Microscopes

Microscope Definition:

An optical instrument that uses a combination of lenses to produce magnified images of small objects, especially of objects too small to be seen by the unaided eye.

Microscopes have been essential tools of cell biologists , generally theirs two types of microscopes :

(1) Light Microscope (LM).

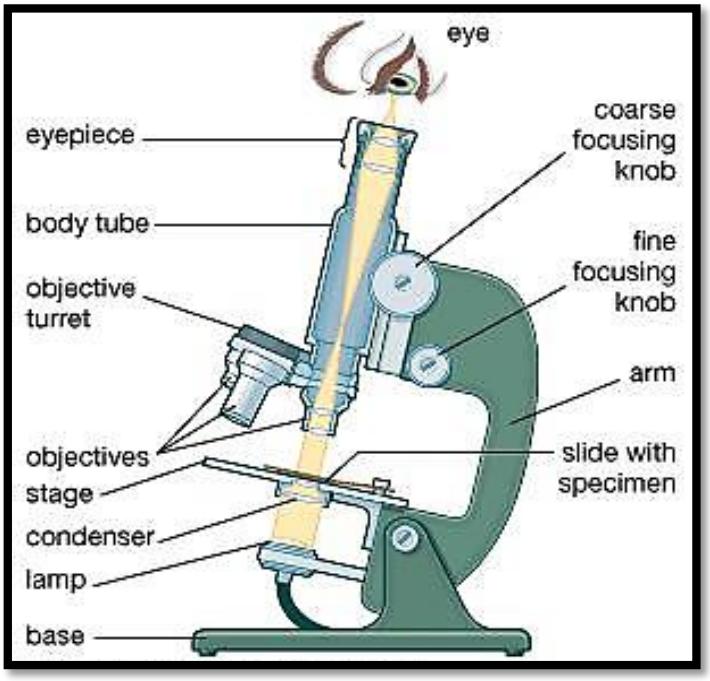
(2) Electron Microscope (EM).

((Light or Compound Microscope))

Bright field Microscopes the most common general use microscope.

Bright field microscopes are named because the microscopic "field" is bright, while the object being viewed is dark.

Features
1- Simple design.
2- Using tungsten or halogen light source to form image.
3- Bright background, dark specimen.
4-Stained specimens show excellent contrast, unstained specimens have poor contrast.
5- Best for stained bacteria, cells, tissues.



The LM microscope consists of:

1- Eye Pieces (Ocular).

2- Body Tube.

3- Revolving nose piece (objective turret).

4- Objective Lenses witch include:

*** Low Power Objective Lenses : (4x and 10x)**

*** High Power Objective Lenses : (40x)**

*** Oil Immersion (100x)**

5- Arm.

6- Mechanical Stage.

7- Condenser.

8- Diaphragm.

9- Stage.

10- Coarse Adjustment (coarse focusing knob).

11- Fine Adjustment (fine focusing knob).

12- Foot or Base.

13- Light Source.

14- Pillar.

((Inverted microscope))

- **The basic design of bright field microscope has been modified for special uses.**

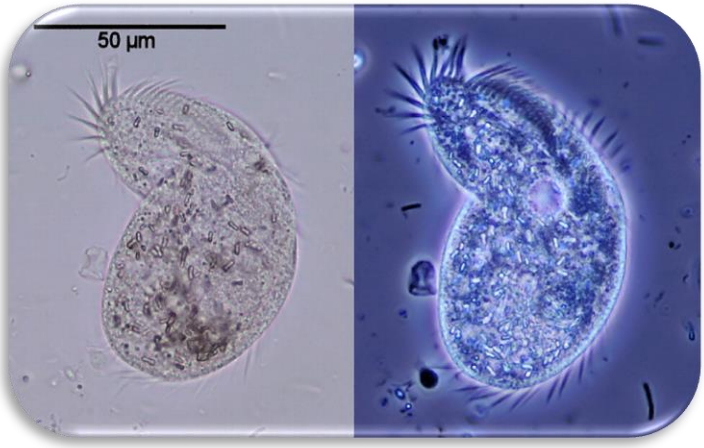
- **Inverted microscopes allow viewing of cells in flasks, welled- plates, or other deep containers that do not fit between the objectives and stage of standard bright field microscope.**

((Phase Contrast Microscope))

- **This microscope is used in the study of non-dyed living cells and is based on the difference in the thickness of the cellular components; the light passing through these components comes out of a different intensity.**

- **This intensity is reflected in varying degrees of lustre between the lions and the luminaries, so that the components of the cell can be seen some darkly, others light or bright.**

- **Examples of cells studied with this type of microscopy are plant cells and other types of cells .**



Ciliate (*Oxytricha saprobia*) in bright field m. (left) and with phase contrast m. (right)

((Interference Microscope))

- **Is used for the study of non-dyed living cells and is based on a similar basis to that of the phase contrast microscope but is equipped with some devices that give quantitative information about the model such as water content, weight, density…**

