
WELCOME

# Microscopy

•Microscopy : Introduction, The Light microscope, Compound microscope, Stereomicroscope, Phase contract microscope, Fluorescence microscope, TEM, SEM, Confocal microscope, Principles and working.

•**Definition**:

"Microscope is an optical system designed for the study of objects not seen by the unaided eye."

•The first microscope was designed by Jenssen and Hans (1590-1610).

•Jenssen microscope is a compound microscope. It is the first microscope, it contains two tubes fitted one inside the other.

•Microscope is the most important instrument to study the structure of a cell.

# Compound Microscope

The compound microscope is an optical instrument to magnify objects. It is formed by the combination of two simple microscopes. It is a light microscope because light is the illuminating source.

**Principles :**

•The compound microscope works on the principles of optics. The lenses magnify objects. By stacking lenses the magnification is increased.

•The compound microscope has a light source, a diaphragm, an object, an objective lens and an eye piece.

•The light passes through the **diaphragm**. The diaphragm gathers the light on the object.

•The **objective lens** produces a real, inverted magnified image of the object.

• The magnified image acts as an object for the eye piece.

•The **eye piece** produces a virtual inverted and magnified image of the object.

•The basic principle of the microscope, is to obtain better resolution.

• light microscope, to increase the resolving power smaller wavelengths are to be used.

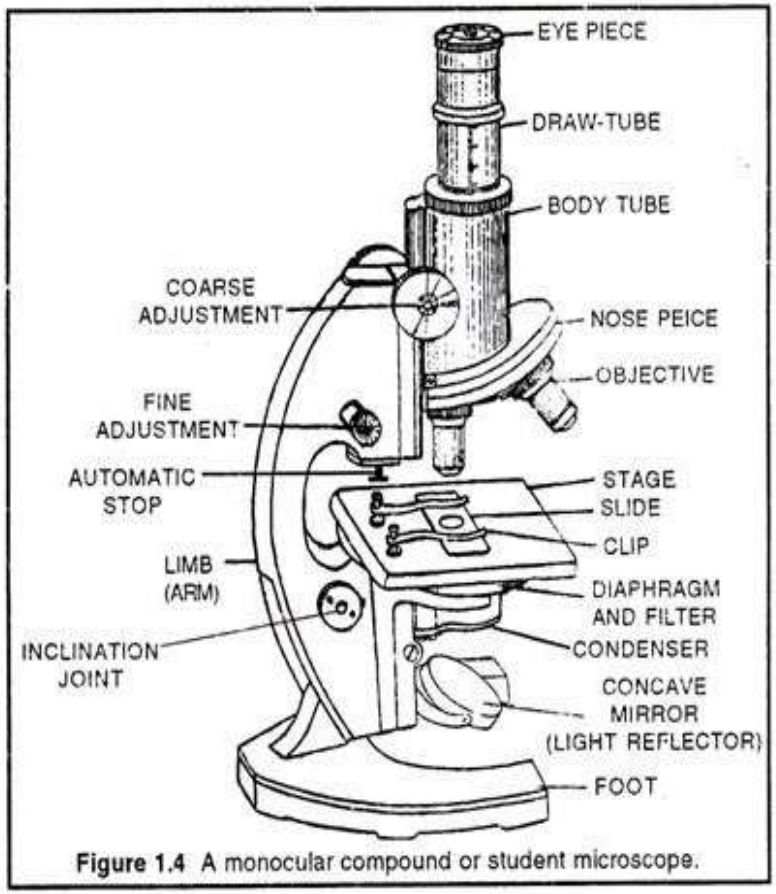
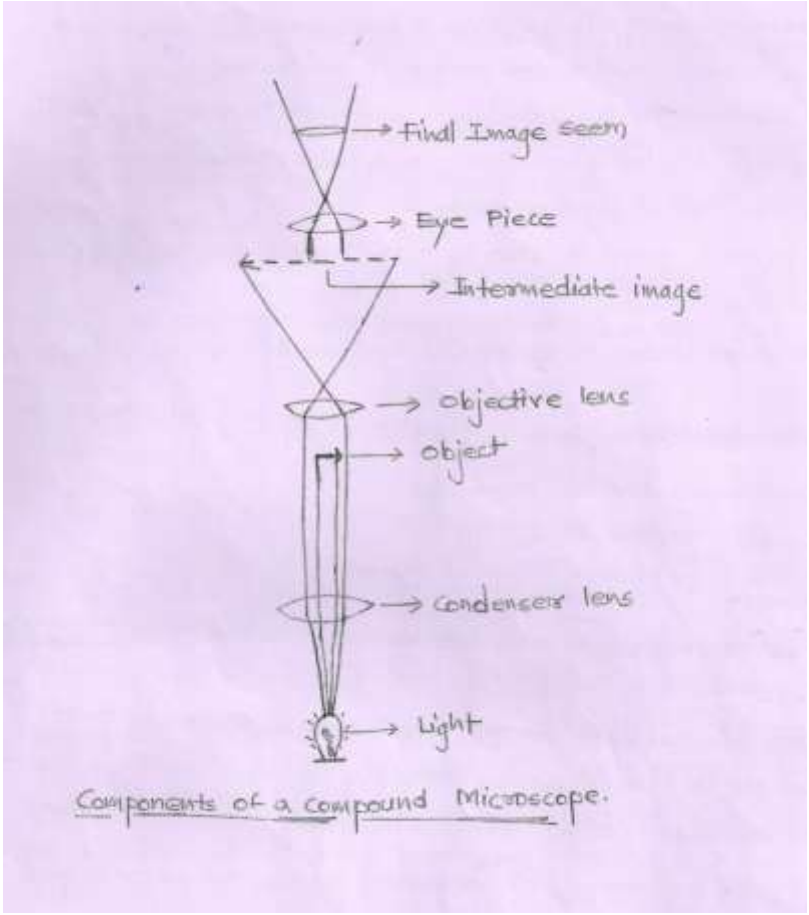



