Types of microscopes

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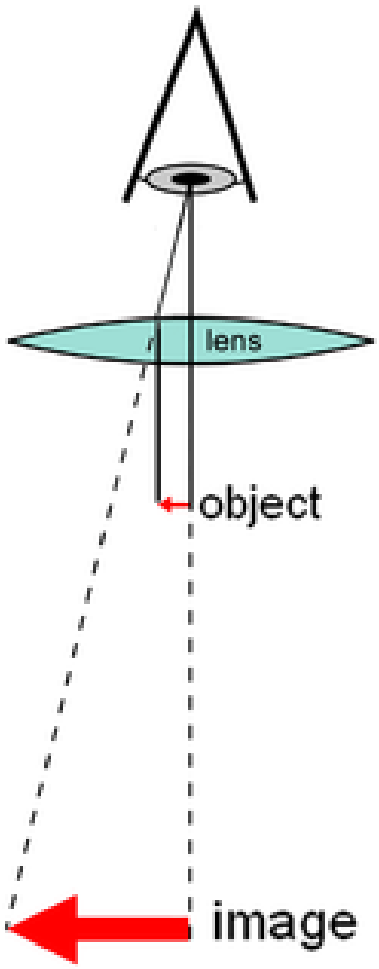
Microscope

- as the name suggests are instruments that help to enlarge minute (micro = very small) organisms or their parts.
- A microscope not only presents a magnified view of the object but also 'resolves' it better.
- ***Resolution*** is the feature which makes it possible to differentiate between two points present close together in the objects being viewed.

- Anton Van Leeuwenhoek (1632-1723) is credited with bringing the microscope to the attention of biologists.
- This, microscope consisted of a *single biconvex lens fitted in a small window of a "board" and the object was viewed through it*.
- After this **compound microscopes**, were developed using combinations of two lenses. Improvements continued, newer and newer' microscopes were designed and are still being improved.

