11.1 Evolutionary Theory

evolution the process in which significant changes in the inheritable traits (i.e., the genetic makeup) of a species occur over time

immutable unchanged and unchanging, believed (before evolutionary theory became accepted) to be characteristic of life forms

For centuries, scientists have been gathering and piecing together evidence to solve the puzzle of the origin and history of life on Earth. They have made careful observations, formulated and tested hypotheses, analyzed data from diverse sources, and drawn inferences to develop the theory that is now generally accepted as the solution to the puzzle of **evolution**. Acceptance of theories of evolution has never been universal. Many people hold cultural and religious beliefs about the origin of life that may not be in harmony with scientifically accepted reasoning and conclusions.

In 1650, for example, a highly regarded Irish scholar and theologian published his calculations for the age of Earth based on astronomy, history, and biblical sources. Archbishop James Ussher of Armagh (**Figure 1**) declared that Earth was created on Sunday, October 23, 4004 B.C., and he went on to calculate the dates of other significant biblical events. In 1701, his chronology was printed as marginal notes in an authorized version of the Bible. About 150 years later, most Europeans mistakenly thought his chronology was part of the original scripture. Today, most people understand that the world is a dynamic environment in which change is both natural and unavoidable, but 500 years ago most people thought that their natural surroundings changed very little and life forms were thought to be **immutable**. Before the technology was available to show otherwise, Earth was thought to be of recent origin.

Figure 1
Archbishop James Ussher of Armagh (1581–1656)

Fossil evidence provided important scientific insights into the past, as a record of both the great diversification of species and the extinction of many others. As well as the fossil record, the geographic distribution of living species began to give scientists valuable clues to patterns of evolution. By the 19th century, the scientific community had accumulated sufficient evidence for general agreement that Earth was very old and that life forms on Earth had undergone and continued to undergo changes. However, not until 1859 did scientists formulate a viable explanation for the mechanism of evolution.

Like all scientific theories, the validity and value of evolutionary biology are based on rigorous and continual analysis and interpretation of accumulating evidence. Today there is a broad consensus among scientists on the facts of evolution—that the history of life on Earth has been one of continual change over billions of years. Although modern knowledge of molecular biology and genetics offers additional evidence and support for evolution, as with other fields, many questions remain open for study.

Section 11.1 Question

Making Connections

1. North American Aboriginal cultures, like societies elsewhere in the world, have stories about their people's origin that have been repeated orally from generation to generation to this day. Find out about and compare some creation stories from Aboriginal cultures in North America, from ancient Sumer and Babylon, from China, Samoa, Persia, and Japan or from other cultures of your choice. Consult print material or the Web for textual and visual sources, or spiritual leaders as oral sources. Discuss possible reasons for different societies having developed different beliefs about the origins of life.

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