**Figure 1.4** A monocular compound or student microscope.



# Working :

The compound microscope has the following parts.

•**Reflecting mirror**: It reflects light on the object.

•**Condenser** : It focuses the reflected light on the object. The condenser has a diaphragm. It allows the required intensity of light to pass through.

•**Objective lens** : It magnifies the object.

•**Eye Piece** : It magnifies the image produced by the objective lens.

•**Body Tube** : It is a tube with the objective lens at the lower end and the eye piece at the upper end.

•**Coarse adjustment** : It moves the body tube up and down rapidly to correct the distance from the object to get focusing.

•**Fine adjustment** : It moves the body tube up and down slowly to make exact focusing.

•**Stage** : It is a platform with a hole in the centre. The light fall on the object through the hole. The slide is placed in the stage.

•**Nose piece** : It is in the form of a rotating disc having holes for fitting the objective lenses.

•**Arm**: It holds body tube and coarse adjustment.

•**Inclination joint** : It permits tilting of the upper part of the microscope to adjust to the level of eye.

•**Base or Foot** : The foot keeps the body in position.

# The Phase Contrast Microscope

•The phase contrast microscope is widely used for examining such specimens as biological tissues.

•It is a type of light microscopy that enhances contrasts of transparent and colorless objects by influencing the optical path of light.

•The phase contrast microscope is able to show components in a cell or bacteria, which would be very difficult to see in an ordinary light microscope.

• **The phase contract microscope separates the illuminating background light and the specimens scattering light.**

•This technique changes the brightness passing through a transparent specimens in the image. This change of brightness is called as **phase shift**.

•This microscope is used to visualize transparent, colourless, unstained, living biological specimen. These objects are called as phase objects.

• The **Object** is illuminated by the apex of a cone of light.

• Some of the **illuminating light** is scattered by the object. The remaining light is unaffected by the specimen and forms the background light.

• The light rays diffracted by the specimen pass through the **objective lens**. The diffracted light pass at various angles based on the refractive index and thickness of the specimen.

• The other light components corresponding to the background , pass through the **phase ring** of the objective. This process an additional phase difference.

• The phase difference between the specimen and the background are amlpified in the final image. So light differences in refractive index are visible.