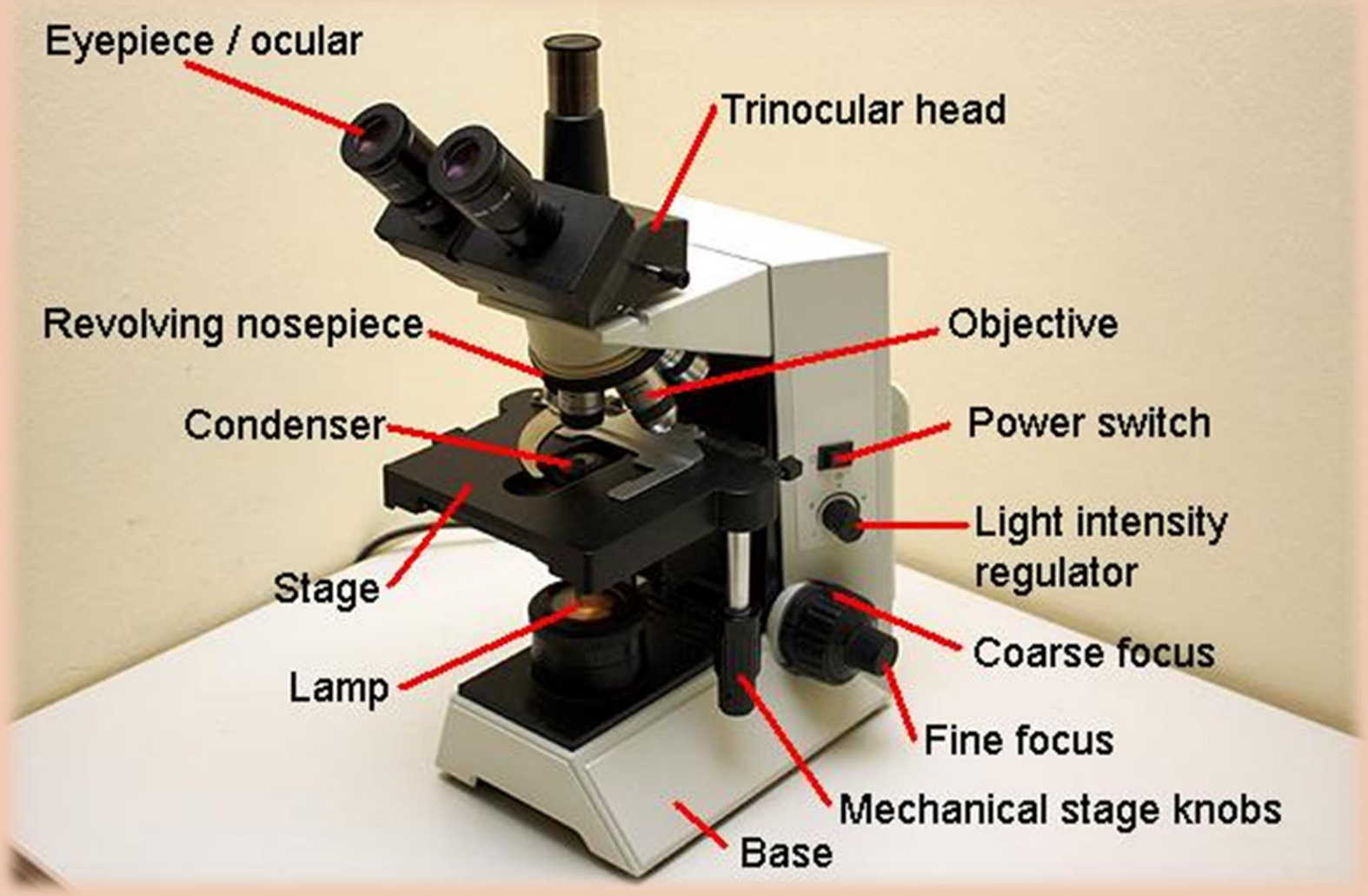
Simple microscope

- A simple microscope uses a lens or set of lenses to enlarge an object through angular magnification alone, giving the viewer an erect enlarged virtual image.



The Compound Light Microscope

- Commonly binocular (two eyepieces), it combines the power of lenses and light to enlarge the subject being viewed.
- Typically, the eyepiece itself allows for 10X or 15X magnification and when combined with the three or four objective lenses, which can be rotated into the field of view, produce higher magnification to a maximum of around 1000X generally.


Eyepiece / ocular
Trinocular head
Revolving nosepiece
Objective
Condenser
Power switch
Light intensity regulator
Stage
Coarse focus
Lamp
Fine focus
Mechanical stage knobs
Base

Here is a quick overview of the most important parts of a compound microscope (biological microscope) and their function.

- **Condenser:** This is a system of different lens elements which is mounted beneath the stage of the microscope. It contains an iris diaphragm which controls the diameter of the light beam. Condensers can be moved up and down. The normal operating position is up.
- **Base:** This is the bottom part of the microscope, it contains the lamp.
- **Coarse Focus:** Also referred to as rough focus, this knob raises and lowers the microscope stage quickly. It should only be used in connection with the low magnification lenses.
- **Eyepiece Lens:** Also known as ocular lenses, they magnify the image of the objective. The eyepiece is the lens into which a person looks into when observing.
- ***The total magnification of a microscope is calculated by multiplying the magnification of the objective by the magnification of the eyepiece.*** Many eyepiece lenses have a magnification of 10x or 15x.

- **Fine Focus:** This focus knob moves the stage up and down in small steps.

- **Head:** This is the top part of the microscope. It carries the eyepiece(s) and other optical elements. There are several different types of heads: a monocular head is designed to carry only one eyepiece, a binocular head carries two and a trinocular head is designed to carry a camera as well.

- **Mechanical Stage:** This type of stage is equipped with a slide holder and two knobs to turn. One knob moves the stage backwards and forwards, the other one moves the slide sideways.

- **Objective Lens:** This is a highly magnifying lens system, it is located close to the specimen to be observed. The image of the objective is then magnified again by the ocular lens which is close to the eye.

- **Stage:** This is the flat surface on which the slides are placed on. It can be moved up and down for focusing.

- **Stage Clips:** These are clips that hold the slide.

- **Trinocular Head:** This microscope head has three exits, two for viewing (for binocular vision) and a third exit to connect a camera.

Stereo microscope

- The **stereo** or **stereoscopic** or **dissecting microscope** is an optical microscope that designed for low magnification observation of a sample,
- Used mainly in dissection and morphology study of the surface of sample in low magnification.

