Pollination

Grade 2
Life Science

This work was collaboratively developed through the Early Elementary Science Partnership by the program partners at the Big Shoulders Fund, the Chicago Academy of Sciences / Peggy Notebaert Nature Museum, the Field Museum, and Northwestern University.

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Unit Overview

Unit Description

In this unit, students will interact with various models in order to explore plant and animal structure-function related to the process of pollination. Students will dissect a flower and act as an animal pollinator in order to analyze the flower structures involved in the process of pollination. Taking what they learned about flower structure-function, students will then observe animal structure-function to determine how certain animals pollinate plants and what those animals obtain in the process. Students will understand the importance of a pollinator's role in the survival of both plants and animals. In the unit assessment, students will bring together concepts learned throughout the unit in order to propose a design for an artificial pollinator that mimics the structure-function of the plant's natural pollinator.

Driving Phenomena

Animals (including humans!) need plants because animals get all of their food, in one way or another, from plants. At the same time, plants need animals because certain animals (like bees, butterflies, hummingbirds, and beetles) pollinate plants as they search for food. Pollination is the process in which plants grow new plants. Without pollination, plants wouldn't be able to grow new plants and animals wouldn't have food. This is a delicate balance, and it is important to recognize and protect the co-dependent relationship between plants and animals.

Prerequisite Knowledge

Prior to teaching the unit, it's important for students to have a baseline understanding of the following key concepts:

- Plants need water, sunlight, oxygen, and nutrients
- Animals need water, food, oxygen, and shelter
- Animals depend on plants for food

NGSS Performance Expectation

This unit builds toward the performance expectation:

The Performance Expectations (NGSS)

2-LS2-2 Develop a simple model that mimics the function of an animal in dispersing seeds or pollinating plants.*

** The performance expectations marked with an asterisk integrate traditional science content with engineering through a Practice or Disciplinary Core Idea.*

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NGSS Unit Alignment

The performance expectation **2-LS2-2** was developed using the following elements from the NRC Document A Framework for K-12 Science Education:

Science and Engineering Practices	Disciplinary Core Ideas	Crosscutting Concepts
Developing and Using Models Modeling in K–2 builds on prior experiences and progresses to include using and developing models (i.e., diagram, drawing, physical replica, diorama, dramatization, or storyboard) that represent concrete events or design solutions. • Develop a simple model based on evidence to represent a proposed object or tool.	**LS2.A: Interdependent Relationships in Ecosystems** • Plants depend on animals for pollination or to move their seeds around. **ETS1.B: Developing Possible Solutions** • Designs can be conveyed through sketches, drawings, or physical models. These representations are useful in communicating ideas for a problem's solutions to other people. *(secondary)*	**Structure and Function** • The shape and stability of structures of natural and designed objects are related to their function(s).

Connections to the three dimensions in this unit:

SEP: Developing and Using Models

In various contexts, students will evaluate models according to the parts of a model as defined by NGSS (components, relationships, and real-world connections). Students will use evidence collected throughout the unit about plant and animal structure-function to develop a model of a pollinator that mimics how an animal pollinates a certain plant naturally.

DCI: LS2.A: Interdependent Relationships in Ecosystems
ETS1.B: Developing Possible Solutions

Throughout the unit, students will examine the relationship between plants and animals, specifically that a plant's pollination needs are met by certain animals. Students will explore the structure-function of plants and animal pollinators to build towards an understanding of how animals assist plants in the process of pollination as they search for food. Students will develop an understanding of this relationship through various methods including a flower dissection, pollination role-play, and developing a model of an animal pollinator.

Students will propose a design of an artificial pollinator for a specific plant. The pollinator will mimic structure-function of the plant's natural pollinator. Students will communicate how their design is a possible solution for pollinating a plant in the absence of its natural pollinator.

CCC: Structure and Function

Students will be able to explain the relationship between plant and animal structure-function, specifically how plants attract certain animals and how the animals in turn pollinate the plants. Students will observe, record, and analyze plant and animal structure-function through multiple means including a completing a flower dissection, viewing videos, and reading text about common animal pollinators.

NGSS Unit Alignment (cont.)

Additional NGSS elements present in this unit:

SEP: **Analyzing and Interpreting Data**
Obtaining, Evaluating, and Communicating Information

Students will analyze information they obtain from multiple sources about plants and various animal pollinators in order to describe the specific structures and functions of the animals that assist them in the process of pollination.

Students will read (or watch a read-aloud video of) the book "What If There Were No More Bees?" in order to obtain information about the important role bees play in making the foods we commonly eat. Students will also be introduced to the real-world problem we face, in that pollinators like bees are disappearing, which is negatively impacting our food sources.

CCC: **Cause and Effect**

Through discussion of their favorite foods, students will explore how the foods they enjoy can be impacted by the disappearance of animal pollinators like bees. Students will recognize the pattern that foods that come from plants and foods that rely on plants to live (like cows and chickens) would not exist without the help of animal pollinators.

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Investigation 1: Where does our food come from?
Lesson 1.1: Favorite Foods

Lesson Description

30 minutes

In this lesson, students will create a food map and trace back the plant origins of foods they eat to begin to understand the presence and importance of plants in everyday foods.

Objective

Students will be able to describe the connected relationship between plants and their favorite foods.

Guiding Questions

What is the connection between our favorite foods and plants?

Materials

Per class

- Board/Smart Board/Chart paper

Per student

- Post It Note or Smart Board
- Pencil

Materials Preparation

- Board/Chart Paper

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Investigation 1: Where does our food come from?
Lesson 1.1: Favorite Foods

Engage — 5 minutes

1. Have students gather as a whole group and tell students they will begin today by discussing their favorite foods.
2. Tell students to share their favorite food. Students can either do this by first discussing with a partner and then contributing to a class list composed on the board or chart paper, or they may think individually and write down their favorite food on a sticky note and post it to the board.
3. Give students a few minutes to complete this task.

Investigate — 20 minutes

1. Have students review all the foods. Ask them to consider what would happen if we didn't have plants to provide us with food. What foods would we have to take off the list?
2. Call to the board any student that put down any food that is a fruit or vegetable or comes directly from a plant. Have them cross out their food or pull down their sticky note. Then after all direct plant-based foods have been removed continue to move through tiers of plant-related food as listed below.
    a. Grains/Corn
    b. Meat
    c. Dairy
    d. Sugar and Chocolate-Based

Teacher Tip: Guide students in a discussion of foods that fall into each tier and ask students to think critically about where those foods come from. For example, if students list foods like pizza, baked goods, or sandwiches those foods are plant-related because they are made with wheat, which is a grain. Refer to ***Teacher Resource 1.1.A*** *for additional information about common foods and how they are connected to plants.*

3. Continue to have students remove their favorite foods until there are no plant-related foods left. Look at what foods are left and double check that the foods remaining have no connection to plants. Ideally all foods should be removed from the board.

Reflect and Share

5 minutes

1. Ask students to share what they noticed through this activity. Discuss with students the idea that all foods have a connection to plants, whether they come from animals that eat plants or they're made from a plant themselves. Even things like flour (wheat) and chocolate (cacao) come from plants.
2. Ask students to discuss with a partner how we get all these plants for food. Where do the plants come from? Listen for students to mention seeds or farming.
3. Explain to students that in the next lesson they are going to look more closely at plants to find out how plants make more plants so that there is more food for animals and us.

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Teacher Resource 1.1.A
Plant-Based Foods

The idea behind this activity is for students to recognize that virtually all of the foods they enjoy are either directly from plants or are connected to plants via other means. In order to help students grasp this idea, below are some examples of the connection between plants and common foods.

