Unit Essential Question

How do the environment and genetics affect who we are and how we are similar or different?

Introduction

In nature, plants and animals have evolved to ensure successful reproduction in a variety of ways—for example, attracting a mate, having fit offspring, and protecting the offspring so that they have a chance to grow and reproduce. Animals attract mates with bright colors, fancy dances, and special songs. Male animals battle to show the female they are the biggest, strongest, and most fit to be the mate of choice. Animals surround their young to protect them from predators and make complex nests to keep their offspring warm and safe from environmental elements. Plants have bright flowers to attract pollinators. Plants have different size stamens, pistils, and petals to encourage pollination by wind, water, birds, bats, and bees. Plants protect their young in the seed and have evolved many types of seed structures that disperse seeds to environments where there is enough sun, water, and minerals for plants to survive. In this activity, students will watch video clips to help them understand the behaviors and structures in plants and animals that ensure successful reproduction. Students will use empirical data about guppy mating to engage in an argument about how guppy physical traits and behaviors may result in different mate choices when predators are absent or present.

Objectives

Students will be able to

Content

- Identify animal behaviors and plant structures that are associated with reproduction.

Science and Engineering Practices

- Construct an argument identifying the correct explanation for how an animal behavior results in successful reproduction.

Equity and Groupwork

- Summarize key points in video clips.
- Debate competing ideas with peers.

Language

- Listen to other's ideas.
- Construct an argument based on evidence.

Academic Vocabulary

- attract
- life cycle
- mate
- mating
- offspring
- ovaries
- plant structure
- pollen
- pollination
- predator
- seed dispersal
- successful reproduction

Language of Instruction

- displaying
- guppy
- prefer

Timing

This task can be completed in 4–5 class periods (based on 45-minute periods).

- Part I • Explore How Animal Behavior Helps Animals Successfully Reproduce (1 class period)
- Part II • Explore How Specialized Plant Structures Help Plants Successfully Reproduce (2 class periods)
  (This part can be condensed into 1 day if short on time by choosing parts of each video clip to show instead of showing the whole videos.)
- Part III • Analyzing Guppy Mating Data (1 class period)
- Part IV • Connect to the Culminating Project and Assessment (1 class period)

Student Materials

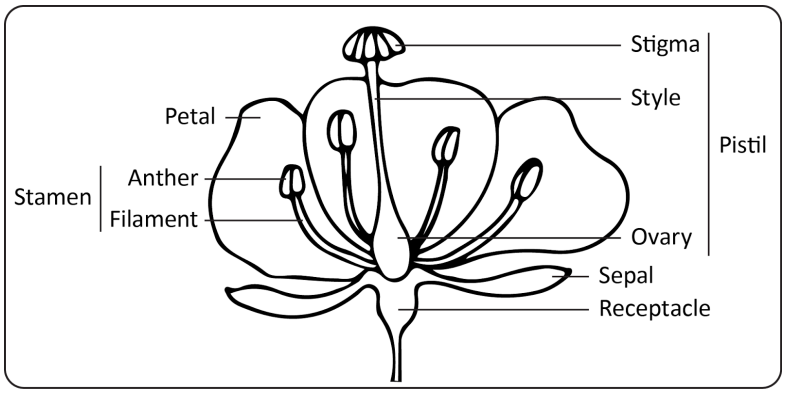
per group

- Computer to play videos
- Video clips (These videos were selected because they specifically show how different animal behaviors and plant structures help animals and plants reproduce, which is the focus of this task's performance expectation.)
  - Pronghorn bucks battle for dominance: https://youtu.be/qJ9s6WF68LQ
  - Peacock mating dance display: https://youtu.be/jTBHiZtnCsA
  - Matriarch Elephants Protect Baby Elephant from Crocodile Attack: https://youtu.be/BGY0BHmjEtg
  - Amazing Animal Babies: Emperor Penguin Chicks: https://youtu.be/lf26jtJfL30
  - Flower Reproduction: https://youtu.be/YqM6rgB_l_o
  - Pollination Rock: https://youtu.be/V5yya4elRLw
  - Seed Dispersal: https://youtu.be/j1hRxuy1ezQ
  - Biggest flower in the world: https://youtu.be/FHaWu2rcP94
  - Butterfly pollination: https://youtu.be/gLJIcKpzH5E
  - Pine pollen blown by the wind: https://youtu.be/V_9palHvAIc
  - Guppy mating dance!: https://youtu.be/1tKOIc0qReQ
- Red and green markers

