

Session 4

Plant Life Cycles

Which life forms reproduce at a distance, give rise to offspring miles away, trick other living things into helping them reproduce even after death, and encourage predators to eat their young as part of their life cycle? Plants! During Session 4, we'll continue our study of life cycles by focusing on the plant kingdom, using flowering plants as our examples. During this session, you'll have a chance to see how different the life cycles of plants are from animals—as well as how similar.

The Video

Our study of plant life cycles begins with the obvious—seeds. Dr. Nancy Landes, representing Science T.R.A.C.S. from the Biological Sciences Curriculum Study (BSCS), tells us of her work with children, who often think that seeds aren't alive. The question "What will it become?" helps launch children into an exploration of life cycles. Our Science Studio children tackle this question as they discuss different plant life stages.

During this session, we hear from several guests. Dan Cousins, the head grower at a large nursery, focuses on the role of seeds in plant reproduction. As we move to an exploration of flowers, Dr. Dan Scheirer, a forensic botanist, shares his understandings of the role of pollen. Dr. Judith Sumner, who researches the role of plants in human culture, describes an intriguing feature of plant life cycles: alternation of generations. She also highlights the challenges that plants face in reproduction, and how flowers and fruits have evolved to provide some solutions.

We return to Lakewood, Colorado to visit Sally Florkiewicz's third-grade class, as they investigate plant life cycles with Science T.R.A.C.S. They're at a point in the activity where the question "Where do seeds come from?" finds them forming hypotheses to be tested later as the plants they are observing complete their life cycles. Finally, Dr. Paul Williams gives us a peek at events taking place in our Bottle Biology systems—including butterflies that have emerged from chrysalises to become partners in completing the life cycle of a plant.

Learning Goals

During this session, you will have an opportunity to build understandings to help you:

- Describe the stages in the life cycle of a flowering plant
- Compare plant with animal life cycles

On-Site Activities

Getting Ready (60 minutes)

Activity One—Problem Set and Reading Discussion (20 minutes)

Work in small groups.

1. Begin the session by reviewing questions 1–4 from the problem set for Session 3. For each question, select a single group member’s response and discuss. Use this as an opportunity to clarify understandings of content.
2. Session 3’s homework asked group members to identify an idea in the reading assignment that they consider useful in teaching about life cycles. As a group, discuss these ideas.

Activity Two—Plant Life Cycles (20 minutes)

1. To prepare for today’s session, you were asked to choose one flowering plant specimen from the group’s collection. You were to assume your specimen is an adult, and you were to answer the question “What will it become?” as a way of generating a sequence of what you believe to be the life stages in the life cycle of a flowering plant. Share your diagram with your partner, identifying any points where answering the question “What will it become?” was challenging for you.
2. Work with your partner to come to a consensus about a general pattern for the life cycle of a flowering plant. Make a new diagram, as needed. Label the life stages in your diagram.
3. As a whole group, review the above diagrams, without arguing their individual merit at this time. Make note of stages that appear on most or all of the diagrams, as well as those that don’t. You’ll revisit these diagrams after you view the video.

Facilitators: Post the diagram of the animal life cycle pattern created by the group during Session 3.

4. As a group, generate a list of ways that animal and plant life cycles are alike and another list of ways that they are different. Accept all ideas at this point, noting where there are alternative ideas.

Activity Three—Seeds, Flowers, and Fruit (20 minutes)

Facilitators: Distribute seeds and flowers to pairs of participants.

1. Rejoin your partner. Your facilitator will distribute at least two different seed types that have been soaked overnight (one will be a lima bean seed), two different flowers, and two different fruits. Use these examples to discuss the questions below.
2. Many K–6 curricula involve a study of seeds, flowers, and fruit. What are your current understandings of these structures? Look at the examples you have been given and answer the following questions for each:
 - What were they before?
 - What will they become?
 - What is their role in a flowering plant life cycle?

Feel free to “dissect” each example to support your ideas. Summarize your ideas on paper, making diagrams if you find them useful.

On-Site Activities, cont'd.

Watch the Video (60 minutes)

As you view the video, think about the following focus questions:

1. Starting with the adult, what life stages occur in the life cycle of a flowering plant?
2. In the Science Studio, the children are encouraged to compare animal with plant life cycles. Listen for their ideas about ways in which animals and plants differ (e.g., seeds vs. eggs, existence of parents). How do their ideas compare to your own?
3. Sally Florkiewicz's third-grade students are focusing on the question "Where do seeds come from?" What are their hypotheses?

Going Further (60 minutes)

1. As a whole group, revisit the life cycle diagrams that were generated before watching the video. What revisions need to be made to align them with what was presented in the video? Try to reach a consensus and create another diagram that reflects any new understandings. Participants may wish to make their own copies.
2. Dr. Judith Sumner introduced "alternation of generations" as part of a plant life cycle. She compared it to having "big adult plants" that give rise to miniature versions of themselves, with these "mini-adult plants" producing the sex cells that then unite in fertilization to form the first cell of a new plant. As a group, check your understandings of this process.
 - Which stages in your diagram reflect the "big adults"?
 - Which reflect the "mini-adults"?
 - How is this different from what happens during an animal life cycle?

