

The Beginning of Life

Key Words

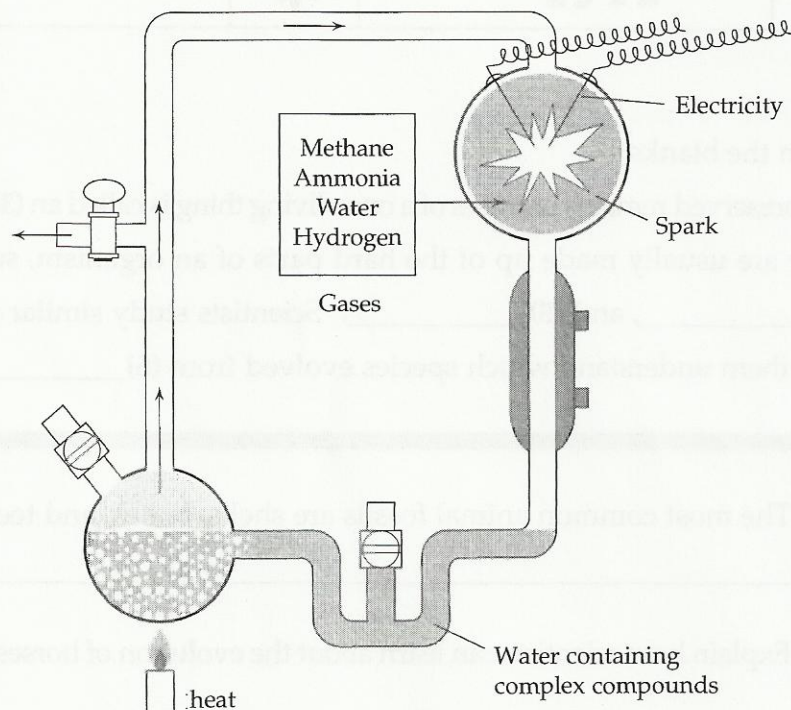
compounds: chemicals that join together in consistent ways
organic compounds: compounds that contain carbon

KEY IDEAS

People have long wondered how life began. Some scientists have shown that gases found on the early earth may have combined to form the compounds that make up living things.

Miller's Experiment. In 1953, a scientist named Stanley Miller set up an experiment to try to find out how life on the earth began. In his experiment, Miller attempted to duplicate the climate and conditions of the early earth. He filled a chamber with water that contained methane, ammonia, water vapor, and hydrogen. Miller then heated the water and added energy in the form of electricity to his system. See Fig. 16-1. Energy, like the lightning of the early earth, is needed to make simple compounds into more complex compounds.

Fig. 16-1



Compounds (KAHM-powndz) are chemicals that join together in certain, consistent ways. Many different compounds make up the cells of all living things. **Organic compounds** (awr-GAN-ihk KAHM-powndz) are compounds that contain carbon.

Miller waited to see what happened to his experiment. At the end of one week, he discovered organic compounds called amino acids in the water. Amino acids are complex compounds that serve as the building blocks of proteins. Miller's experiment showed that complex compounds found in living things could sometimes be made outside of cells.



1. What did Miller's experiment show? _____

After Miller showed that complex compounds found in living cells could be made in the lab, other scientists tried to duplicate his results. In other laboratory experiments, scientists were able to produce other organic compounds, including sugars and fatty acids. They did this by combining the four main elements found in the atmosphere of the early earth: carbon, hydrogen, oxygen, and nitrogen. Scientists also showed that some of these large organic compounds react with each other to make still larger compounds. This process is similar to what happens inside cells.

The Early Earth. Most scientists agree that the early earth was much different from the earth today. Most of the compounds found in living things were not present when the earth and solar system formed. The early earth was covered with water warmed by the earth itself and by the sun. Steam from the seas formed clouds, which in turn produced violent thunderstorms. The atmosphere of the early earth was made up of ammonia, water vapor, hydrogen, and methane. These gases were also dissolved in the ocean.

