**How to Estimate Size Under a Microscope**

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Measuring items under a microscope at low power is not difficult if you are prepared to work with estimates and accept approximation. Estimating at higher power involves using some mathematics, but you can accomplish this with a simple division formula and a scale drawing of the object you are measuring.

* **Basic parts of the microscope:**
* **STRUCTURAL COMPONENTS**
* **Tube:** Connects the **eyepiece** to the **objective lenses**.
* **Arm**: Supports the tube and connects it to the **base**. It is also used to carry the microscope.
* When carrying a compound microscope always take care to lift it by both the arm and base, simultaneously.
* **Base**: The bottom of the microscope, used for support.



* **OPTICAL COMPONENTS**
* There are two optical systems in a compound microscope: Eyepiece Lenses and Objective Lenses:
* **Eyepiece or Ocular** is what you look through at the top of the microscope. Typically, standard eyepieces have a magnifying power of 10x. Optional eyepieces of varying powers are available, typically from 5x-30x.
* **Eyepiece Tube** holds the eyepieces in place above the objective lens. Binocular microscope heads typically incorporate a diopter adjustment ring that allows for the possible inconsistencies of our eyesight in one or both eyes. The monocular (single eye usage) microscope does not need a diopter. Binocular microscopes also swivel (Interpupillary Adjustment) to allow for different distances between the eyes of different individuals.
* **Nosepiece (Revolver):** houses the objectives. The objectives are exposed and are mounted on a rotating turret so that different objectives can be conveniently selected. Standard objectives include 4x, 10x, 40x and 100x although different power objectives are available.
* **Coarse and Fine Focus knobs** are used to focus the microscope. Increasingly, they are coaxial knobs - that is to say they are built on the same axis with the fine focus knob on the outside. Coaxial focus knobs are more convenient since the viewer does not have to grope for a different knob.
* **Stage**is where the specimen to be viewed is placed. A mechanical stage is used when working at higher magnifications where delicate movements of the specimen slide are required.
* **Stage Clips** are used when there is no mechanical stage. The viewer is required to move the slide manually to view different sections of the specimen.
* **Illuminator** is the **light source** for a microscope, typically located in the base of the microscope. Most light microscopes use low voltage, halogen bulbs with continuous variable lighting control located within the base.
* **Condenser** is used to collect and focus the light from the illuminator on to the specimen. It is located under the stage often in conjunction with an iris diaphragm.
* **Iris Diaphragm**controls the amount of light reaching the specimen. It is located above the condenser and below the stage. Most high quality microscopes include an Abbe condenser with an iris diaphragm. Combined, they control both the focus and quantity of light applied to the specimen.
* **Condenser Focus Knob** moves the condenser up or down to control the lighting focus on the specimen.

The magnification is how many times, the object has been enlarged. To calculate the magnification, you will need to multiply the magnification of the ocular lens with the magnification of the objective lens.

Ocular:10x: objective:4x Magnification:40x

When looking into a microscope, you will see a lit circular area. The distance across the center of the circle is referred to as the **diameter of field of view (dFOV)**

* **Estimating Size Under a Microscope**

There is two major process; First one is to measure of view field, second is to count of the cells along the diameter line.

We will use peripheral blood slides that have been prepared before. The cells have been dyed with Giemsa , so you can see the cells very easily. There are 5-5.5 million erythrocyte in per mm3 blood, but there are 5-10 thousand leukocyte in per mm3.

Begin sizing the microscope's viewing field at 100 times magnification(10x objectives).

1. Set the clear ruler into the line of view; it will measure the view field at approximately ~2 millimeters.
2. You can only measure wiev field with 10x times objectives, but you can count the cells only 100x times objectives.
3. The wiev field diameter for the 100x times objectives is 10 times shorter than the diameter with 10x objectives
4. Set 1000 times magnification(100x objectives), it can be estimated at about 0,2 millimeters. Convert this measurement to microns; the view at 1000 times can be estimated at 200 microns (1 mm is equal to 1000µ (micron)). You can estimate anything you want to measure in this range, based on how much of the field it covers.
5. If you divide the length of diameter to the number of the cells that you have counted you can find the diameter length of a single cell.

**The mathematical formula is :**

**Length of the cell = diameter of the viewing field/ estimated number of cells**