Background Knowledge

Animals and animal behaviors are typically interesting and familiar to most students. On the other hand, the structure and function of plant parts and the reproductive cycle of plants are not as familiar to most students. This task thus introduces students to plant structures and how a plant reproduces in order to provide the basic information they need in order to analyze specialized plant structures that encourage successful reproduction. The main focus of the task is not for students to learn the scientific terms of all of the plant structures, but rather to understand the relationship between plant structures themselves (pollen, egg, and seed) for pollination and fertilization, and between plants and animals for pollination.

The diagram and chart below describe plant reproduction processes and define parts and functions. Although the terms are mentioned in the video clips, students are not expected to memorize them. Instead, the terms should be used in class to refer to the different parts of a flower (the reproductive part of a plant) so that students can start learning plant academic language.



Plant Reproduction Processes and Structures	How the Process/Structure Relates to Plant Reproduction
Pollination	The transfer of pollen usually from one flower to another
Fertilization	The meeting of the sperm (part of the pollen) and the egg (in the ovary)
Stamen	The male structure of the flower; made up of the anther and the filament
Anther (part of the stamen)	The part of the male structure (stamen) where the pollen is made
Filament (part of the stamen)	The part of the male structure (stamen) below the anther that keeps the anther raised up so that pollen on the anther can be dispersed (swept away by the wind, picked up by bees, etc.)
Pistil	The female structure of the flower; made up of the stigma, style, and ovary
Stigma (part of the pistil)	The part of the female structure (pistil) that pollen from the wind, bees, etc. sticks to (stigma = sticky)
Style (part of the pistil)	The part of the female structure (pistil) that holds up the stigma so that pollen can find the sticky stigma
Ovary (part of the pistil)	The part of the female structure (pistil) that holds and protects the eggs
Petal	Flower part that attract insects, birds, and bats

In the third part of the task, students analyze the mating patterns of guppies. There have been many studies about guppy courtships and mating preferences. Female guppies choose the male mate; scientists have found that environmental factors (biotic and abiotic) contribute factors to the female's choice. Male guppies are typically smaller and brighter in color than females. The males use their bright colors and courtship dances to entice females of the same species. However, the bright colors can also attract predators, thereby increasing the male's risk of predation. In multiple studies, evidence suggests that females are aware of the risk of predators and change their mating decisions with different levels of risk. Evidence also shows that guppies with more orange spots are more physically fit than other guppies.

Introduction

1. Read the introduction from the Student Edition aloud as a class. The purpose of this introduction is to connect students' learning from the previous task to the upcoming task.
2. Have students answer the prior knowledge question on their own and then share with a partner in a think-pair-share format.
   - The purpose of this question is to elicit students' prior knowledge of reproductive behaviors and traits.
   - If students are stuck, you can encourage them to think about animals they have seen at the zoo, or even human beings themselves. Note: If discussing human traits for attracting mates, make sure the discussion is culturally sensitive, and that it focuses on the fact that social norms for attractive features vary widely among cultures and across time periods and are heavily influenced by media.

   Possible responses include: a peacock's feathers, bird mating dances, kindness and attention in human courtship, shows of strength between some male animals, etc.

LANGUAGE SUPPORT: PAIRING SCAFFOLD

Pair ELLs with lower levels of proficiency with another student who shares the same home language, and invite them to discuss the question in their native language first and then share in English. Also, ensure expanding level ELLs are paired with students who have higher English proficiency.

Part I • Explore How Animal Behavior Helps Animals Successfully Reproduce

1. Place students in their project groups with a computer or tablet. Designate student roles and review the norms.
2. Review the questions that students need to answer for each video.
   - Encourage students to take notes during each video to help them remember facts. Consider having students make a grid in their science notebook that they can use to take notes.

Pronghorn bucks video notes: 1. 2.	Peacocks video notes: 1. 2.
Elephants video notes: 1. 2.	Penguins video notes: 1. 2.

   - Encourage students to discuss each question before they write answers into their science notebook.
   - Remind students that they may revise their answers as the discussion progresses.
3. Have students watch each video, discuss the questions, and then write their answers in their science notebook.

4. Hold a class discussion about the videos. The focus of the discussion should be on how animal behavior attracts a mate or helps offspring survive. The chart below gives a few ideas for discussion.

