1.2 1.2 Humans Are Related to Other Animals

1.2 Humans Are Related to Other Animals

LEARNING OUTCOMES

Upon completion of this section, you should be able to

1. **1.** Summarize the place of humans in the overall classification of living organisms.
2. **2.** Describe the relationship between humans and the biosphere, and the role of culture in shaping that relationship.

Biologists classify all life as belonging to one of three **domains.**The evolutionary relationships of these domains are presented in Figure 1.5. Two of these domains, domain Bacteria and domain Archaea, contain prokaryotes, one-celled organisms that lack a nucleus. Organisms in the third domain, Eukarya, are classified as being members of one of four **kingdoms** (Fig. 1.6)—plants (Plantae), fungi (Fungi), animals (Animalia), and protists (Protista). Most organisms in kingdom Animalia are *invertebrates,* such as earthworms, insects, and mollusks. **Vertebrates** are animals that have a nerve cord protected by a vertebral column, which gives them their name. Fish, reptiles, amphibians, and birds are all vertebrates. Vertebrates with hair or fur and mammary glands are classified as mammals. Humans, raccoons, seals, and meerkats are examples of mammals.

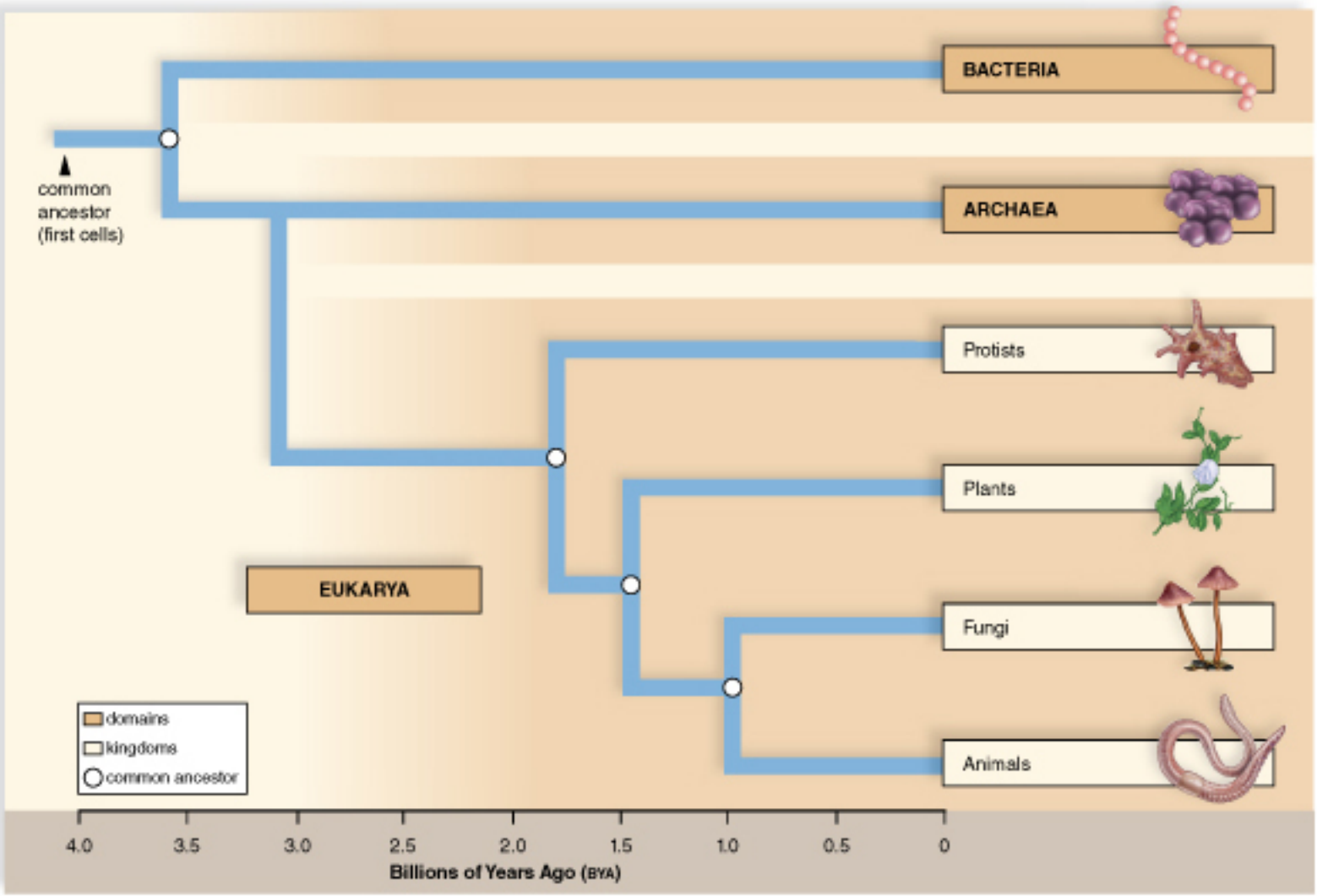

Figure 1.5
The evolutionary relationships of the three domains of life.