Plant-Based

These foods come directly from a plant or a tree:

- Fruits
- Vegetables
- Nuts

Sugar Cane-Based

These foods have sugar as an ingredient (which comes from the sugarcane plant):

- Candy
- Baked goods (i.e. cookies, cake, rolls)

Chocolate-Based

These foods have chocolate as an ingredient (which comes from cocoa beans from the cacao tree):

- Brownies
- Chocolate bars

Grains/Corn-Based

These foods have plants such as grain, wheat, or corn as an ingredient:

- Baked goods (i.e. cookies, cake, rolls)
- Pizza crust
- Bread
- Cereal
- Crackers
- Chips (i.e. Cheetos, pretzels, potato chips)

Animal Byproducts

These foods come from animals (which eat plants in order to survive):

- Bacon
- Eggs
- Cheese
- Pepperoni
- Ice cream
- Gelatin products (i.e. Jell-o, gummy bears, marshmallows)
- Hotdogs
- Chicken nuggets
- Yogurt
- Hamburgers

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Investigation 1: Where does our food come from?
Lesson 1.2: Plant Parts

Lesson Description

30 minutes

In this lesson, students will dissect a flower in order to examine and identify the essential plant parts. Students will create a scientific drawing of the flower at different points during the dissection to document specific structures. Students will use their scientific drawings to identify plant structures that allow plants to reproduce.

Objective

Students will be able to create and use scientific drawings to describe the parts of a flower that are involved in the process of pollination.

Guiding Questions

How do plants make more plants?

Materials

Per class

- Teacher Resource 1.2.A
- Teacher Resource 1.2.B
- Teacher Resource 1.2.C

Per student

- Pencil
- Copy of Student Resource 1.2.A
- Flower - 1 per student
  (Recommended: Lily, Daisy – Half the class will receive 1 type flower, half the class the other type)
- Plastic Knife and/or Tweezers

Materials Preparation

- Collect materials for flower dissection (flower, plastic knife and/or tweezers) for each student
- Copy Student Resource 1.2.A for each student
- Prepare to project or copy Teacher Resource 1.2.A and 1.2.B

New Vocabulary

Pollen – sticky, yellow-orange powder made by plants
Pollination – transfer of pollen from plant to plant in order to create new plants

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Investigation 1: Where does our food come from?
Lesson 1.2: Plant Parts

Engage — 5 minutes

1. Ask students to recall what they learned about the connection between plants and their favorite foods. Remind students they started to think about how we seem to have enough food, but where does that food come from? How do plants make new plants?
2. Elicit student responses. Guide students to the idea that plants have seeds and seeds are important because they make new plants.
3. Project or hold up **Teacher Resource 1.2.A**. Ask students to identify the different parts of the plant (stem, leaves, flower petals). If students do not identify these parts, point out each part.
4. Tell students that today they will take a closer look at the parts of flowering plants, and even look inside the flower, to get a better understanding of how plants make seeds.

Investigate — 20 minutes

1. Split class into two groups.
2. Distribute one type of flower to each group or group member. Hand out **Student Resource 1.2.A** to each student. Tell students to take one minute to look closely at the flower and make observations about the flower's size, shape, smell, color, etc.
3. Have students make a scientific drawing (see **Teacher Resource 1.2.C** for directions on how to facilitate scientific drawing) of the outside of the flower under Step 1 of **Student Resource 1.2.A** and label the flower parts and any details they observed.
4. Pass out plastic knives and/or tweezers to students. Instruct students to gently cut the flower open and take it apart to get a better view of its interior structures. Tell students to create another scientific drawing under Step 2 of **Student Resource 1.2.A** of the smaller parts inside the flower.
5. Pair students with a partner who had a different type of flower then they did. Have students compare their scientific drawing with their partner and discuss similarities and differences between the two flowers.

Reflect and Share

5 minutes

1. Ask students if they saw a sticky, yellow-orange substance inside the flower. Ask if anyone knows what the substance is called. Listen for students to recognize that it's pollen.
2. Have students share what they know about pollen. Explain that pollen is very important in creating new plants because it is what helps a flower make a seed, and seeds are what grow into new plants.
3. Project or hold up **Teacher Resource 1.2.B**. Ask students to identify the flower parts they recognize. Use the resource to talk through how pollen and the different flower parts create new seeds through a process called pollination.
4. Explain that in order for pollination to happen, the pollen needs to move from one flower to another flower. Ask students to turn and talk to a partner about how pollen can get to another flower if plants can't walk around. Listen for students to say wind, animals, or humans.
5. Tell students that they will explore one way that pollen moves from plant to plant next time.

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Teacher Resource 1.2.A
Example Flower

Photo Credit: Cillas, Wikimedia Commons, 2009

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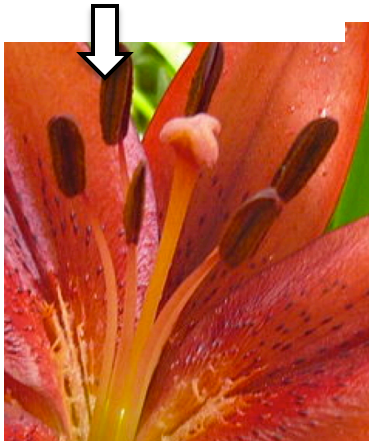
Teacher Resource 1.2.B
Scientific Drawing

STEP #1

Flower makes pollen here!

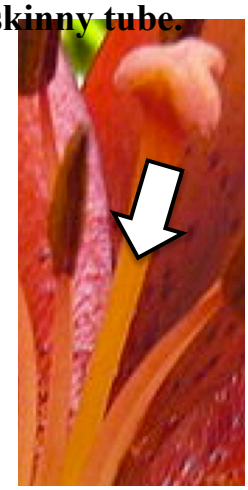


STEP #2

Pollen moves to another flower's sticky pad called the stigma.

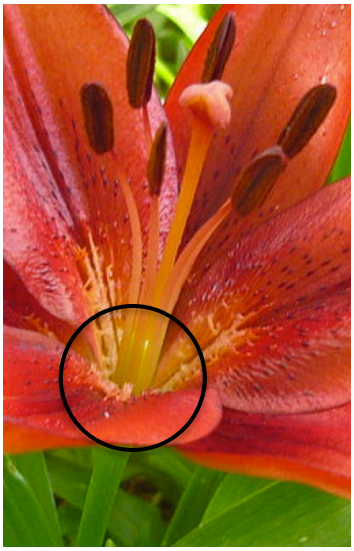
STEP #3

Pollen travels down a skinny tube.



STEP #4

Pollen falls to the bottom of the tube, where it lands on a tiny egg.



STEP #5

The egg grows into a new seed, which (when planted) becomes a new plant!

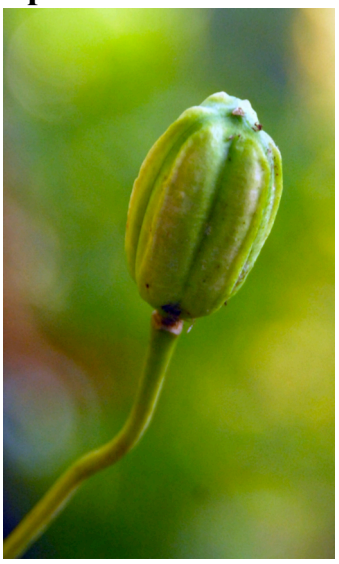


Photo Credits: Cillas, Wikimedia Commons, 2009
M. Baskin, ncwildflower.org

Teacher Resource 1.2.C
Scientific Drawing

What is Scientific Drawing?

Scientific drawing is a research-based instructional strategy that allows students to concretely show what they are thinking through drawing. This strategy is useful in supporting students in making detailed observations and it serves as an opportunity for teachers to assess student understanding.

How to Facilitate Scientific Drawing

1. Explain to students that scientists often draw what they observe as a way to capture details about the object or specimen they are studying. Scientists refer back to these drawings in order to remember important information like the color, size, shape, and where/when it was found.
2. Tell students they will create a scientific drawing so they can practice making close observations and have a record of their observations to refer back to in the future.
3. Have students closely observe the object for a minute or two.
4. After observing, tell students to draw the object. Encourage students to be as detailed in their drawing as possible. If appropriate, have students include labels with additional information (i.e. color, shape, other descriptive words) on their drawing.
5. If time permits have students, either in pairs or with the whole group, share their drawings and discuss what other observations they made as they drew.

