Guided Inquiry • Skills Lab

Chapter 1 Lab Using a Microscope to Estimate Size

Problem
How can you use a microscope to estimate the size of an object?

Introduction
When you view objects with a microscope, the objects appear to be much larger than they really are. When an object is magnified, you can get a false sense of its actual size.

You can estimate the size of magnified objects if you know the size of the field of view. The field of view is the brightly lit circle you see as you look through the eyepiece of a microscope. The size of the field depends on which objective lens you are using. When you switch from a low-power to a high-power lens, you zoom in on an object. The field of view decreases as you zoom in.

In this lab, you will determine the diameter of the field of view for each objective lens. Then you will use your results to compare the sizes of a plant cell and a bacterial cell.

Skills Focus
Observe, Measure, Calculate, Predict

Materials
• compound microscope
• transparent 15-cm plastic ruler
• prepared slide of a plant root or stem
• prepared slide of bacteria

Safety
Handle slides gently to avoid breaking them and cutting yourself. Alert your teacher if you break a glass object. Review the rules for handling a microscope. To avoid electrical shocks, make sure that cords, plugs, and your hands are dry when using the light source.
Pre-Lab Questions

1. **Review** Which lens provides more magnification—a low-power lens or a high-power lens? Which lens provides the larger field of view?

2. **Use Analogies** A photographer may take wide views and close-ups of the same scene. How are these views similar to the low-power and high-power lenses on a microscope? What is an advantage of each view?

3. **Calculate** Eight cells fit across a field of view of 160 µm. What is the width of each cell?

4. **Predict** Which cell do you think will be larger, the plant cell or the bacterial cell? Give a reason for your answer.

Procedure

**Part A: Determine a Field of View for Each Objective Lens**

1. Make sure the low-power lens is in place. Place the ruler on the microscope stage so that the millimeter marks are lined up on the diameter of the lit circle.

2. Look through the eyepiece of the microscope. Focus on the millimeter marks. Slowly move the ruler until a millimeter mark is lined up with the left edge of the circle.

3. Count the number of whole millimeters you see. Estimate what fraction of the partial millimeter is visible. Record the diameter in millimeters in the data table on page 19. Then convert the data to micrometers. (There are 1000 micrometers in a millimeter.)

4. Record the power of the low-power, medium-power, and high-power objective lenses in the data table.
5. Divide the power of the low-power lens by the power of the medium-power lens. Multiply the result by the diameter of the low-power field of view to calculate the diameter of the medium-power field of view.

6. Repeat Step 5 for the high-power lens.

<table>
<thead>
<tr>
<th>Objective</th>
<th>Power</th>
<th>Diameter (mm)</th>
<th>Diameter (µm)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Low power</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Medium power</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>High power</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Part B: **Compare the Size of a Plant Cell and a Bacterial Cell**

7. Examine a prepared slide of a plant stem or root at low power and at high power. The small round shapes you see are cells. Decide whether to estimate the size of a plant cell at low power or at high power. Using the diameter of the field of view you choose, estimate and record the size of a typical plant cell.

8. Repeat Step 7 with a prepared slide of bacteria. Estimate and record the size of a typical bacterial cell.

**Analyze and Conclude**

1. **Infer** Why didn’t you use the ruler to measure the field of view of the medium-power and high-power lenses?

2. **Classify** Are bacteria unicellular organisms or multicellular organisms? Provide evidence for your answer.
3. **Control Variables** How did you decide which lens to use to estimate the size of the plant cell? The size of the bacterial cell?


4. **Predict** Some plant diseases are caused by bacteria. Could bacteria injure plant cells by surrounding and eating them? Could bacteria injure plant cells by entering them? Explain your thinking.


**Extend Your Inquiry**

With your teacher’s permission, use the microscope to observe a hair from your head. Use the data you collect to estimate the width of the hair. You and your classmates might want to pool your data to establish a range of widths for human scalp hair.