The Cell

Lesson 1

Your first lesson consists of seven assignments that cover Chapters 1–7 of your textbook, pages 1–110. Chapter 1 introduces the science of biology. Chapters 2–7 cover the cell.

When you complete this lesson, you'll be able to

- Describe the characteristics of living things
- Discuss the levels of biological organization and how organisms are classified
- Explain the atomic structure of matter and the different kinds of chemical bonds
- Explain why water is vital to life on Earth
- Summarize the properties of organic compounds based on carbon
- Describe and explain the structural organization of cells
- Explain how cells make adenosine triphosphate (ATP)
- Identify the basic processes of photosynthesis
- Discuss the nature of cellular respiration

ASSIGNMENT 1: A VIEW OF LIFE

Refer to the following information as you read Chapter 1, "A View of Life," pages 1–14 in your textbook.

The Unity and Diversity of Life

Biology is the scientific study of life. Several characteristics help to define the term *life:*

1. All living things are composed of cells, which inherit DNA from a parent organism through reproduction.
2. All living things obtain energy from their surroundings and use it to grow, develop, and maintain specific internal conditions.
3. Living organisms can sense changes in their environment and adjust their activities in response to those changes.

Review and study the illustrations on page 1 of your textbook. As you examine these illustrations, think about life's diversity. Review Figure 1.1 on page 2 to consider the chain of biological organization from molecules to cells and onward to tissues, organs, organ systems, and complex organisms that live and breath. The *cell,* which you'll be studying throughout this lesson, is the smallest unit of biological organization that displays all of the characteristics of life. Multicelled organisms are made up of specialized cells that have been organized into tissues and organs.

How the Biosphere Is Organized

Many organisms of the same kind that live in close proximity to one another make up a *population*. All populations (of different types of organisms) that live in a certain area form a *community*. A community together with its physical environment forms the next level of organization—the *ecosystem*.

Within an ecosystem are producers, consumers, and decomposers. Review Figure 1.4 on page 5 of your textbook for an illustration of the three members that make up a grassland, which is one kind of terrestrial ecosystem. The highest level of organization is the *biosphere*. Looked at from space, the biosphere is a thin, fragile layer over Earth's surface. It includes the areas of the lower atmosphere, the oceans, and various land surfaces that are able to support life.

How Organisms Are Classified

Biologists use the science of *taxonomy* to classify organisms into groups, according to the way in which they're related to one another. Classification categories range from the most specific (a *species*) to the very general (a *domain*).

The standard system of classification separates all living organisms into three domains (domain Archaea, domain Bacteria, and domain Eukarya). Domain Eukarya is further categorized into four kingdoms. Here's an explanation of each:

1. *Domain Archaea* is made up of prokaryotic, unicellular organisms that live in extreme habitats, such as deep ocean steam vents. (The term *prokaryotic* is used to describe an organism that lacks the membrane-bounded nucleus and membranous organelles typical of eukaryotes.)
2. *Domain Bacteria* consists of prokaryotic, unicellular, bacteria. They inhabit a wide variety of environments and display a remarkable range of adaptations.
3. *Domain Eukarya* consists of four kingdoms:
    a. *Kingdom Protista* are organisms that may be unicellular, multicelled, or *colonial* (living in colonies). They have more internal complexity than prokaryotes.
    b. *Kingdom Fungi* are eukaryotic, multicelled organisms that display extracellular digestion. That is, they break down organic debris as a source of sustenance.
    c. *Kingdom Plantae* are multicelled, eukaryotic, photosynthetic producers with vascular tissues.
    d. *Kingdom Animalia* are eukaryotic, multicelled, consumers that are usually mobile.

Review the excellent photographs and accompanying text in Figures 1.5–1.10 on pages 6 and 7 to get a feel for the nature of the biological domains and kingdoms.

Science As a Way of Knowing

The scientific approach to studying biology should always include the following steps:

1. Develop a question you would like to answer based on observations you've made.
2. Based on your observations and on what others have found in the past, develop a hypothesis, which is your best guess of possible answers to the questions you've posed.

3. Based on your hypothesis, predict what you think will occur.
4. Find ways to test your predictions by conducting experiments or by making further observations.
5. Develop conclusions by analyzing and reporting your test results.

Figure 1.12 on page 9 presents a flow diagram describing the scientific method. Study this figure and then read the example of a controlled study on pages 10–11.

Science and Society

Technologies developed from the biological sciences have often provided mixed blessings. For example, the use of fertilizers produced spectacular increases in agricultural efficiency and productivity. On the other hand, fertilizer runoff from farmlands has also contaminated groundwater and caused other kinds of ecological damage. In a nutshell, human needs must be evaluated in terms of the ecological pros and cons of new technologies.

Self-Check 1

At the end of each section of *Introduction to Biology,* you'll be asked to pause and check your understanding of what you've just read by completing a "Self-Check" exercise. Answering these questions will help you review what you've studied so far. Please complete Self-Check 1 now.

1. _____ are the smallest units of life.

   a. Protons
   b. Cells
   c. Molecules
   d. Proteins

2. Which one of the following lists shows the *correct* order of biological organization?

   a. Ecosystem, population, community, biosphere
   b. Community, population, biosphere, ecosystem
   c. Population, community, ecosystem, biosphere
   d. Biosphere, community, population, ecosystem

3. Organisms that depend on food energy stored in other living organisms are called

   a. protists.
   b. producers.
   c. composers
   d. consumers.

4. The processes in organisms by which internal conditions—like temperature and acidity—are kept about the same is called

   a. homeostasis.
   b. photosynthesis.
   c. metabolism.
   d. nutrition.

5. The life-domain whose members live in very harsh environments, such as salt lakes and hot springs, is called

   a. Fungi.
   b. Eubacteria.
   c. Archaea.
   d. Protista.

6. During a scientific experiment, the control group is

   a. identical to the experimental group.
   b. not aware of the experiment taking place.
   c. different from the experimental group in all respects.
   d. identical to the experimental group in all areas except the variable being tested.

Check your answers with those on page 193.