Chapter 1: Evolution, the Themes of Biology, and Scientific Inquiry

1.1 Use examples to illustrate each theme of this book.
1.2 Summarize how evolution accounts for the unity and diversity of life.
1.3 Discuss the scientific process.
1.4 Evaluate the contribution of diversity among scientists to scientific progress.

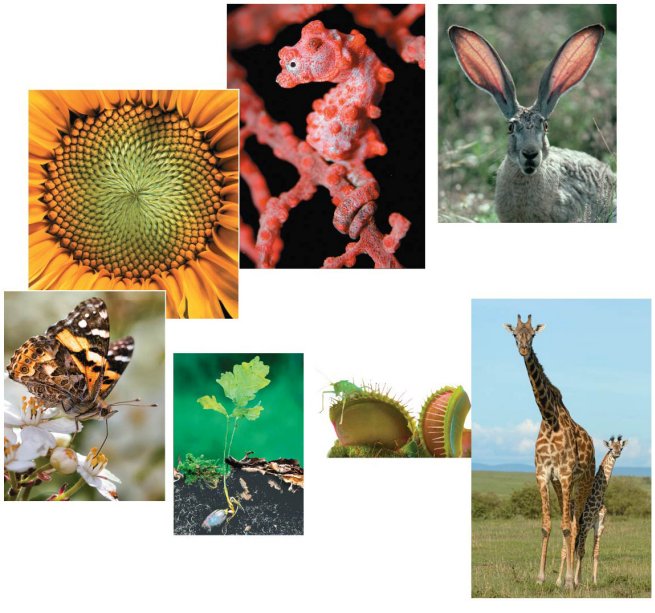
This chapter will serve as a review of biological concepts that you may have learned in an earlier course and give you an overview of what you will study this year. It introduces the major themes of biology and provides a foundation for understanding scientific inquiry.

Study Tip: In Figure 1.1, notice the light coat color of the beach mouse against the white sand. This mouse, like all organisms on Earth, demonstrates the unifying themes of biology. Read through the examples in this figure, as they will be visited repeatedly in your study of biology.

Concept 1.1 The study of life reveals unifying themes

LO 1.1: Use examples to illustrate each theme of this book.

1. In the overview in your text, Figure 1.2 notes many of the properties of life. Label the seven properties illustrated in the following figure and give a *different* example of each.



2. What are **emergent properties?** Give two examples.

3. Life is organized on many scales. Figure 1.3 in your text zooms you in from viewing Earth from space all the way to the level of molecules. As you study the figure in your text, write in a brief definition of each level.

1. The Biosphere

2. Ecosystems

3. Communities

4. Populations

5. Organisms

6. Organs and Organ Systems

7. Tissues

8. Cells

9. Organelles

10. Molecules

4. Our study of biology will be organized around recurring themes. Make a list here of the themes that are presented and give an example that illustrates each theme. This will help you see the big picture and organize your thinking. (Go to the *Summary of Key Concepts* that begins on page 25 of your text for a concise look at the themes.)

Theme Description	Example

5. As you read this concept on unifying themes, you may be reminded of things you have studied in an earlier course. Because this material will be presented in detail in future chapters, you will come back to these ideas, so don't fret if some of the concepts presented are unfamiliar. However, to guide your study, define these terms as you come to them.

eukaryotic cell

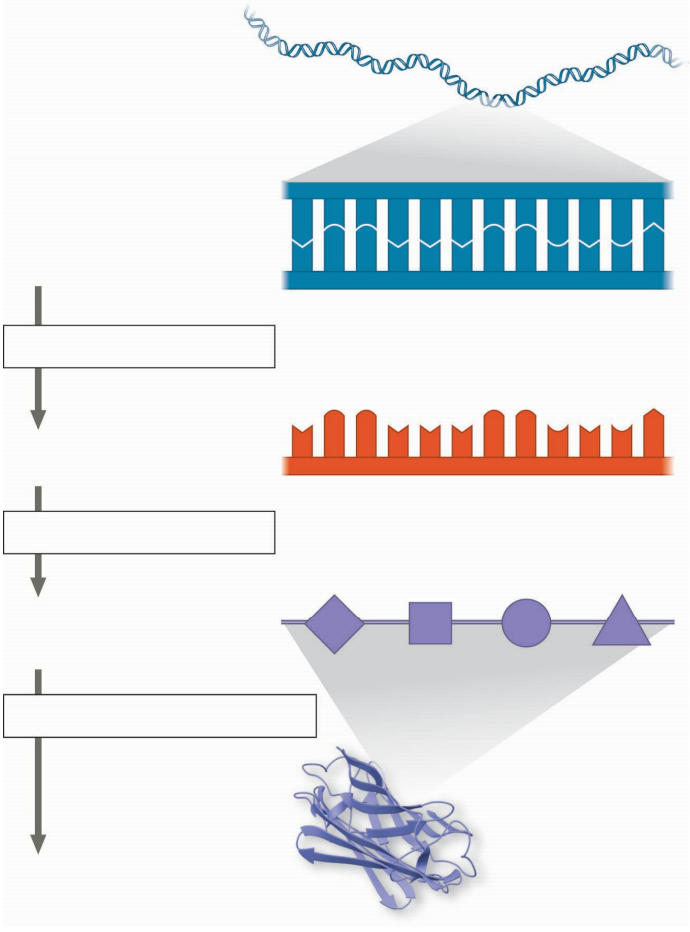
prokaryotic cell

genes

gene expression

genome

6. All organisms, from bacteria to you, produce proteins from DNA instructions. Refer to Figure 1.8b in your text, and then label the gene, DNA, RNA, amino acids and protein on the figure below. Next label the three steps in the process and describe each.