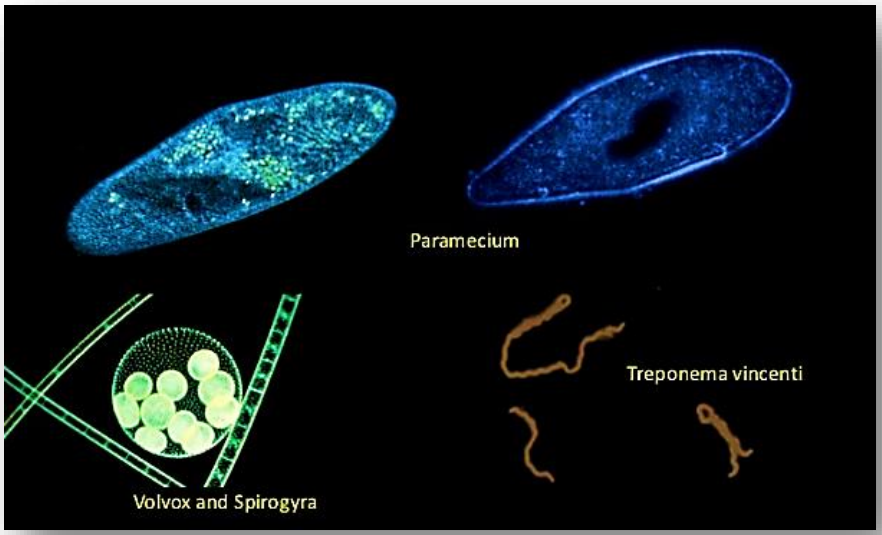
- **Examples of cells studied in this type of microscope are dividing cells .**

((Dark Field Microscope))

- **A condensed optical microscope in which the ground is opaque and the model is past.**

- **In this case the capacitor is replaced by a diagonal condenser, the optical beam will then pass through the model in a tilted manner and the model floor will appear dark while the model will be bright and this increases the degree of cell clarity.**

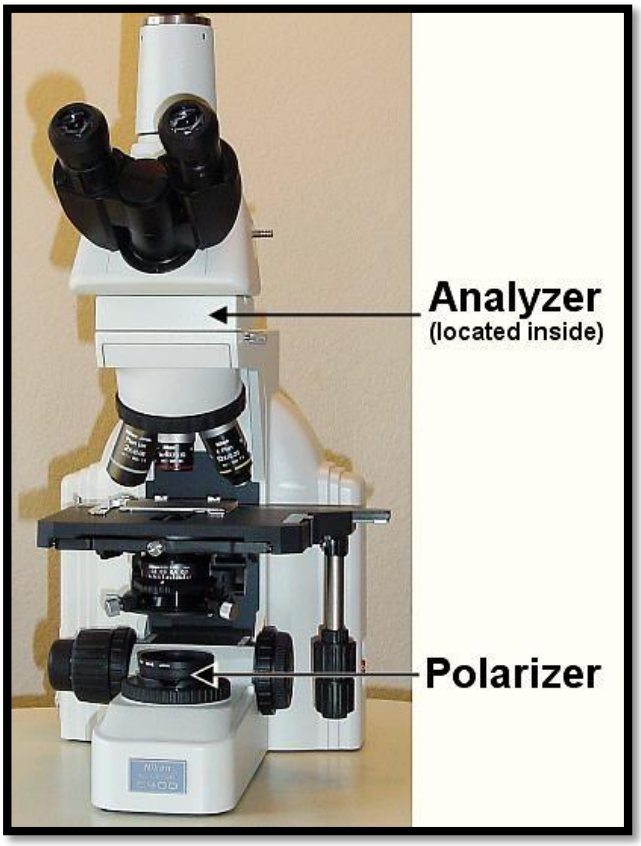
- **Examples of cells studied with this type of microscope are blood cells, algae and prokaryotes.**



((Polarization Microscope))

- **The work of this microscope depends on the fact that the parts of the cell differ in their degree of absorption or reversal of polarized light.**

- **This microscope differs from the conventional microscope by having a polarizer placed under the condenser and analyzer placed above the objective lens.**
- **This microscope used to study bifurcation structures such as (mitotic spindle, myosin filaments, and green plastids).**

