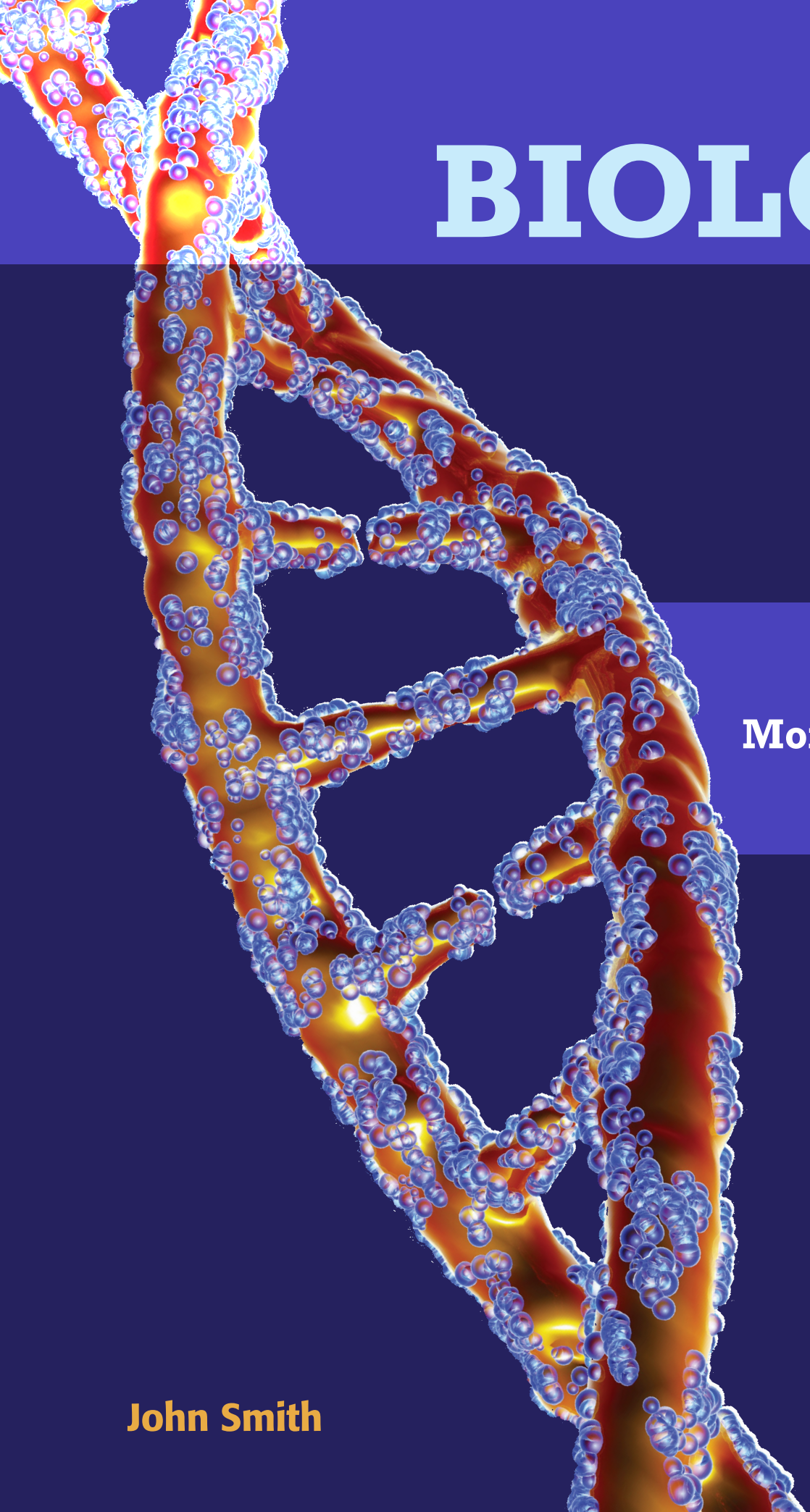


BIOLOGY

Lab Manual

Customized for
Morton University

John Smith

The Invisible World
Understanding Microscopy

3

The microscope is one of the most important and frequently used tools in the biological sciences. It allows the user to peer into the world of the cell as well as discover the fascinating world of microscopic organisms. A typical compound microscope is capable of extending the vision of the observer more than a thousand times (Fig. 3.1). Other microscopes, such as the transmission electron microscope, can magnify objects up to 1 million times. Since its invention more than 300 years ago, the microscope has greatly improved our understanding of the cell, tissues, disease, and ecology.

The most commonly used microscope in the biology laboratory today is the light microscope. A simple light microscope can have a single lens, similar to the early microscopes. Compound microscopes use two sets of lenses to magnify an object. They are capable of a magnification range of 10–2,000× and a resolution of 300 nanometers.

FIGURE **3.1** The compound microscope is an essential instrument in the biology laboratory.

OBJECTIVES

At the completion of this chapter, the student will be able to:

- Discuss the importance of the microscope in biology.
- Identify and describe the function of the parts of a compound microscope.
- Properly handle and care for a microscope and stereomicroscope.
- Exhibit the proper technique when using and focusing a microscope.
- Determine the total magnification of a compound microscope using different objectives.
- Properly prepare a wet mount.

