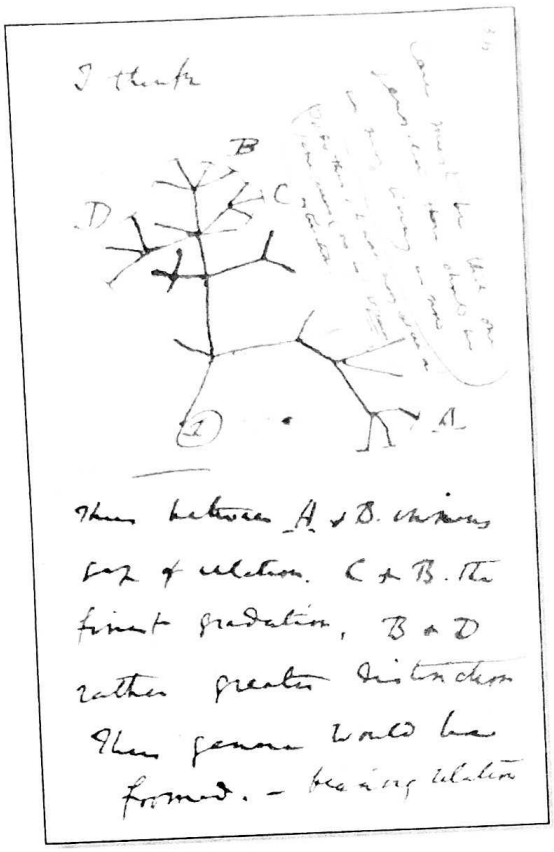

FIGURE 16–12 Descent With Modification This page from one of Darwin's notebooks shows the first evolutionary tree ever drawn. This sketch shows Darwin's explanation for how descent with modification could produce the diversity of life. Note that, just above the tree, Darwin wrote, "I think."

Common Descent

What does Darwin's mechanism for evolution suggest about living and extinct species?

Natural selection depends on the ability of organisms to reproduce, which means to leave descendants. Every organism alive today is descended from parents who survived and reproduced. Those parents descended from their parents, and so forth back through time.

Just as well-adapted individuals in a species survive and reproduce, well-adapted species survive over time. Darwin proposed that, over many generations, adaptation could cause successful species to evolve into new species. He also proposed that living species are descended, with modification, from common ancestors—an idea called *descent with modification.* Notice that this aspect of Darwin's theory implies that life has been on Earth for a very long time—enough time for all this descent with modification to occur! This is Hutton and Lyell's contribution to Darwin's theory: Deep time gave enough time for natural selection to act. For evidence of descent with modification over long periods of time, Darwin pointed to the fossil record.

Darwin based his explanation for the diversity of life on the idea that species change over time. To illustrate this idea, he drew the very first evolutionary tree, shown in **Figure 16–12.** This "tree-thinking" implies that all organisms are related. Look back in time, and you will find common ancestors shared by tigers, panthers, and cheetahs. Look farther back, and you will find ancestors that these felines share with dogs, then horses, and then bats. Farther back still is the common ancestor that all mammals share with birds, alligators, and fish. Far enough back are the common ancestors of all living things. **According to the principle of common descent, all species—living and extinct—are descended from ancient common ancestors.** A single "tree of life" links all living things.

16.3 Assessment

Review Key Concepts

1. a. Review What happens in the process of natural selection?

b. Explain Why do organisms with greater fitness generally leave more offspring than organisms that are less fit?

c. Compare and Contrast How are natural selection and artificial selection similar? How are they different?

2. a. Review Why were Hutton's and Lyell's ideas important to Darwin?

b. Apply Concepts What do evolutionary trees show? What does a tree of life imply about all species living and extinct?

VISUAL THINKING

3. Look at the teeth in the lion's mouth. How is the structure of the lion's teeth an adaptation?