

The Second Laboratory

Microscope

- Microscope is the combination of two words; "micro" meaning small and "scope" meaning view.
- Compound deals with the microscope having more than one lens.



Introduction to the Microscope

Microscope

- What is a microscope?
- is an **instrument** used to see objects that are too small for the naked eye.

- What is an instrument?
- In science, it refers to laboratory equipment or tools in a laboratory used by Scientists. This includes instruments such as a microscope.

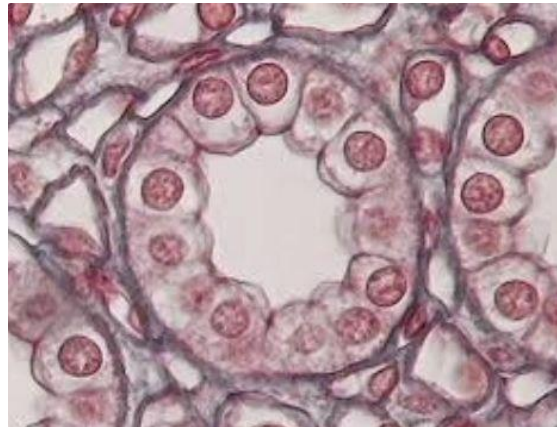
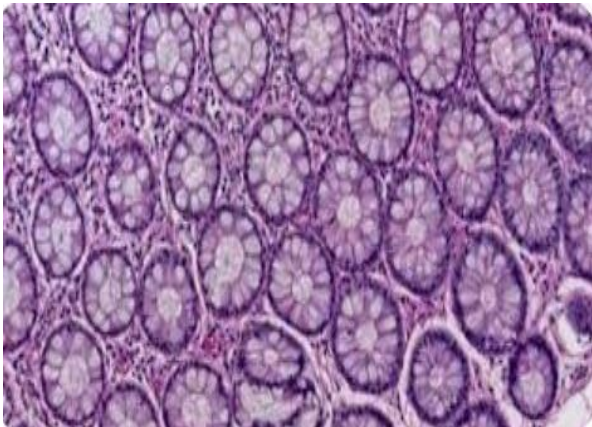


Introduction to the Microscope

What Is Microscope?

A microscope is an instrument that produces an enlarged image of an object.

Or, It is an instrument which deals with too small organisms that may cannot be seen distinctly with the naked eye.



