Glossary

acid: a substance that donates hydrogen ions and therefore lowers pH

base: a substance that absorbs hydrogen ions and therefore raises pH

buffer: a solution that resists a change in pH by absorbing or releasing hydrogen or hydroxide ions

litmus paper: filter paper that has been treated with a natural water-soluble dye so it can be used as a pH indicator

pH scale: a scale ranging from 0 to 14 that measures the approximate concentration of hydrogen ions of a substance

Chapter 3 Biologically Important Molecules

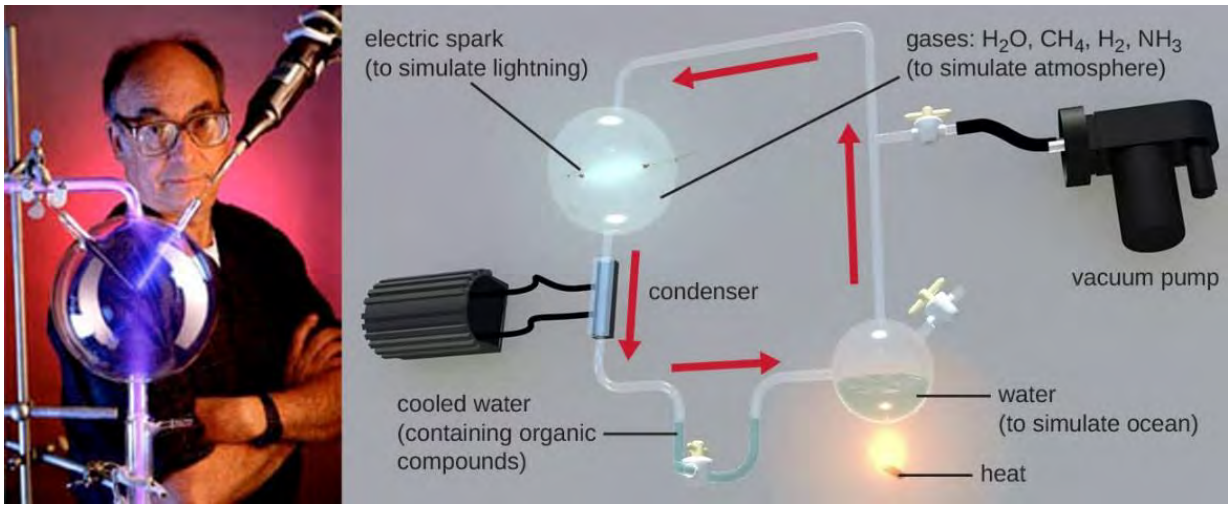

Figure 3.1 Scientist Stanley Miller (pictured) and Harold Urey demonstrated that organic compounds might have originated naturally from inorganic matter. (credit: "photo": modification of work by NASA; credit "illustration": modification of work by Courtney Harrington / Microbiology OpenStax)

The earth is estimated to be 4.6 billion years old, but for the first 2 billion years the atmosphere lacked oxygen. Without oxygen, the planet could not support life. One hypothesis about how life emerged on earth involves the concept of "primordial soup." This hypothesis proposes that life began in a body of water when metals and gases from the atmosphere combined with a source of energy, such as lightning or ultraviolet light. These interactions formed carbon compounds, the first chemical building blocks of life. In 1952, Stanley Miller (1930–2007), a graduate student at the University of Chicago, and his professor Harold Urey (1893–1981) set out to confirm this hypothesis. Miller and Urey combined what they believed to be the significant components of the earth's early atmosphere—water (H_2O), methane (CH_4), hydrogen (H_2), and ammonia (NH_3)— in a sealed, sterile flask. Next, they heated the flask to produce water vapor and passed electric sparks through the mixture to mimic lightning in the atmosphere (Figure 3.1). When they analyzed the contents of the flask a week later, they found amino acids. Amino acids are carbon compounds that make up proteins. Proteins are essential for life. Their data provided evidence that supported the "primordial soup" hypothesis.

In this chapter, students will look at the atom carbon and the role it plays in making up the four major classes of carbon-based molecules: carbohydrates, lipids, proteins, and nucleic acids. Students will also learn to identify and describe the functions of different macromolecules.