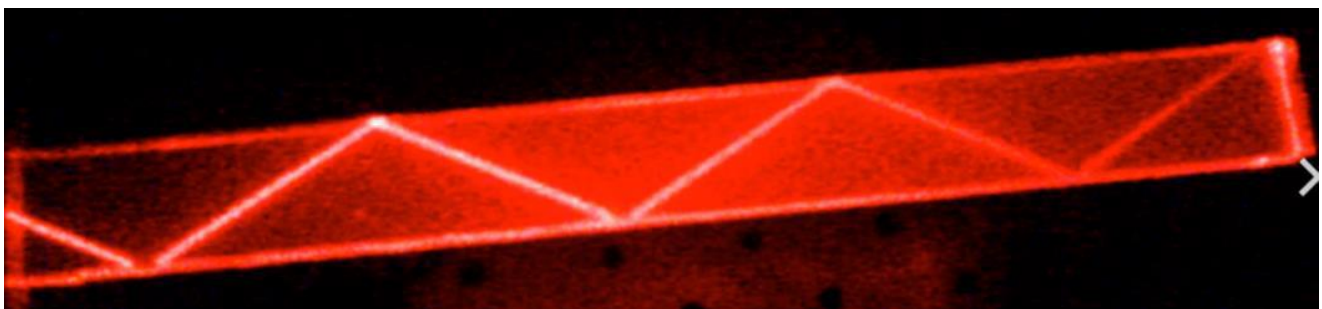
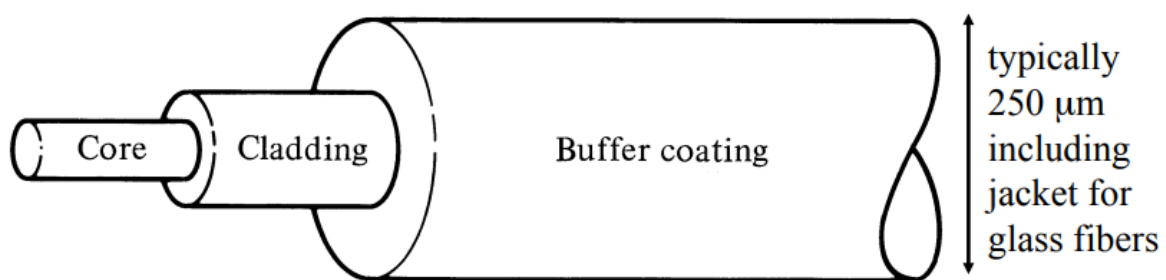


Optical Fiber Structure :

A typical optical fiber consists of a core, a cladding, and a polymer jacket (buffer coating) .

The polymer coating is the first line of mechanical protection

The coating also reduces the internal reflection at the cladding, so light is only guided by the core .



Properties of Optical Fiber :

- 1- The optical fiber has a very high flexibility .
- 2- It has optical beams, each containing an amount of optical fibers ranging from (20,000) to (40,000).
- 3- This large amount of optical fibers allows many light reflections, and from the properties of reflection is that light travels from one end of the beam to the other .