Origins of Life. Some scientists think that lightning from the violent storms of the early earth provided energy to split the molecules of ammonia, water vapor, hydrogen, and methane, in the early earth's atmosphere. The divided molecules recombined to form small organic compounds. These compounds collected in shallow pools, forming a kind of "organic soup." Some of the simple compounds in the "soup" reacted with other compounds to form larger organic compounds. Eventually these large organic compounds began to replicate. The ability of molecules to copy themselves is necessary for life as we know it.

Some of the first simple cells on the earth gave off oxygen and carbon dioxide that collected in the atmosphere. Once these gases were available, living things began to evolve rapidly.

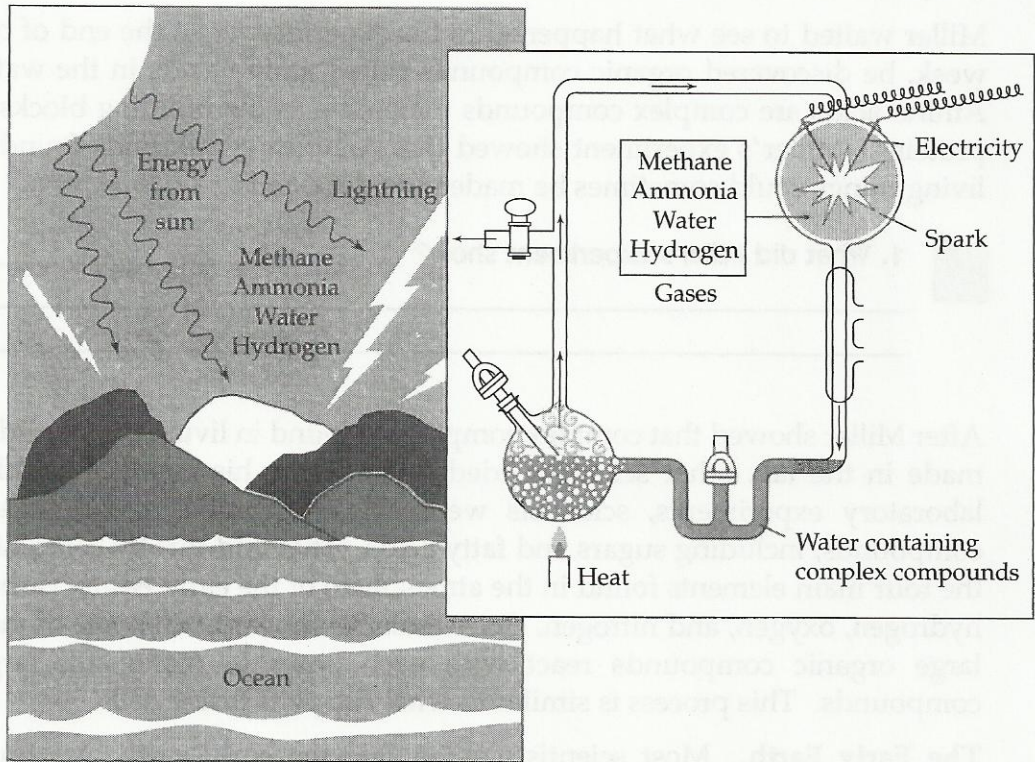


2. What was the early earth like? _____

**TAKE
ANOTHER
LOOK**

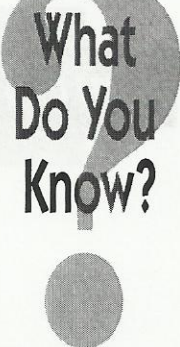
Study Fig. 16-2 to see how Miller's experiment reflected conditions on the early earth.

Fig. 16-2



**Check Your
Understanding**

3. In your own words, write a paragraph describing Miller's experiment. Explain how each part of the experiment modeled conditions of the early earth.



What
Do You
Know?

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4. In one or two sentences, explain how life on the earth might have begun.

5. Miller showed that complex compounds might have been formed in the early ocean. How could these compounds form cells?

6. Imagine that humans could travel back in time to the early earth. Would they be able to survive? Why or why not?