EXERCISE 3.7 Observing Eukaryotic Cells in Plant Tissue

Kingdom Plantae includes some of the most conspicuous organisms on Earth. The plant kingdom contains approximately 280,000 species of multicellular, photosynthetic autotrophs. Plants vary in size and complexity from the minute duckweed to the giant redwood tree. Two of the primary cell types found in plants are the **collenchyma cells**, which provide support in actively growing plants, and the **epidermal cells**, which cover and protect the underlying cells and tissues in leaves and stems.

Procedure

Representative Plant Tissues

Epidermal tissue in plants is usually made up of a single layer of living cells. They serve to cover and protect roots, stems, leaves, flowers, and fruits. Plant epidermis is composed of a closely packed single layer of living cells. Epidermal cells do not perform photosynthesis and do not contain chloroplasts.

Materials

- ❑ Compound microscope
- ❑ Blank slide and coverslip
- ❑ Pipette
- ❑ Prepared slide of plant epidermal tissue
- ❑ Specimen of onion skin

1 Procure a microscope, prepared slide, and specimen.

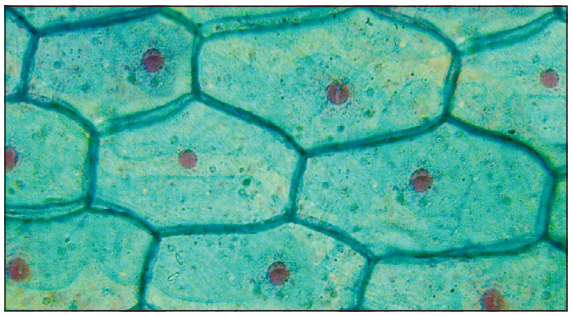


FIGURE **3.16** Epidermal cells from onion skin.

Plant epidermal tissue

Magnification _____

Wet mount of onion skin

Magnification _____

Procedure

Elodea

Materials

- ❑ Compound microscope
- ❑ Living specimen of *Elodea*
- ❑ Blank slides and coverslips
- ❑ Pipette

Elodea is a common plant that lives in freshwater habitats such as ponds and lakes. The leaves of *Elodea* are only a few cells thick and allow light to pass through the leaf without special preparation techniques. Refer to Figure 3.17 and Table 3.3 for references to plant cell anatomy.

1 Procure a microscope, a blank slide, coverslips, and a pipette. Carefully remove a single healthy leaf from the *Elodea*. Place the leaf in a drop of water on the blank slide with the top surface facing upward. (The cells on the upper surface are much larger and easier to observe.) Place a coverslip over the *Elodea*. Periodically check the leaf, making sure it does not dry out. If the leaf begins to dry, add a drop of water with a pipette.

2 Examine the leaf surface with the scanning and low-power objectives. Focus through the cell layers of the *Elodea*. Describe and sketch *Elodea* in the space provided below.

3 Using the high-power objective, examine a single cell of *Elodea*. Attempt to locate the structures indicated in Figure 3.18. The gray-colored nucleus may be difficult to locate. The nucleus may become more evident if a drop of iodine is placed upon the leaf. In a good preparation, the nucleolus may be evident. Carefully notice if

Elodea Magnification _____

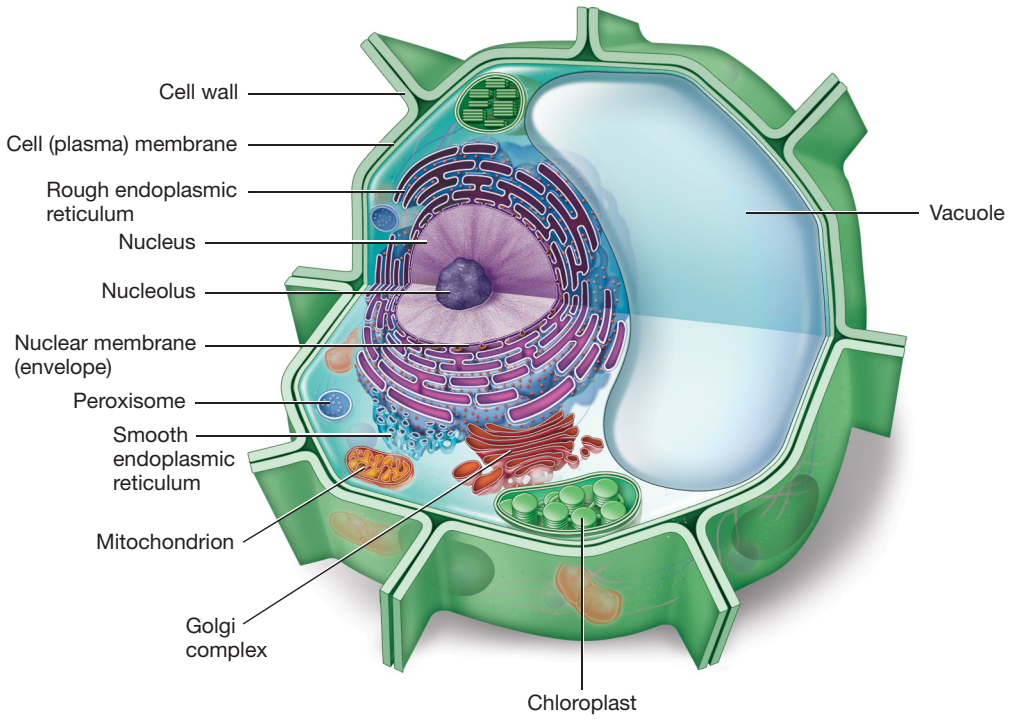


FIGURE **3.17** Typical eukaryotic plant cell.

