Be a Plant Biologist

How do biologists observe and classify living things to understand how they interact with their environment?

Prepare

1. Choose an outdoor area for your field research site. It should include enough space and enough plants that each student (or small group of students) can safely observe their own plant. Any type of plant can be included—trees, bushes, weeds, grass, or planted flowers.
2. Hang your Research Lab sign in a visible location. (For this activity, your "Research Lab" might be outdoors!)

Engage

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

1. Introduce the plant biologist career by showing the group the career card and asking questions to encourage students to think about what a plant biologist might do:
   - *What do you notice about this picture? What do you think this person is doing?*
   - *What does the name "plant biologist" make you think of? What do you think a plant biologist might do or study?*

MATERIALS:

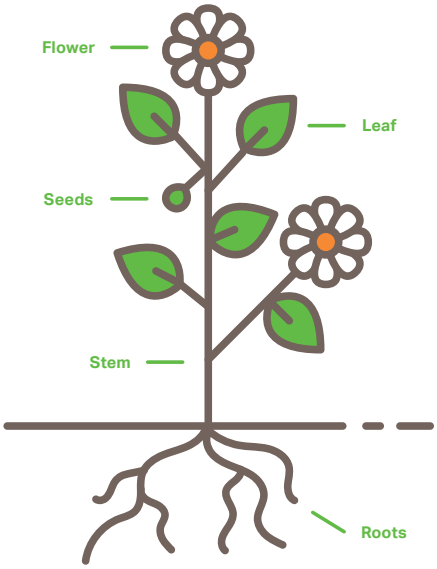
- Outdoor area with plants growing in it (yard, park, empty lot, or even a sidewalk with plants growing in the cracks) OR optional materials for indoor adaptations (See Indoor Alternatives section below)
- Magnifying glasses (one per student)
- Student lab notebooks
- Pencils
- Science skills stickers
- Whiteboard or chart paper and markers
- Research Lab sign
- Plant biologist career card
- (Optional) cameras or phones for photographing plants
- (Optional) "Be a Plant Biologist" introduction video

2. Explain that a plant biologist studies how plants work, how they grow, and how they interact with other parts of their environment, like soil, air, or insects.
3. Introduce the storyline of the activity like this:
   - Our research team works for a plant nursery that grows and sells plants for landscaping yards, parks, and public areas.
   - Our job is to decide which kinds of plants grow best in different environments, so that we can recommend plants for each area that won't require a lot of extra care and attention.
   - We've been asked to research areas like [name your chosen area: our play yard/ sidewalk edge/empty lot] to find out what different types of plants are growing in them, and which ones seem to be the healthiest.
4. Ask the group to think about how they might work on this kind of problem:
   - *What could we do to figure out what kinds of plants grow best in an area like this?*
   - *How could we tell which ones are the healthiest? What would we look for?*

Explore

1. Explain to the group that your team will be doing **fieldwork** - when biologists go outside their labs to study living things in the environment where they live. You will be observing different plants in your outdoor area to see how they are similar or different, which groups or types of plants there seem to be the most of, and how or where they are growing.
2. Ask students to look at p. 13 in their lab notebooks and review the different plant parts they will be observing:
   - *What different parts can plants have?*
   - *What are some ways those parts can be the same or different between plants?*

For younger students, you may want to review the different parts of a plant and ask students to think of some examples of each (grass stem vs. tree trunk, etc.), to connect to their experience and help them start thinking about similarities and differences.



3. Distribute magnifying glasses and **make connections** to students' prior experience:
   - *Have you used a tool like this before? If not, what does it remind you of?*
   - *What could a tool like this help you do?*
4. Invite students to practice using their magnifying glasses to look at a nearby object, like their lab notebooks. Demonstrate with this technique:
   - Hold the magnifying glass close to the notebook or other object—not close to your eye!
   - Move the magnifying glass slowly away from the object, toward your eyes. Notice how the image in the glass changes.
   - If the image in the glass gets too blurry, move the glass back closer to the object. Find the spot where the image is as big as it can be, without being too blurry to see details.
   - What details can you see with the magnifying glass that you didn't notice without it?
5. Before leaving your classroom space, discuss any field safety rules the group should follow, including:
   - Personal safety—where students may or may not go, staying within sight of adults, etc.
   - Plant safety—touching gently, not uprooting or breaking off leaves, etc.
6. Ask students to bring their lab notebooks, pencils, and magnifying glasses out to your **field research site**.
7. **Encourage scientific thinking** by asking the group to make observations about the plants they see in the research site:
   - If we wanted to sort them into a few big categories or groups, what are some ways we could sort them? (For example: big, medium, and small; trees, bushes, grasses, and small plants; red-leaved, brown-leaved, and green-leaved.)
   - Which group or category seems to have the most plants in our research site?
8. Invite each student (or small group of students, if necessary) to choose one plant in the research site to observe closely. Encourage them to make a sketch of the plant in their field notebooks and use their magnifying glasses to notice details.
9. (Optional) Use cameras or phones to take photos of each plant the students study.

