Cell biology

⇒ Principles of Electron & light microscope.

Definition:- An electron microscope is a microscope that uses a beam of accelerated electrons as a source of illumination.

It is a special type of microscope having a high resolution of images able to magnify objects in nanometers, which are formed by controlled use of electrons in vacuum captured on a phosphorescent screen.

⇒ Working principles of Electron microscope

Electron microscope use signals arising from the interaction of an electron beam with the sample to obtain information about structure, morphology, and composition.

1. The electron gun generates electrons.
2. Two sets of condenser lenses focus the electron beam on the specimen and then into a thin tight beam.
3. To move electrons down the column, an accelerating voltage is applied between tungsten filament and anode.
4. The specimen to be examined is made extremely thin, Ultra-thin sections of 20-100 nm are cut which is already placed on the specimen holder.

5. The electronic beam passes through the specimen and electrons are scattered depending upon the thickness or refractive index of different parts of the specimen.

6. The denser regions in the specimen scatter more electrons and therefore appear darker in the image since fewer electrons strike that area of the screen. In contrast, transparent regions are brighter.

7. The election beam coming out of the specimen passes to objective lens, which has high power and forms the intermediate magnified image.

8. The ocular lenses then produce the final further magnified image.

⇒ Types of Election microscope

There are two types of election microscopes with different operating styles:-

1. The transmission election microscope (TEM)
2. The scanning election microscope (SEM)

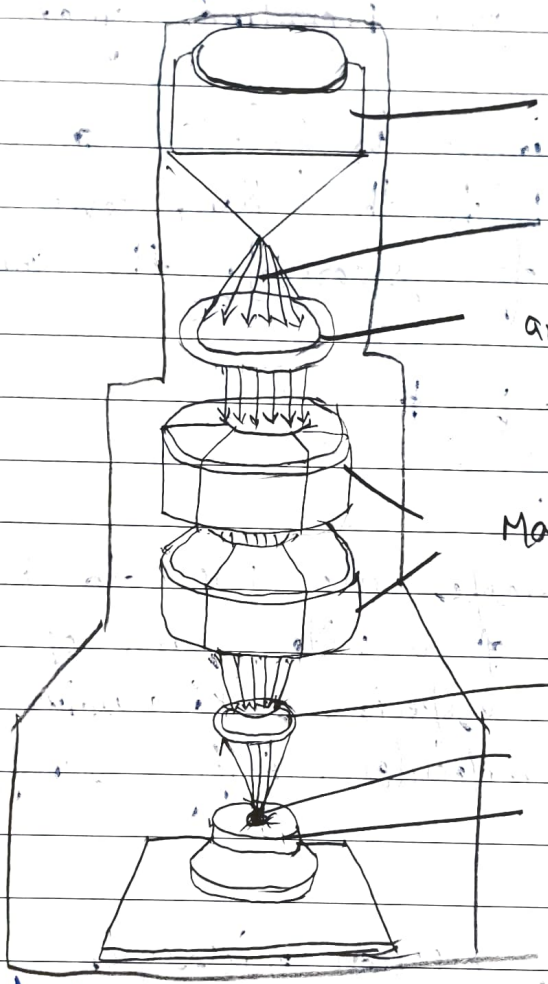
⇒ Parts of Election microscope :-

EM is in the form of a tall vacuum column which is vertically mounted. It has following components:

1. Electron gun :- It is a heated tungsten filament which generates electrons.

2. Electromagnetic lenses :

* Condenser lens :- focuses the electron beam on the specimen. A second condenser lens forms the electrons into a thin tight beam.



* The electron beam coming out of the specimen passes down the second set of magnetic coils called the objective lens, which has high powers.

* The third set of magnetic lenses called projector (ocular) lenses produce the final further magnified image.

* Each of these lenses acts as an image magnifier all the while maintaining an incredible level of detail & resolution

3. Specimen holder :- It is an extremely thin film of carbon or collodion held by a metal grid.

4. Image viewing and Recording System :-

The final image is projected on a fluorescent screen and below the fluorescent screen is a camera for recording the image

Applications :-

1. Electron microscopes are used to investigate the ultrastructure of a wide range of biological and inorganic specimens including micro organisms, cells, large molecules, biopsy samples, metals and crystals.

2. Industrially, electron microscopes are often used for quality control and failure analysis.

3. Modern electron microscopes produce electron micrographs using specialized digital cameras and frame grabbers to capture the images.

4. Science of microbiology owes its development to the electron microscope. Study of micro-organisms like bacteria, virus & other pathogens have made the treatment of diseases very effective.

⇒ Advantages ∈

* Very high magnification.
* Incredibly high resolution.
* Material rarely disposed by preparation.
* It is possible to investigate a greater depth of field.
* Diverse applications: