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Chapter 1

Section 1 The World of Biology

Objectives

- **Relate** the relevance of biology to a person's daily life.
- **Describe** the importance of biology in human society.
- **List** the characteristics of living things.
- **Summarize** the hierarchy of organization within complex multicellular organisms.
- **Distinguish** between homeostasis and metabolism and between growth, development, and reproduction.



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Preview 

Main 

Biology and You

- **Biology and Society**

- **Biology** is the study of life and can be used to both solve societal problems and explain aspects of our daily lives.



Characteristics of Life

- Living things share the same 7 characteristics: organization and cells, response to stimuli, homeostasis, metabolism, growth and development, reproduction, and evolution.



The Seven Properties of Life

- Cellular organization
- Reproduction
- Metabolism
- Homeostasis
- Heredity
- Responsiveness
- Growth and development

Characteristics of Life, *continued*

- **Organization and Cells**
 - **Organization** is the high degree of order within an organism's internal and external parts and in its interactions with the living world.
 - A **cell** is the smallest unit of an organism that can perform all life's processes.



Characteristics of Life, *continued*

- **Organization and Cells**
 - **Multicellular** organisms are made up of many cells and show a hierarchy of organization going from the organism to the atom.



Characteristics of Life, *continued*

- **Response to Stimuli**

- Another characteristic of life is that an organism can respond to a *stimulus*—a physical or chemical change in the internal or external environment.



Characteristics of Life, *continued*

- **Homeostasis**

- All living things have mechanisms that allow them to maintain stable internal conditions.

Homeostasis is the maintenance of a stable level of internal conditions even though environmental conditions are constantly changing.



Characteristics of Life, *continued*

- **Metabolism**
 - **Metabolism** is the sum of all the chemical reactions that take in and transform energy and materials from the environment.



Characteristics of Life, *continued*

- **Growth and Development**
 - The growth of living things results from the division and enlargement of cells.
 - **Development** is the process by which an organism becomes a mature adult.



Characteristics of Life, *continued*

- **Reproduction**
 - Living organisms pass on hereditary information from parents to offspring, also called **reproduction**.



Characteristics of Life, *continued*

- **Change Through Time**

- Populations of living organisms *evolve* or change through time.



Characteristic of Life	Description
Made of one or more cells	The cell is the basic unit of life. Some organisms have one cell only. Others have many cells.
Displays organization	The organization of a biological system begins with atoms and molecules. Each organized structure in an organism has a specific function. For example, an anteater's snout is long because it functions as a container for the long tongue.
Grows and develops	Growth results in an increase in mass. Development results in different abilities. For example, a tadpole grows larger and develops into an adult frog.
Reproduces	Organisms reproduce and pass on traits to the next generation. Reproduction must occur for a species to continue to exist.
Responds to stimuli	Reactions to stimuli from inside and outside the body are called responses. For example, a cheetah responds to the need for food by chasing a gazelle. The gazelle responds by running away.
Requires energy	Energy is needed for life processes. Many organisms get energy by taking in food. Other organisms make their own food.
Maintains homeostasis	Homeostasis is the process that keeps conditions inside the bodies of all organisms stable. For example, humans perspire when hot to lower body temperature.
Adaptations evolve over time	Adaptations are inherited changes that occur over time and help the species survive.

Objectives

- **Outline** the main steps in the scientific method.
- **Summarize** how observations are used to form hypotheses.
- **List** the elements of a controlled experiment.
- **Describe** how scientists use data to draw conclusions.
- **Compare** a scientific hypothesis and a scientific theory.
- **State** how communication in science helps prevent dishonesty and bias.



Science as a Process

- **Steps of the Scientific Method**
 - The **scientific method** involves making observations, asking questions, forming hypotheses, making predictions, designing experiments, analyzing data, and drawing conclusions.



Scientific Processes

- Collecting observations
- Asking questions
- Forming hypotheses and making predictions
- Confirming predictions (with experiments when needed)
- Drawing conclusions

Observing and Asking Questions

- The process of science begins with an observation.
- An **observation** is the act of perceiving a natural occurrence that causes someone to pose a question.



Forming a Hypothesis

- A **hypothesis** is a proposed explanation for the way a particular aspect of the natural world functions.



Forming a Hypothesis, *continued*

- **Predicting**
 - To test a hypothesis, scientists make a **prediction** that logically follows from the hypothesis.



Designing an Experiment

- **Performing the Experiment**

- A *controlled experiment* compares an experimental group and a control group and only has one variable.



Designing an Experiment, *continued*

- **Performing the Experiment**
 - The **control group** provides a normal standard against which the biologist can compare results of the experimental group.
 - The **experimental group** is identical to the control group except for one factor.



Designing an Experiment, *continued*

- **Performing the Experiment**
 - The experimenter manipulates the **independent variable**.
 - The experimenter measures the **dependent variable** because it is affected by the independent variable.



Designing an Experiment, *continued*

- **Testing the Experiment**
 - Experiments should be conducted without bias and they should be repeated.



Collecting and Analyzing Data

- **Analyzing and Comparing Data**
 - Scientists analyze data to draw conclusions about the experiment performed.



Drawing Conclusions

- **Making Inferences**

- An *inference* is a conclusion made on the basis of facts and previous knowledge rather than on direct observations.



Drawing Conclusions, *continued*

- **Applying Results and Building Models**
 - Scientists often apply their findings about the natural world to solve practical problems.



Constructing a Theory

- A **theory** is a set of related hypotheses confirmed to be true many times, and it can explain a great amount of data.



Communicating Ideas

- **Publishing a Paper**

- Scientists submit research papers to scientific journals for publication.
- In *peer review*, the editors of a journal will send submitted papers out to experts in the field who anonymously read and critique the paper.



Honesty and Bias

- Communication between scientists about their methods and results helps prevent dishonesty and bias in science.



Honesty and Bias

- **Conflict of Interest**

- The threat of a potential scandal based on misleading data or conclusions is a powerful force in science that helps keep scientists honest and fair.



