

Be a Paleobiologist

How do biologists use fossil evidence to draw conclusions about living things from long ago?

Prepare

1. If needed, label the footprint replica, skull replicas, and plant fossil photo with numbers as listed at right. **Make sure to remove or cover any labels that identify what the items are.**
2. Hang your "Research Lab" sign in a visible location.
3. Set up three research stations. Place the footprint at one station, the two skulls at the second station, and the plant photos at the third station.

Engage

Note: You could also use the "Be a Paleobiologist" video to introduce the activity.

1. Introduce the Paleobiologist career by showing the group the career card and asking questions to encourage students to think about what a paleobiologist might do:
 - ▶ *What do you notice about this picture? What do you think this person is doing?*
 - ▶ *Have you heard words like "paleo" or "biologist" before? What do you think a paleobiologist might do or study?*
2. Explain that paleobiologists study things that were alive a long time ago—creatures like dinosaurs, but also plants, other animals, even tiny living things like bacteria! Since we can't see them alive, we have to look for clues to what they were like. One important kind of clue is a fossil – something the animal left behind that is preserved in rock.
 - ▶ *Why might we want to know what life was like long ago?*
 - ▶ *What kinds of things might we find as fossils?*
3. Introduce the storyline of the activity like this:
 - We are a team of paleobiologists. We work for an organization that is studying how environments change when the climate gets warmer.
 - Our organization has found a collection of fossils in a nearby area. We think they come from a long time ago when the climate was very different than it is now.
 - Our job is to look at these fossils and see what we can figure out about the living things they came from, and what their environment was like.

MATERIALS:

- Footprint fossil replica, labeled "Fossil #1"
- 2 replica skulls, labeled "Fossil #2" and "Fossil #3"
- 2–3 copies of laminated plant fossil photo, labeled "Fossil #4"
- Student lab notebooks
- Pencils
- Science skills stickers
- Research Lab sign (see Printable Resources)
- Paleobiologist career card
- (Optional) Rulers
- (Optional) Whiteboard or chart paper and markers
- (Optional) "Be a Paleobiologist" introduction video



Explore

1. Introduce the group to the three research stations, but don't give any information about what the "fossils" are.
2. Remind the group that biologists need to handle materials carefully, so they don't get harmed or broken. Provide appropriate instructions for your group for how they should handle the footprint replica and skulls.
3. Divide the class into three groups and assign one group to each research station. Encourage students to turn to pp. 9–10 in their lab notebooks and draw or write their observations about their fossil(s) in the appropriate section.

For older students, you could provide rulers and encourage them to include measurements in their observations. They can use measurements to not only compare the fossils to each other, but also to compare the ancient animals to themselves.

- **How do the lengths of the two skulls compare? What might that tell you about the sizes of the animals? How would you expect their footprints to compare to each other?**
- **How long is the footprint and how does it compare to the length of your own foot? What might that tell you about the animal who left the print?**

4. Rotate the groups through each research station, allowing about 10 minutes at each station.
5. As students work, use the Core Four strategies to support their research:

Ask questions to encourage observation and prediction:

- ▶ *What do you notice about the shape of this fossil?*
- ▶ *What part of a living thing do you think this came from?*

Encourage scientific thinking by inviting them to draw conclusions based on evidence:

- ▶ *What does this footprint tell you about the animal? How do you know?*
- ▶ *What kind of animal do you think made this footprint? What do you see in the fossil to make you think that?*
- ▶ *What other clues or fossils would we need to know for sure?*

Make connections to students' lives and experience:

- ▶ *What does this remind you of?*
- ▶ *Have you ever seen something that looked like this before? What was it?*

Cultivate rich dialogue by encouraging students to discuss their observations and conclusions with their group:

- ▶ *What details did you each notice that the others may have missed?*
- ▶ *How are your ideas about the fossils the same or different?*

Younger students' discoveries may focus on basic conclusions about the fossils: what they are (footprint, skull, leaf), the size of the animal, or what parts or features they show. Encourage them to think about how their ideas are supported by the evidence (What do you see on the fossil that helps you know that?) Highlight connections to their own experience to help them draw conclusions:

- **When your foot makes a footprint, how many toes does it have?**
- **Have you ever made a footprint on mud? Have you ever left wet footprints on the sidewalk? Which one looks like this fossil does?**

Reflect

1. Gather the group back together. Explain that your research team needs to share the results of your research on the fossils with your organization.
2. Ask the group to share their discoveries about each of the fossils. Encourage them to **support their ideas with evidence** by saying what they saw on the fossil and what it tells them about the animal or its environment. You may want to write their ideas on a whiteboard or chart paper.
3. Help the group summarize their findings:
 - ▶ *How many kinds of animals were living in this environment (based on our fossils)?*
 - ▶ *What do we know about each of them?*
 - ▶ *What was the environment like? (Wet or dry? Desert or forest?)*
 - ▶ *What do we still not know? What kinds of fossils or evidence would we want to find to help us know more?*

