

Planet of Life: The Birth of Earth & Ancient Oceans: Teacher's Guide

Grade Level: 6-8

Curriculum Focus: Earth Science

Lesson Duration: Two class periods

Program Description

Survival of the fittest has been the law since the beginning. Explore the primordial planet and find out how life emerged from a sea of toxins in *The Birth of Earth*. Descend into the deep of *Ancient Oceans* to witness the explosion of life preserved today in the Burgess Shale.

Onscreen Questions and Activities

Segment 1, *Planet of Life: The Birth of Earth*

- Pre-viewing questions:
 - Discuss what you know about current theories that explain how Earth was formed. How do these theories account for the beginning of life on Earth?
 - As you watch the program, keep track of the significant events, such as the creation of the Moon and the oceans, that made an ideal environment for life forms to thrive.
- Post-viewing questions:
 - Earth's first organisms thrived in a toxic soup of chemicals. Discuss how bacteria may have formed and adapted to these toxic environments.
 - How different are ancient bacteria from the bacteria living today?
- Activity: Mix hay or dried grass with tap water and let it sit in a beaker for four to five days. Then, using a microscope, look at water samples for bacteria. Draw, research and identify what you have found.

Segment 2, *Planet of Life: Ancient Oceans*

- Pre-viewing questions:
 - What do you know about fossils? What conditions are necessary for their formation?
 - While watching the documentary, pay attention to how scientists study fossils to create a picture of ancient ocean life forms.
- Post-viewing questions:

- Paleontologists have unearthed more than 100 specimens of Cambrian organisms in the Burgess Shale in the Rocky Mountains of Canada. Why are these fossils so important?
 - Consider the way fossils are interpreted. Then discuss the statement, "The present is key to the past."
 - Activity: Visit a local museum, or a paleontologist or science teacher who is familiar with fossil locations in your area. Then plan a fossil-collecting field trip using the information that you gathered.
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Lesson Plan

Student Objectives

Students will understand:

- Earth formed about 4.6 billion years old; since then, there have been important milestones in Earth's development.
- Early Earth was very different from the planet we know today.
- Earth has existed as we know it today for only a very short time, relative to the number of years since its origin.

Materials

- *Planet of Life: The Birth of Earth & Ancient Oceans* video and VCR, or DVD and DVD player
- Computer with Internet access
- Books and articles concerning the formation and development of the Earth
- Forty-six sheets of white paper
- Tape
- Markers

Procedures

1. Tell the students that they will be creating a time scale of Earth's history. Introduce the following background information to the class:
 - Scientists estimate that Earth formed approximately 4.6 billion (4,600,000,000) years ago.
 - Our planet began as a lifeless sphere, surrounded by hydrogen and methane and devoid of water; it was nothing like the planet we call our home today.
 - Certain important events are considered milestones in Earth's history.



2. Write the following chronology and major geologic events on the chalkboard, and have students record them:

- 4.6 billion years ago: Earth was created.
- 4.5 billion years ago: Earth's moon was formed.
- 3.8 billion years ago: Bacteria arose.
- 3.6 billion years ago: A cooling process began on Earth.
- 3.0 billion years ago: Clouds formed.
- 2.0 billion years ago: Eukaryotic cells (single cells with a nucleus) evolved.
- 0.5 billion year ago: Oxygen began to saturate the atmosphere.

Point out to students that the Earth's atmosphere has contained oxygen for only the most recent 10 percent of our planet's history. Announce that they are about to discover more surprising facts about Earth's geologic history.

3. Invite students to use the materials you have provided to research the development of Earth so that they can answer the following questions about additional important milestones in Earth's geologic history:
 - When did primordial oceans form?
 - When did plant life begin to appear on Earth?
 - When did animal life begin to appear in the oceans?
 - When did the first land animals evolve?
 - When did humanlike life appear on Earth?
4. Have students share their findings by adding to the list of geologic events on the chalkboard.
5. Have volunteers help you to tape the 46 sheets of paper around the room, explaining that each sheet represents 100 million years of Earth's history. Students should use markers to label the sheets: "4.6 billion years ago," "4.5 billion years ago," and so on.
6. Have additional volunteers work to transfer onto the appropriate sheets of paper the list of geologic events that you and the class have developed. If possible, involve each student in creating the geologic time scale.
7. Discuss with students what the time scale they have created reveals:
 - Which time period shows the most developments?
 - For approximately what fraction of the Earth's total history have animals existed?
 - What about human beings?
 - How much space would an average human life span cover on the scale?
8. Ask students if creating the time scale has made them think in any new ways about our planet or about the relative place of human history in the bigger scheme of geologic history.

