

19.3 Earth's Early History

Lesson Objectives

-  Identify some of the hypotheses about early Earth and the origin of life.
-  Explain the endosymbiotic theory.
-  Explain the significance of sexual reproduction in evolution.

Lesson Summary

The Mysteries of Life's Origins Earth's early atmosphere contained toxic gases. The atmosphere also contained little or no oxygen.

- ▶ In the 1950s, Stanley Miller and Harold Urey set out to determine if organic molecules could assemble under early Earth conditions. They filled a container with water and gases that they thought represented the composition of Earth's early atmosphere. They passed electric sparks through the mixture to simulate lightning. Soon, organic compounds formed. The experiment showed that molecules needed for life could have arisen from simpler compounds.
- ▶ Under some conditions, large organic molecules form tiny bubbles called proteinoid microspheres. Structures similar to proteinoid microspheres might have become the first living cells. RNA and DNA also could have evolved from simple organic molecules.
- ▶ The first known life forms evolved about 3.5 billion years ago. They were single celled and looked like modern bacteria. Eventually, photosynthetic bacteria became common. During photosynthesis, the bacteria produced oxygen. The oxygen accumulated in the atmosphere. The rise of oxygen drove some life forms to extinction. At the same time, other life forms evolved that depended on oxygen.

Origin of Eukaryotic Cells The first eukaryotes, or organisms with nuclei, evolved from prokaryotes that began to develop internal cell membranes. One explanation for how eukaryotes evolved is the **endosymbiotic theory**. This theory proposes that smaller prokaryotes began living inside larger cells and evolved a symbiotic relationship with the larger cells.

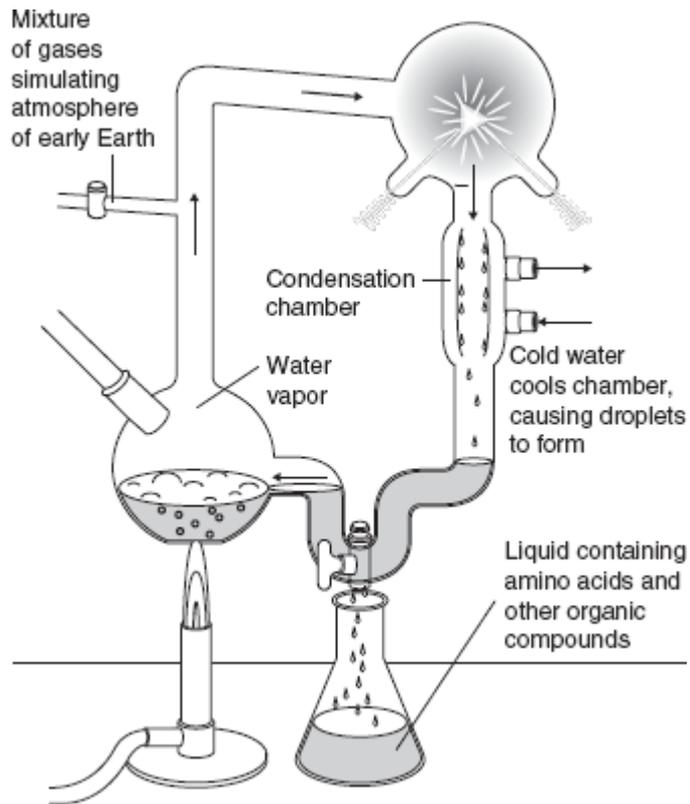
Sexual Reproduction and Multicellularity Sexual reproduction evolved after eukaryotic cells. Sexual reproduction increased genetic variation, so evolution could occur more quickly. Several hundred million years after sexual reproduction evolved, multicellular life evolved.

The Mysteries of Life's Origins

1. What are proteinoid microspheres?

2. Why do scientists think that RNA may have evolved before DNA?

Use the diagram of the Miller-Urey experiment to answer Questions 3–5.



3. **THINK VISUALLY** the diagram to show which part of Miller and Urey's apparatus simulated lightning storms on early Earth.

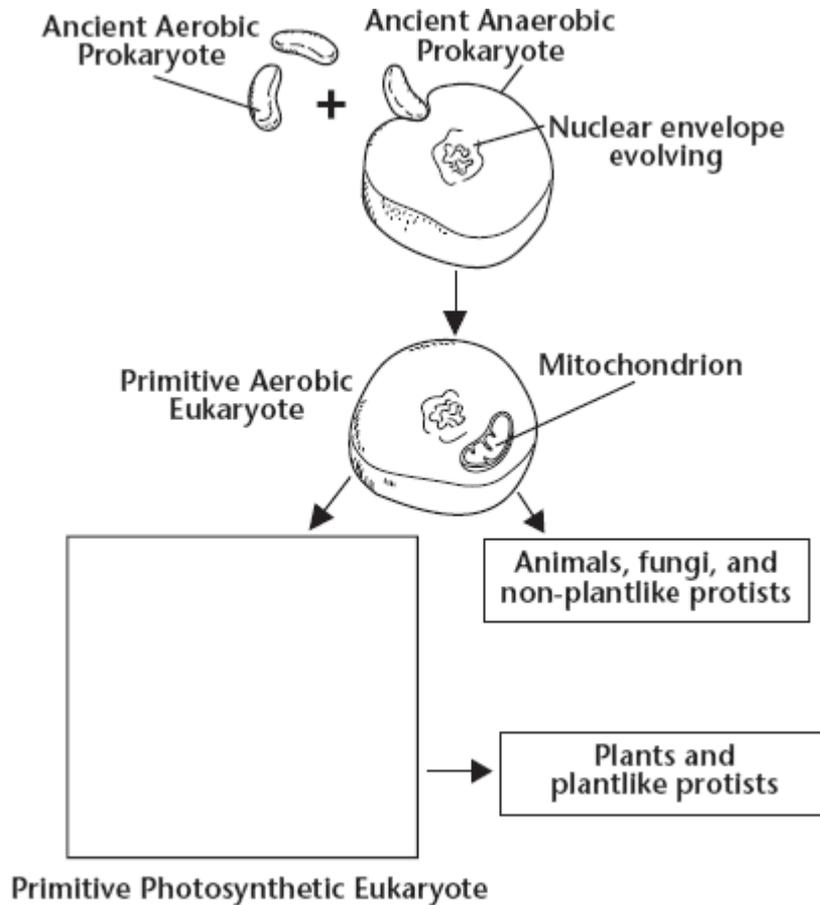
4. What was the purpose of Miller and Urey's experiment? _____

5. Explain the results of the Miller-Urey experiment. What did these findings suggest?

Origin of Eukaryotic Cells

6. Explain the endosymbiotic theory. _____

7. **THINK VISUALLY** Draw the step in the endosymbiotic theory that shows the origin of chloroplasts. Label the structures in your drawing.



Sexual Reproduction and Multicellularity

8. How did sexual reproduction speed up the evolutionary process?

9. What is the most likely cause of the great amount of diversity currently seen in multicellular life forms?

Apply the Big idea

10. Once DNA evolved, what could have caused it to become the primary means of transmitting genetic information instead of RNA?
