

Session 3

Animal Life Cycles

There are life processes that are so much a part of our experience that it's easy to take them for granted. Reproduction is one of these processes. It seems quite simple: Life cycles result in offspring that resemble their parents. The life cycle patterns of different life forms vary, but the outcome is always the same. The continuity of life is somehow ensured from generation to generation. The next two sessions explore two different life cycle patterns: animals and plants. In Session 3, we'll focus on the animal kingdom as one example of life cycles that involve sexual reproduction. We'll also explore the underlying role of DNA in the process of reproduction.

The Video

What was it before? Dr. Rodger Bybee, representing Science T.R.A.C.S. (Teaching Relevant Activities for Concepts and Skills) of the Biological Sciences Curriculum Study (BSCS), brings us into the world of elementary school children as they answer this question during their investigation of life cycles. The children in the Science Studio take this question a step further by sharing their ideas about "What comes before an egg?" This leads to an exploration of DNA, and how hereditary information is passed reliably from parents to offspring in sexual reproduction.

An interview with Dr. Sigal Klipstein answers "What comes *after* an egg?" as she describes the process of embryo development in animals. She also contrasts the technology of cloning with sexual reproduction and describes some pros and cons of this process. Mary Bitterlich's third graders in Lakewood, Colorado offer us a first-hand view of the study of animal life cycles. We visit them as they finish a Science T.R.A.C.S. unit where the darkling beetle—an insect—is their animal example.

An overview of different life cycle patterns within the animal kingdom follows, including fish, amphibians, birds, reptiles, and mammals. Finally, Bottle Biology returns, with Dr. Paul Williams introducing us to the "Brassica and Butterfly System"—one strand of this Web site-based activity that brings together the life cycles of a plant and an animal.

Learning Goals

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

- Describe the life stages in the life cycle of an animal
- Comprehend the role of DNA in ensuring the continuity of life from generation to generation

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 2. For each question, select a single group member’s response and discuss. Use this as an opportunity to clarify understandings of content.
2. Each group member should share several children’s ideas identified from the reading for this discussion. Make a list of the questions formed about the content and cite the evidence you are using to support your answers.

Activity Two—Reproduction (15 minutes)

1. One of the characteristics of life presented in Session 1 is that all living things have a lifespan—including a living beginning, growth, development, reproduction, and death. Working with a partner, discuss the following questions. Record your answers.
 - What is reproduction?
 - What function does it serve?
 - What are the requirements for successful reproduction?
 - How are asexual and sexual reproduction different in this regard?
2. With your partner, discuss your understandings of DNA. What is DNA? What does DNA have to do with reproduction? Make a diagram showing how you think DNA is involved in animal reproduction.

Activity Three—Animal Life Cycles (25 minutes)

1. As a whole group, distinguish between “life span” and “life cycle.” Which applies to an individual? To a population of individuals? Where does reproduction fit in?
2. Rejoin your partner. To prepare for today’s session, you were asked to choose two animals from the group’s animal collection from Session 2, and one additional animal that interests you. You were to assume that your animals are adults, and you were to answer the question, “What was it before?” for each animal until you couldn’t “go back” any further. Share your work with your partner. At what point(s) did this question become challenging?
3. It can be useful to study life cycles by defining life stages that occur *within* a life cycle. With your partner, look at your examples again, and identify what you consider to be distinct stages in their life cycles. Then, look for a pattern in all of your animal examples. Are there any stages that seem common to each example? What are they? What sequence, if any, can you derive for an animal life cycle? Make a diagram that portrays your ideas about a general pattern for an animal life cycle.
4. Share your diagram with the whole group, providing brief details about your animal examples. Try to come to a group consensus about the most accurate animal life cycle pattern. You’ll revisit your choice once you have viewed the video.

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 during the life cycle of an animal?
2. What is the role of DNA in an animal life cycle?
3. The children in the Science Studio discuss the role that parents play in animal reproduction. Listen for their ideas about the role of the mother vs. the father. How do their ideas compare to yours?
4. In the featured classroom, Mary Bitterlich's third graders are learning about animal life cycles by studying the darkling beetle. According to her students, what are the life stages in the life cycle of this animal?

Going Further (60 minutes)

1. Spend a few minutes with your partner discussing the video. What sequence of life stages was described as a general pattern for an animal life cycle? Rejoin the whole group. How do the group's ideas before viewing the program compare to what was presented in the program? Try to reconcile any differences—can the group's original animal life cycle pattern be integrated somehow into the pattern presented? Create a revised animal life cycle diagram for the group. Participants may wish to make their own copies.
2. Work with your partner to check your understanding of the role of DNA in an animal life cycle.
 - What new understandings do you have, if any?
 - What, if anything, surprised you?
 - Where is DNA located at each stage?
 - How is it organized?
 - What role is it playing in the life cycle?

Compare your ideas with those in the diagram you drew earlier, and revise as needed.

Note: More information about DNA and its role during a life cycle can be found on our Web site (A Closer Look: Body Cell Reproduction, Sex Cell Production):

<http://www.learner.org/channel/courses/essential/life/session3/>

3. In the video, the following was stated: "For any type of living thing, if offspring are to resemble their parents, sexual reproduction must maintain the genome between generations—packaged as a characteristic number and assortment of chromosomes." As a whole group, discuss the meaning of this statement. How is this accomplished in an animal life cycle—actually, *any* life cycle involving sexual reproduction? Use the human animal, with a genome of 46 chromosomes, as your example. How does this resolve questions about the role of each parent in animal reproduction?

On-Site Activities, cont'd.