Living organisms are classified into three domains: Bacteria, Archaea, and Eukarya. The Eukarya are further divided into kingdoms (see Fig. 1.6). A geologic timescale is provided on the bottom for reference.

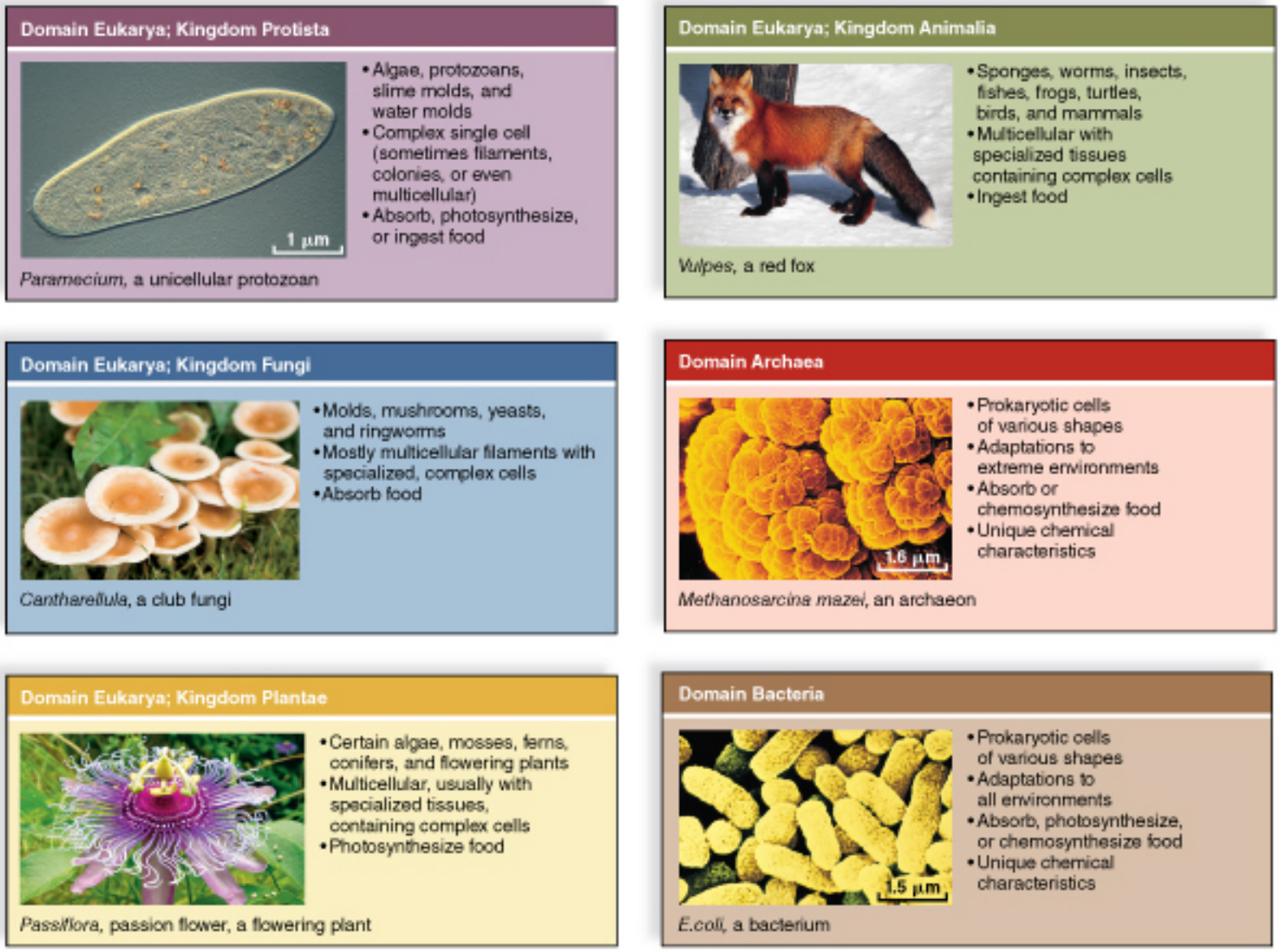

Figure 1.6
The classification of life.

