SIEMENS STEM DAY | Science Technology Engineering Math

SIEMENS STEM DAY ACTIVITY

THE TIME OF OUR LIFE

REAL-WORLD SCIENCE TOPICS

- An exploration of when certain organisms first appeared on Earth.
- An exploration of how events in Earth's history were spread out over time.

ADDRESSES NGSS

LEVEL OF DIFFICULTY

2

GRADE RANGE

6–8

OVERVIEW

In this activity, students will research ancient organisms and create a timeline showing when they appeared on Earth.

TOPIC

History of Life

OBJECTIVE

Students will use research skills to learn about the long history of life on Earth.

MATERIALS NEEDED FOR EACH TEAM OF 2–4 STUDENTS

- posterboard
- markers
- scissors
- Internet access or print research materials related to ancient organisms

MATERIALS NEEDED PER CLASS

- meter stick or tape measure
- tape or small flags (utility marking flags are available at hardware stores)

NGSS THREE-DIMENSIONS

Science and Engineering Practices	Disciplinary Core Ideas	Crosscutting Concepts
Constructing Explanations and Designing Solutions Construct a scientific explanation based on valid and reliable evidence obtained from sources (including the students' own experiments) and the assumption that theories and laws that describe the natural world operate today as they did in the past and will continue to do so in the future.	**ESS1.C: The History of Planet Earth** The geologic time scale interpreted from rock strata provides a way to organize Earth's history. Analyses of rock strata and the fossil record provide only relative dates, not an absolute scale.	**Scale, Proportion, and Quantity** Time, space, and energy phenomena can be observed at various scales using models to study systems that are too large or too small.

1. **Warm-up Activity:** Before class begins, draw a timeline of the school year on the board. Ask the students to suggest important events to add to the timeline, such as vacations or tests. When this is finished ask them to explain how a timeline can be a useful way of organizing information. There are many reasons that a timeline is useful, including the fact that it allows you to see visually how much time has elapsed since an event occurred, and it allows you to easily compare the lengths of different periods of time.

   Distribute The Time of Our Life handout to the students. Ask students what they think a timeline of life on Earth would look like. Have them draw a timeline of the entire history of Earth. They should include on their timelines the times when they think life first appeared, when dinosaurs were around, and when humans first appeared. Have students share and discuss their timelines. Explain that this activity will help them learn about when different forms of life arose on Earth.

2. Assign each group of students one of the groups of organisms from the list below. If your class is small, you can either give each student group multiple organisms to research, or eliminate some of the organisms from the list below. Do not give students the dates on the list below.

prokaryotes—3.5 billion years ago	reptiles—300 million years ago
photosynthetic bacteria—3 billion years ago	dinosaurs—250 million years ago
eukaryotes—2.5 billion years ago	mammals—200 million years ago
jellyfish—575 million years ago	birds—150 million years ago
fish—500 million years go	flowering plants—125 million years ago
land plants—450 million years ago	rodents—50 million years ago
amphibians—350 million years ago	horses—25 million years ago
insects—325 million years ago	humans—2 million years ago

3. Students will research the group of organisms that they were assigned using available resources, including the Internet and textbooks. If there are not enough computers available for all groups to complete this research

at the same time, then you can assign the research prior to the class as a homework assignment.

4. Students should include a basic description of the group of organisms, including a picture from the Internet or a drawing. The information that they report should mention when this group of organisms first appeared on Earth, and what made this group distinct from other groups that came before and after.
5. Once students have completed this research, they should use the information that their group found to make a poster about their organism. The poster should include all of the information listed in the previous step. If you have the computer resources available, allow students to use an online program such as Glogster to create their posters. If you do not have the computer capacity then a traditional poster on poster board will be adequate.
6. Once students have completed their posters, have each group present the information about their group of organisms to the class. The presentations need only be brief introductions to the groups of organisms. All students should use the back of the handout to record the time that the group of organisms first appeared.
7. When you are done with the presentations, lead the students to the area where they will make the timeline. A field, a wall along the side of the school, or a hallway are the recommended sites for this activity. Longer timelines will be able to show more detail.
8. For the sample timeline, we will use a scale of one centimeter equals one million years. At this scale, one meter equals 100 million years, and one billion years is 10 meters long. Since Earth formed 4.6 billion years ago, the timeline has to be 46 meters long. If that amount of room is not available, then you can use a different scale (for example, one centimeter equals 5 million years). A variety of timeline calculators are available online; these calculators will allow you to input a distance, and then they will select a scale for you. Here are a few suggested links:
   http://www.edhelper.com/timelines.htm
   http://dohistory.org/on_your_own/toolkit/timeline.html
9. Select two students to measure the timeline. One student should be in charge of the meter stick, and another should be in charge of marking off one meter increments with tape, or small flags, depending on where you place the timeline. The student should label each increment on the tape or flag. For example, when the student reaches 5 meters, he or she should write “500 million years” on the marker, if using the scale mentioned above. If you wish, you can perform this step before class to save time.
10. Now that students have created a timeline, it is time for them to place themselves on the timeline. To do this, they will need to determine how far along the timeline their organisms first appeared. To calculate the distance, students should divide the time at which the organism first appeared by the scale factor. For example, dinosaurs first appeared about 230 million years ago. If 1 m = 100 million years, then dinosaurs should appear on the timeline 230 million X 100 million = 2.3 m from the present day. (Note: It is important to be clear on the reference point for your marks. Because students will most likely identify the time at which each organism appeared in years before today, you will need to measure back from the mark representing the present time to correctly locate each organism on the timeline.) Students should write the names of the groups of organisms that they are representing on pieces of paper. Assign one student to represent the formation of Earth. Because space will be tight, only one member of each group can