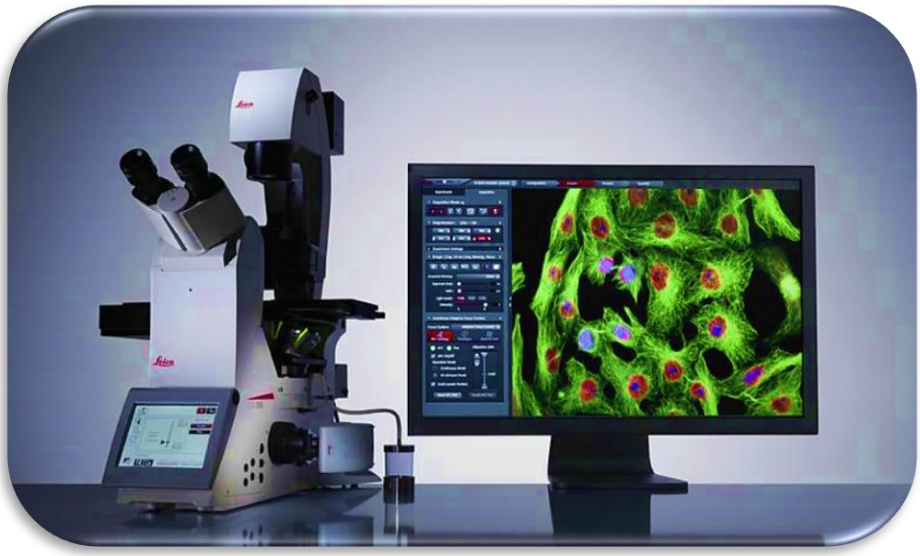


((Fluorescence Microscope))

- **Used to study the cellular components that appear sparkling when illuminated by ultraviolet radiation, such as molecules of chlorophyll and nucleic acid.**

- **The light in this type of microscope is replaced by an ultraviolet light source that has very short wavelengths that may interact with components that do not have the ability to shine and are treated with brilliant pigments before being examined with a fluorescence microscope.**

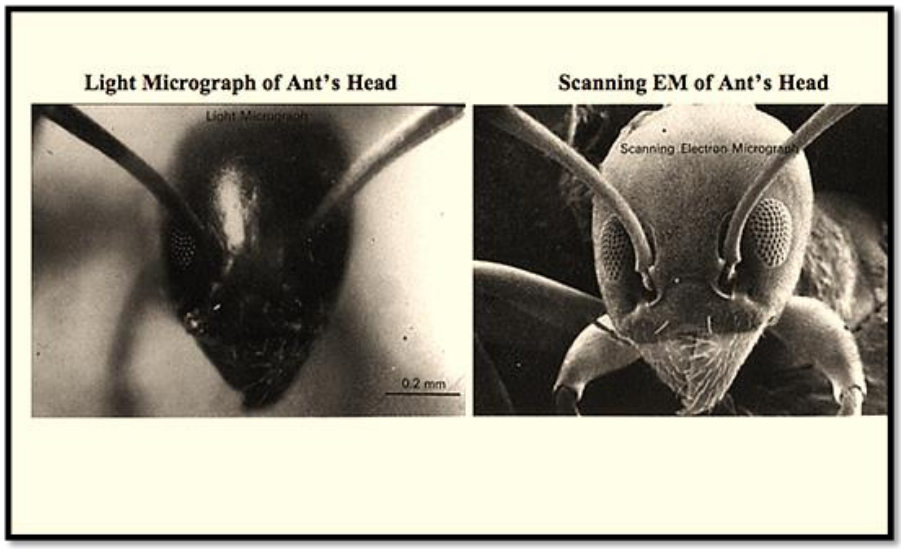
- **The type of lenses made in this microscope is quartz instead of glass because the glass does not allow ultraviolet light to pass through.**



((Electron Microscope))

1- Scanning electron microscope (SEM)

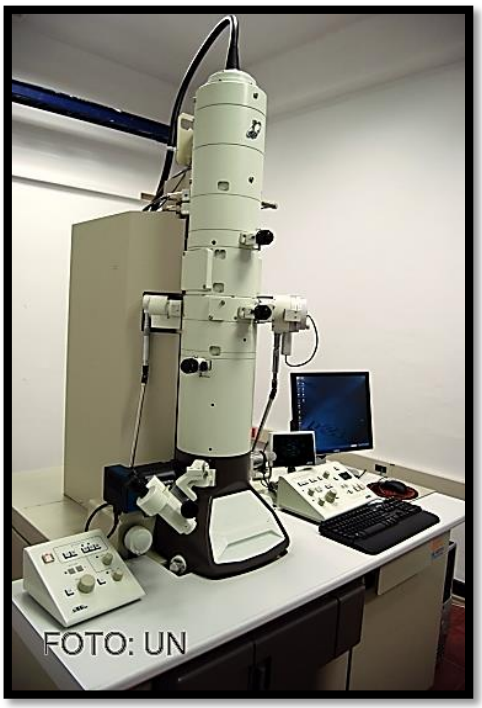
- Electron beam is focused using a magnetic field.
- SEM provides a 3-D image.
- Gives information about external features of specimen.
- Much higher resolution and magnification than possible in LM.



2- Transmission electron microscope (TEM)

- Electron beam is focused using a magnetic field.
- TEM provides a 2-Dimage.
- Revels internal cell structure.
- High resolution , high magnification.

(SEM)



(TEM)

Comparison between Light and Electron Microscope

Characters	Light microscope	Electron microscope
Source	The light	The electron or X-ray
Size	Smaller and lighter	Larger and heavier
Cost	Less expensive	More expensive
Radiation type	uses light in the range (400-700)nm	uses beams of electrons (1) nm
Resolution	Lower resolution	Higher resolution
Magnification	Lower magnification	Higher magnification
Image formation	Images can be viewed directly	Requires the use of a fluorescent screen electronic display
View	See the picture with the naked eyes	See the picture on the screen