Microscopes provide the observer with

* Enhanced resolution: ability to observe two nearby objects as distinct objects



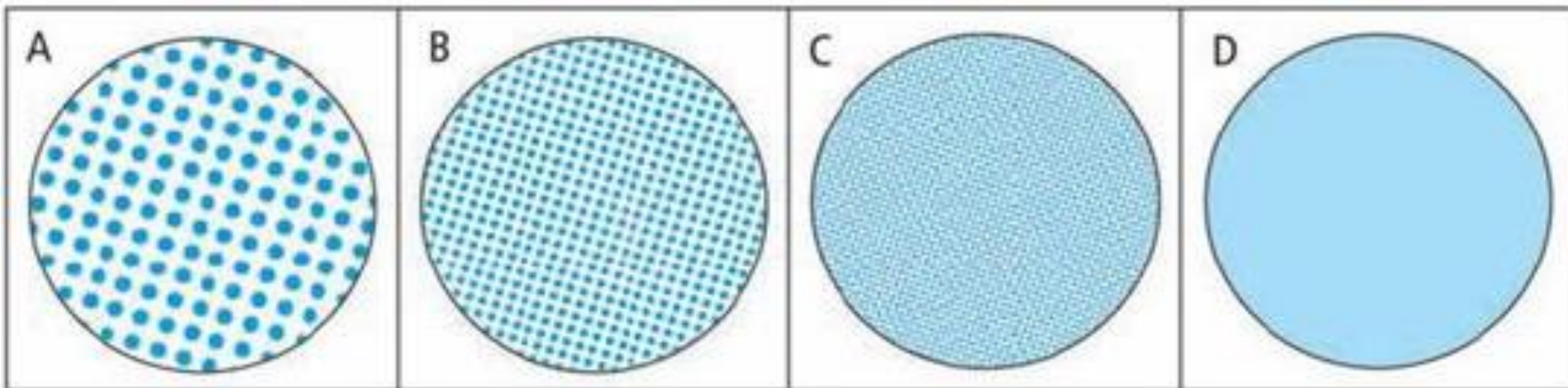
well resolved



just resolved

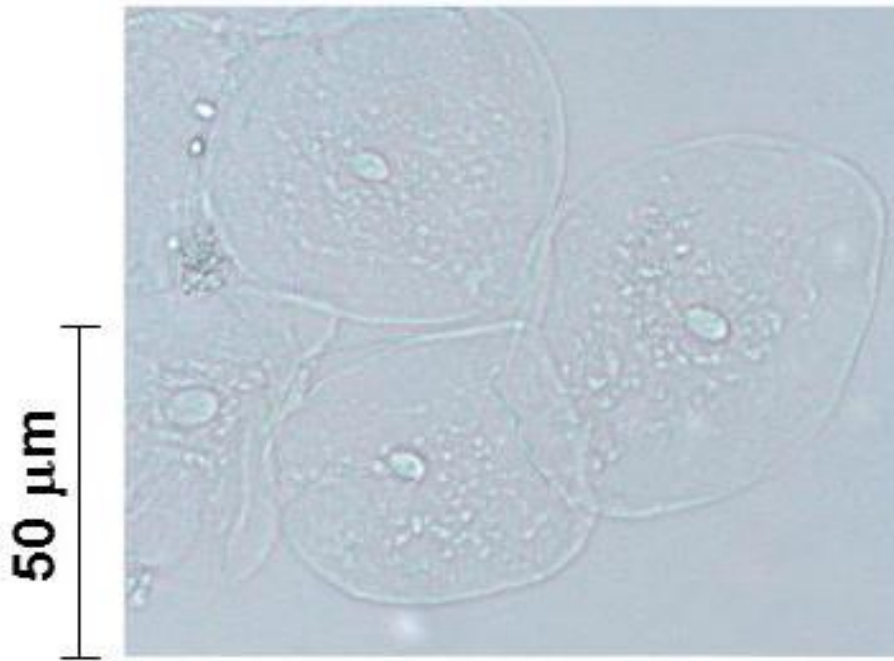


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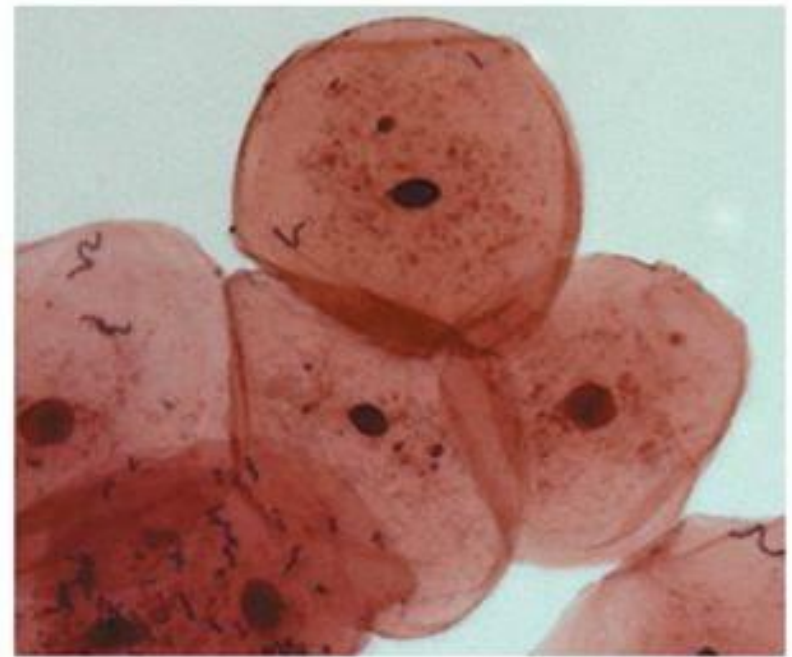


*Contrast : ability to detect different regions of the specimen on the basis of intensity or color.

Light Microscopy (LM)

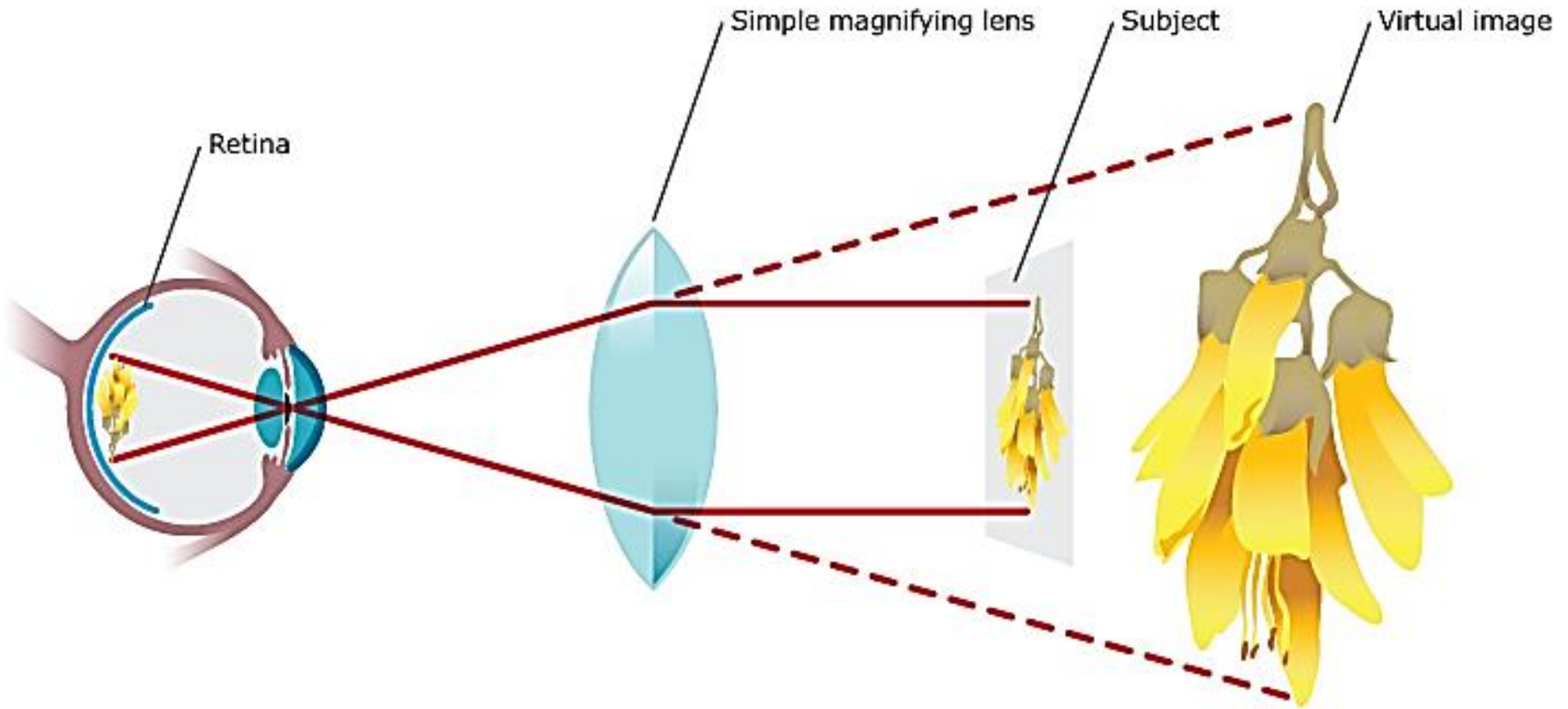


Brightfield
(unstained specimen)

