Techniques in Cell Biology

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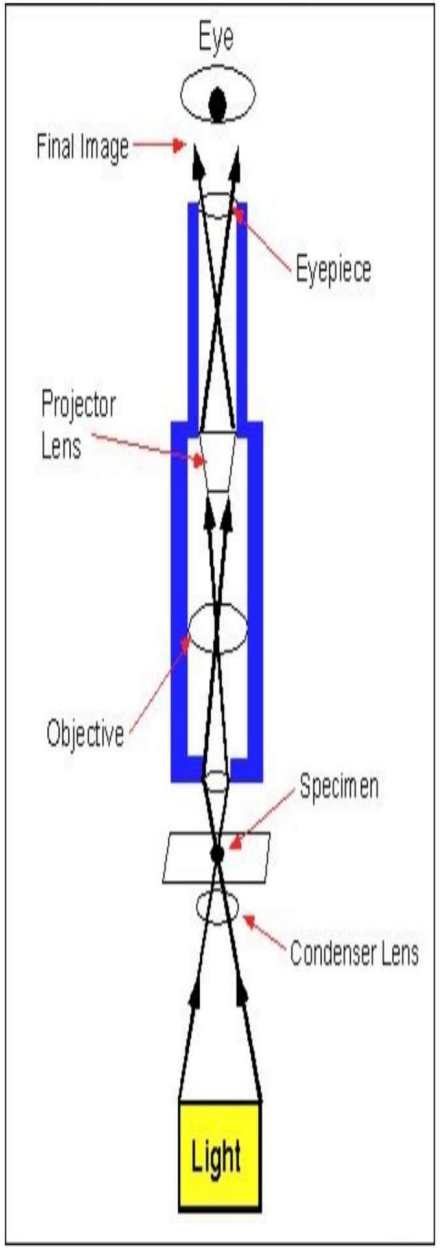

1) Microscopy :

- **Introduction** :
- Micros – small and scope – to look or see
- Microscope is a laboratory instrument used to examine objects that are too small to be seen by the naked eye.
- Microscopy is the science of investigating small objects and structures using a microscope.
- Microscopic means being invisible to the eye unless aided by a microscope.

Components of microscope

- **Compound microscope**
- **Optical Components:**

- 1) Eye piece : lense at top, usually 10x or 15x
- 2) eyepiece tube : holds the eye piece lense at fixed distance
- 3) Body tube : Separates the objective and eye piece
- 4) Course focus knob : focus the specimen
- 5) Fine focus knob : bring the specimen into sharp focus
- 6) Objective lense : primary optical lense range from 4x to 100x
- 7) Stage & mounting clips : specimen to be viewed is placed
- 8) Condenser : collect and focus light
- 9) Reflector or mirror : reflects the light towards condenser

Simple microscope :

- **Components :**

- 1) objective lens
- 2) Adjustment knob : a small hollow cylindrical knob attached to the base which is used to hold the microscope
- 3) Adjustment screw : one adjustment screw used for focusing by moving the limb up and down
- 4) mirror or reflector : Concave reflecting type is used

Basic principle :

- ## Magnification :

- To what an extend a microscope can produce an enlarged image of an object
- It also known as linear magnification
- The light microscope can magnify upto 400 times the actual size
- Maximumm Magnification achieved by a compound microscope is 1500x
- It is calculated by using formula :-
- m= image size÷object size
- The total magnification (mf) produced by a compound microscope is the product of magnification of eye piece (me) and objective (mo) lense
- . Mf = me×mo

Resolution :

- Resolution refers the ability of microscopes to distinguish two objects close to each other.
- It depends on resolving power, which refers the minimum distance.
- Resolution power is refers the minimum distance or Power of seperation between two points
- Ex : Man has the resolving power of 0.2 mm (meaning that he can distinguish two objects with a distance of 0.2 mm close to each other)

- Resolving power = $\mu \div n (\sin \theta)$

- where, μ is the wave length of light source and n ($\sin \theta$) is the numerical aperture (NA).
- Numerical aperture – it is ability of an objective lense to collect the amount of light
- For compound microscopes, resolving power is μ/2NA. The resolving power of an
- microscope can be improved either by reducing the wave length of light or by increasing the n($\sin \theta$) value

Working of Microscope :

- There are three main optical pieces in the compound light microscope.
- All threee are essential for a sharp and clear image.
- These are:
- ❍ Condenser
- ❍ Objectives
- ❍ Eye-pieces.