7. Study Figure 1.9 in the text. Describe the difference between the movement of energy and the movement of chemicals in an ecosystem.

8. Describe three ways in which organisms interact with either other organisms or their environment.

9. Interactions can be controlled by feedback regulation. Explain and give an example of each type of feedback.

   negative feedback

   positive feedback

Concept 1.2 The Core Theme: Evolution accounts for the unity and diversity of life

LO 1.2: Summarize how evolution accounts for the unity and diversity of life.

10. Explain how the process of evolution accounts for both the unity and diversity of life on Earth.

11. Taxonomy is the branch of biology that names and classifies organisms. Because of new molecular information, there have been many changes in the placement of certain groups in recent years. All life is now organized into three domains. Which two domains are prokaryotic, and which one is eukaryotic? What four major life groups form the Eukarya?

    Bacteria

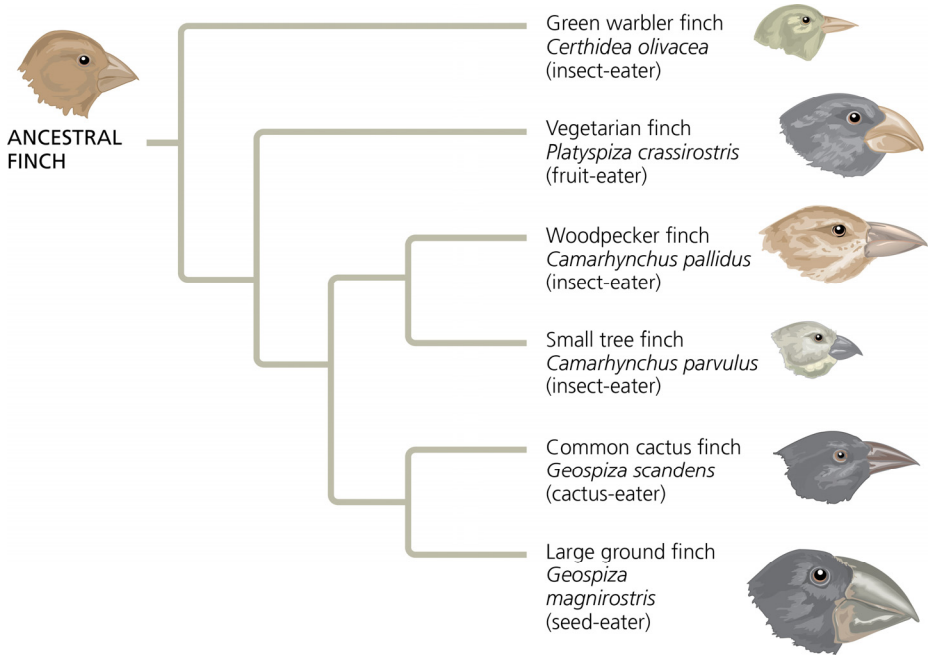
    Archaea

    Eukarya

12. What two main points were articulated in Darwin's *The Origin of Species*?

13. What did Darwin propose as the mechanism of evolution? Use Figure 1.18 as your example to summarize this three-part mechanism.

14. Study Figure 1.20 from your text (shown in the following), which shows an evolutionary "tree." What is indicated by each twig? What do the branch points represent? Label the branch point that represents the ancestral point for all species of finch.



Concept 1.3 In studying nature, scientists form and test hypotheses

LO 1.3: Discuss the scientific process.

15. In your Biology course, you will be involved in *inquiry*. What does this mean, and what may be involved?

16. What is *data*?

17. Distinguish between *quantitative* and *qualitative data*. Which type would be presented in a data chart and could be graphed? Which type is found in the field sketches made by Jane Goodall?

18. In science, how do we define *hypothesis*?

19. A scientific hypothesis has two important qualities. The first is that it is *testable*. What is the second?

20. Can a scientific hypothesis be proven? Explain your answer!

21. What types of hypotheses do not meet the criteria of science, that is, are not testable?

22. Study Figure 1.23 in your book to get a better idea of the scientific process. Notice that it does not follow the steps of what has been called "the scientific method" but rather shows how making and testing hypotheses are interwoven with other activities to answer questions. This realistically portrays what you will encounter in your own inquiry labs. For example, in what different directions may the data you collect lead?

23. What is a *controlled experiment*?

24. Explain the difference between the *dependent* and *independent variable.* Understanding this will be useful when you analyze and graph your data.

25. The text points out a common misconception about the term *controlled experiment*. In the mouse coloration experiment, what factors were held *constant*?

26. Explain what is meant by a scientific *theory* by giving the three ways your text distinguishes a theory from a hypothesis or mere speculation.

    a.

    b.

    c.

Test Your Understanding, p. 26

Now you should be ready to test your knowledge. Place your answers here:

1. ____ 2. ____ 3. ____ 4. ____ 5. ____ 6. ____ 7. ____