Older students can draw more detailed conclusions from the evidence and think about possible relationships between the animals & plants in this environment. Encourage them to think critically about whether there is more than one interpretation of the evidence, and what other evidence they might look for to support their ideas:

- **That's one idea. What other explanations could fit with the fossils we have?**
- **If we think the footprint animal ate the skull animals, what kind of fossil might we find that would help us know for sure?**

4. Encourage the group to reflect on how they were like biologists during the activity. You may want to show the paleobiologist career card again, or refer to the science skills stickers in their notebooks:
 - ▶ *What are some of the things we did today as paleobiologists?*
 - ▶ *How did we think like scientists? What science skills did we use?*
 - ▶ *What did you do today that made you feel like a scientist?*
5. Allow time for students to draw or write their reflections in their lab notebooks. Invite them to choose two science skills stickers that reflect skills they used and add them to their notebooks.



Extend

- Invite students to draw different pictures from their imaginations of what they think these animals might have looked like, based on the fossil evidence. Discuss what evidence you would need to determine whether one depiction is more likely than another.
- Find out more about what footprints can tell about an animal and its movement:
 - Ask students to make footprints in sand or mud (or with water on pavement) while doing a variety of movements like walking, running, and jumping. How do the tracks change?
 - Explore animal tracking and footprint identification resources to learn how people identify living animals from their tracks. Paleontologists use the same techniques to learn about ancient animals from their fossil footprints!
- Encourage students to identify types of current environments around the world. Find photo examples on the internet of very wet and very dry environments. Can they think of environments that exist today that are usually very warm and those that are usually very cold?
 - How do those places compare with each other? Does one type of environment have more types of plants and animals than another?
 - How do you think these modern places compare to the ancient one we looked at today? What could comparing environments that humans can still visit tell us about a place in the past we can't?
 - Do you think these places have always looked this way? Do you think the plants and animals that live in a place today are the same types of plants and animals that lived there millions of years ago? Why or why not?

Background

- “Paleo” means “old or ancient.” Paleobiologists study ancient life using fossils—evidence of living things preserved in rock. Students may have heard the name “paleontologist” instead of “paleobiologist”; both terms are used to describe scientists who use fossils to study ancient life. This activity uses “paleobiologist” to highlight the connection to other biology fields.
- Fossils can be parts of the living thing, like bones or shells, or other traces that the living thing left behind, like a footprint or leaf imprint. Paleobiologists use these clues to figure out what ancient living things looked like, and what the environment was like.
- Fossils only preserve a very small part of any ancient environment, so there are many things about it that can't be known for sure. Paleobiologists make educated guesses by comparing the evidence they find to animals and plants that are alive today.
- Because the Earth's climate has changed in the past, paleobiologists use their findings to predict the effects of climate change in the future and how we can protect ecosystems and living things today.
- The set of “fossils” in this activity is designed to help students imagine the kinds of evidence a paleobiologist might use, but they are not all fossils and not from the same location or time period:

Footprint: A cast (copy) of a fossil footprint from a small theropod dinosaur that walked on two legs. The exact species can't be told from the footprint, so all footprints of this type are called “grallators.”

Skulls: Replicas (copies) of skulls from small mammals—animals that have fur and give birth to live young. These skulls come from animals that are alive today, such as rabbits, rats, or beavers. Other types of small mammals existed in the past, including during the time when dinosaurs lived.

Leaf: A photo of a fossil imprint of a seed fern—a now extinct type of plant that had fronds similar to modern ferns.

Paleobiologist Quick Guide



ACTIVITY SECTION	DO	ASK
Engage	Use poster to discuss career	<p><i>What do you think this person is doing?</i></p> <p><i>Have you heard words like “paleo” or “biologist” before?</i></p>
	<p>Introduce story: Studying how climates change when warmer Looking at fossils from a long-ago climate Clues in the fossils tell us what the living things were like</p>	<p><i>Why do you think it’s important to study what life was like in the past?</i></p> <p><i>What kinds of things do you think we could find as fossils?</i></p>
Explore	Investigate three types of evidence	<i>What part of a living thing do you think this came from?</i>
	Observe details, write or draw observations	<i>Have you ever seen something that looked like this before? What was it?</i>
	Draw conclusions about the living things & their environment	<p><i>What kind of animal do you think this fossil came from? What do you see in the fossil to make you think that?</i></p> <p><i>What other clues or fossils would we need to know for sure?</i></p>
Reflect	Share conclusions based on fossil evidence	<p><i>What do we know about the animals in this environment?</i></p> <p><i>What was the environment like?</i></p> <p><i>What do we still not know? What kinds of fossils could help us know more?</i></p>
	Reflect on career connections	<i>How were we like paleobiologists today?</i>
	Use stickers & notebook to draw/write reflections	<i>What science skills did you use?</i>