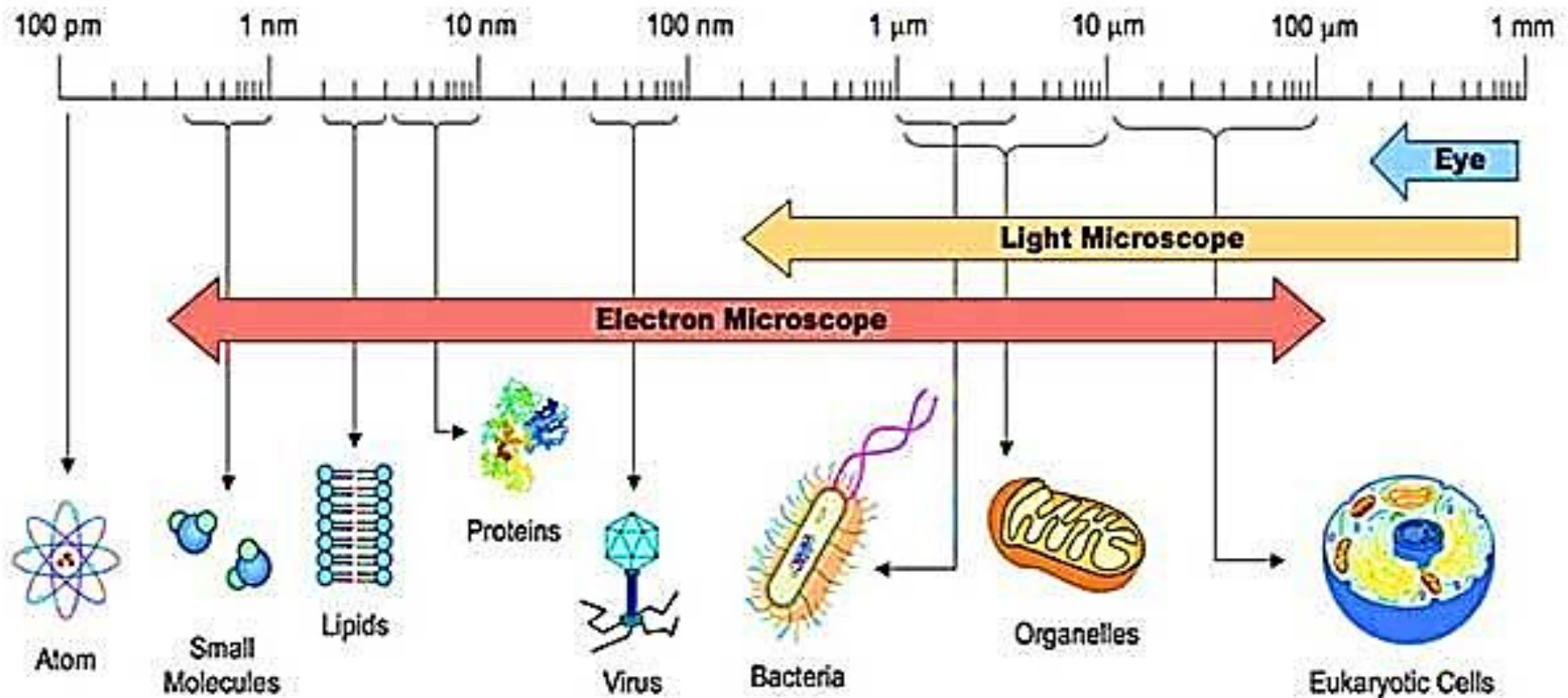


Brightfield
(stained specimen)

* Magnification ability to make small objects visible



The human eye can resolve objects of the order of 0.1 mm, while the light microscope can resolve objects on the order of 0.2 μm (200 nm) with a magnification of 1000. The transmission electron microscope, can resolve objects on the order of 0.1nm (100 \AA units).



Introduction to the Microscope

- *Types*
- *Care*
- *Parts & functions*
- *Focusing* *Introduction to the Microscope*

Types of Microscopes

- 1. Compound Microscope*
- 2. Dissection Microscope*
- 3. Scanning Electron Microscope (SEM)*
- 4. Transmission Electron Microscope (TEM)*

Types of Microscopes

Compound Microscope



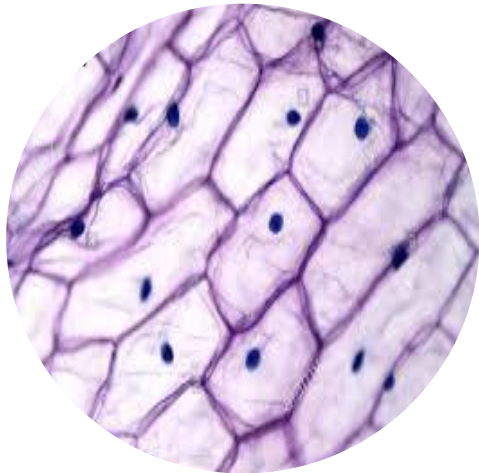
Dissection Microscope



Types of Microscopes

1. Compound Microscope

Compound microscopes are light illuminated. The image seen with this type of microscope is **two dimensional (2-D)**. This microscope is the most commonly used. You can view individual cells, even living ones. It has high magnification. However, it has a low resolution.



