AL-Mustaqbal university college

Department of Medical Laboratory Techniques

Medical Laboratory Instruments

Microscopes

Lecture (1)

A microscope is a high precision optical instrument that uses a lens or a combination of lenses to produce highly magnified images of small specimens or objects especially when they are too small to be seen by the naked (unaided) eye. A light source is used (either by mirrors or lamps) to make it easier to see the subject matter.

Is an important device that produces a magnified image of objects too small to be seen with the naked eye .The microscope is widely used in medicine and biology.

Types of microscope :

1-Light microscope : The types of light microscope including :-

A- Bright - field microscope: It used to view stained or naturally pigmented specimens .The name "bright field" is derived from the fact that the specimen is dark and contrasted by the surrounding bright viewing field. Simple light microscopes are sometimes referred to as bright field microscopes.

B- Dark - field microscopy: is used to illuminate unstained samples causing them to appear brightly lit against a dark background. This type of microscope contains a special condenser that scatters light and causes it to reflect off the specimen at an angle.

C -Ultraviolet microscope: It has quartz lenses and slides and uses ultraviolet radiation as the illumination. The use of shorter wavelengths than the visible range enables the instrument to resolve smaller objects and to provide greater magnification than the normal optical microscope.

D -Fluorescent microscope :It used to examine material that fluoresces under ultraviolet light. Fluorescence microscopy is based on the principle that fluorescent materials emit visible light when they are irradiated with ultraviolet rays or with violet-blue visible rays.

E - Phase contrast microscope: Transparent microorganisms suspended in a fluid may be difficult and sometimes impossible to see. One method of making them more visible is to use phase contrast

Phase contrast is useful for examining Unstained bacteria : cholera vibrio's in specimens • . and cultures ;

- Amoebae in faecal preparations

• .Cerebrospinal fluid, lymph gland fluid•

• Urine sediments. :

2- Electronic microscope: These types are :

A- Scanning electron microscope (SEM): This microscope helps in viewing three-dimensional images of microorganisms and other specimens. Gold and palladium is used to stain the specimens mounted on a scanning electron microscope. Gold and palladium is used to stain the specimens mounted on a scanning electron microscope

B-Transmission electron microscope (TEM) : is used to study cells. Ultrathin slices of microorganisms like viruses are placed on a wire grid, then these cells are stained with gold or palladium and then used to observe under a transmission electron microscope. The electron beam is deflected on the densely coated parts of the cells and the image is observed on dark and light background.

Parts of Microscope:-

A- Frame work :- is divided to

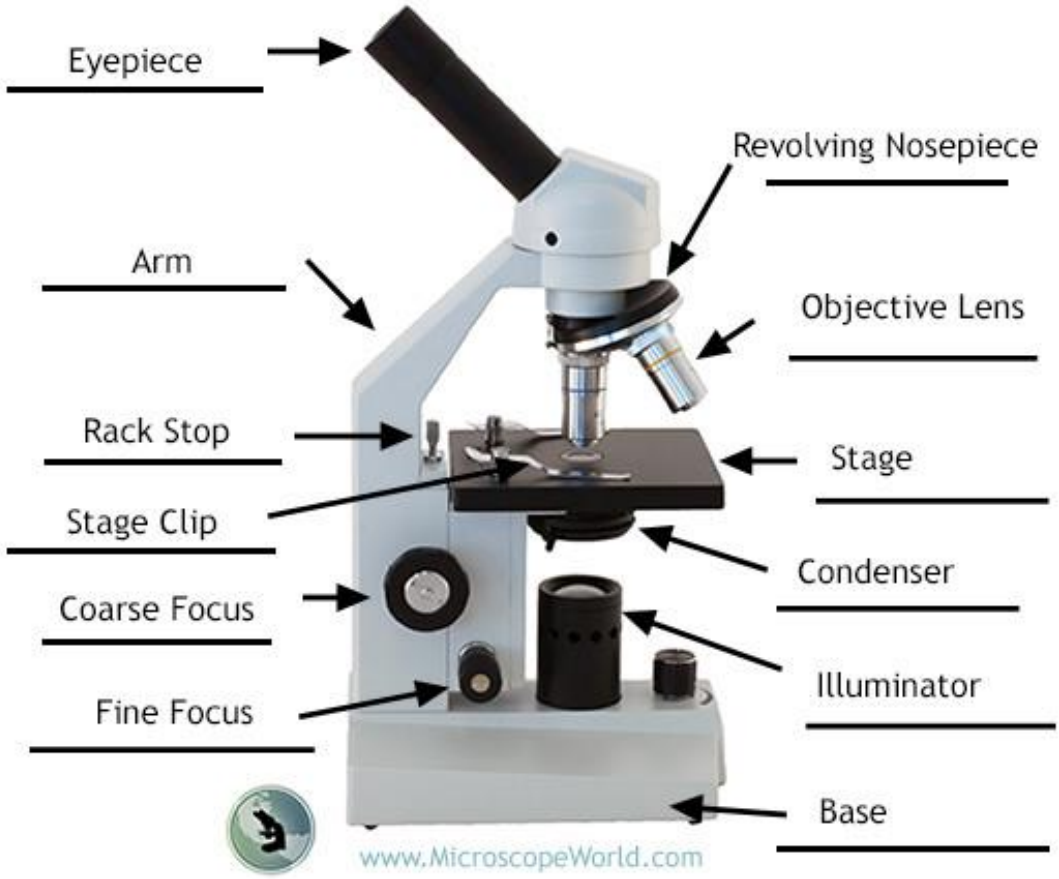
1-Body Tube: It is an integral part of the microscope as it holds the eye piece and connects it to the objective.

