

TIMELINE

Students explore plant development through sorting and drawing stages of budding, flowering, and fruiting. Then they discuss possible functions of plant parts.

This activity focuses students on life cycles of plants. As students search for flowers in different stages of growth and attempt to put them in order, they will recognize the major structures and notice how they change. Students will not only learn about that individual plant but also make meaning about the function of different plant parts and how this corresponds to the plant's life cycle.

NATURAL PHENOMENON

This activity should be conducted in an outdoor space where students can observe plants and flowers in different stages of growth, such as a school garden or natural area. Look for species that show stages from bud to flower to fruit or seed at one time. Students could also make a timeline of fungi if you find mushrooms in different stages of development, or of leaves in different phases of decomposition.

PROCEDURE SUMMARY

1. Find a flower in the peak of its bloom and describe it in the center of the page with words and pictures.
2. Find the oldest and youngest versions of this flower and draw them on the left and right sides of your page.
3. Find as many intermediate stages as you can and draw them, arranging them sequentially on the page.
4. Write down any questions that come to you, and include written notes.

DEMONSTRATION

When the whiteboard icon appears in the procedure description: Demonstrate finding and adding stages of flower development, sorting them, and adding notes or questions. Start with one flower in full bloom and show how you can work backward or forward as you add stages. Add stages out of sequence, showing how to leave space for other elements later.



Time

Introduction: 10 minutes
Activity: 20–50 minutes
Discussion: 10–20 minutes



Materials

- Journals and pencils



Teaching Notes

This activity won't work in every season. Plan to do it at a time of year when you know there will be enough plants in different stages of growth for students to observe, and scout a location ahead of time.



Certain flowers with complex structures or curling petals can be challenging to draw. If your group is newer to drawing, encourage students to pick a flower with a simple structure to draw, or offer students strategies for drawing complex flowers efficiently.

See instructional videos on johnmuirlaws.com and *The Laws Guide to Nature Drawing and Journaling* for more details about specific strategies for drawing different types of flowers

PROCEDURE STEP-BY-STEP

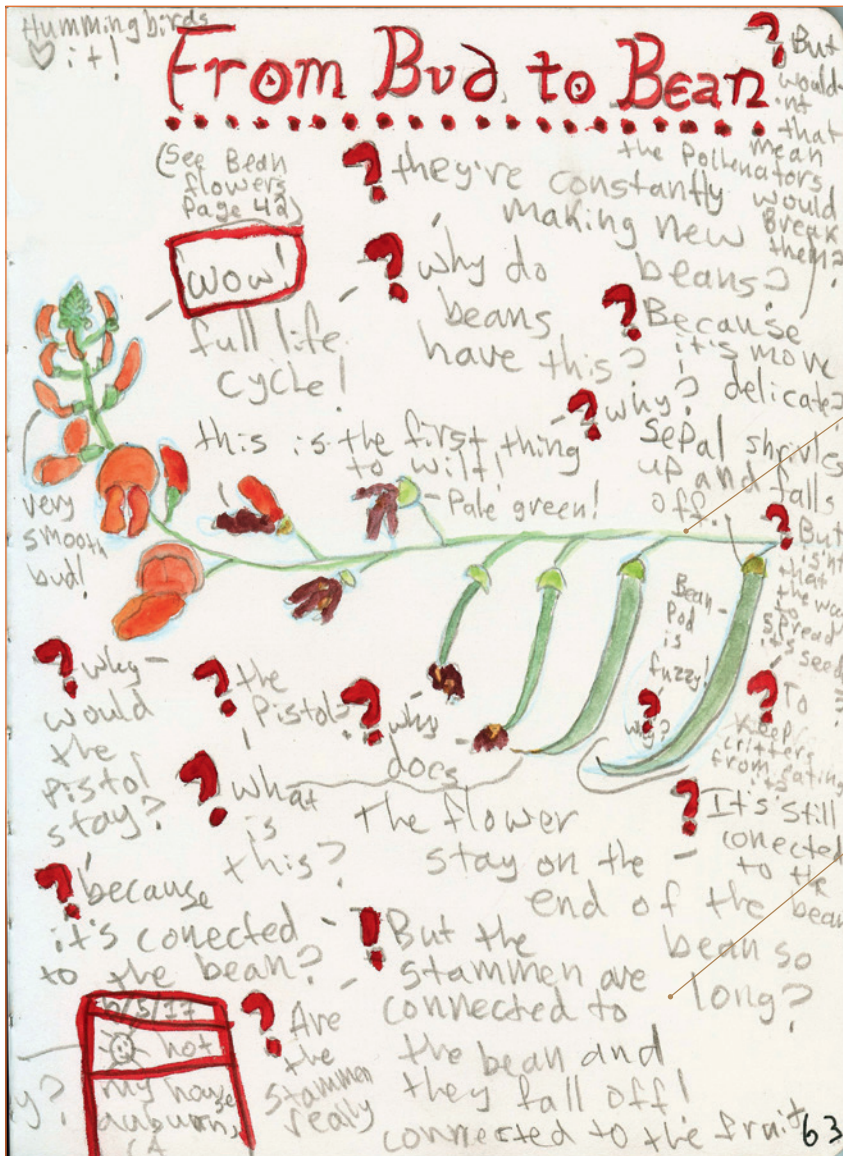
1. Explain that students will record observations of a flower at its peak bloom, then will add drawings of older flowers to the right of the original diagram and younger flowers to the left.