2. Dissection Microscope

(also called stereo microscope)

A dissecting microscope is light illuminated. The image that appears is **three dimensional (3-D)**. It is used for dissection to get a better look at the larger specimen. You cannot see individual cells because it has a low magnification

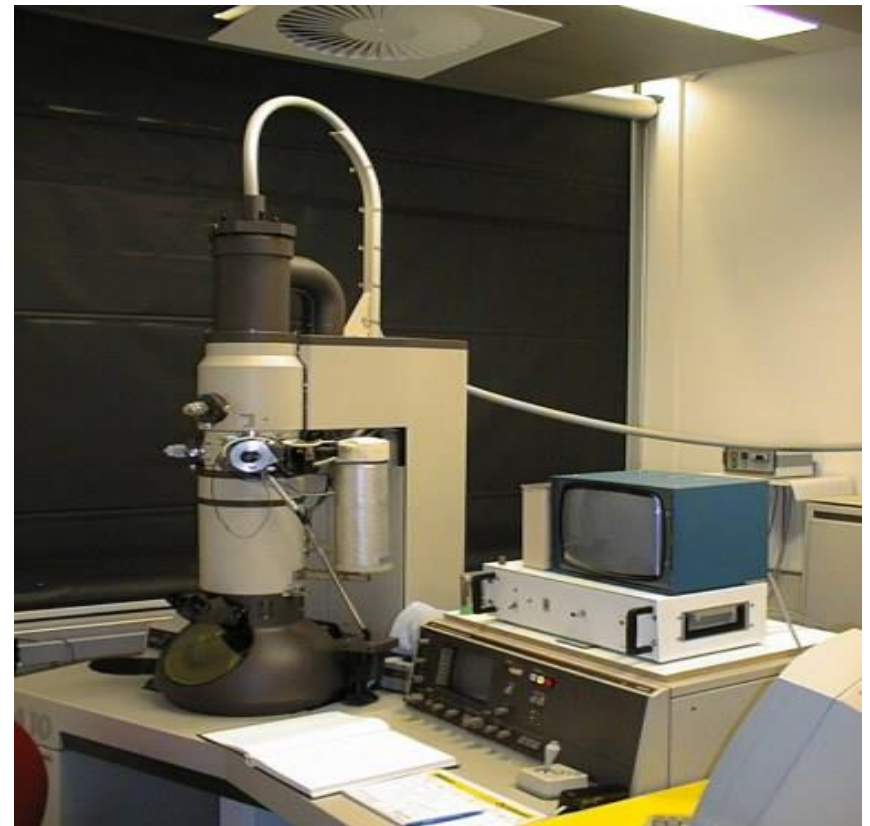


Types of Microscopes

3. Scanning Electron Microscope (SEM)



4. Transmission Electron Microscope (TEM)



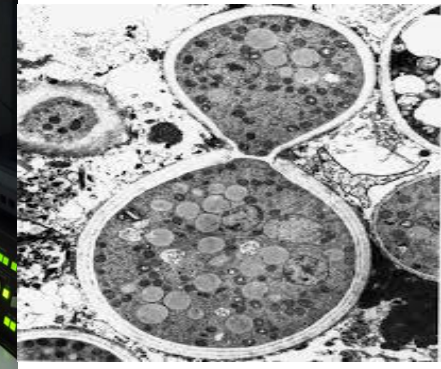
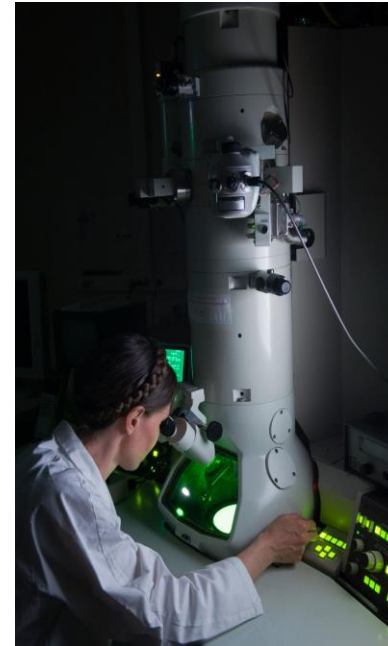
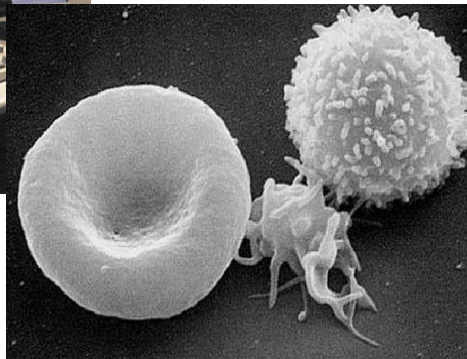
Types of Microscopes

