**1 INTRODUCTION**

***CHAPTER* 1 A VIEW OF LIFE**

The text opens with a description of the characteristics of life, followed by a discussion of the human species’ integration into the highly-diverse biosphere. Taxonomic classification, the system by which all organisms are categorized, is discussed. The steps of the scientific method are outlined. A scientific experiment is described in detail. Section 1.4, Challenges Facing Science, includes new, topical sections on emerging diseases and ecosystems threatened with extinction.

**Learning Outcomes**

* 1. **The Characteristics of Life**

1. Distinguish among the levels of biological organization.
2. Identify the basic characteristics of life.
   1. **Evolution and the Classification of Life**
3. Explain the relationship between the process of natural selection and evolutionary change.
4. Distinguish among the three domains of life.
   1. **The Process of Science**
5. Identify the components of the scientific method.
6. Distinguish between a theory and a hypothesis.
7. Analyze a scientific experiment and identify the hypothesis, experiment, control groups, and conclusions.
   1. **Challenges Facing Science**
8. Distinguish between science and technology.
9. Summarize the major challenges facing science and society.

**Chapter Outline**

**1.1 The Characteristics of Life**

A. Life Is Organized

1. Organization of living systems begins with **atoms**, which make up basic building blocks called **elements**.

2. The **cell** is the basic structural and functional unit of all living things.

1. **Unicellular** organisms are single-celled organisms that either live independently, or as colonies.
2. **Multicellular** organisms are made up of many cells that work together.

3. Different cells combine to make up **tissues** (e.g., nerve tissue).

4. Tissues combine to make up an **organ** (e.g., the brain).

5. Specific organs work together as an **organ system** (e.g., the brain, spinal cord, etc.).

6. Multicellular organisms (each an “individual” within a particular species) contain organ systems.

7. A species in a particular area (e.g., gray squirrels in a forest) constitutes a **population**.

8. Interacting populations in a particular area comprise a **community**.

9. A community plus its physical environment is an **ecosystem**.

10. The biosphere is comprised of regions of the Earth’s crust, waters, and atmosphere inhabited by organisms.

11. Each level of organization is more complex than the level preceding it.

12. Each level of organization has *emergent properties* due to interactions between the parts making up the whole; all emergent properties follow the laws of physics and chemistry.

B. Life Requires Materials and Energy

1. Maintaining organization and conducting life-sustaining processes requires an outside source of **energy**, which is defined as the capacity to do “work.”

2. **Metabolism** is all the chemical reactions that occur in a cell.

3. The ultimate source of energy for nearly all life on Earth is the sun; plants and certain other organisms convert solar energy into chemical energy by the process of **photosynthesis**.

C. Living Organisms Maintain Homeostasis

1. All organisms must maintain a state of biological balance, or **homeostasis**.

2. Temperature, moisture level, pH, etc., must be maintained within the tolerance range of the organism.

3. In order to maintain homeostasis, body systems monitor internal conditions and make adjustments when needed.

4. Organisms have intricate feedback and control mechanisms to maintain homeostatic balance.

D. Living Organisms Respond

1. Living things interact with the environment and with other living things.

2. Response often results in movement of the organism (e.g., a plant bending toward the sun to capture solar energy, a turtle withdrawing into its shell for safety, etc.).

3. Responses help ensure survival of the organism and allow the organism to carry out its biological activities.

4. The collective responses of an organism constitute the behavior of the organism.

E. Living Organisms Reproduce and Develop

1. **Reproduction** is the ability of every organism to give rise to another organism like itself.

2. Bacteria, protozoans, and other unicellular organisms can reproduce asexually by splitting in two (binary fission).

3. Multicellular organisms often reproduce sexually, uniting sperm and egg, each from a different individual, resulting in an immature individual that develops into the adult.

4. The instructions for an organism’s organization and development are encoded in **genes**.

5. Genes are comprised of long molecules of **DNA (deoxyribonucleic acid)**; DNA is the genetic code in all living things.

6. Genes are passed on from generation to generation. Methods to ensure genetic variability include random combination of sperm and egg and **mutations**.

F. Living Organisms Have Adaptations

1. **Adaptations** are modifications that make organisms better able to function in an environment.

2. **Evolution** includes the way in which populations change over the course of generations to become more suited to their environments.