How to Facilitate Scientific Drawing

It is important to emphasize that scientific drawing is not about artistic ability or how well a student can draw. Rather, scientific drawing is an important scientific skill that allows for students to "think with a pencil" as they make observations and critically think about the object in front of them.

Encourage students to think of scientific drawing as being:

- Accurate and detailed
- Labeled
- Colorful
- Evidence being collected to explain a phenomena

This is an instructional strategy that needs to be practiced so that students feel comfortable drawing through a scientific lens as opposed to an artistic one.

Students are not limited to drawing one object or specimen, but if they are going to draw something that is larger or has multiple objects (i.e. a museum diorama or an outdoor garden), it is important that students focus on one particular area or aspect that they feel will provide them with the most relevant evidence for the investigation at hand.

Student Resource 1.2.A **Drawing a Flower**

Name: _____ **Date: _____**

Step 1:

1. Make a drawing of the flower.

2. Circle the parts of the flower you see.

Petal Leaf Stem

3. Write down the other parts you see.

_____

_____

_____

4. Label these parts on your drawing.

Step 2:

5. Make a drawing of the <u>inside</u> of the flower.

6. Circle the parts of the flower you see.

Petal Leaf Stem

7. Write down the other parts you see.

_____

_____

_____

8. Label these parts on your drawing.

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Investigation 2: How does pollination work?
Lesson 2.1: Pollination Lab

Lesson Description

30 minutes

In this lesson, students will complete a hands-on representation of pollination using Cheetos (or glitter) to represent pollen.

Objective

Students will be able to describe the process of pollination through the experience of modeling the role of an animal pollinator.

Guiding Questions

How does the process of pollination work?

Materials

Per class

- Teacher Resource 1.2.B
- Teacher Resource 2.1.A
- Teacher Resource 2.1.B
- Cheese Puffs or Glitter
- Wrapped Candy (3 per student)
- 1-2 Large Bowls (depending on number of students)
- 5-6 Brown Paper Bags
- Small Cups (1 per student)

Materials Preparation

- Prepare to project or show Teacher Resource 1.2.B
- Gather materials
- Make copies of Teacher Resource 2.1.B: Flower Pattern (one for each small cup and one for each paper bag)
- Use Teacher Resource 2.1.A to set up lab

New Vocabulary

Nectar – a sweet liquid that flowers make, which certain animals eat
Pollinator – something that spreads pollen from one plant to another

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Investigation 2: How does pollination work?
Lesson 2.1: Pollination Lab

Engage — 5 minutes

1. Ask students to recall plant parts and how those parts are part of the pollination process. Guide them through the process of pollination as outlined on **Teacher Resource 1.2.B**.
2. Remind students of the importance of pollen in making more plants, and that pollen is moved from one flower to another in the process called pollination. Ask students to consider how pollen is able to move?
3. Tell students that they will answer this question by pretending to be hummingbirds who visit different flowers in a garden. Ask students to think about why hummingbirds would fly from flower to flower?
4. Listen for students to recognize that hummingbirds do this because they are looking for food. Explain that hummingbirds look for a sweet, sticky liquid called nectar and that nectar is found inside flowers.
5. Explain that, as hummingbirds, the students will search for their own nectar (candy) and in doing so they might learn a little bit about how hummingbirds help move pollen.

Investigate — 20 minutes

1. Allow students to engage in the Pollinator Lab (Use **Teacher Resource 2.1.A** for set up and facilitation directions).

Reflect and Share — 5 minutes

1. Bring students back together. Ask students to recap what it felt like to act like a hummingbird.
2. Ask students to share if they were able to find their nectar (candy). Then ask if students noticed what happened when they moved from flower to flower searching for nectar. Listen for students to recognize that they moved cheese puff dust or glitter around.
3. Ask student to consider what the cheese puff dust or glitter represents - pollen! Have students discuss how this experience is like the process of pollination and think about what role they, as hummingbirds, played in moving pollen.
4. Explain that hummingbirds are called pollinators because they support the process of pollination by moving pollen from one flower to another as they search for nectar.
5. After discussing, ask students if they think hummingbirds are the only animals that are pollinators. What other animals could be pollinators? Explain that they will explore this question next time.

Teacher Resource 2.1.A
Pollination Lab

Set-Up

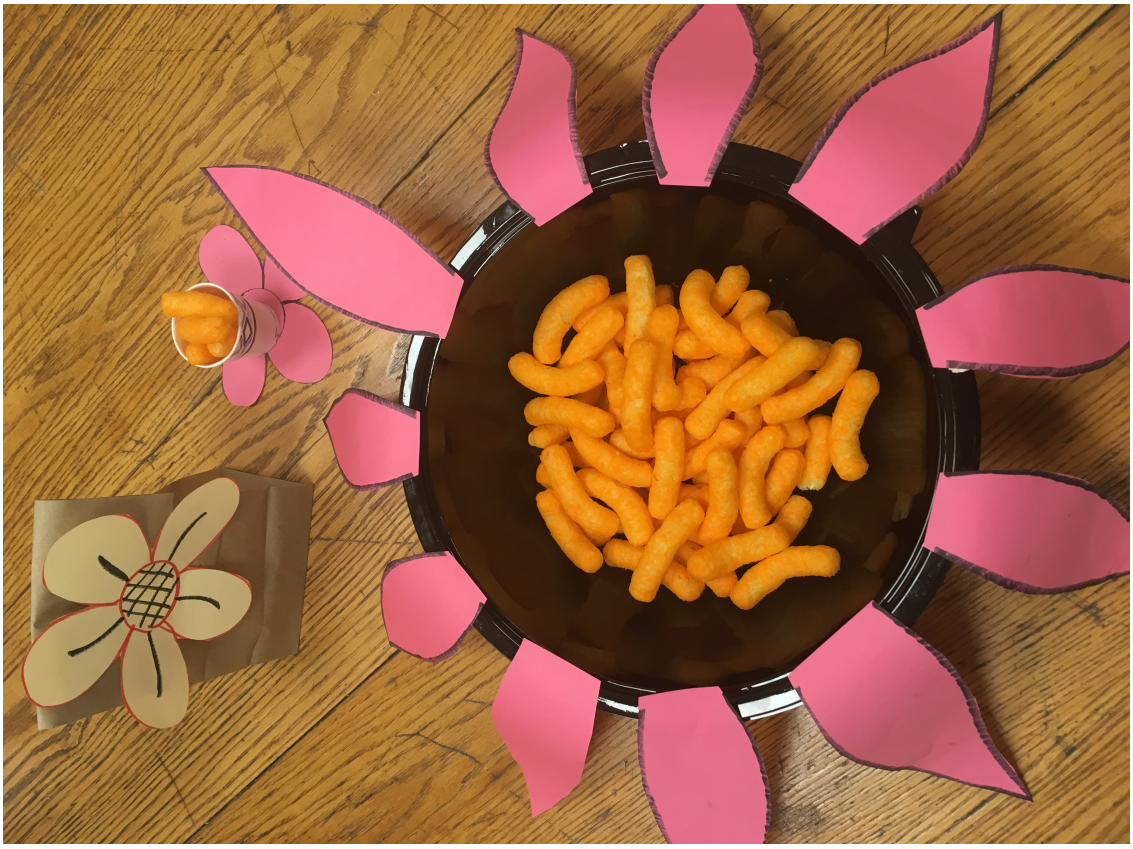
1. Prepare materials: cheese puffs/glitter, wrapped candy, 1-2 large bowls, small cups, brown paper bags, copies of **Teacher Resource 2.1.B**.
2. Place wrapped candies at the bottom of the bowls, small cups, and brown paper bags. Cover candies with cheese puffs.
3. Cut out copies of flower patterns (**Teacher Resource 2.1.B**).
4. Fold down part of the brown paper bags and tape one of the flower cutouts to the front of the bag (so that students will have to touch the flower in order to access the candy inside the bag).
5. Tape one flower cutout to the bottom of each small cup. Tape the flower petal patterns to the edges of the large bowl. (See Example 1 for an example of each "flower")
6. Arrange large bowls, small cups, and brown paper bags throughout the classroom so that students must "fly" from one area of the "garden" to another to access the flowers.