4. Rejoin your partner. According to Mary Bitterlich's students, what life stages are present in the life cycle of the darkling beetle? How do these stages align with those of the general animal life cycle pattern presented in the video? In your teaching, you may use different animals to introduce your students to animal life cycles.
 - What animals do you use?
 - What stages do you teach about?
 - How can the stages presented in the video be helpful in teaching the examples you use?
 - What might you add or leave out? Explain your reasoning.
5. Revisit the questions generated from the reading assignment and check for remaining content issues.

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. 1–4: Reproduction as a criterion for life; human reproduction; continuity of life; biology of reproduction in organisms)

This is the same reading as for Session 2. Review the material first and then look at the tables that follow. For each table, read "The Challenge for Pupils." Identify and be prepared to discuss ideas expressed by the authors that you think are most useful in teaching about life cycles.

Life Science Problem Set*

(Suggested answers are listed in the Appendix.)

1. "Offspring resemble their parents." This is a simple way of summarizing the outcome of reproduction in the living world. Yet this is profoundly significant. Life has evolved a way of ensuring that like begets like. Discuss why this is significant. Then, discuss what you think is most important in ensuring the continuity of life and the millions of life forms on Earth today.
2. Part of a life cycle involves growth and development—processes that involve reproduction at the level of cells. In animals (and other multicellular organisms) this is very different from reproduction at the level of populations. In each case, a distinct cell process is involved. Compare and contrast these two processes.
 - What is the role of each process in a life cycle?
 - Where does each process occur?
 - How many cell divisions are involved?
 - What happens to the chromosomes?

Between Sessions, cont'd.

- How many cells result?
- How many chromosomes are in each cell that results?
- What is the significance of this?

Visit our Web site to read about these cell processes (A Closer Look: Body Cell Reproduction, Sex Cell Production):

<http://www.learner.org/channel/courses/essential/life/session3/>

3. “Egg” is a word that has several meanings—both familiar and scientific. How do you define what an egg is? How are these different meanings for “egg” connected to an animal life cycle? How do the eggs of different groups of animals reflect adaptation to their environment?

Visit our Web site and read about eggs (A Closer Look: The Incredible Egg):

<http://www.learner.org/channel/courses/essential/life/session3/>

4. In the video, Dr. Sigal Klipstein describes the process of cloning—a process that has been described as “bypassing the normal life cycle.” What is a clone? How is cloning accomplished? Compare and contrast cloning to sexual reproduction. What parts of a “normal life cycle” are bypassed?

Visit our Web site to learn more about cloning (A Closer Look: Cloning):

<http://www.learner.org/channel/courses/essential/life/session3/>

Ongoing Concept Mapping*

Develop a concept map around the central concept of animal life cycles. Be sure to include the life stages involved and indicate their sequence. Also include DNA in your map. Provide details (i.e., specific examples) where you can. Try to make connections between this map and previous maps (i.e., to the characteristics of life in Session 1 and to the animal kingdom in Session 2).

Guided Journal Entry

During the video, our hosts, Dr. Zook and Dr. Grisham, introduced analogies as a way of trying to understand the process of reproduction in the living world. The first analogy they used was that of a photocopying machine. The second was “a computer that has software that can be transferred to another computer that can then run using this software.” Critique each analogy. What works for each and what doesn’t? What would an analogy have to encompass to make it better? Try to come up with such an analogy. From your efforts, what can you conclude about reproduction in the living world?

Guided Channel-TalkLife Posting

Animal life cycles—and, more generally, reproduction—can be understood at different levels (e.g., populations, organisms, cells, organic molecules). In the video, you were encouraged to explore this topic by considering the role of DNA—an organic molecule. DNA isn’t something with which K–6 students are likely to have had any direct experience (the Kiwi fruit extraction can help here). However, many children use DNA in their vocabulary, and some know it has something to do with heredity. How might an understanding of DNA be incorporated into a unit about animal life cycles in a meaningful way at the K–6 level? Is this possible? Why or why not? State your position on this along with any suggestions for other teachers in your Channel-TalkLife posting for this session.

Between Sessions, cont'd.

Textbook Reading Suggestions

- reproduction
- sexual reproduction
- gamete
- sperm
- zygote
- chromosome
- karyotype
- cell cycle
- meiosis
- differentiation
- direct development
- asexual reproduction
- animal reproduction
- egg
- fertilization
- embryo
- DNA replication
- genome
- mitosis
- development
- metamorphosis

Preparing for the Next Session*

For "Getting Ready"

In the next session, we will be exploring plant life cycles. Choose one flowering plant specimen from the group's collection. Consider your specimen to be an adult. Generate a sequence of life stages by asking and answering the question, "What will it become?" Make a diagram that you believe best represents the life cycle of your specimen and provide labels for each life stage that you include.

Materials Needed for Next Time

- Your specimen and diagram

Between Sessions, cont'd.

Ongoing Activities

Bottle Biology

At this point in your course, we hope that you have selected a Bottle Biology strand for exploration of course topics. 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.” This system starts with the seeds of a plant and the eggs of an insect and demonstrates both the individual life cycles as well as how the life cycles of each intertwine. Visit the Web site for more information and to track the progress of our own *Life Science* systems by checking out our Bottle Biology Spotlights for this session.

Bottle Biology Spotlights: Session 3

System	Activity
<i>Brassica</i> and Butterfly System	The <i>Brassica</i> Life Cycle
<i>Brassica</i> and Butterfly System	The Salad Bar

Graduate Credit Activities

Continue your work on the annotated bibliography and action research project.

Notes