Dissecting stereomicroscope

Oil Immersion Microscopy

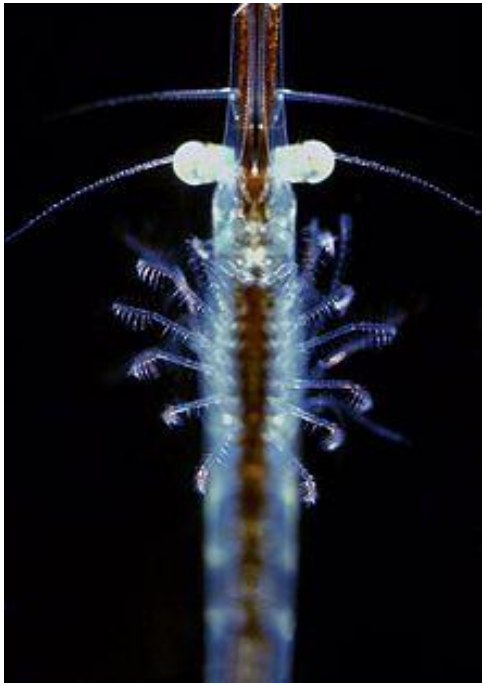
- increases the refractive index of a specimen when used properly.
- With limited disadvantages, slides prepared with oil immersion techniques work best under higher magnification where oils increase refraction despite short focal lengths.

Inverted microscope

- An **inverted microscope** is a microscope with its light source and condenser on the top, above the stage pointing down, while the objectives are below the stage pointing up.
- useful for observing living cells or organisms at the bottom of a large container (e.g., a tissue cultureflask) under more natural conditions than on a glass slide, as is the case with a conventional microscope.

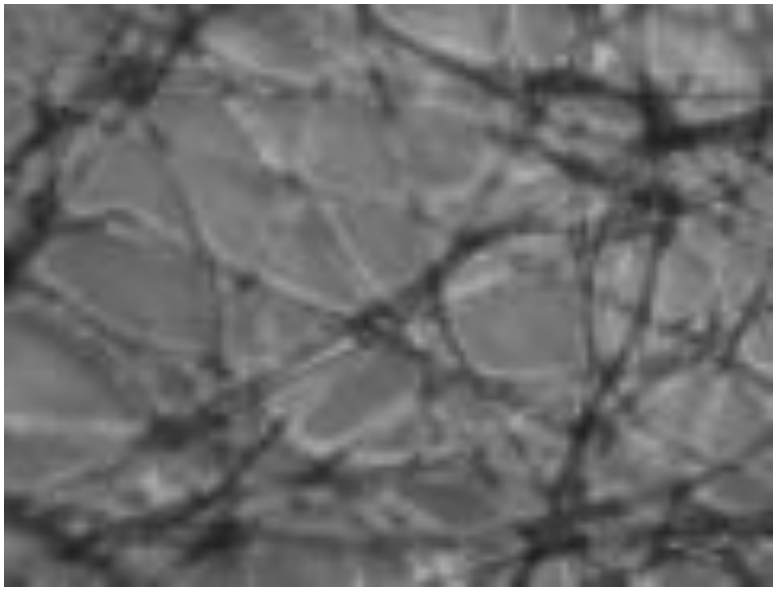
Dark Field Microscope

- Dark Field illumination is a technique used to observe unstained samples causing them to appear brightly lit against a dark, almost purely black, background.



Differential Interference Contrast (Phase contrast microscope)

- Takes advantage of differences in the light refraction by different parts of ***living cells*** and ***transparent specimens*** and allows them to become visible during microscopic evaluation.



- This is used to study the behavior of **living cells**,
  - observe the nuclear and cytoplasmic changes taking place during mitosis
  - and the effect of different chemicals inside the living cells,
  - living cells can be examined in their natural state without previously being killed, fixed, and stained.

Fluorescence Microscope

- High intensity is used instead of the standard illumination commonly found in compound microscopes.
- Using **mercury and xenon arc lamps as high-intensity illumination sources causes a large amount of excitation energy in the specimen providing those details not visible using traditional light.**

Tunel fluorescent stain