# Phase Contrast Microscope

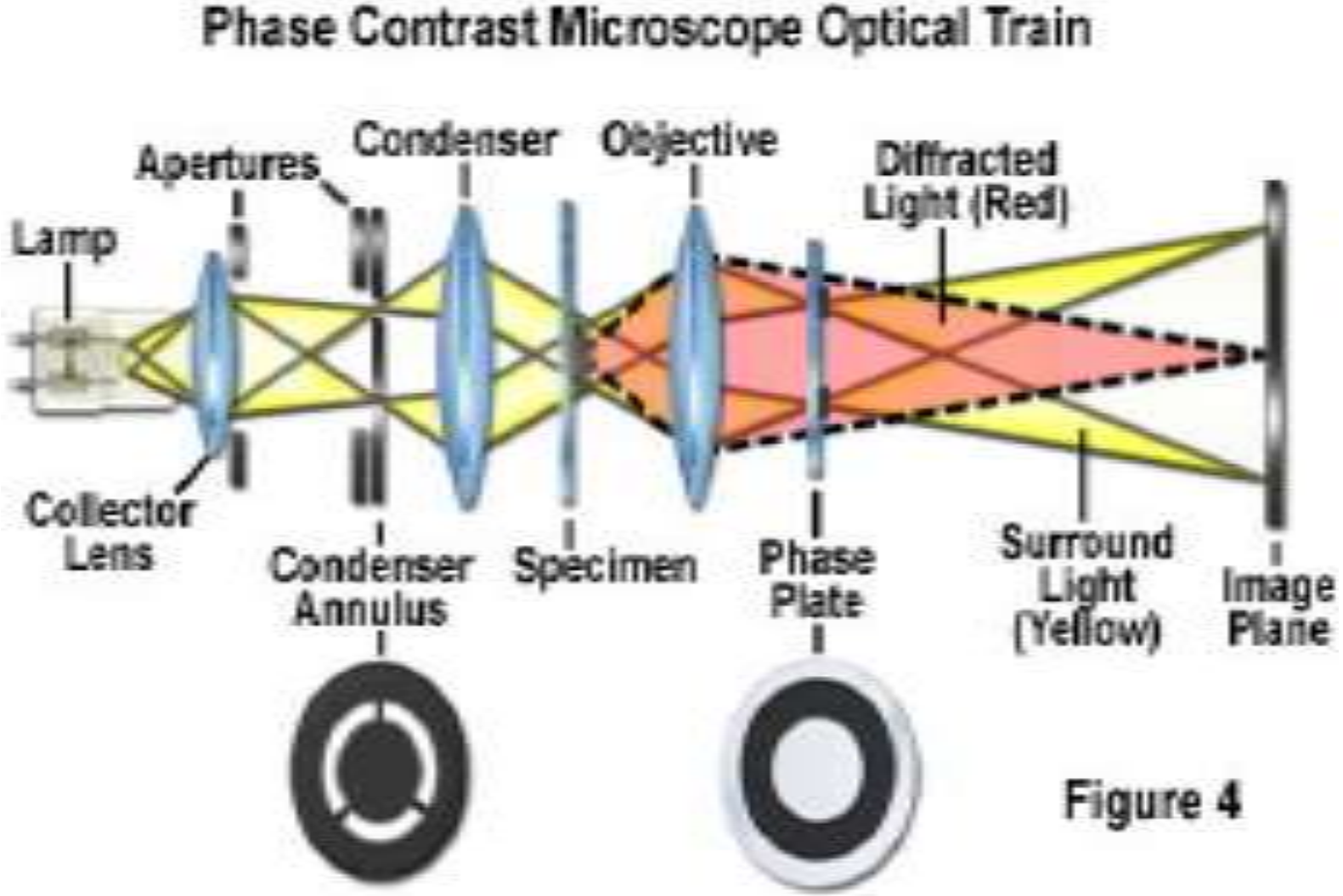

Phase Contrast Microscope Optical Train
Lamp
Apertures
Condenser
Objective
Diffracted Light (Red)
Collector Lens
Condenser Annulus
Specimen
Phase Plate
Surround Light (Yellow)
Image Plane

Figure 4

# Fluorescence microscope

•The microscope produce an image from light that pass through the specimen.

•**An objects also can be seen because it actually emits light and the basis of fluorescence microscope**.

•When some molecules absorb radiant energy they become excited and later release much of their trapped energy as light. Any light emitted by an excited molecule will have a longer wavelength than the radiation originally absorbed.

•Fluorescent light is emitted very quickly by the excited molecule as it gives up its trapped energy and returns to a more stable state.

•**Working:**

•In microscope specimen is exposed to **ultraviolet** , violet or blue light and forms an image of the object with the resulting fluorescent light.

•A **mercury vapor arc lamp** or other sources produces an intense beam and heat transfer is limited by a special infrared **filter**.