3. Scanning Electron Microscope (SEM)

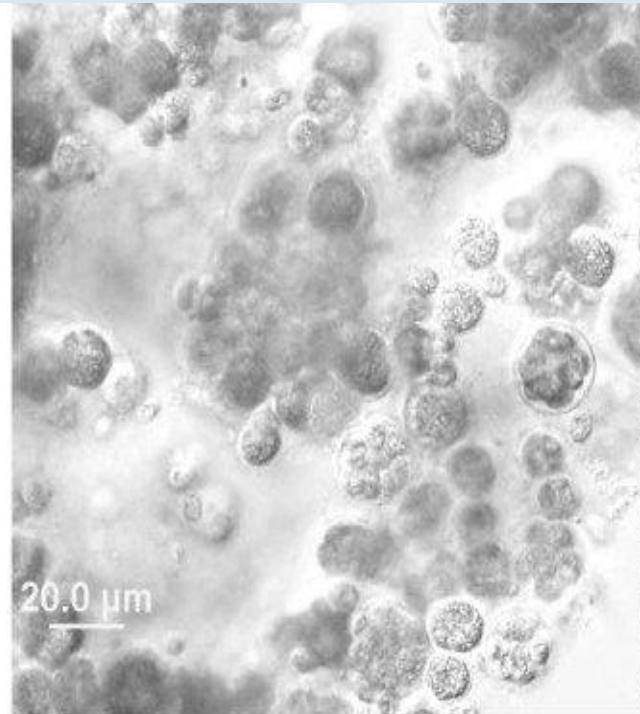
SEM use electron illumination. The image is seen in **3-D**. It has high magnification and high resolution. The specimen is coated in gold and the electrons bounce off to give you an exterior view of the specimen. The pictures are in black and white. It Can magnify up to **100,000x**.

4. Transmission Electron Microscope (TEM)

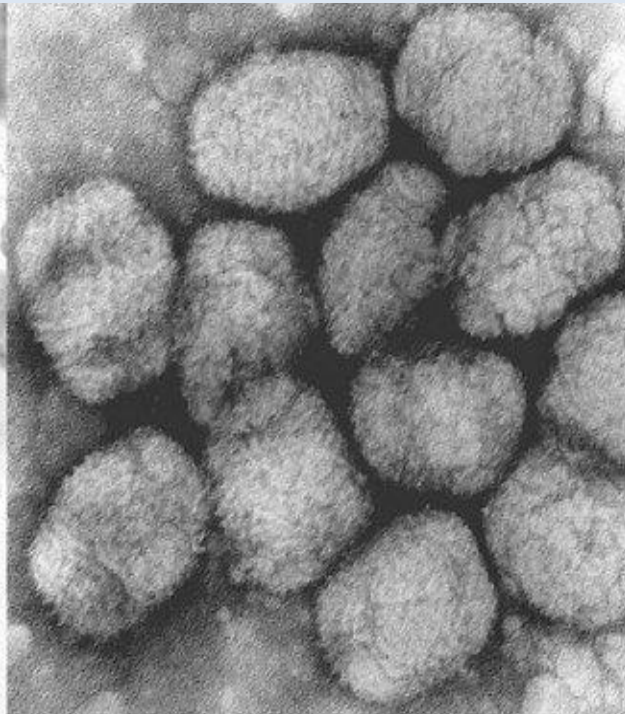
TEM is electron illuminated. This gives a **2-D view**. Thin slices of specimen are obtained. The electron beams pass through it. It has high magnification and high resolution. It Can magnify up to **250,000x**.



Types of Microscopes



Light Microscope



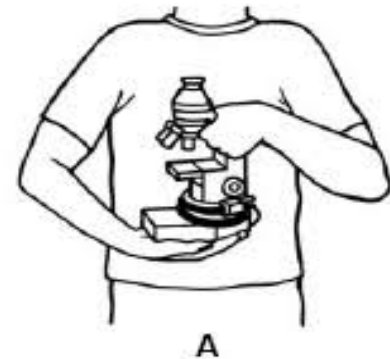
**Scanning Electron
Microscope (SEM)**



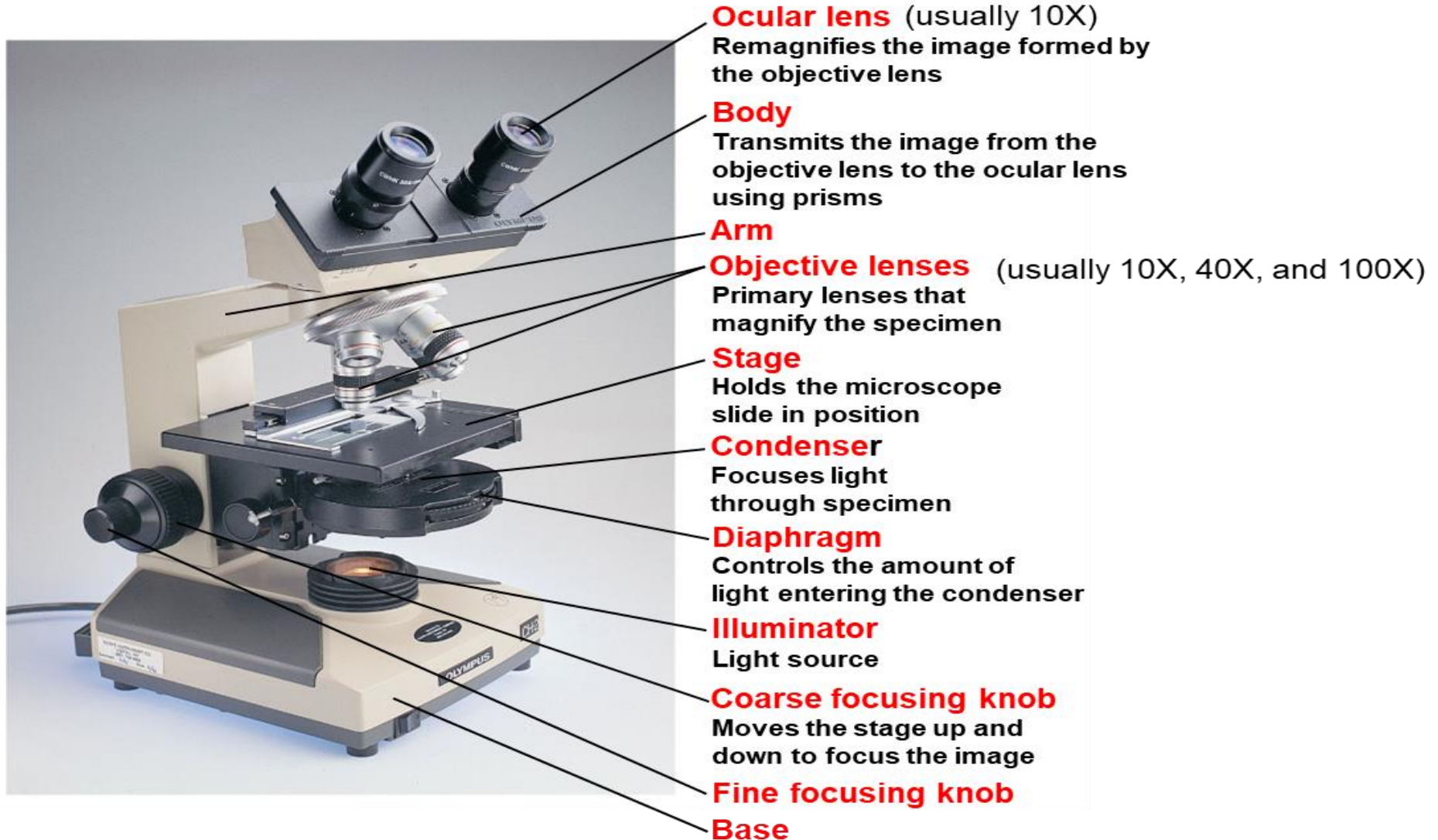
**Transmission Electron
Microscope (TEM)**