2-Revolving Nosepiece or Turret: That is the part of the microscope which holds two or more objectives to provide various magnifications in order to view the same specimen in various dimensions.

3. Arm: is the part of microscope that connects to the base and helps carry the microscope easily. One can hold the arm with one hand and put another hand under the base of the microscope so that it can be carried easily.

4.Stage: is an important part of the microscope. It is a flat surface where the slide with the specimen is placed. A mechanical stage is used when working with higher magnifications. It is moved by using knobs as even the slightest moment can affect the results

5. Base: It is the bottom part of the microscope, usually made up of durable material as it supports the microscope to stand and provides stability.



6- Glass slide: A glass slide is a thin and flat piece of . glass used in the microscope. The specimen is kept on the glass slide and put under the objective in order to study it. A typical glass slide is of dimensions 75 x 26mm and about 1 mm thick

7. Power Switch: It is an electrical switch present at the bottom of the microscope in order to switch of the light source .

B – Mechanical adjustments (Focusing system

A focus control allows you to adjust the focus of the microscope. Every microscope includes a focusing control (knob) for quick (coarse) focusing of the image. More expensive compound microscope models include a coarse (quick) and fine focusing control. The fine focus is particularly advantageous in high power applications and required for 400x and

higher but is not available on stereo microscopes since they are only low power.

1-Coarse adjustment : is a knob present on the arm of a microscope. The main function of this knob is to move the specimen back or forth to adjust the slide containing specimen in order to bring it to focus and show the best image possible.. the specimen back or forth to adjust the slide containing specimen in order to bring it to focus and show the best image possible. The coarse adjustment should be carefully moved and adjusted to attain desired results.

2 -Fine adjustment : This knob is a sub part of the Coarse adjustment knob. It is used to bring the specimen into sharp focus.

3- Slide adjustment -

4.Condenser adjustment :The condenser is used to condense the light required for visualization. The condenser aperture is adjusted by the iris diaphragm ,which is found just below the condenser.

. **C- Magnification system (Lenses)**:

1-Eyepiece (Ocular lens): is a magnifying lens attached to the microscope which helps in magnifying the sample object. It is called an eyepiece as we need to place our eye near it in order to see the magnifying image of the sample Eyepiece may be monocular or binocular. Eye lenses magnification 10X , 12X

2. Objective lens : is the part of microscope responsible for magnifying the image of specimen. There are four objective lenses in a standard microscope as following :

1-Scanning Objective (4X): This shortest objective is useful for getting an overview of the slide (especially handy with some of the slides that contain whole organs like a section of the spinal cord, lung, digestive tract, ovary……).

2-Low Power Objective (10X): This next shortest objective is probably the most useful lens for viewing slides.

3-High Power Objective (40X): This objective (sometimes called the "high-dry" objective) is useful for observing fine detail such as the striations in skeletal muscle, the arrangement of Haversian systems in compact bone, types of nerve cells in the retina, etc.

4-Oil Immersion Objective (100X): This longest objective is used for observing the detail of individual cells such as white blood cells, the cells involved in spermatogenesis, etc….. . The lens must be used wit a specially formulated oil that creates a bridge between the tip of the objective and the cover slip. Since the refractive indices of air and this lens are different the oil immersion using to increase the refractive index to . make the field clear

The product magnification depend on .

-Mechanical tube length .

-Focal length of objective lenses

Magnification of Microscope = Magnification of objective lens x Magnification of eye lens

Focal length : is the distance between it' s center and point where parallel rays of light is brought to focus .

D- illumination system :-

1- Condenser and iris : Condenser is a large lens with an iris diaphragm , the condenser lens receives a beam from the light source and passes it into the objective .The iris is a mechanical device mounted underneath the condenser and controls the amount of light entering the condenser

2-Mirror :Is situated below the condenser and iris ,it - 2 reflects the beam of light from the light source up wards through the iris into the condenser .The mirror .is used to reflect ray or electrical light

3-Sources of illumination-

.Day light : is enough for oil immersion work - Electrical light.