Directions

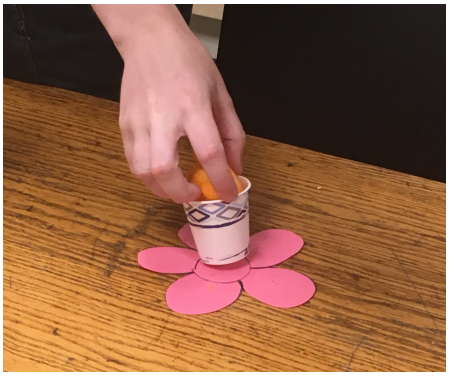
1. Remind students that they are hummingbirds searching for nectar, which is a sweet and sticky liquid that is made inside of a flower. Explain that hummingbirds depend on nectar to live, so getting enough nectar is extremely important for hummingbirds!
2. Tell students that as hummingbirds they will fly around the room visiting three kinds of flowers to find nectar (candy). The flowers are different sizes and shapes: small flowers (small cups), medium flowers (brown paper bags), and large flowers (bowls).
3. Explain that as hummingbirds they will have to search inside the flowers to find their nectar, and they might discover that the flowers have pollen (cheese puff dust).
4. Tell students that they shouldn't wipe the pollen off, but they should leave it on their hand as they travel to the next flower searching for nectar.
5. Let students know that they will have an opportunity to eat the nectar at a later time, but for right now they should collect the candies and carry them to the next flower.
6. When students are ready, have them stand up and put one hand behind their backs. Tell them that the other hand will be the one they use to search for nectar. Encourage students to fly around the room visiting the flowers (See Example 2).
7. Walk around assisting as needed, and remind students again to use the same hand to reach into the flower for the nectar and to not wipe/wash hands.
8. When students have collected their nectar (three pieces of candy) they can wipe/wash their hands and head back to their seats.

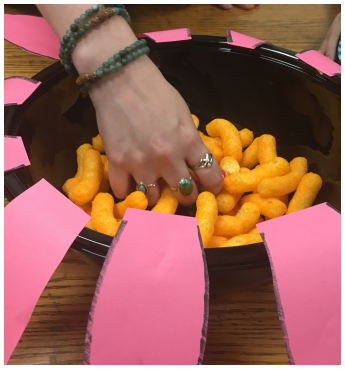
Teacher Resource 2.1.A
Pollination Lab

Example 1

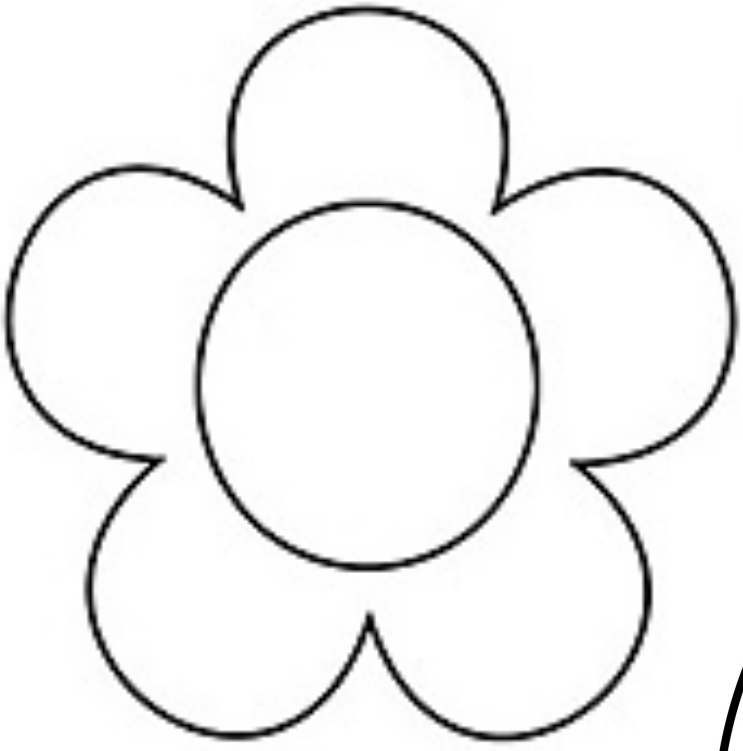


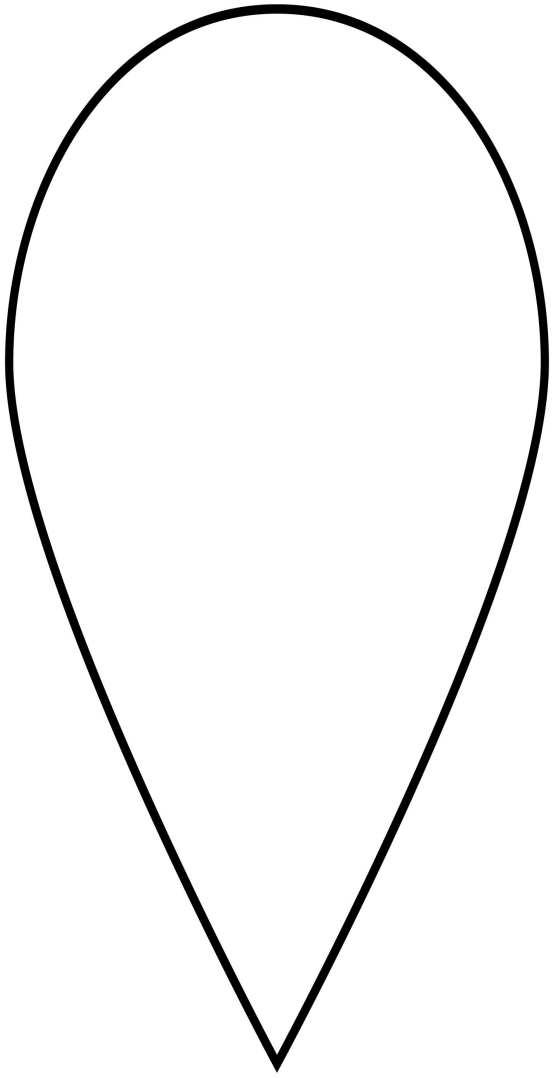
Example 2





Teacher Resource 2.1.B
Flower Cutouts





Animal Survival **Life Science** **Grade 2**

Investigation 2: How does pollination work?
Lesson 2.2: Animal Pollinators

Lesson Description

30 minutes

By interacting with various kinds of media (video, text, photos), students will study the structures of different animal pollinators. Students will identify which structures are involved in plant pollination, and they will draw a model to explain how the animal structures work, or function, in order to collect and move pollen from one flower to another.

Objective

Students will observe basic animal structures that facilitate pollination from watching videos, reading texts, and examining photos of common animal pollinators.

Guiding Questions

How does an animal pollinate a plant?

