1.1: Introduction

Objectives

- Review the principles of light microscopy and identify the major parts of the microscope.
- Learn how to use the microscope to view slides of several different cell types, including the use of the oil immersion lens to view bacterial cells.
- Learn about the shapes and arrangements of some common types of bacteria.
- Review the taxonomic classification system used in scientific nomenclature.

The first microscope was developed in 1590 by Dutch lens grinders Hans and Zacharias Jansen. In 1667, Robert Hooke described the microscopic appearance of cork and used the term cell to describe the compartments he observed. Anton van Leeuwenhoek was the first person to observe living cells under the microscope in 1675—he described many types of cells, including bacteria. Since then more sophisticated and powerful scopes have been developed that allow for higher magnification and clearer images.

Microscopy is used by scientists and health care professionals for many purposes, including diagnosis of infectious diseases, identification of microorganisms (microscopic organisms) in environmental samples (including food and water), and determination of the effect of pathogenic (disease-causing) microbes on human cells. This exercise will familiarize you with the microscopes we will be using to look at various types of microorganisms throughout the semester.

The Light Microscope

What does it mean to be microscopic? Objects are said to be microscopic when they are too small to be seen with the unaided eye—they need to be magnified (enlarged) for the human eye to be able to see them. This includes human cells and many other types of cells that you will be studying in this class. The microscope you will be using uses visible...
light and two sets of lenses to produce a magnified image. The total magnification will depend on which objective lens you are using—the highest magnification possible on these microscopes is 1000X—meaning that objects appear 1000X larger than they actually are.

resolution vs. magnification

**Magnification** refers to the process of making an object appear larger than it is; whereas **resolution** is the ability to see objects clearly enough to tell two distinct objects apart. Although it is possible to magnify above 1000X, a higher magnification would result in a blurry image. (Think about magnifying a digital photograph beyond the point where you can see the image clearly). This is due to the limitations of visible light (details that are smaller than the wavelength of light used cannot be resolved).

The limit of resolution of the human eye is about 0.1 mm, or 100 microns (see Table 1 for metric review). Objects that are smaller than this cannot be seen clearly without magnification. Since most cells are much smaller than 100 microns, we need to use microscopes to see them.

The limit of resolution of the light microscope you will be using today is about 0.1 µm, or 100 nm. This means that we can view objects that are 1000X smaller than what we can see with our eyes alone. Biologists typically use microscopes to view all types of cells, including plant cells, animal cells, protozoa, algae, fungi, and bacteria. The nucleus and chloroplasts of eukaryotic cells can also be seen—however smaller organelles and viruses are beyond the limit of resolution of the light microscope (see Figure 1).

**Table 1**: Metric units commonly used in Microbiology

The basic unit of measurement of length in the metric system is the meter.

There are 1000 millimeters (mm) in one meter. $1 \text{ mm} = 10^{-3} \text{ meter}$.

There are 1000 micrometers (microns, or µm) in one millimeter. $1 \text{ µm} = 10^{-6} \text{ meter}$.

There are 1000 nanometers in one micrometer. $1 \text{ nm} = 10^{-9} \text{ meter}$.

![Figure 1.1: Resolving Power of Microscopes](https://bio.libretexts.org/?title=Bookshelves/Ancillary_Materials/Laboratory_Experiments/Microbiology_Labs/Book:_Laboratory…)
Key Terms

microorganism, magnification, resolution, working distance, parfocal, parcentric, prokaryotic, eukaryotic, bacillus, coccus, spirillum, spirochete, morphology, bacterial arrangements, depth of field, field of view, taxonomic classification