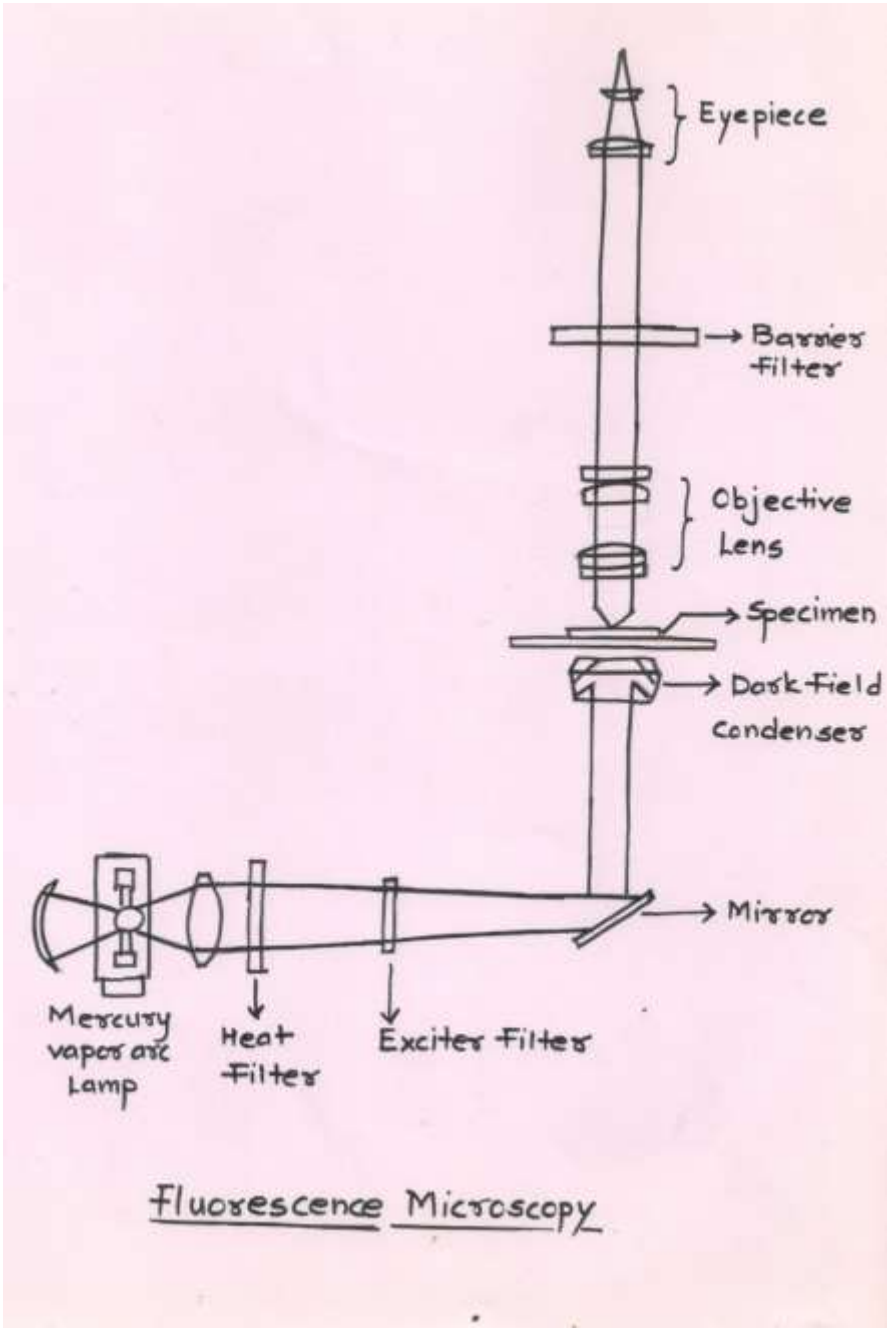
•The light passes through an **exciter** that transmits only the desired wavelength.

•A **dark field condenser** provides a black background against which the fluorescent objects glow.

•Usually the **specimens** have been stained with dye molecule, called fluorochromes that fluorescence brightly upon exposure to light of a specific wavelength but some microorganisms are autofluorescing.

•The microscope forms an image of the fluorochrome labeled microorganisms from the light emitted when they fluoresce.

•A **barrier** filter positioned after the **objective lens** removes any remaining ultraviolet light, which could damage the viewers eyes or blue and violet light which would reduces the images contract.




Fluorescence Microscopy

# Electron Microscope :

•Electron microscope is a system of electromagnetic coils where electron beam is used as the source of illumination.

•The wavelength of electron is very short (0.05 $A^0$ ) the magnification is very high, the magnification is 2000 times greater than of light microscope.

•First Electron microscope was designed by Knoll and Ruska in 1932.

•There are two types of electron microscopes a) Transmission Electron microscope b) Scanning Electron microscope.

**Principles :**

•Electron microscope works in **vacuum** because the electrons move in a straight line in vacuum only.

•The lenses used in Electron microscope are called **Electromagnetic coils**. They work on electric current.

•Two **condenser lenses** are kept on the path of the electrons. They make the electrons into a narrow beam and focus on the object.

•The brighter and finer the electron beam, the higher the level of observation of the object.

•The **objects** absorbs, diffracts, reflects and transmits the electrons.

•The image results from the scattering of electrons by the atoms present in the specimen.

•The presence of heavy atoms will increase the image contrast. Hence the electron microscopists incorporate heavy atoms like gold into the specimen.

•The part of the specimen which transmits electrons appears bright. The portion of specimen which absorbs or scatter electrons appear dark.