Materials

Per Student
- Student Resource 2.2.A
- Pencils

Per Pair
- Blank Paper

Per Class
- Teacher Resource 2.2.A: Video Links
- Teacher Resource 2.2.B
- Teacher Resource 2.2.C

Materials Preparation

- Print Student Resource 2.2.A
- Prepare to project or print a color copy of Teacher Resource 2.2.A
- Prepare to show video clips

New Vocabulary

Structure – parts of a plant, animal, or object

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Investigation 2: How does pollination work?
Lesson 2.2: Animal Pollinators

Engage — 7 minutes

1. Ask students to recall the Pollinator Lab and what it was like being hummingbirds. Have students discuss what they were trying get from the flowers (candy i.e. nectar) and what they moved from flower to flower (cheese puff dust i.e. pollen).
2. Ask whether or not the students actively meant to move the pollen, or if it happened by accident as they collected nectar? Have students think about whether or not hummingbirds mean to move the pollen, or if it also happen by accident as they are searching for food?
3. Guide students to the idea that hummingbirds don't collect and move pollen on purpose, but rather it happens naturally as they search for and drink nectar. Ask students to think about what parts of the hummingbird makes it a good pollinator?
4. Explain that, in searching for nectar from a flower, hummingbirds collect pollen on their feathery foreheads. When they visit a different flower to get more nectar, they rub pollen from the first flower onto this new flower, helping to pollinate!
5. Ask students if they think hummingbirds are the only animals that visit flowers for food. Elicit responses, and tell students that they will explore other animals that drink nectar in order to investigate what the animals get from flowers and how those animals help move pollen.
6. If there is time, show students the trailer from the Disney Nature movie "

}" Ask students to start thinking about what animals they

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Investigation 2: How does pollination work?
Lesson 2.2: Animal Pollinators

Investigate — 20 minutes

Students will explore different animal pollinators by watching videos, reading text, and creating detailed scientific drawings. Hand out **Student Resource 2.2.A** to each student. You can set up four stations and have groups rotate, facilitate as one large class, or have groups study one animal in-depth and share their findings with the rest of the class.
For each animal, students should engage in the process below:

1. Watch a video of the animal as it pollinates. (See **Teacher Resource 2.2.A** for possible videos)
2. Look at the different photos of the animal (**Student Resource 2.2.B**) and read about how it pollinates.
3. Create a scientific drawing of the animal and label the parts (or structures) that are involved in eating food from the flower and moving pollen from one flower to another.
4. Answer the following questions:
    a. What food does the animal get from the plant? How does the animal get the food?
    b. How does the animal collect pollen in the process of getting food?
    c. How does the animal move pollen to another plant?

Reflect and Share — 3-5 minutes

1. Bring students back together and if time allows encourage a few students to share their scientific drawings.
2. Guide students in a discussion of each animal and its structures involved in getting food from flowers, as well as the structures involved in pollination. Use **Teacher Resource 2.2.C** as a guide for this discussion.
3. Have students discuss with a neighbor what they think would happen if these pollinators disappeared. What would happen to plants? What would happen to our food?
4. Tell students that they will learn more about the problem of disappearing pollinators next time.

Pollination **Life Science** **Grade 2**

Teacher Resource 2.2.A
Safeshare.tv video links

Title or Description	Link
Disney Nature: Wings of Life Trailer	{ HYPERLINK "https://safeshare.tv/x/_VRvhFLRCk0" }
Bees Pollinating a Pumpkin	{ HYPERLINK "https://safeshare.tv/x/WBXVeFzHwCM" }
Butterfly Pollinating Pink Flowers	{ HYPERLINK "https://safeshare.tv/x/BDR09-gE28Y" }
What's the Buzz on Pollinators: Hummingbird Facts	{ HYPERLINK "https://safeshare.tv/x/h2IP2-KYkRU" }
Pollination of the Giant Amazon Water Lily	{ HYPERLINK "https://safeshare.tv/x/ss5b6c7a7a34170" }

Student Resource 2.2.A **Examining a Pollinator**

Name: _____ Date: _____

Animal:_____

Make a scientific drawing of the animal.

How does the animal collect pollen from the flower?

How does the animal move pollen to another flower?

What does the animal get from the flower?

Student Resource 2.2.B **Animal Pollinator Info**

Name: _____ **Date:** _____

BEE

Photo Credit: J. Wilkins, Wikimedia Commons, 2013

Photo Credit: M. Palmer, Wikimedia Commons, 2014

Photo Credit: L. Docker, Wikimedia Commons, 2011

Important Information

- Bees eat nectar and pollen.
- Bees have hair on their body, legs, and feet. Pollen sticks to the hair.
- Bees have a lot of hair on their legs called a "pollen basket."
- Bees carry pollen in the pollen basket back to their home.

Student Resource 2.2.B	Animal Pollinator Info

Name: _____ **Date:** _____

HUMMINGBIRD

Photo Credit: Pslawinski, Wikimedia Commons, 2013

Photo Credit: Charlesjsharp, Wikimedia Commons, 2010

Important Information

- Hummingbirds eat nectar.
- Hummingbirds have a long beak and a long tongue.
- Hummingbirds use their tongue to eat nectar.
- Pollen sticks to hummingbirds when they eat.

Student Resource 2.2.B **Animal Pollinator Info**

Name: _____ **Date:** _____

BUTTERFLY

Photo Credit: R. Bartz, Wikimedia Commons, 2008

Important Information

- Butterflies eat nectar.
- Butterflies use their tongue to eat.
- Butterflies stand on top of flowers when they eat.
- Pollen sticks to their feet.

Photo Credit: T. Wills, Wikimedia Commons, 2009

Student Resource 2.2.B **Animal Pollinator Info**

Name: _____ **Date:** _____

BEETLE

Photo Credit: B. Martin, Wikimedia Commons, 2003

Photo Credit: Pollinator, Wikimedia Commons, 2015

Photo Credit: B. Moisset, Wikimedia Commons, 2005

Important Information

- Beetles eat pollen and flowers.
- Beetles use their mouths and sharp jaws to eat.
- Beetles poop inside the flower and roll around in it. This makes them sticky.
- When beetles roll around, pollen sticks to them.

Pollination **Life Science Grade 2**

Teacher Resource 2.2.B
Discussion Guide

You can use the following information to assist in facilitating a conversation with your students about the structure and function of different animal pollinators. Do not feel obligated to read this to your students or make sure they have articulated every piece of information, but rather this can be used to check for general student understanding of the major components of how these animals pollinate plants.

Bee

How does the animal collect pollen?
When a bee is inside a flower the tiny, fuzzy hairs on its body, legs, and feet collect pollen. The bee pushes some of the pollen down towards the pollen basket on its leg, which is a collection of thick hairs designed to trap lots of pollen. Some pollen remains on its body, legs, and feet.

How does the animal move pollen to another plant?
When a bee arrives at a new flower, it steps inside, and some of the pollen on its body, legs, and feet brushes off into the new flower.

What does the animal get from the plant?
The bee eats nectar from the flower. It also collects pollen from the flower and stores it in the pollen basket on its leg. The bee flies back to the hive and shares the pollen in the pollen basket for the rest of the bees to eat.

Hummingbird

How does the animal collect pollen?
When a hummingbird is feeding from a flower, it has to push its head deep inside in order to get to the nectar. In doing so, the hummingbird's feathery forehead pushes up into the flower. The flower's pollen gets caught in the bird's forehead.

How does the animal move pollen to another plant?
When a hummingbird arrives at a new flower, it again pushes its head inside towards the nectar. The pollen collected from the first flower gets rubbed off the bird's head and onto the new flower.

What does the animal get from the plant?
The hummingbird eats nectar from the flower.

Pollination **Life Science** **Grade 2**

Teacher Resource 2.2.B
Discussion Guide

Butterfly

How does the animal collect pollen?
When a butterfly lands on a large flower or cluster of flowers, it walks around the flower(s) searching for food with its tongue. As it walks, pollen collects on the butterfly's feet and legs.

How does the animal move pollen to another plant?
When a butterfly lands on a new flower or cluster of flowers, it steps inside and the pollen from the first flower gets rubbed off into the new flower.

What does the animal get from the plant?
The butterfly eats nectar from the flower.

Beetle

How does the animal collect pollen?
Beetles eat their way inside a flower, where they defecate and then roll around in it. This causes their bodies to become sticky. When they roll around, they also pick up the flower's pollen and their body becomes covered with pollen.

How does the animal move pollen to another plant?
When a beetle eats its way into a new flower, it again defecates and rolls around. The rolling action transfers pollen from the first flower to the new flower.

What does the animal get from the plant?
The beetle eats just about everything the flower offers, including the nectar, pollen, petals, and other plant parts.