Microscope Care

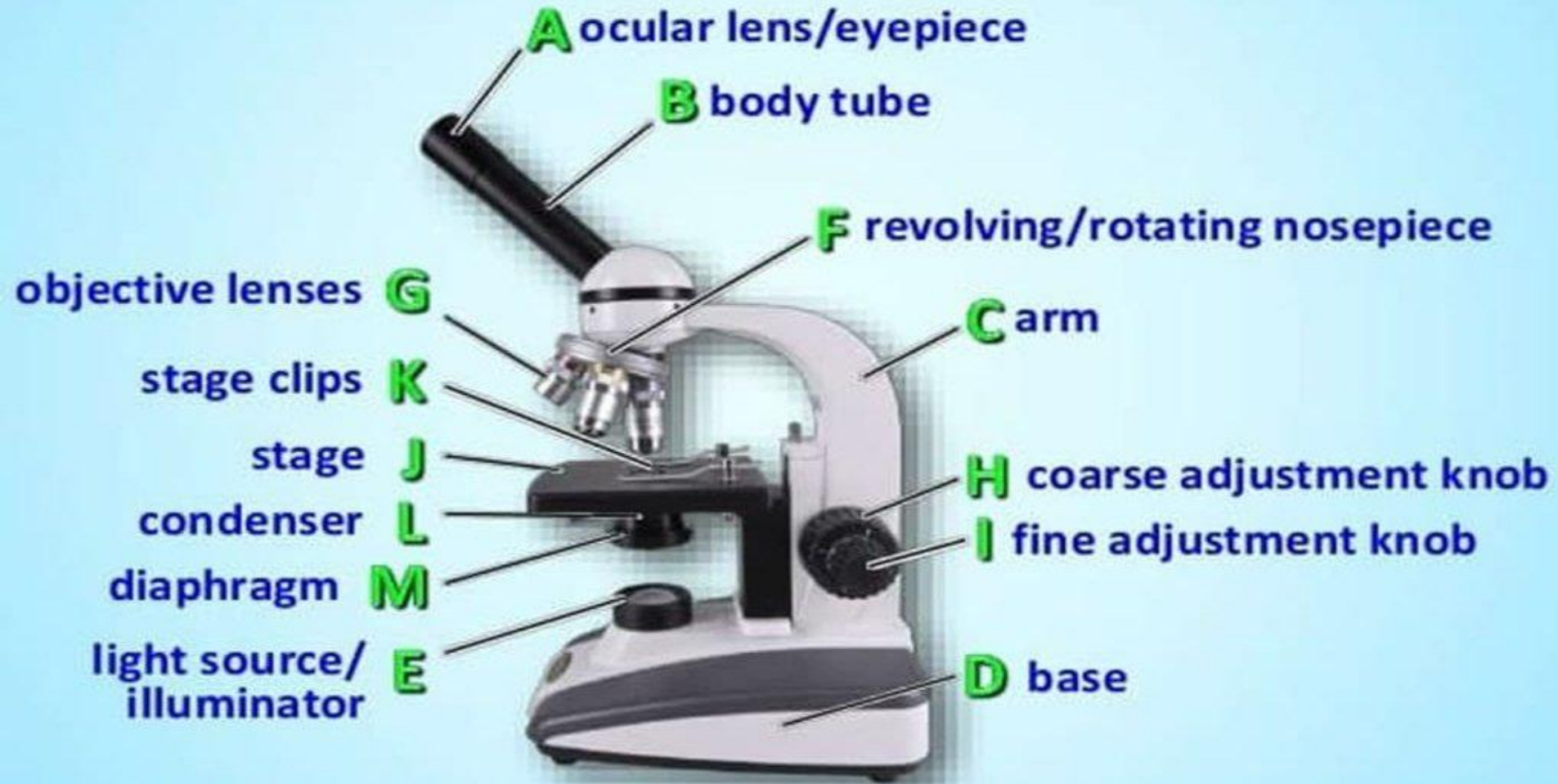
- *Always carry with 2 hands*
- *Never touch the lenses with your fingers.*
- *Only use lens paper for cleaning*
- *Keep objects clear of desk and cords*
- *When you are finished with your "scope", rotate the nosepiece so that it's on the low power objective, roll the stage down to lowest level, rubber band the cord, then replace the dust cover.*