If this isn't entirely clear to you at this point—don't worry! An understanding of the basic idea is a good start. If you have questions, please visit our Web site for more information (A Closer Look: Alternation of Generations):

<http://www.learner.org/channel/courses/essential/life/session4/>

3. Review the group's lists comparing the life cycles of animals and plants. Make revisions that reflect any new understandings. Are the life cycles of animals more or less like those of plants than what was originally thought? Discuss this question as a group.
4. Rejoin your partner. Focus once again on your examples of seeds, flowers, and fruit. This time, look at another example in light of what was presented in the video.
 - What are its parts?
 - What functions do these parts play?
 - How do different examples compare?
 - How do these structures fit into a flowering plant life cycle?

Be sure to use your examples to "walk through" important processes during the life cycle of a flowering plant (e.g., germination, pollination, fertilization, seed formation, dispersal).

Between Sessions

Homework (* = required)

Reading Assignment*

Driver, R., et al. (1992). *Life and Living Processes*. Leeds National Curriculum Support Project, Part 2. Leeds City Council and the University of Leeds, UK.

Research Summary: Children's Ideas About Reproduction and Inheritance (pp. 5–8: Variation and resemblance; mechanism of inheritance; sources of variation; adaptation; random chance)

As you read:

1. Identify several children's ideas that compare to your own, represent some uncertainty to you, or are particularly prevalent among your students.
2. For each idea, form a question about the content involved and try to answer it.
3. Note what evidence you are using to support your answers.

Life Science Problem Set*

(Suggested answers are listed in the Appendix.)

1. In Session 3, the role of DNA in an animal life cycle was introduced. The idea that the genome must be maintained between parent and offspring generation during sexual reproduction was also introduced. Animals and plants are no different in this regard. Apply your understandings of DNA and sexual reproduction to the flowering plant life cycle. What is the role of DNA? How is the genome maintained?
2. Distinguish between pollination and fertilization. Identify the specific structures that are involved in each and describe the details of each process in a flowering plant.
3. Dr. Judith Sumner noted that plants have a challenge in completing a life cycle that animals don't. What is this challenge? How have plants evolved to "get around" this challenge? Give specific examples.
4. Flowering plants are only one group within the plant kingdom. How are all plant life cycles alike? How are they different? Visit our Web site, and read about other plant groups and how they reproduce (A Closer Look: Life Cycles of Plants):

<http://www.learner.org/channel/courses/essential/life/session4/>

Ongoing Concept Mapping*

Develop a concept map around the central concept of plant life cycles. Be sure to include the life stages involved and somehow indicate their sequence. Provide details about seeds, flowers, and fruit. Try to make connections between this map and previous maps (i.e., to the characteristics of life in Session 1; to the plant kingdom in Session 2; to stages in an animal life cycle in Session 3).

Guided Journal Entry

Seeds and eggs represent the first life stages in the lives of plants and animals. How are these structures alike and different? Craft your journal entry to be a "beginner's guide" to a comparison of these stages in plant vs. animal life cycles. What role do these structures play? What are their parts? What are the functions of their parts? What features adapt them to the environment of a new animal or plant? For more information about these structures, visit our Web site (A Closer Look: Seeds vs. Eggs):

<http://www.learner.org/channel/courses/essential/life/session4/>

Between Sessions, cont'd.

Guided Channel-TalkLife Posting

An understanding of animal and plant life cycles requires an understanding of reproduction—specifically, sexual reproduction. The topic of reproduction is a sensitive one, for which formal instruction is typically left until middle school or even later. Even then, it's frequently a health education topic. How can animal and plant life cycles be taught in a scientifically accurate way in K–6 while still respecting personal, school, and district positions on the teaching of reproduction? How might this topic be made *less* sensitive through the teaching of animal and plant life cycles? Share your ideas in your Channel-TalkLife posting for this session.

Textbook Reading Suggestions

- reproduction
- plant reproduction
- seed
- embryo
- stamen
- pollen
- fruit
- co-evolution
- sexual reproduction
- alternation of generations
- seed leaves
- flower
- carpel
- pollination
- seed dispersal

Preparing for the Next Session*

For “Getting Ready”

For the next session, you will need to find a type of plant or animal specimen for which you can collect 3–5 different examples (they can be a part or whole). Make a list of the characteristics that vary among the individuals. Collect data that quantifies the extent of variation. Bring your specimens and data to the next session.

Materials Needed for Next Time

- 3–5 individual specimens of the same type of plant or animal (can be a part or whole)

Between Sessions, cont'd.

Ongoing Activities

Bottle Biology

Continue work on your Bottle Biology system. The bottle system that has been designed to accompany Sessions 3 and 4—Animal Life Cycles and Plant Life Cycles—is called the “*Brassica* and Butterfly System.” The plants depend on the animals, and vice versa, for completion of their life cycles. How do you think this works? Visit the Web site for more information and check out Bottle Biology Spotlights to track the progress of our very own *Life Science* systems.

Bottle Biology Spotlights: Session 4

System	Activity
<i>Brassica</i> and Butterfly System	The Butterfly Life Cycle
<i>Brassica</i> and Butterfly System	Mother Knows Best

Graduate Credit Activities

Continue your work on the annotated bibliography and action research.