TABLE **3.3** Common Anatomical Features of Eukaryotic Cells

Structure	Function
Cell wall	In plant cells, a cellulose envelope that provides protection and shape
Plasma membrane	A phospholipid bilayer that provides support and regulates the movement of substances into and out of the cell
Cytoplasm	A semifluid medium located between the plasma membrane and nucleus; inclusions and organelles are found in the cytoplasm
Nucleus	The control center of the cell
Nuclear envelope	Membrane surrounding the nucleus; possesses numerous nuclear pores
Nucleoplasm	Cytoplasm within the nucleus
Nucleolus	Chromatin-rich region that serves to combine proteins and RNA to make ribosomal subunits; many cells possess numerous nucleoli
Chromatin	Diffuse, threadlike strands composed of DNA and proteins
Mitochondrion	Site of aerobic cellular respiration
Endoplasmic reticulum (ER)	Network of membranes throughout the cytoplasm; synthesis of protein and nonprotein products
Rough ER	Lined with ribosomes; involved in the synthesis and assembly of a variety of proteins and production of membranes
Smooth ER	Not associated with ribosomes; main site of steroid, fatty acid, and phospholipid synthesis; site of detoxification
Golgi apparatus	Stacks of flattened membranous sacs or cisternae; receives, packages, stores, and ships protein products; produces lysosomes and other vesicles
Peroxisome	Vesicle containing enzymes that help in breaking down fatty acids and neutralizing hydrogen peroxide
Lysosome	In animal cells, vesicle containing hydrolytic digestive enzymes used in destroying cellular debris and worn-out organelles; also important in programmed cell death
Centrioles	Found in animal cells with the exception of roundworms (nematodes); appear as a pair of cylindrical structures made of microtubules; form the spindle apparatus in cell division
Ribosomes	Sites of protein synthesis
Cytoskeleton	Structures that help the cell maintain its shape, anchor organelles, and move; three kinds of cytoskeletal elements are recognized: microtubules, microfilaments, and intermediate fibers
Chloroplasts	In plant cells, sites of photosynthesis; contain grana, or "stacks," composed of chlorophyll-rich thylakoids
Central vacuole	In plant cells, large, fluid-filled sac that helps maintain the shape of the cell and stores metabolites
Middle lamellae	Region between adjacent plant cells that cements the cell walls together

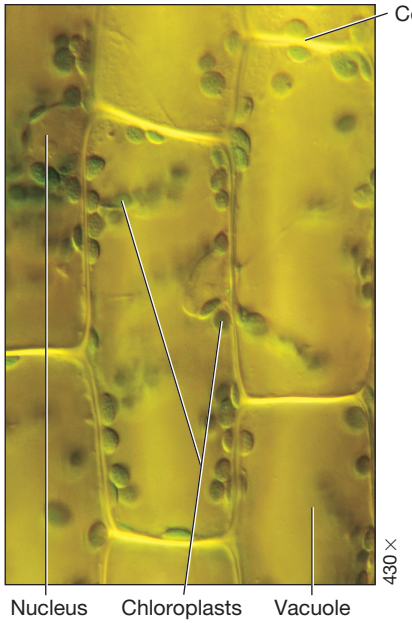
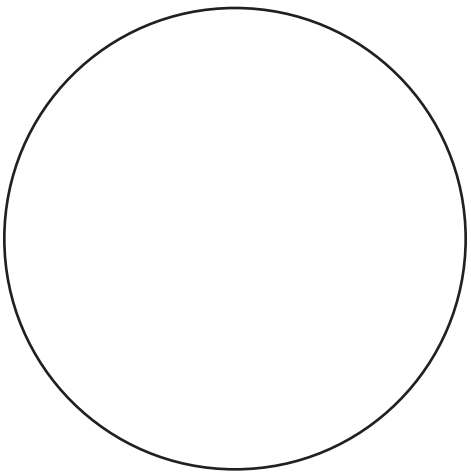


FIGURE **3.18** *Elodea* is a common plant found in freshwater ponds and lakes.



Elodea Magnification _____

Chapter 3 Review

Name _____ Date _____ Section _____

1 Describe the functions of the components you viewed in *Elodea*.

2 Describe the shape and size of the central vacuole.

3 Describe the shape of the chloroplasts.

4 Describe the location of the nucleus and the majority of the chloroplasts in the onion and *Elodea* cells.

5 Describe cytoplasmic streaming and suggest a function for this process.