Microscope Parts



Microscope Parts

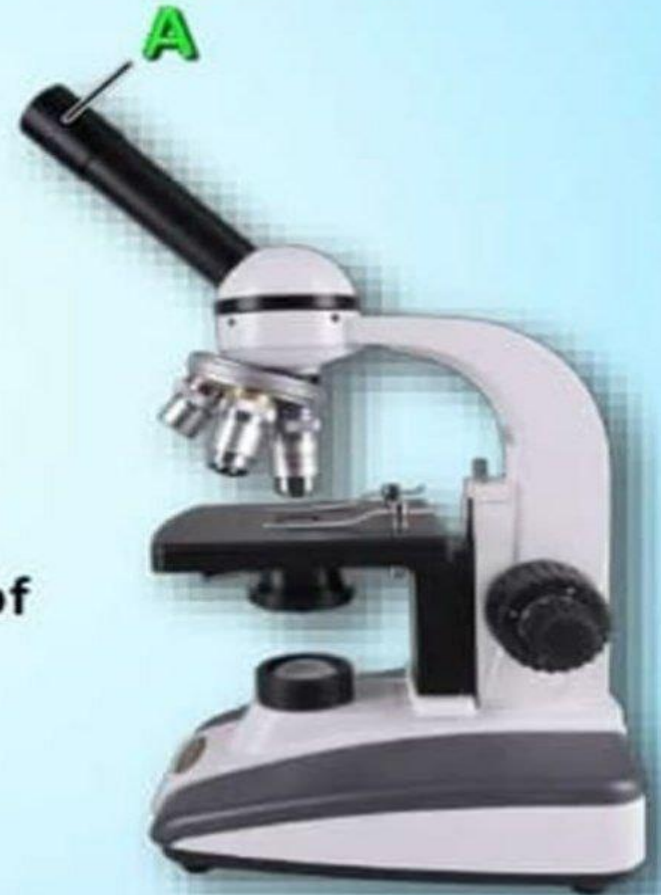


Microscope Parts & Functions

Ocular Lens / Eyepiece



- Contains a lens to **magnify** the image of the specimen.
- The usual magnification is **10** X.



Microscope Parts & Functions

Body Tube



- It **connects** the eyepiece to the objective lenses.
- It ensures the correct **alignment** of the microscope components to correctly **direct** the light from the specimen into the viewer's eye.

Microscope Parts & Functions

Arm



- It **connects** the body tube to the base.
- One **hand** should be around the arm when **carrying** the microscope (the other should be under the **base**).



Microscope Parts & Functions

Arm



- It **connects** the body tube to the base.
- One **hand** should be around the arm when **carrying** the microscope (the other should be under the **base**).



Microscope Parts & Functions

Base



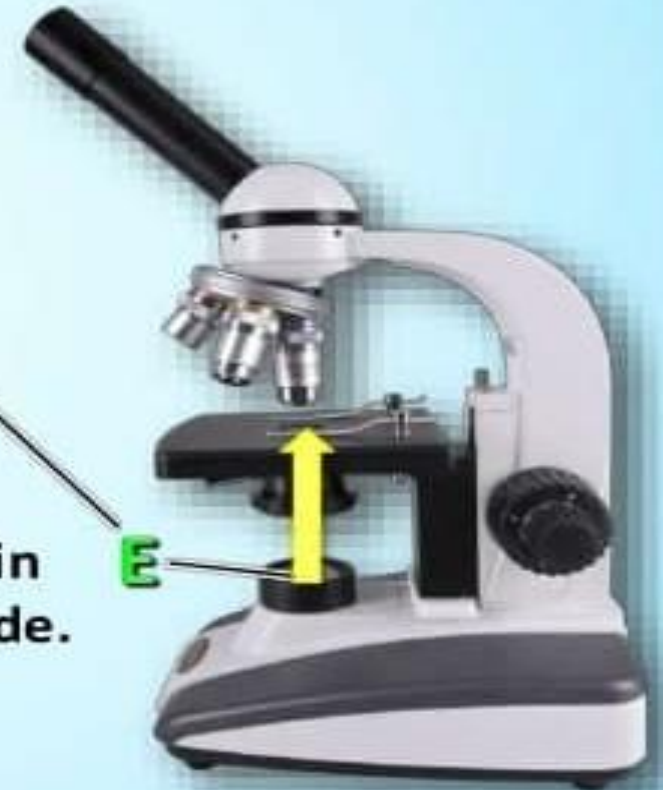
- It **supports** the weight of the microscope.
- It contains the **electronics** and **light source**.
- One hand should be **under** the base while **carrying** the microscope (the other hand should be holding the arm).



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Microscope Parts & Functions

Light Source / Illuminator



- It sends light **upwards** through the **condenser lens** and through the **hole** in the stage onto the **specimen** on the slide.

Microscope Parts & Functions

Light Source / Illuminator



- It sends light **upwards** through the **condenser lens** and through the **hole** in the stage onto the **specimen** on the slide.
- Older microscopes used to use **mirrors** to **reflect** the ambient light upwards.



Microscope Parts & Functions

Revolving/Rotating Nose Piece



- The **objective lenses** are attached to it.
- **Rotating** the nose piece allows you to **switch** between the different lenses.