Explore (Continued)

10. As students work, **ask questions** to help them distinguish details and differences about their plant:
    - *Stem or trunk: Is there one stem coming out of the ground or several? Is it straight, or does it split or branch? What color is it? What texture is it (smooth, ridged, bumpy?)*
    - *Leaves: What shape are the leaves? What color(s) and texture are they? How are they arranged on the stem – across from each other, alternating up the stem, several attached in the same spot? Do the front and back of the leaf look the same or different? What other details do you notice?*
    - *Flowers: Do you see anything that looks like a flower? What shape and color is it? What parts does it have? Where on the plant is it located?*
    - *Seeds or fruit: Do you see anything that looks like a seed or a fruit? What shape and color is it? What parts does it have? Where on the plant is it located?*
    - *Damage: Are there any holes in leaves (from insects eating them)? Parts that should be green but are yellow or brown instead?*
    - *Location: Is it growing by itself or close to other plants? Under a larger plant? Between rocks? In a small crack in a sidewalk or wall?*
    - *Soil: What color is the soil? What does it feel like? Is it wet or dry?*
    - *Sunlight: Is it growing in the shade or the sun? Or some of both?*
11. Gather the group together to share the results of your field research. Remind the group of the different ways you discussed grouping the plants at your research site (big/medium/small, red/green/brown, etc.)
    - Now that you have looked closely at some of the plants, are there other ways of sorting them—for example, based on the shape of the stem, or how the leaves are arranged?
12. Decide as a class which way of grouping makes sense to help them sort the plants they studied. One way you could do this:
    - Call out each of the categories and have students raise their hand if the plant they studied fits the category. ("Raise your hand if your plant had green leaves. Now raise your hand if your plant had red leaves..." etc.)
    - If all the plants fit in just one or two of the categories (for example, all the plants have green leaves), that way of sorting won't be as useful for your plants.

For younger students, you could simplify the activity by choosing one of the plant-sorting systems suggested in the opening discussion and asking the group to use that system, rather than having the group evaluate and choose which grouping system to use.

13. Divide the class into groups based on the grouping system you decided on (for example, all the students who studied "big" plants in one group, "medium" plants in a second group, and "small" plants in a third group. **Cultivate rich dialogue** by encouraging students to compare the plants they studied with their group:
    - *How are they the same, and how are they different?*
    - *Do you think they are all the exact same kind of plant, or different kinds? What makes you think so?*
    - *Are there more categories you could sort the plants into within this group?*
    - *Did they all seem healthy where they were growing?*

Reflect

1. Bring the whole class together and ask each group to share what they discovered. Use a whiteboard or chart paper to record their results:
   - *How many plants were in your group? Were there others in our research site besides the ones you each looked at? A lot, or just a few?*
   - *Were they all exactly the same kind of plant, or different? What made you think so?*
   - *Where were they growing? Did they look healthy there? How could you tell?*
2. Based on the evidence each group collected, discuss what advice you should give your plant nursery about the kinds of plants to recommend for outdoor spaces like this one.
   - *Which plants seem to be growing the best in our research site?*
   - *What other features might be important for people choosing plants? How they look? How tall they are? Does that change what plants we should suggest?*
3. Encourage the group to reflect on how they were like biologists during the activity. You may want to show the plant biologist career card again, or refer to the science skills stickers in their notebooks:
   - *What are some of the things we did today as plant biologists?*
   - *How did we think like scientists? What science skills did we use?*
   - *What did you do today that made you feel like a scientist?*
4. 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

- How will you share the results of your group's research? Create a visual representation of your data (graph, chart, graphic organizer) that shows the grouping system you decided on, which plants you found in each group, how many of each you found, and what you recommend for the best plants to grow in this area.
- Provide photo examples of plants from other regions or environments. Ask students to decide how those plants fit into the sorting system you chose. Are there other sorting systems (or new categories to add to your system) that might fit these new plants better?
- Use online sources or books to try to identify the plants the group found and learn more about them. Are there other kinds of places where these plants grow well? Are there other plants that grow well in the same conditions? Would those plants be good choices for your research site as well?