Pollination **Life Science** **Grade 2**

Investigation 2: How does pollination work?
Lesson 2.3: Disappearing Pollinators

Lesson Description

30 minutes

Students will be able to obtain information about the problem of disappearing pollinators and will communicate the possible effects of this problem on plants and animals (including humans).

Objective

Students will be able to obtain information about the problem of disappearing pollinators, and will communicate the possible effects of this problem on plants and animals (including humans).

Guiding Question

What is happening to animal pollinators?

Materials

Per class

- "What if There Were No Bees? A Book About the Grassland Ecosystems" by Suzanne Slade
- Smart board/ projector*
- Speakers*

**Dependent on if using hard copy or video*

Materials Preparation

- Order/Purchase book "What if There Were No Bees? A Book About the Grassland Ecosystems" by Suzanne Slade, or follow link in *Materials* for a read aloud video of the story

Pollination — Life Science — Grade 2

Investigation 2: How does pollination work?
Lesson 2.3: Disappearing Pollinators

Engage — 5 minutes

1. Review with students the pollination process and how certain animals can play a key role in the process. Discuss not only how a plant is pollinated, but also why pollination is important.
2. Ask students to consider what would happen if there were no more pollinators.
3. Explain to students that they are going to learn about a very big problem in the world today – our pollinators are disappearing. Ask students to turn and talk to a neighbor and discuss reasons they think that the pollinators may be disappearing. Elicit student responses.
4. Explain to students that today they are going to look into why pollinators are disappearing and why that may be a big problem for humans.

Investigate — 20 minutes

1. Read aloud the book "What if there were No Bees? A Book About the Grassland Ecosystems" by Suzanne Slade, or follow the link to display.

Reflect and Share — 10 minutes

1. Ask students to think back to the first day of this unit and remember their favorite meals, then ask students to use all they have learned and think about why we won't be able to have these meals in the future. Listen for students to connect our lack of food with the loss of pollinators.
2. Explain to students that without plants, pollinators can't eat, and this means pollinators cannot survive. Without pollinators to pollinate the plants, we will have no new plants. Without new plants, we, as humans, would run out of food, and that is a big problem.
3. Have students turn and talk to a partner about one reason they learned about that is causing the pollinators to disappear. Listen for things such as pesticides or other ideas discussed in the text.
4. Tell students that, now that they have learned about this giant problem, in the next lesson they will think about how to help the pollinators so plants and animals (including humans) can all survive.

Pollinators **Life Science** **Grade 2**

Investigation 3: Where can we do to help pollination?
Lesson 3.1: Design a Model Pollinator

Lesson Description

60 minutes (may be broken up over two class periods)

Students will develop a model as a solution to a real world problem: pollinators in the world are being threatened by disease because of excessive pesticide usage and loss of land due to development, and as a result local plants are no longer being pollinated. Before developing their model, students will first explore different examples of models in order to understand how models can help explain a concept and present a possible solution. Then students will work in small teams to develop a model that could be used to pollinate a plant in the absence of its natural pollinators. The model will mimic the structure and function of the animal that pollinates the plant.

Objective

Students will analyze different models, and then determine how to develop a model of an artificial pollinator that mimics the structure and function of an animal pollinator.

Guiding Questions

If pollinators disappeared, how could we pollinate a plant?

Materials

Per Class

- Teacher Resource: 3.1.A

Per Group

- Student Resource 3.1.A
- Completed Student Resource 2.2.A
- Student Resource 3.1.B for a specific pollinator
- Student Resource 3.1.C for a specific flower
- Writing Utensils
- Teacher Resource 3.1.B

Materials Preparation

- Copy Student Resource 3.1.A for each group
- Prepare to project (or print) Teacher Resource 3.1.A
- Copy Completed Student Resource 2.1.A for each group
- Copy Student Resource 3.1.B for each group
- Copy Student Resource 3.1.C and cut out the flower cards
- Copy Teacher Resource 3.1.B for each group

New Vocabulary

Function – how parts, or structures, work together for a purpose
Model – a representation of an object or system; used to explore and explain the world

Pollination **Life Science** **Grade 2**

Investigation 3: What if pollinators disappeared?
Lesson 3.1: Exploring Models

Engage — 3 minutes

1. Ask students to recall what they have learned recently about animals, plants, and pollination.
2. Ask students to think back to the Animal Pollinator Lab and discuss what they think would happen if there were no pollinators. Elicit student responses.
3. Remind students that they started thinking about how, without plants, pollinators can't eat, and this means pollinators cannot survive. Without pollinators to pollinate the plants, we will have no new plants. Without new plants, we, as humans, would run out of food.
4. Remind students that they learned about this real-world problem in the last lesson when they read the book "What if There Were No Bees?" Ask students to recall some of the ways people, like scientists and farmers, are working to save animal pollinators like the bees. Elicit student responses.

Investigate — 15 minutes

1. Tell students that while people are figuring out ways to save the animal pollinators, we still need to pollinate plants in the meantime! Other scientists are working on this problem by developing something called a model that is designed to move pollen from flower to flower.
2. Inform students that they will help out these scientists by designing their own model that looks and acts (or functions) like one of the animal pollinators they learned about in this unit.
3. Explain that before developing a model, they will observe different models to get an idea of the types of models scientists use to explain their thinking or solve problems.
4. Have students get into small groups. Pass out a copy of **Student Resource 3.1.A** to each group.
5. Give students 3-5 minutes to discuss the example models and answer the questions on the resources.
6. When time is up, bring students back together for a group discussion. If possible, project the images as students are discussing. Ask students to share their answers to the questions on the resources:
    a. What is this model showing?
    b. What does this model help us understand?
    c. What does this model NOT help us understand?
7. Encourage students to identify what parts, or structures, of the model are based off of something found in the real world (e.g. the lines on the blueprint are based-off of walls, the metal grip is based-off an elephant's trunk).
8. Discuss with students how a model is a representation of something found in the real world, and it's used to explore and explain answers to questions like: What will the house look like? How can an elephant's trunk inspire a robot arm?

Reflect and Share — 2 minutes

1. Tell students to think back to the Pollinator Lab, and ask them to think about how *they* were models as they explored and explained the process of pollination (i.e. they acted like hummingbirds and they used their hands and other materials to represent how a hummingbird collects and moves pollen.)
2. Let students know that, now that they have an understanding of models, they will work in teams to develop a model of an animal pollinator that could be used to pollinate a plant.

–Optional Lesson Break–

Engage — 5 minutes

1. Remind students that their challenge is to develop a model of an animal pollinator that acts like, and has similar parts as, a real-world pollinator.
2. To gives students an example of what their model could look like, project or hold up **Teacher Resource 3.1.A**. Explain that bats are pollinators too; they drink nectar from flowers that open up at night like banana tree flowers, and when they stick their head into the flower, it gets covered in pollen, which the bat then brings to a new plant as it searches for more nectar.
3. Have students observe the model pictured on **Teacher Resource 3.1.A** and discuss what this model explains or shows and how the model is like the animal pollinator it represents.

Investigate — 25 minutes

1. Place students into small groups. Hand out completed **Student Resource 2.2.A** to each student. Explain that they may use their notes to help them in developing their model.
2. Either have the groups select the animal pollinator they would like to develop a model of, or assign each group to an animal pollinator.
3. Once the groups know their assignment, hand out **Student Resource 3.1.B** and the appropriate flower card from **Student Resource 3.1.C**.
4. Instruct students to work together to answer the questions and develop their model. Walk around, assisting as needed.