Microscope Parts & Functions

Objective Lenses



Low (scanning) **4 X**

Medium **10 X**

High **40 X**

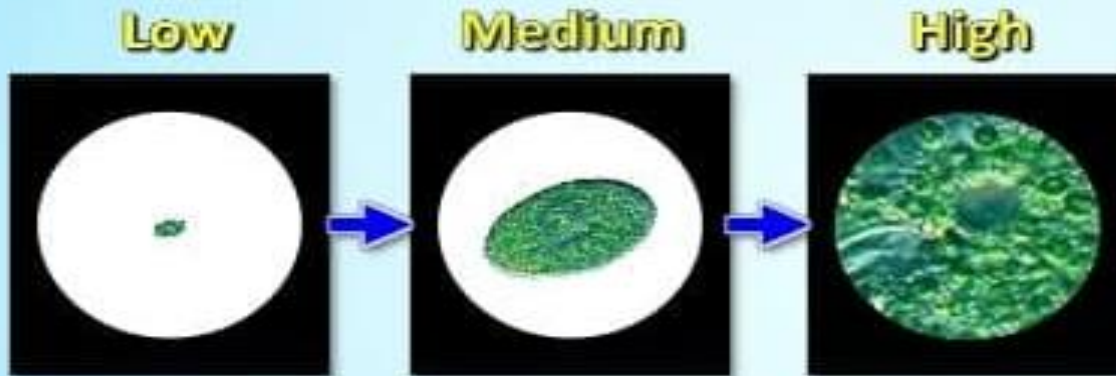
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- These lenses further magnify the image of the specimen.
- The magnifications are usually 4 X , 10 X and 40 X .
- There are usually **3** lenses

Microscope Parts & Functions

Objective Lenses



- As the power increases, the magnification becomes **larger** , but the field of view (visible area) becomes **smaller** .

Total Magnification

Total magnification is the ocular magnification multiplied by the objective magnification as shown in the following table.

Objective	Magnification	Ocular Lens	Total Magnification
Scanning	4x	10x	40x
Low Power	10x	10x	100x
High Power	40x	10x	400x
Oil Immersion	100x	10x	1000x

Microscope Parts & Functions

Coarse Adjustment Knob



H

- The **first** knob you should use, and always under **low** power. Never use it in **high** power.



Microscope Parts & Functions

Fine Adjustment Knob



- The **first** knob you should use, and always under **low** power. Never use it in **high** power.
- The **second** knob you should use under **higher** power for **exact** focusing.
- Both knobs move the **stage** up and down to help put the specimen in **focus**.

Microscope Parts & Functions

Fine Adjustment Knob



- Some microscopes have the two knobs located **one on top of the other**
- The smaller one on the bottom is always the **fine** adjustment knob.

Microscope Parts & Functions

Stage

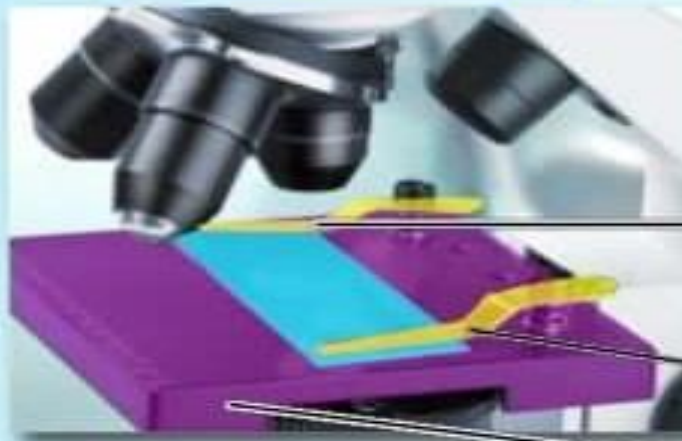


- The stage is where you place the slide which contains the specimen.
- It contains a hole that allows light to pass through the stage and onto the specimen.



Microscope Parts & Functions

Stage Clips



K

J



- The stage is where you place the **slide** which contains the **specimen**.
- It contains a **hole** that allows **light** to pass through the stage and onto the specimen.
- The stage clips **secure** the slide on the stage.

Microscope Parts & Functions

Condenser Lens



- The lens under the stage that **focuses light** from the illuminator through to the **hole** in the stage.



Microscope Parts & Functions

Condenser Lens



- The lens under the stage that **focuses light** from the illuminator through to the **hole** in the stage.



Microscope Parts & Functions

Condenser Lens



- The lens under the stage that **focuses light** from the illuminator through to the **hole** in the stage.



Microscope Parts & Functions

Diaphragm



- The lens under the stage that **focuses light** from the illuminator through to the **hole** in the stage.
- It contains a dial that rotates to **adjust** the **amount of light** that reaches the specimen.



How to use a microscope

- Use stage clips to secure slide
- Adjust nosepiece to lowest setting
- Place the slide on the stage
- (Lowest = shortest objective)
- Look into eyepiece
- Use coarse adjustment knob



How to use a microscope



Microscope Vocabulary

- *Magnification: increase of an object's apparent size*
- *Multiply the eyepiece magnification (10X) by the objective magnification (4X, 10X, 40X)*
Example: 4 x 10 = 40X total
- *Resolution: power to show details clearly*
- *Both are needed to see a clear image*



Types of Light Microscope

There are a variety of light microscopes mostly employed in Microbiology:

1. Bright-field
2. Dark-field
3. Phase-contrast
4. Fluorescence

Three factors determine the quality of an optical image:

- a. Magnification
- b. Resolution
- c. Contrast.

The End!