•The **objective lens collects** the image of the specimen and focuses it towards the amplifier lens. The **amplifier lens** magnifies the image several thousand times.

•A **projector lens** focuses the image on a photographic plate.

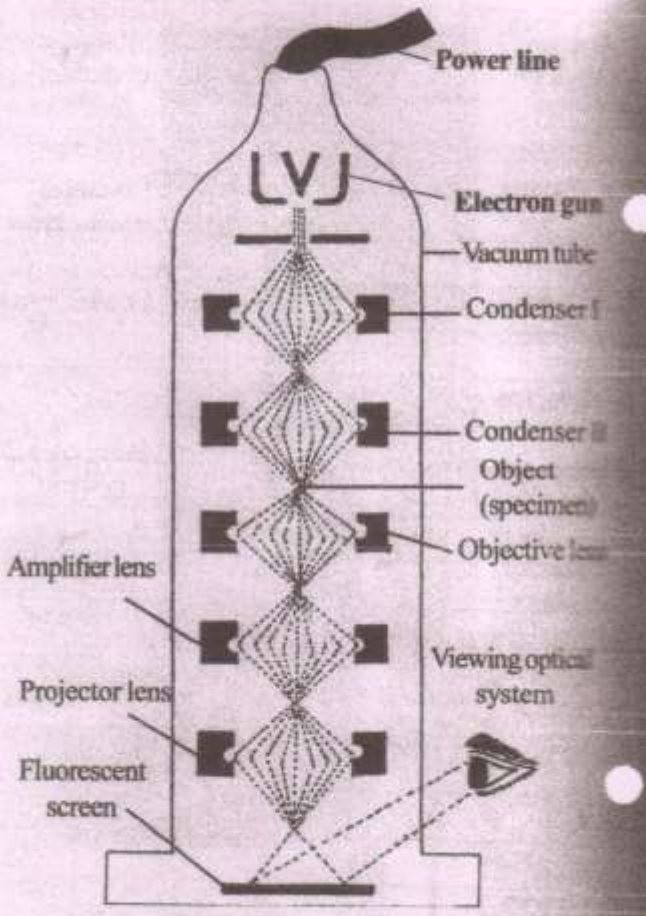
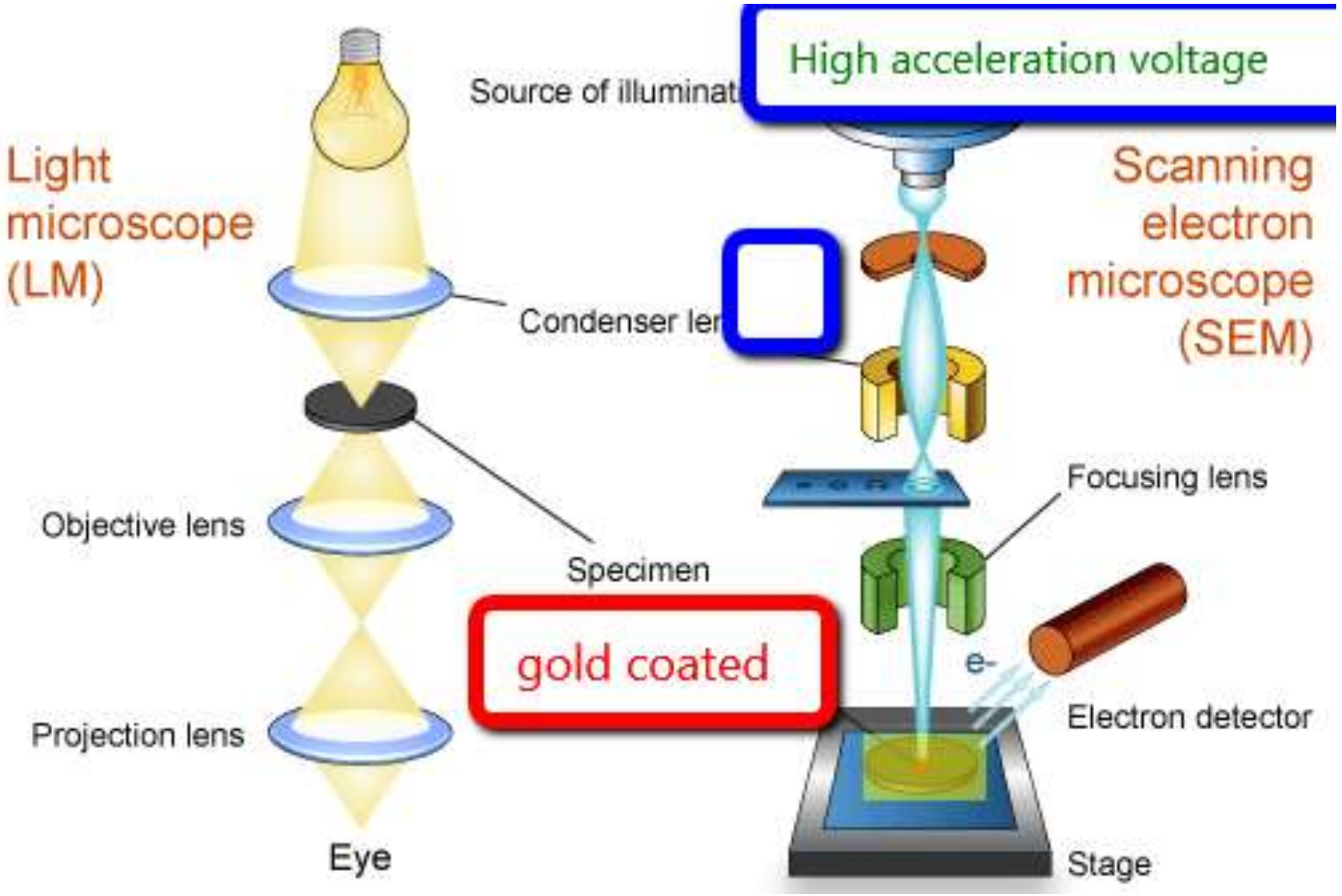