Video	Animal Behavior That Attracts a Mate or Helps the Babies Survive
Pronghorn Bucks	Male fighting: The male that wins the battle becomes the main male for the herd of females. He is considered the strongest by the females. Females will mate with this stronger buck so that their offspring might also be strong, enabling them to survive and pass on their genes.
Peacocks	Male beauty: The male presents his beautiful feathers to encourage the female to mate with him. Females often consider the males with the most brightly-colored feathers as being the most fit (healthy), and thus prefer the colorful males for their healthy genes that they can pass on to their offspring.
Elephants	Herd protection: The elephants surround their babies to protect them from predators. Since elephants only have one baby every four to five years, it is important that they protect their young in order to perpetuate their species.
Penguins	Parental protection: The male penguins keep their babies warm in the extreme cold. The babies grow fast, have dense feathers, and huddle in groups to survive to breed again.

Part II • Explore How Specialized Plant Structures Help Plants Successfully Reproduce

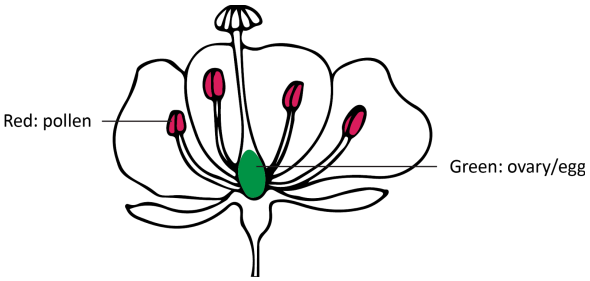
A. Introduction to Plant Reproduction

1. Place students in their project groups with a computer or tablet. Designate student roles and review the norms.
2. Review the questions that students need to answer for each video.
   - Encourage students to take notes during each video to help them remember facts. Consider having students make a grid in their science notebook that they can use to take notes.

Flower reproduction video notes: 1. 2.	Pollination rock video notes: 1. 2.

   - Encourage students to discuss each question before they write answers in their science notebook.
   - Remind students that they may revise their answers as the discussion progresses.
3. Have students watch each video, discuss the questions, and then write their answers in their science notebook.
4. Hold a class discussion about the videos. The focus of the discussion should be on the structures and processes in plants that help the plants reproduce. Students don't have to know all the parts of a flower. What students should understand is:
   - The flower is the reproductive part of the plant.
   - The pollen is the male reproductive part of the plant, analogous to the sperm.
   - The ovary/egg is the female part of the plant.
   - The pollen has to get to the egg (from one flower to another flower).
   - The pollen and the egg make a seed, which will grow to be a new plant (successful reproduction).

The chart below gives a few ideas for discussion.

Video or Question	Structures and Processes in Plants That Help Them Reproduce (Reminder: Naming all the specific plant parts is not the focus.)
Flower Reproduction	• Pollination: Movement of pollen to the pistil (female structure in a flower) • Pollen: Male reproductive part of a flower; made in the stamen • Pistil: Female structure in a flower • Nectar: Sweet part in a flower that attracts pollinators • Pollinators: Bees, birds, wind, water • Fertilization: Pollen meets with the egg • Seed: Develops after pollen and egg meet
Pollination Rock	• Pollination: Must occur to get another plant; bees accidently pick up pollen and bring it to other flowers • Pollinators: Insects, water, wind, dogs, birds, man • Nectar: Sweet part of a plant used to make honey • Pistil: Female structure in a flower • Seed: Fertilized egg
Questions 1 and 2	
Question 3	• Without pollination we would never have new plants. • Pollination is when the pollen from one flower moves to the flower (pistil) of another plant. • Pollination helps a plant get the pollen and egg together to produce a seed. A new plant will then grow from the seed.

B. Successful Reproduction

1. Review the questions that students need to answer for the four video clips.
   - Encourage students to take notes during each video to help them remember facts. Consider having students make a grid in their science notebook that they can use to take notes.

Seed dispersal video notes: 1. 2.	Biggest flower video notes: 1. 2.
Butterfly video notes: 1. 2.	Wind video notes: 1. 2.

   - Encourage students to discuss each question before they write answers into their science notebook.
   - Remind students that they may revise their answers as the discussion progresses.
2. Have students watch each video, discuss the questions, and then write their answers in their science notebook.
3. Hold a class discussion about the videos. The focus of the discussion should be on plant structures and/or animal behaviors around a plant that help the plant successfully reproduce.

