

## Chapter 14 History of Life

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## Chapter 14 Section 1 Biogenesis

### Objectives

- **Compare** the principle of biogenesis with the idea of spontaneous generation.
- **Summarize** the results of experiments by Redi and by Spallanzani that tested the hypothesis of spontaneous generation.
- **Describe** how Pasteur's experiment disproved the hypothesis of spontaneous generation.



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## Chapter 14 Section 1 Biogenesis

### Redi's Experiment

- Before the 1600s, it was generally thought that organisms could arise from nonliving material by **spontaneous generation**.



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## Chapter 14 Section 1 Biogenesis

### Redi's Experiment, *continued*

- Redi showed in 1668 that rotting meat kept away from flies would not produce new flies.
- Maggots appeared only on meat that had been exposed to flies.



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## Chapter 14 Section 1 Biogenesis

### Spallanzani's Experiment

- Spallanzani showed in the 1700s that microorganisms would not grow in broth when its container was heated and then sealed.
- He inferred that microorganisms do not arise spontaneously but, rather, are carried in the air.



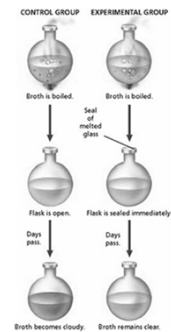
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## Chapter 14 Section 1 Biogenesis

### Spallanzani's Experiment



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### Section 1 Biogenesis

#### Pasteur's Experiment

- Pasteur in the 1800s used a variation of Spallanzani's design to prove that microorganisms are carried in the air and do not arise by spontaneous generation.



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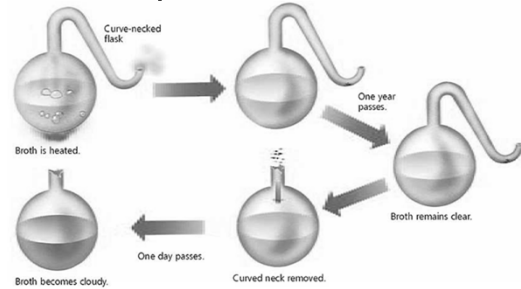
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## Chapter 14

### Section 1 Biogenesis

#### Pasteur's Experiment



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## Chapter 14

### Section 2 Earth's History

#### Objectives

- **Outline** the modern scientific understanding of the formation of Earth.
- **Summarize** the concept of half-life.
- **Describe** the production of organic compounds in the Miller-Urey apparatus.
- **Summarize** the possible importance of cell-like structures produced in the laboratory.



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### Section 2 Earth's History

#### The Formation of Earth

- **Earth's Age**
  - Scientists think that Earth formed more than 4 billion years ago by the gravitational accumulation of dust and debris moving through space.



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### Section 2 Earth's History

#### First Organic Compounds

- **Synthesis of Organic Compounds**
  - The first simple organic compounds on early Earth may have formed under conditions of high energy and in an atmosphere very different from that of today's Earth.
  - Further chemical reactions may have converted simple organic compounds into the macromolecules important to life.
  - These conditions have been experimentally modeled.



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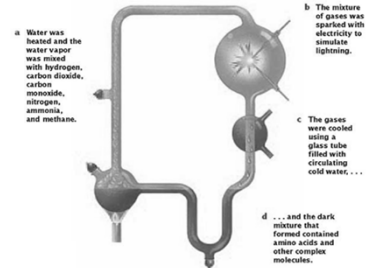
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### Section 2 Earth's History

#### Miller-Urey Experiment

This apparatus was used by Stanley Miller, when he was a graduate student studying under Harold Urey, to simulate the conditions then thought to be present on a young Earth.



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### Section 2 Earth's History

#### First Organic Compounds, *continued*

- **Organic Compounds from Beyond Earth**
  - Meteorites may have brought organic compounds to Earth.



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## Chapter 14

### Section 3 The First Life-Forms

#### Objectives

- **Explain** the importance of the chemistry of RNA in relation to the origin of life.
- **List** three inferred characteristics that describe the first forms of cellular life on Earth.
- **Compare** the two types of autotrophy used by early cells.
- **Relate** the development of photosynthesis to the development of aerobic respiration in early cells.
- **Explain** the theory of endosymbiosis.



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### Section 3 The First Life-Forms

#### The Origin of Heredity

- The first molecule that held hereditary information may have been RNA rather than DNA.



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### Section 3 The First Life-Forms

#### The Roles of RNA

- In addition to serving as a template for protein assembly, some RNA molecules can act as self-replicating enzymes and are called **ribozymes**.



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### Section 3 The First Life-Forms

#### The First Cells

- The first cells that formed on Earth were probably heterotrophic prokaryotes.



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### Section 3 The First Life-Forms

#### The First Cells, *continued*

- **Chemosynthesis**
  - The first autotrophic cells probably used chemosynthesis to make food.
  - **Chemosynthesis** produces energy through the oxidation of inorganic substances, such as sulfur.



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## Chapter 14

Section 3 The First Life-Forms

### The First Cells, *continued*

- **Photosynthesis and Aerobic Respiration**
  - Most modern autotrophic cells, such as **cyanobacteria**, use photosynthesis to make food.
  - An important byproduct of photosynthesis is oxygen.



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Section 3 The First Life-Forms

### The First Cells, *continued*

- **Photosynthesis and Aerobic Respiration**
  - Once oxygen began to accumulate on Earth, cells would need to bind oxygen to other compounds in order to prevent damage to cell enzymes.
  - This binding function may have been a first step toward aerobic respiration in cells.



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Section 3 The First Life-Forms

### The First Eukaryotes

- Eukaryotic cells may have evolved from large prokaryotic cells that engulfed smaller prokaryotic cells. This is known as the theory of **endosymbiosis**.
- The engulfed prokaryotic cells may have become the ancestors of organelles such as mitochondria and chloroplasts.



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