Reflect and Share

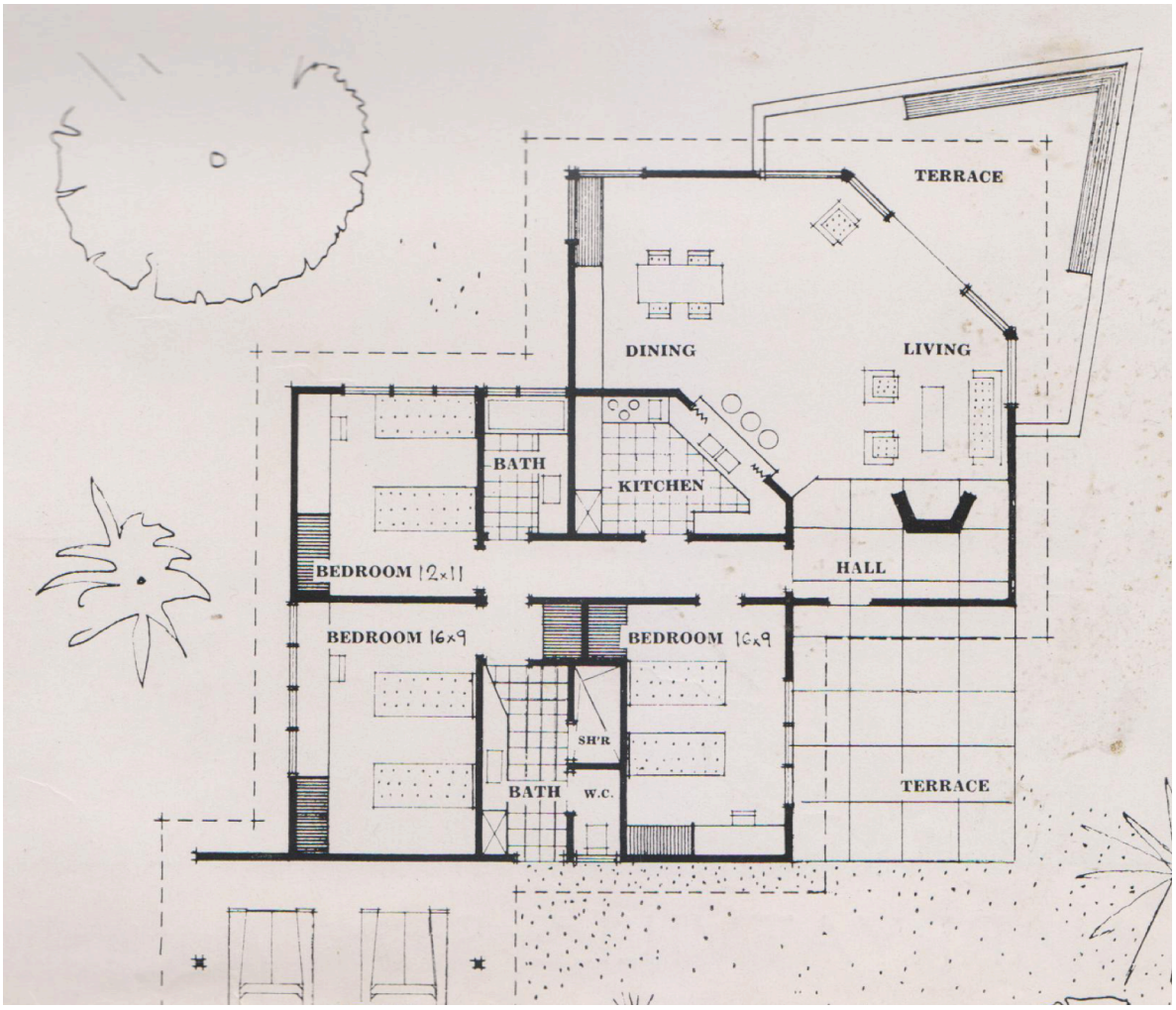
10 minutes

1. When groups are finished with their models, have them take turns presenting as they explain what animal parts they replicated in their model and how the model would move pollen from flower to flower.
2. Use the rubric (**Teacher Resource 3.1.B**) to score each group's model and presentation.

Optional Teaching Tip: If students would like to construct their model, encourage them to make a list of materials they would need. Work with students and parents to gather materials and schedule additional class time for construction.

Student Resource 3.1.A	Animal Pollinator Info

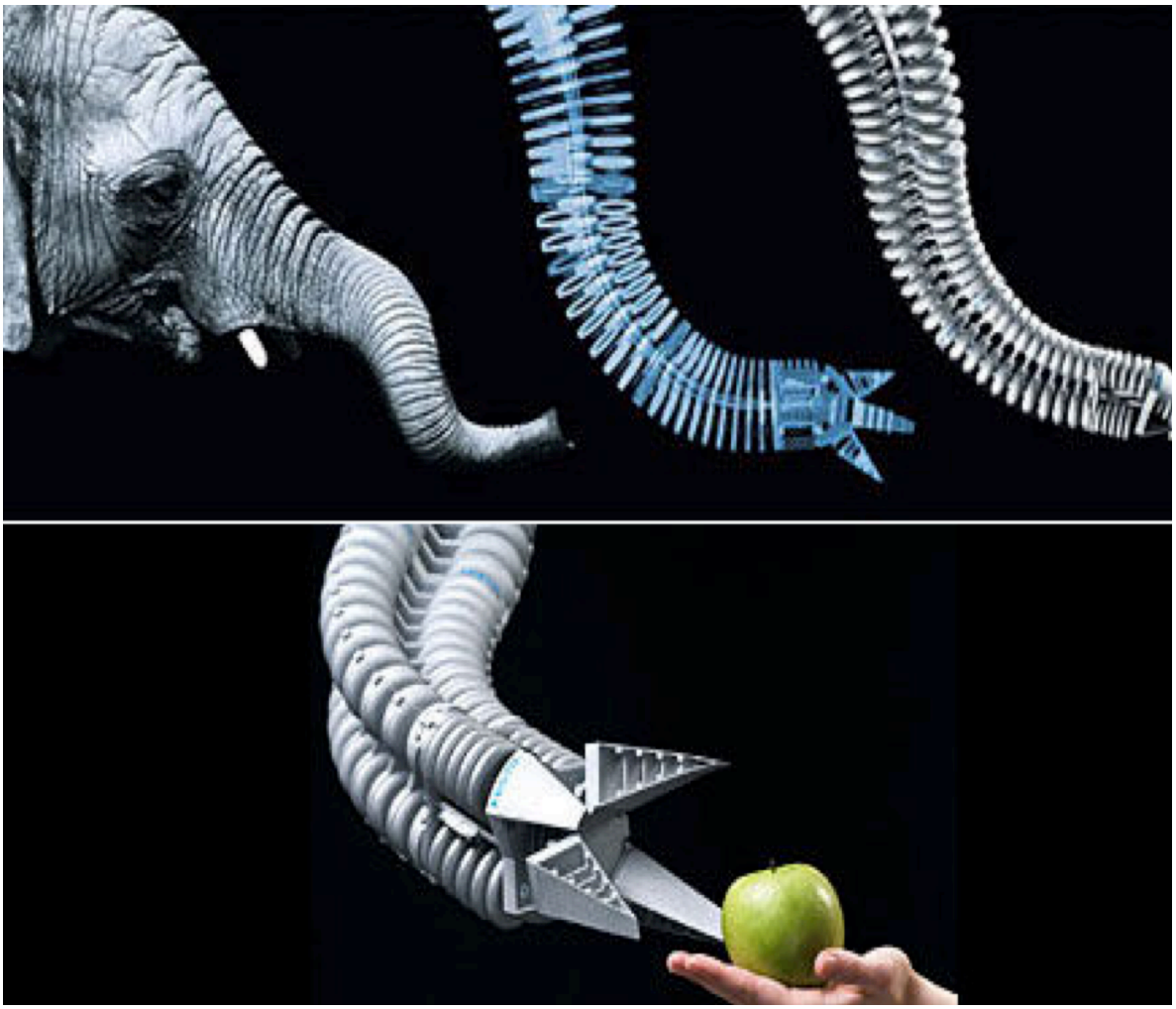
Name: _____ **Date:** _____



1. What is this model showing?
2. What does this model help us understand?
3. What does this model **NOT** help us understand?