Discussion Questions

1. Describe the organic, geologic, and atmospheric events that led to the formation of oxygen-enriched oceans.
2. Discuss the reasons life on Earth developed more slowly than life in the seas.
3. Many scientists consider the theory of natural selection the primary mechanism for the evolution of organisms. Describe how natural selection was evident during the development of early organisms like bacteria and cyanobacteria.
4. Discuss what is meant by the statement "DNA is a genetic library; etched in its code is the history of life on this planet."
5. Describe the relationship between hard-shelled bacteria and the mitochondria, and soft-membrane bacteria and the nucleus. Discuss how these relationships led to the formation of eukaryotic cells – cells with a well-defined nucleus.
6. Describe how geology has influenced the formation and development of life. Think about geothermal energy, plate tectonics, tides, mountain formation, and atmospheric conditions.
7. Describe several ways the formation and presence of the moon changed life on Earth.

Assessment

Use the following three-point rubric to evaluate students' work during this lesson.

- 3 points: Students made significant additions to the given list of geologic events; accurate dating of events.
- 2 points: Students made some additions to the given list of geologic events; accurate dating of events.
- 1 point: Students made few additions to the given list of geologic events; some inaccuracies.

Vocabulary

amino acids

Definition: Any of the acids that are the chief components of proteins and are synthesized by living cells or are obtained as essential components of a diet.

Context: Amino acids are necessary for the formation of life; they link to form proteins that act as enzymes and direct cell chemistry.

bacteria

Definition: Any of a group (kingdom Procaryotae or kingdom Monera) of prokaryotic round, spiral, or rod-shaped, single-celled microorganisms that are often aggregated into colonies.

Context: Bacteria are tiny, bar-shaped life forms.



cyanobacteria

Definition: A group of large, photosynthetic bacteria that are blue-green in color.

Context: Cyanobacteria produced oxygen in the ocean.

DNA

Definition: Any of various nucleic acids that are the molecular basis of heredity, are localized especially in cell nuclei, and are constructed of a double helix held together by hydrogen bonds.

Context: Because DNA stores the cell's genetic information, it is like the blueprint of a living cell.

greenhouse effect

Definition: Warming of the surface and lower atmosphere of a planet caused by conversion of solar radiation into heat.

Context: The process of gases trapping heat from the sun in the Earth's atmosphere is called the greenhouse effect.

hydrothermal

Definition: Relating to hot water – especially to the formation of minerals by hot solutions rising from a cooling magma.

Context: Underwater volcanoes can form hydrothermal chimneys.

mitochondria

Definition: Any of various round or long cellular organelles of most eukaryotes that are found outside the nucleus; produce energy for the cell through cellular respiration; and are rich in fats, proteins, and enzymes.

Context: Mitochondria supply the cell with energy by hosting the reaction between glucose and oxygen.

nucleus

Definition: A cellular organelle in eukaryotes that is essential to cell functions, composed of nuclear sap and a nucleoprotein-rich network from which chromosomes arise, and is enclosed in a definite membrane.

Context: Eukaryote cells have a nucleus in their center where the genetic material resides.

primordial

Definition: First created or developed.

Context: The building blocks of life accumulated in a primordial soup of chemicals.

Academic Standards

Mid-continent Research for Education and Learning (McREL)

McREL's Content Knowledge: A Compendium of Standards and Benchmarks for K-12 Education



addresses 14 content areas. To view the standards and benchmarks, visit

<http://www.mcrel.org/compendium/browse.asp>.

This lesson plan addresses the following national standards:

- Science – Life Science: Understands biological evolution and the diversity of life.
- Science – Earth Science: Understands Earth's composition and structure.

National Academy of Sciences

The National Academy of Sciences provides guidelines for teaching science in grades K-12 to promote scientific literacy. To view the standards, visit this Web site:

<http://books.nap.edu/html/nses/html/overview.html#content>.

This lesson plan addresses the following national standards:

- Life Science: Diversity and adaptations of organisms
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Support Materials

Develop custom worksheets, educational puzzles, online quizzes, and more with the free teaching tools offered on the Discoveryschool.com Web site. Create and print support materials, or save them to a Custom Classroom account for future use. To learn more, visit

- <http://school.discovery.com/teachingtools/teachingtools.html>
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