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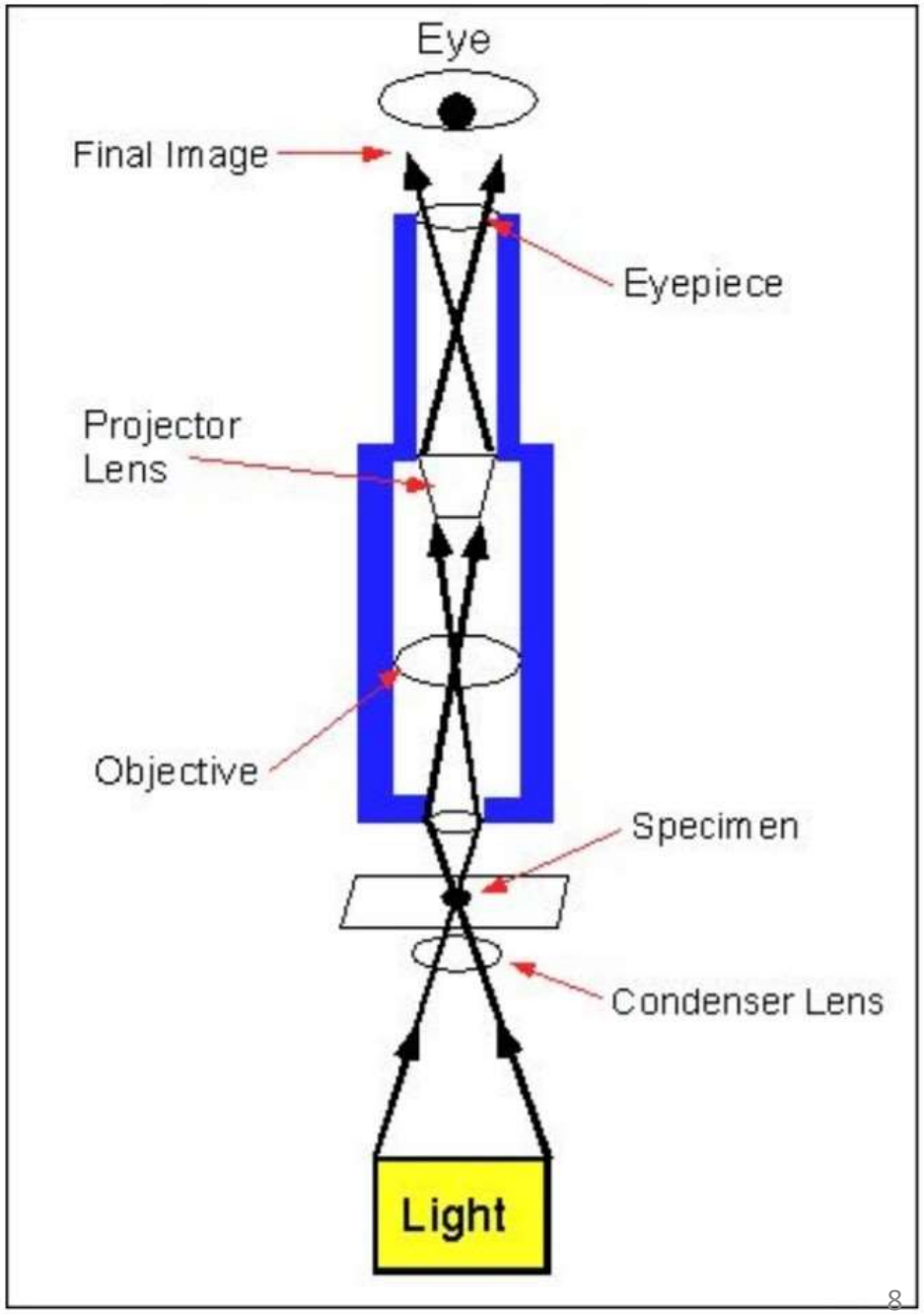
- The condenser illuminates the object by beam of light
- The objective forms a magnifie invertedd (upside down) image of the object.
- The eye-piece magnifies th imagee formed by the objective.
- The total magnification of the microscope is the product of the magnifying powerss of the objective and the eye-piece.
- For example, if the magnifying power of the eye-piece is 10x and that of the

Objective is 100x, then the total magnification of the compound light

microscope is: 10x X 100x = 1000-fold magnification.



Applications of Simple microscope :

- It is usually used for the study of microscopic algae, **fungi,** and biological specimens.
- It is commonly used by watchmakers to see the magnified view of small parts of a watch.
- It is also used by the jewelers to see the magnified view of the fine parts of jewelry.
- It is used to see the enlarged image of letters of a book, textures of fibers or threads of a cloth.
- It is used to see the magnified view of different particles of different types of soils.
- It is used by palmists to see an enlarged view of the lines of our hand.
- It is used by skin specialists to find out various diseases of the skin.
- It is also used to see the details of stamp and engravings.

Applications of compound microscope :

- A compound microscope is of great use in pathology labs so as to identify diseases.
- Various crime cases are detected and solved by drawing out human cells and examining them under the microscope in forensic laboratories.
- The presence or absence of minerals and the presence of metals can be identified using compound microscopes.
- Students in schools and colleges are benefited by the use of a microscope for conducting their academic experiments.
- It helps to see and understand the microbial world of bacteria and viruses, which is otherwise invisible to the naked eye.
- Plant cells are examined and the microorganisms thriving on it can be ascertained with the help of a compound microscope. Thereby, a compound microscope has proved to be crucial to biologists.
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Electron Microscope :

Applications of Electron microscope :

- Electron microscopes are used to investigate the ultrastructure of a wide range of biological and inorganic specimens including microorganisms, cells, large molecules, biopsy samples, metals, and crystals.
- Industrially, electron microscopes are often used for quality control and failure analysis.
- Modern electron microscopes produce electron micrographs using specialized digital cameras and frame grabbers to capture the images.
- Science of microbiology owes its development to the electron microscope. Study of microorganisms like bacteria, virus and other pathogens have made the treatment of diseases very effective.
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