Background

- Scientists **classify**, or sort, living things into groups based on similar traits. This helps biologists understand differences between living things, how they are related to one another, and how they have changed or evolved over time.
- Modern classification systems are all based on a hierarchy of shared characteristics, starting with the highest-level groups, called kingdoms, and moving to the most specific level, species.
- These classification systems keep changing over time, as scientists develop better tools and can observe more details. Microscopes and DNA tests show that animals that look similar on the outside can be very different on the inside!
- Biologists also use many other ways of classifying living things to help them find different patterns and relationships between them. For example, grouping animals that live in water vs. on land, or that are nocturnal (awake at night) vs. diurnal (awake in the daytime), can help biologists see what features make it easier to live in those environments.
- **Field research**—studying living things in their natural environments—is an important tool for biologists. It helps them see how a living thing interacts with the other plants and animals around it, as well as with the air, water, and soil.
- Understanding how plants fit into their environments helps landscapers and gardeners decide on the best plants for different locations. If a plant grows well in a certain type of soil, or with a certain amount of sunlight or rain, planting it in a similar environment means it will be more likely to grow well and stay healthy. It also means less time and fewer resources (like extra water or fertilizer) are needed to take care of it.

Indoor Alternatives

Exploring this activity in an outdoor area is strongly recommended, but if your group is not able to safely be outdoors, here are some possibilities for adapting it to indoors:

- Ahead of the activity, take photos of individual plants in an outdoor area visible from your classroom space. Print enough copies of the photos for each student to have one plant photo to examine. Start the activity by looking at the outdoor area together (from indoors) to discuss different ways to group the plants. Distribute plant photos for students to use in their individual plant observations.
- Use a Google Street View tour of an area near you or an online virtual ecosystem tour (see resource list below) in place of the outdoor area. Bring in live examples of plants similar to those in the tour, or photos of similar plants, for students to examine.
- Use pre-assembled landscape dioramas (see resource list below) in place of the outdoor area, and live plants or individual photos of plants for students to examine.

Resources

Virtual ecosystem tours:

- U.S. National Parks: https://artsandculture.google.com/project/national-park-service and https://upgradedpoints.com/travel/virtual-tours-of-national-parks-in-us/
- European forest sites: https://vr-easy.com/tour/transea/210927-hnee_vfts/#pano=2

Landscape dioramas:

- Landscape kits: https://woodlandscenics.woodlandscenics.com/show/category/BasicKits
- Individual elements: https://woodlandscenics.woodlandscenics.com/show/category/SARLandscape

Plant Biologist Quick Guide

ACTIVITY SECTION	DO	ASK
Engage	Use poster to discuss career	*What do you think this person is doing?* *What do you think a plant biologist does or studies?*
	Introduce story: • Work for a plant nursery • Study what plants are growing in an outdoor area & decide which kinds grow best	*What could we do to figure out what kinds of plants grow best in an area like this?* *How could we tell which ones are the healthiest?*
Explore	Review plant parts	*How can these parts be alike or different between plants?*
	Practice using magnifying glasses & review field safety	*Have you used a tool like this? What does it remind you of?*
	Observe outdoor research site	*How could we sort these plants into a few big groups?*
	Study individual plants	*What shape and color is each part?* *Where is it growing?* *Does it show signs of damage?*
	Decide on a grouping system	*How can we decide which grouping system works best for these plants?*
	Small groups compare plants in their group	*Are these plants exactly the same kind?* *Are there smaller groups you could sort them into?*
Reflect	Share group evidence & conclusions	*How many plants were in each group? Were they all the same kind of plant or different? Did they look healthy there?*
	Recommend best plants for this environment	*Which plants seem to be growing the best in our research site?*
	Reflect on career connections	*How were we like plant biologists today?*
	Use stickers & notebook to draw/write reflections	*What science skills did you use?*