Video	Plant Structures and/or Animal Behaviors around a Plant That Help the Plant Successfully Reproduce
Seed Dispersal	Seeds have many shapes and structures that help move them to different places to germinate.
Biggest Flower	Since this plant only flowers once every 1,000 days, it **must** be pollinated; therefore, this flower has an extremely large, smelly pistil that attracts flies and insects, who bring pollen to the flower.
Butterflies	Butterflies are attracted to brightly-colored flowers; they move pollen from one flower to another.
Wind	Wind blows the pollen out of a tree.

Part III • Analyze Guppy Mating Data

1. Place students in their project groups with a computer or tablet. Designate student roles and review the norms.
2. Review the task. Students will
   - Watch a video about guppies.
   - Analyze data about traits female guppies choose in male guppies when predators are present and when predators are absent.
   - Read competing arguments from two scientists that explain guppy mating.
   - Choose the best argument and explain their choice using a claim, evidence, and reasoning format.
3. Have students watch the video about guppies. (The video clip is 3 minutes long, but students will get a sense of the interactions after about 1 minute. Students can continue to watch or stop watching any time after a minute.)
4. Have students read the information in steps 2 and 3 of the Student Edition about:
   - Data about traits female guppies choose in male guppies when predators are present and when predators are absent
   - Two competing arguments that explain guppy mating

LANGUAGE SUPPORT STRATEGIES

Support students by having them read the situation/problem three times, each time with a particular focus:

1. Students read the situation with the goal of comprehending the text.
2. Students read the situation with the goal of analyzing the language used.
3. Students read the situation in order to brainstorm which argument is best.

5. Have students use the scientific ideas from Part I and Part II as well as the guppy mating data provided to choose the better of the two arguments. They should revise that argument and add evidence in order to write their own scientific argument to explain **why female guppies prefer certain male traits when predators are absent or when they are present**.
   - As with the discussion questions from Parts I and II, this activity emphasizes the crosscutting concept of cause and effect.
   - Remind students to use the claim, evidence, reasoning format when writing their argument. A sample response is shown below. As with previous tasks, it may be helpful to provide sentence stems based on the sample answers provided.

Claim *Female guppies prefer certain male traits that will help their offspring survive and reproduce, but their choice can depend on whether a predator is around.*
Evidence *Regardless of whether predators were present or not present, females chose orange-spotted males 32–33% of the time. When predators were not present, colorful males were chosen more often (55%); when predators were present, drab males were chosen more often (44%).*
Reasoning *Orange-spotted males are physically fit and will pass the most fit genes on to their offspring regardless of whether predators are present. Passing on the likelihood to reproduce is beneficial when predators are not present, but if predators are present, survival is more important to the female. Females clearly prefer certain traits based on the likelihood that it will help offspring survival and reproduction.*

6. Have each group share their argument using one of these options:
   - Each group presents their argument to the class.
   - Two groups get together and each one presents their argument to the other group. This option could lead to counterarguments.

7. At the end of the task, ask students to reflect on what they have learned over the course of the task by answering the following question from the Student Edition: At the beginning of this task, you were asked whether you could think of any traits (physical or behavioral) of plants and animals you have seen that may help them attract a mate. Look back at your response. Is there anything you can add to your answer based on what you have learned through this task? What types of examples had you never thought about before this task?

   There is no right answer. Encourage students to look back at the prior knowledge question from the start of the task. They should not change their initial answer, but rather use this reflection to modify their original idea and add evidence they have collected over the course of this task.

Part IV • Connect to the Culminating Project and Assessment

1. Have students independently complete the task 2 section of the Individual Project Organizer in class.
2. Collect the Individual Project Organizers and assess using these criteria:
   - The "Engaging in Arguments from Evidence" row of the Science and Engineering Practices Rubric
   - A criterion of your choice
3. Return the Individual Project Organizers. Give students time to make revisions based on one of these two options.
   - Have students make changes to their Individual Project Organizer according to your comments. (This could be done for homework, depending upon students' needs and/or class scheduling.)
   - Ask students to exchange their Individual Project Organizer with a partner, and give partners 5 minutes to provide written feedback. Then allow students time to make changes to their work according to the feedback.