*Fig. 24.14: Simplified diagram showing the electron path of TEM.*

## Transmission Electron Microscope :

•Electron microscope in which electron beam is passed through the specimen to produce its image is called TEM.
•The first TEM was designed by Max Knoll and Ernst Ruska in 1931.
•The TEM has wide applications in the research on Virology, Oncology, Pollution studies, Material sciences and Semi- conductor research.

**Uses** :
•TEM is an ideal tool for the study of ultra structure of cells.
•It is used in the identification of plant and animal viruses based on their structural features.
•It is employed in the localization of nucleic acid , enzymes and proteins in cells and cell organelles.
•It is used in cancer research for the cytological observation of cancer cells.


Light microscope (LM)
Source of illuminat
Condenser le
Objective lens
Specimen
Projection lens
Eye
High acceleration voltage
Scanning electron microscope (SEM)
Focusing lens
gold coated
e-
Electron detector
Stage

# Scanning Electron Microscope :

- Electron microscope that scans the surface of specimen by passing an electron beam is called as Scanning Electron microscope.
- The first SEM was designed by Max Knoll in 1935.
- **Working :**
- Electrons are focused on the specimen , it produces **secondary electrons (SE)**, **back scattered electrons (BSE)**, **characteristic X-rays**.
- **Secondary electrons (SE)** are those which are reflected due to interactions between the atoms at the surface of the specimen and electrons.
- **Back scattered electrons (BSE)** give information about the distribution of different elements in the sample.
- **Characteristic X-rays** are emitted by the sample when the electron beam removes electrons in the inner shell of the atoms at the surface of the specimen.
- The **SE, BSE** and **X-ray** are detected accurately using separate detectors. The detector used to create the current distribution in the specimen.
- **Electronic amplifiers** are measure the electric signals and converted into bright spots of varying density by a scanning circuit to give the image of the specimen on the screen.

# Uses of Scanning Electron Microscope :

•It is very useful to view the surface architecture of microscopic creatures like Bacteria, Diatoms, Pollen grains.

•SEM gives the 3-D structure of the objects to reveal the structure of organism and organelles.

•SEM is employed in the analysis of structural features of compound eyes of insects.

•Hairs and Scales on plant and animal surfaces are characterized with the SEM.

•SEM is used to study the surface of small archeological specimens and fossils.


Thank you
From
Dr. Abhijeet R. Kasarkar


WELCOME
Dr. Abhijeet Rajaram Kasarkar

# “ Study of Some Common Weeds ”

# INTRODUCTION

A **weed** is a plant considered undesirable in a particular situation, "a plant in the wrong place".

**Classification of weed Based on :**

**1. Morphology : Grasses, Sedges, Broad leaved weeds.**

**2. Based on nature of stem : Woody weeds, Semi-woody weeds, Herbaceous weeds**

**3. Based on specificity : Poisonous weeds, Parasitic weeds**

# *Portulaca oleracea* L.

| | |
|---|---|
| Kingdom: | Plantae |
| *Clade*: | Angiosperms |
| *Clade*: | Eudicots |
| Order: | Caryophyllales |
| Family: | Portulacaceae |
| Genus: | *Portulaca* |
| Species: | ***P. oleracea*** |

**Binomial name**

***Portulaca oleracea***

L.

