

## HOW TO MEASURE MICROSCOPIC OBJECTS

It is often important for a biologist to know the dimensions of the object being observed under the microscope. A simple method is described below to obtain estimates of the size of microscopic objects. This method enables you to obtain an approximate estimate of the size of an object by comparing it with the diameter of the field of view. To do this it will first be necessary to measure the size of the field of view using the metric system.

Fig. 1 Metric Ruler

The unit of length that is commonly used for microscopic objects is the micrometer. The prefix *micro-* is given the symbol of the Greek letter mu ( $\mu$ ). A micrometer ( $\mu\text{m}$ ) is equal to one-millionth of a meter. More appropriately, for microscopic objects a micrometer is equal to one-thousandth of a millimeter ( $0.001 \text{ mm.}$ ), or  $1000 \mu\text{m} = 1 \text{ mm.}$

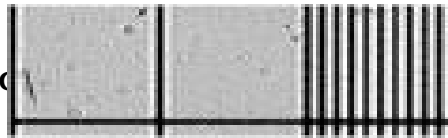


### Procedure:

Fig. 2

1.

1. With the 10X objective in position, place the micrometer slide on the stage of the microscope.



objective in position, on the stage of the

2. When you focus the scale you should see the millimeter scale divided into 0.1 mm. Divisions. Align the scale so that you have one of the 0.1 mm. lines on the left-hand edge of the field of view and the 0.01mm. lines showing on the right.

3. Count the number of millimeters and tenths of millimeters from one side of the field to the opposite side. (Record your answer on the worksheet)

4. Move the 45X objective in place, realign the micrometer divisions and record your answer.

5. Calculate what the field of view would be if you had a 4X objective or a 100X objective on your microscope. Use the following equation.

$$\underline{(\text{Field of View } 1) \times (\text{Magnification } 1) = (\text{Field of View } 2) \times (\text{Magnification } 2)}$$

Do your labeled calculations on the worksheet

2. **Question:** The electron micrograph below shows a Red Blood Cell (RBC) in cross-section. Using your millimeter ruler and the scale that is included with the photograph, calculate the diameter of this cell.



\* Answer question 2 on the worksheet that pertains to this photograph.

3. Human Blood Smear

- obtain a prepared slide of a human blood smear
- focus the slide under 100X and find an area of the slide with a dense collection of cells which span the diameter of the field of view.
- center the dense region you have located and switch to 450X.
- after focusing with the fine adjustment, carefully adjust the slide and count the number of cells that fit across the diameter of the high power field of view. (Repeat this count two more times and take the average)

Place your “raw” data from the three counts in the space below along with the labeled average.

**MICROSCOPIC MEASUREMENT  
WORKSHEET**

1. Actual:

10X (Objective) field of view \_\_\_\_\_ mm. \_\_\_\_\_ um.  
(Field of view = 40X)

450X field of view \_\_\_\_\_ mm. \_\_\_\_\_ um.  
(Field of view = 40X)

Calculated :

4X(Objective) field of view \_\_\_\_\_ mm. \_\_\_\_\_  
um.  
(Field of view = 40X)

Calculations: (Label all work)

100X(Objective) field of view \_\_\_\_\_ mm. \_\_\_\_\_  
um.  
(Field of view = 1000X)

Calculations: (Label all work)

2. Diameter of Red Blood Cell in electron micrograph? \_\_\_\_\_  
(Show calculations)

3. Average RBC count across 450X field diameter \_\_\_\_\_ cells.

4. (Based on the diameter of the RBC in the electron micrograph)

A.# of RBC's that would fit across  
diameter of 100X field

Calculations

\_\_\_\_\_

B.# of RBC's that would fit across  
diameter of 450X field

Calculations

\_\_\_\_\_

5. How does your actual RBC count (#3) compare to the calculated number of RBC (#4-B) expected to fit across the diameter of the high power (450X) field?

What is the percent deviation between these two values?  
(Percent deviation is determined by dividing the difference between the actual and calculated values by the average of the two values and then multiplying by 100.) (Show your calculations)

$$\% \text{ Deviation} = \frac{\text{actual} - \text{calculated}}{\text{average of the two}} \times 100$$

6. Identify a number of possible sources of error in this method of measuring microscopic objects.