This figure provides some of the characteristics of the organisms of each of the major domains and kingdoms of life. Humans belong to the domain Eukarya and kingdom Animalia.

Page 8

Humans are most closely related to apes. We are distinguished from apes by our (1) highly developed brains, (2) completely upright stance, (3) creative language, and (4) ability to use a wide variety of tools. Humans did not evolve from apes; apes and humans share a common, apelike ancestor.

Today's apes are our evolutionary cousins. Our relationship to apes is analogous to you and your first cousin being descended from your grandparents. We could not have evolved from our cousins because we are contemporaries—living on Earth at the same time.

Humans Have a Cultural Heritage

Humans have a cultural heritage in addition to a biological heritage. *Culture* encompasses human activities and products passed on from one generation to the next outside of direct biological inheritance. Among animals, only humans have a language that allows us to communicate information and experiences symbolically. We are born without knowledge of an accepted way to behave, but we gradually acquire this knowledge by adult instruction and imitation of role models. Members of the previous generation pass on their beliefs, values, and skills to the next generation. Many of the skills involvetool use, which can vary from how to hunt in the wild to how to use a computer. Human skills have also produced a rich heritage in the arts

and sciences. However, a society highly dependent on science and technology has its drawbacks as well. Unfortunately, this cultural development may mislead us into believing that humans are somehow not part of the natural world surrounding us.

Page 9

Humans Are Members of the Biosphere

All life on Earth is part of the biosphere, a living network that spans the surface of the Earth into the atmosphere and down into the soil and seas. Although humans can raise animals and crops for food, we depend on the environment for many services. Without microorganisms that decompose, the waste we create would soon cover the Earth's surface. Some species of bacteria can clean up pollutants like heavy metals and pesticides.

Freshwater ecosystems, such as rivers and lakes, provide fish to eat, drinking water, and water to irrigate crops. Many of our crops and prescription drugs were originally derived from plants that grew naturally in an ecosystem. Some human populations around the globe still depend on wild animals as a food source. The water-holding capacity of forests prevents flooding, and the ability of forests and other ecosystems to retain soil prevents soil erosion. For many people, these same forests provide a place for recreational activities like hiking and camping.

Humans Threaten the Biosphere

The human population tends to modify existing ecosystems for its own purposes. Humans clear forests and grasslands to grow crops. Later, houses are built on what was once farmland. Clusters of houses become small towns that often grow into cities (Fig. 1.7*a*). The overuse of water supplies by large human populations can result in desertification, or the expansion of desert regions (Fig. 1.7*b*). Human activities have altered almost all ecosystems and reduced **biodiversity,** or the number of different species present in a given area. The present biodiversity of our planet has been estimated to be as high as 15 million species. So far, fewer than 2 million have been identified and named. It is estimated that we are now losing as many as 20,000 to 30,0000 species per year due to human activities. Many biologists are alarmed about the present rate of **extinction** (death of a species). Studies are suggesting that the rate of species loss is now greater than the rates of the five mass extinctions that occurred earlier in our planet's history. Unlike previous extinctions, which were caused by asteroid impacts or changes in the chemistry of the atmosphere, the current extinction crisis has been conclusively linked to human activity.

a. b.

Figure 1.7
Humans negatively influence many ecosystems.

a. When humans build cities, diversity is lost. Notice the absence of a variety of plants/trees. **b.** An overuse of water resources can lead to desertification.

One of the major bioethical issues of our time is preservation of the biosphere and biodiversity. If we adopt a conservation ethic that preserves the biosphere and biodiversity, we will ensure the continued existence of our species.

APPLICATIONS AND MISCONCEPTIONS
How many humans are there?

As of the end of 2011, it was estimated that there were over 7 billion humans on the planet. Each of those humans needs food, shelter, clean water and air, and materials to maintain a healthy lifestyle. We add an additional 78 million people per year—that is like adding ten New York Cities per year! This makes human population growth one of the greatest threats to the biosphere.

CHECK YOUR PROGRESS 1.2

1 1 Define the term *biosphere*.

Answer

2 2 Explain why it is important to know the evolutionary relationships between organisms.

Answer

3 3 Summarize how the increase in the human population affects our biosphere.

Answer

CONNECTING THE CONCEPTS

To learn more about the preceding material, refer to the following discussions:

Chapter 22 examines recent developments in the study of human evolution.

Chapter 23 provides a more detailed look at ecosystems.

Chapter 24 details some of the emerging threats that humans pose to the biosphere.