be placed on the timeline. Alternatively, the students can just place a marker in that spot using tape or a small flag. If the class has a digital camera and there is space, take a picture of the timeline once it is fully formed. Otherwise have the second member of each group sketch the timeline on the handout.

Wrap-up Activity: Take the students back to the classroom and lead them in a discussion of the history of Earth. Begin by asking them where the organisms they were most familiar with were located on the timeline. They should have been able to see that most of the organisms they are familiar with, such as birds, mammals, and humans, all appeared in the last meter of the timeline. In other words, Earth had no animal life for about 80% of its history. Similarly, there were no plants on Earth for nearly 40% of its history. Encourage students to compare the final timeline with the timelines they made during the Warm-Up activity. Most students will have guessed that dinosaurs and humans appeared much earlier in Earth's history than they actually did. Encourage students to discuss the similarities and differences between the "real" timeline and the timelines they made at the beginning of class. They should identify any misconceptions they held about the history of life on Earth.

THE TIME OF OUR LIFE EXTENSION ACTIVITY

To extend this activity, you could have students shrink the timeline to focus it on more recent history. For example, you could reduce the length of time represented on the timeline from 3.5 billion years to 600 million years, when animals first appeared. Students could recalculate the scale, as well as their place on the timeline, and rearrange themselves accordingly.

When did life first evolve on Earth?

Scientists have found fossil evidence that the first life forms appeared on Earth more than 3.8 billion years ago. These organisms were similar to bacteria that are still found on Earth today.

The earliest organisms probably obtained energy by eating naturally occurring amino acids and sugars that were found in their marine environments. Earth at that time was a very different place, primarily because the atmosphere did not contain oxygen.

What evidence do scientists have for early life?

It is very hard to find conclusive evidence of early life on Earth. Organisms that would be visible to the naked eye did not evolve for more than two billion years after the first organisms appeared.

However, the earliest organisms did leave behind some fossils. One of these types of fossils is called a stromatolite. A stromatolite is a fossilized mat of single-celled organisms that lived in shallow pools. Mucus secreted by the organisms trapped sediment. Over time, this sediment formed rock, preserving the remains of the bacterial mat as a fossil. Scientists think that photosynthetic organisms in early stromatolites may have been responsible for much of the oxygen in the atmosphere.

How do scientists know how old fossils are?

Scientists have many different techniques for figuring out how old a fossil is. One primary technique is to find out how old the rocks and fossils are that a given fossil is buried near. This is called relative dating. Certain fossils appear in the geological record for only a short period of

time, but are numerous and widespread. Those fossils are called index fossils. Index fossils can help scientists pinpoint the age of a particular rock layer. Another dating technique is called absolute dating. In absolute dating, scientists attempt to find the true age of a rock or fossil using tools such as radiometric dating. All materials on Earth contain some level of radioactive elements, which decay at a steady rate over time. By measuring the amount of radioactive material in several samples from a rock, scientists can infer the age of the rock.

KEY VOCABULARY

prokaryotes: organisms whose cells do not have a nucleus; mostly bacteria
eukaryotes: organisms whose cells do have a nucleus, including animals, plants, algae, and fungi

THE TIME OF OUR LIFE

Draw a timeline of the history of Earth that includes the time the first living organisms appeared, the time that dinosaurs were on Earth, and the time that humans first appeared on Earth. The beginning of the time-line should represent when Earth first formed, and the end should be the present.

What group of organisms were you assigned?

When did this group first appear on Earth?

What made this group distinct from its ancestors?

Use the space below to draw a timeline of life on Earth based on the larger timeline that your class created in the activity. Label the events that are covered in the activity.

How does this timeline compare to your original timeline?
[It is very different. I thought humans had been around much longer.]

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