- a. "Find a flower that's at the peak of its bloom. Make a careful drawing or diagram of it in the middle of your page and include written observations and numbers. Leave room to either side for making other notes."
- b. "Then try to find stages of growth that are more developed (older) than your first drawing. Draw and describe these with notes to the right of the central drawing. Try to sort these drawings on your page with the oldest ones farther to the right. Challenge yourself—what is the oldest stage you can find?"
- c. "Next, look for stages that are younger than the central flower. Draw and describe these on the left side of the

page. Try to sort these so that the youngest stages are farther to the left."

- 2. Tell students to use words, pictures, and numbers to record their observations, and encourage them to write down any questions they have as they're working.
 - a. "Write, draw, and use numbers to describe what you see."
 - b. "If any questions occur to you while you are working, write them down in your journal so that you don't forget them, then focus back on the project."
- 3. Set boundaries, send students out to journal, then circulate, troubleshoot, and talk to students about their observations.
- 4. (When half the allotted journaling time has elapsed) Say:
 - a. "We're about halfway done. If you've only been working on finding stages older than the original flower, move on to looking for and recording some younger ones.



Here, all the stages of the life cycle appear on a single plant. On other species, you will have to look at several plants to find all the stages.

Curiosity chain: Study this series of questions and observations. Notes about the persistence of the flower and stamen on developing fruit lead to a discovery about the closer relationship between the fruit and the pistil.

Fiona, age 13

DISCUSSION

Lead a discussion using the general discussion questions and questions from one of the Crosscutting Concept categories. Interperse pair talk with group discussion.

General Discussion

- a. "In groups of four, share your notes and observations. Find out: Did everyone make the same decisions about what was young or old? If you do not all agree, share your evidence for why you each arranged them the way you did."
- b. "It's OK to respectfully disagree with each other. Be willing to change your mind in the face of new evidence. After you are done with your discussion, number your observations to sort them from youngest to oldest."
- c. "Look at the different stages you drew, and discuss: What might the function of the flower be at this stage? Then group the stages together based on a common function by labeling each group with a name that describes what you think it might do."

Patterns

- a. "Please lay your journals on the ground [picnic table, rock...], then look through the observation notes made by your group. What similar patterns do you see among the different stages of flowers in your journal entries?"
- b. "Are there any flower structures that you see at every stage? What's different among them?"
- c. "Now look at the ways the plant structures change over time. Do you see any patterns in what changes, and when? Which structures are the first to change?"
- d. "How do you think the growth patterns of other flowers might compare?"

Cause and Effect

- a. "What changes did you see between different stages of flowers? Which of those changes could have been caused by environmental factors, such as temperature changes or impacts from organisms? Which ones do you think might have been caused by genetic factors?"
- b. "Why are these flowers changing? How might this help the plant survive?"

Stability and Change

- a. "Take a look at your drawings. What parts of the flowers changed? What stayed the same?"
- b. "Did you see any evidence of a change in the rate of change—in other words, were there bursts of activity and pauses? Why? What might have caused those changes?"
- c. "What was the youngest stage we found? What do you think came before that? What was the oldest stage we found? What do you think would come after that?"

Structure and Function

- a. "With a partner, describe in detail some of the structures you observed."
- b. "Pick one structure to focus on, and try to trace how it changed from young flower to old flower."
- c. "Pick one structure to focus on, and come up with some possible explanations for its function, thinking about how its function might have changed over time. For example, if a leaf petal became withered at a certain point, why might that be the case? How is its function changing?"
- d. "Did you see any evidence of a change in function of the flower or of any individual structures in the flower? How might the functions of this plant change over time? What about individual structures? How did their function change?"