# *Portulaca oleracea*

## Classification :

Class : Dicotyledone
Family: Portulaceae

## Morphology :

Habit : Prostrate Herb
Root: Tap root sysyem
Stem: Prostrate, branched, herbacious, succulent, reddish in colour, smooth
Leaf: Simple, sessile, alternate, succulent, reticulate venation, margin slightly redish
Inflorescence : Axillary or terminal, flowers in cluster, Cymose
Flower : Small, sessile, bractiate, actinomorphic, bisexual, yellow coloured
Calyx: Sepals -2, polysepalous, green colour
Corolla: Petals 4-5, polypetalous, yellow colour
Androecium: stamens 8-12, yellow colour
Gynoecium : syncarpous, pentacarpellary, ovary superior, unilocular with many ovules, basal placentation
Fruit: Capsule with many black seed

## Ecology:

It is very common in waste land areas, under shady places and near moist watery areas. Also grow in crop plants like Jowar, Soybean, Groundnut , Maize, Rice, Sugarcane, Banana.

## Reproduction :

It is propagated by seeds and vegetative methods like stem cutting.

## Mode of Dispersal:

Seeds are dispersed by wind and through stem cutting due to human activity.

## Control Measure :

- Uprooting plant before flowering
- Continuous Hoeing
- Deep ploughing of land
- Use of pre emergence herbicide like Goal
- Use of herbicide like Atrazine, Simazine, 2-4 D and Meera – 71.

# *Alternanthera sessilis*

- Domain: Eukaryota
- Kingdom: Plantae
- Phylum: Spermatophyta
- Subphylum: Angiospermae
- Class: Dicotyledonae
- Order: Caryophyllales
- Family: Amaranthaceae
- Genus: Alternanthera
- Species: *Alternanthera sessilis*

•It is an annual or perennial herb, of 0.2-1 m high, with strong taproots.
•The stems are generally prostrate, creeping, often rooting at the nodes, sometimes floating or ascending at the tips, cylindrical and slightly hairy, with numerous, erect branches.
•The leaves are simple, opposite, shortly petiolate or sessile, broadly lanceolate or spatulate to almost linear, 0.6-5 cm long, and 0.3-1 cm wide. They are attenuated at the base, and the apex is acute to blunt, with entire, glabrous or pilose (thin, fine, articulate hairs) margins.
• The inflorescences are dense, sessile, silvery-white clusters of compressed spikes in the leaf axils.
•Perianth segments are equal in length, acute, 1.5-2.5 mm long with a short point. Bracts are ovate, concave, 0.3-1 mm long and persistent; bracteoles are oblong-ovate, 1-1.5 mm long, may be acute, and not deeply lacerated. Sepals are 2-3 mm long, white or purplish, glossy with a green base, glabrous or with a few long hairs, and a strong midrib.
•The fruits are indehiscent, a small, flattened, obcordate or obovate utricle, 2-2.5 mm long, enclosing the seed.
•Seeds are dark-brown to black, disc-shaped and shiny, about 0.8-1 mm in diameter.

## Reproduction:

It is propagated by seeds and vegetative methods.

## Mode of Dispersal:

Seeds are small, light in weight so dispersed by wind and propagate vegetative method so rapidly spreading.

## Control Measure :

- Hoeing and hand weeding before flowering
- Clean cultivation
- Regular ploughing
- Use of herbicide like Simazine, 2-4 D and Paraquet

# *Cyperus rotundus* L.

| | |
|---|---|
| Kingdom: | Plantae |
| *Clade*: | Angiosperms |
| *Clade*: | Monocots |
| *Clade*: | Commelinids |
| Order: | Poales |
| Family: | Cyperaceae |
| Genus: | *Cyperus* |
| Species: | ***C. rotundus*** |
| **Binomial name** | |
| ***Cyperus rotundus*** L. | |

•The dark green, shiny, three-ranked leaf blades arise from or near the base of the plant. They are narrow and grass-like ranging in size from 5-12 mm wide to 50 cm long and have a prominent channel in cross section.
•The upright culms or stems are 10-50 cm tall, smooth, triangular in cross section, and support a much-branched inflorescence.
•The leaf sheaths are tubular and membranous and attach to compact nodes at or near the base of the plant.
•. Two to four leaf-like bracts subtend the inflorescence which is umbel-like consisting of 3-9 unequal length branches (sometimes referred to as rays) bearing spikes of 3-10 spikelets. Spikelets are flattened and linear ranging in length from 10-30 mm long, and generally dark reddish purple or reddish brown in color. Each of the 20 or so flowers (florets) in a spikelet are each subtended by a keeled scale (glumes) 2-5 mm long that have a green midvein and a membranous margin. The flowers are bisexual each with three stamens and a pistil bearing three stigmas.
•Fruit, although rarely produced, consists of a three-angled achene (nutlet).

## Ecology:

It is very common in black and red solis. Also grow in crop plants like Jowar, Soybean, Maize, Rice, Sugarcane.

## Reproduction:

It is propagated by seeds and vegetative propagation like rhizome tubres.

## Mode of Dispersal:

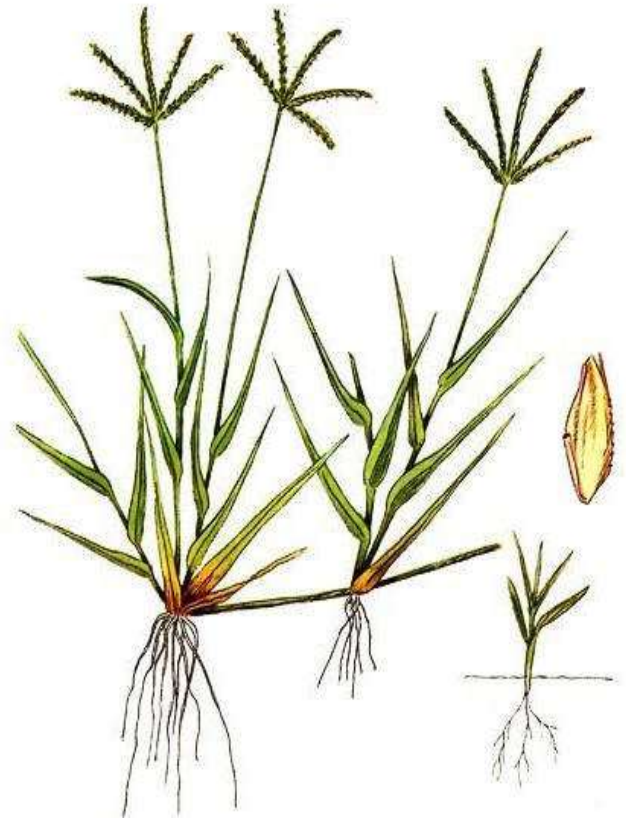
Seeds are small, light in weight so dispersed by wind and propagate vegetative by tubers so rapidly spreading through during hoeing and ploughing.

## Control Measure :

- Regular ploughing during summer season.
- Hand picking
- Hand weeding
- Clean cultivation
- Use of herbicide like 2-4 D, Glyphoset, NaCl and MCPA.

# *Cynodon dactylon* (L.) Pers

| | |
|---|---|
| kingdom: | Plantae |
| *Clade*: | Angiosperms |
| *Clade*: | Monocots |
| *Clade*: | Commelinids |
| Order: | Poales |
| Family: | Poaceae |
| Genus: | *Cynodon* |
| Species: | ***C. dactylon*** |
| **Binomial name** | |
| ***Cynodon dactylon*** (L.) Pers. | |



• Slender, stoloniferous creeping perennials.
• The erect stems can grow 1–30 cm (0.39–11.81 in) tall.
The stems are slightly flattened, often tinged purple in colour.
• Leaves 1-10 x 0.1-0.5 cm, linear-lanceolate, acuminate, glaucous; sheaths keeled; ligules fimbriate, membranous.
• Inflorescence of terminal, digitate 3-4 spikes; spikes 1-sided, oblong to 5 cm long. Spikelets sessile, 2-3 mm long, oblong-lanceolate, laterally compressed, 1-flowered.
• Lower glume 1.5-2 x 0.5 mm, lanceolate, chartaceous,1-nerved. Upper glume c. 2 x 0.5 mm, lanceolate, chartaceous, 1-nerved. Lemma 2-3 x 1.5-2 mm, boat-shaped, ovate-oblong when spread, keeled. Palea 2-2.5 x 0.5-1 mm, boat-shaped or oblong when spread, chartaceous.
• Stamens 3; anthers 1-1.5 mm long.
• Ovary 0.5 mm long, oblong; stigmas 0.5-1 mm long, pink.
• Caryopsis 1 mm, linear.

## Ecology:

It is very common in black , red solis and waste lands. Also grow in crop plants like Jowar, Soybean,  Maize, Rice, Wheat, Sugarcane.

## Reproduction:

It is propagated by seeds and vegetative propagation like runner.

## Mode of Dispersal:

Seeds are small, light in weight so dispersed by wind and propagate vegetative by runner so rapidly spreading through by human activity.

## Control Measure :

- Regular ploughing during summer season.
- Hand picking
- Hand weeding
- Clean cultivation
- Cultivation of fast growing and shade providing crops like Soybean, Mung.
- Use of herbicide like 2-4 D, Glyphoset, Simazin and Atrazin.


THANK YOU