Student Resource 3.1.A **Animal Pollinator Info**

Name: _____ **Date:** _____

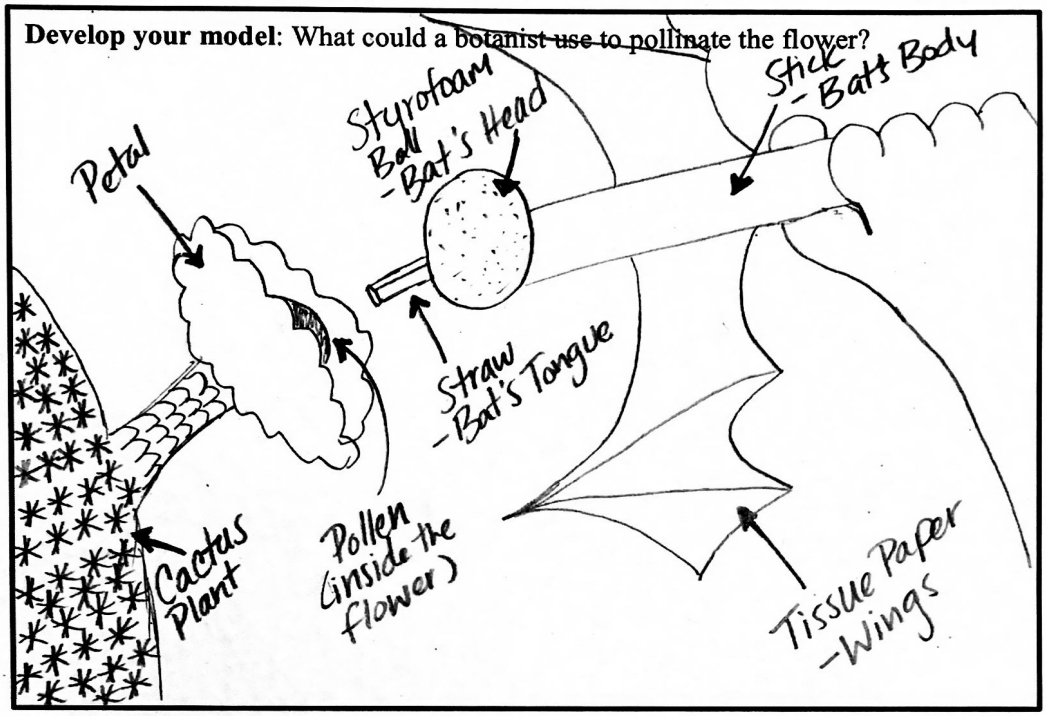


1. What is this model showing?
2. What does this model help us understand?
3. What does this model **NOT** help us understand?

Student Resource 3.1.A	Animal Pollinator Info

Name: _____ **Date:** _____

Develop your model: What could a botanist use to pollinate the flower?



Don't forget to include:

- *The parts of the flower (including pollen)*
- *The parts that look and act like the animal*
- *Labels to explain the parts of model*

4. How will your model work?

you hold the stick and point the styrofoam ball towards the flower. Place the straw inside the flower where the nectar is, and make sure the styrofoam touches the pollen..

5. How will your model act like the animal during pollination?

The styrofoam ball will collect pollen, just like the bat's head. When the model is moved to another flower it takes the pollen from the first flower to the second flower, just like a bat moving from flower to flower eating nectar.

Student Resource 3.1.B **Animal Pollinator Info**

Name: _____ **Date: _____**

You will have 20 minutes to create a model and prepare a short presentation.

Your model should:

- Explain how to pollinate the flower
- Include the parts of the flower (including pollen)
- Include parts that look and act like the animal
- Include a written statement explaining how your model will work

Your presentation should:

- Explain how your model works
- Explain how your model acts just like the animal when it pollinates the flower

To get started, answer the questions below:

1. What parts of the animal are used in pollination?

_____

_____

2. What parts of the flower are used in pollination?

_____

_____

3. How does the animal pollinate the flower?

_____

_____

_____

Develop your model: What could a botanist use to pollinate the flower?

Don't forget to include:

- *The parts of the flower (including pollen)*
- *The parts that look and act like the animal*
- *Labels to explain the parts of model*

4. How will your model work?

_____

_____

_____

5. How will your model act like the animal during pollination?

_____

_____

_____

Student Resource 3.1.C **Animal Pollinator Info**

Name: _____ **Date:** _____

FLOWER: Tickseed
ANIMAL: Butterfly

Structure & Characteristics
Color: Bright Yellow
Shape: Small Tubes filled with Nectar
Scent: Light, Fresh Smell
Pollen Amount: Some Pollen
Photo Credit: F. Mayfield, Wikimedia Commons, 2007

FLOWER: Spiderwort
ANIMAL: Bee

Structure & Characteristics
Color: Blue
Shape: Shallow, Flat Landing Area
Scent: Light, Sweet Smell
Pollen Amount: Some Sticky Pollen
Photo Credit: T. Alter, Wikimedia Commons, 2014

FLOWER: Trumpet Honeysuckle
ANIMAL: Hummingbird

Structure & Characteristics
Color: Red
Shape: Long Tubes filled with Nectar
Scent: Very Light Smell
Pollen Amount: Some Pollen
Photo Credit: S. Shebs, Wikimedia Commons, 2004

FLOWER: Nodding Wakerobin
ANIMAL: Beetle

Structure & Characteristics
Color: White
Shape: Bowl-Shaped
Scent: Strong Smell
Pollen Amount: Lots of Pollen
Photo Credit: S. Shebs, Wikimedia Commons, 2004

Teacher Resource 3.1.B
Student Presentation Rubric

After each group's presentation, ask the questions below. Then use the rubric on the following page to score **Student Resource 3.1.B** and their answers to the presentation questions.

Student Names: _____

Presentation Questions:

1. How does the animal pollinate the flower?

2. How does your model act like the animal?

3. What are the parts of your model?

4. What do the parts do to pollinate the flower?

Student Names: _____

Total Score: _____ / 10 points

Rubric Elements	**Scoring**	**Additional Information**	**Examples**
Components of the Model	Model includes: ☐ Relevant animal structures (1pt. each) ☐ Relevant plant structures (1pt. each) ☐ Pollen (1pt.) _____ **/ 6 points**	Relevant Animal Structures include: ☐ *Butterfly* feet, legs, tongue ☐ *Bee* body, feet, legs, ☐ *Beetle* body, feet, legs ☐ *Hummingbird* beak, head, feathers Relevant Plant Structures include: ☐ Flower petals ☐ Nectar tubes (if applicable)	In the "Develop Your Model" section of **Student Resource 3.1.B**, model includes labels that clearly identify the relevant animal and plant structures and pollen.
Relationships between Components	Students explain the relationship between: ☐ How the animal and plant structures interact to move pollen (1pt.) ☐ How the model mimics animal structures (1pt.) _____ **/ 2 points**	Students can explain the relationship between these structures on **Student Resource 3.1.B** and/or during their presentation.	"When the hummingbird puts it's head into the flower to eat nectar, pollen sticks to the feathers on the hummingbird's head (1pt.). Our model uses a cotton ball to act like the feathers, so it picks up the pollen just like the hummingbird (1pt)."
Connections	Students describe the connections between: ☐ The structure of their model (1pt.) and how their model functions to move pollen (1pt.) _____ **/ 2 points**	Students can describe the connections on **Student Resource 3.1.B** and/or during their presentation.	"Our model has a straw attached to a cotton ball, and it has a handle to move it easily (1pt.). The straw is placed into the flower to suck up nectar, and once the straw is inside the flower, the cotton ball is pressed up against the pollen. The pollen sticks to the cotton ball and can be moved to another flower by using the handle to carry the straw and cotton ball to another flower. (1pt.)."

Pollination	Life Science	Grade 2
Glossary		

Function- how parts or structures work together for a purpose

Model- a representation of an object or system; used to explore and explain the world

Nectar- a sweet liquid that flowers make, which certain animals eat

Pollen- sticky, yellow-orange powder made by plants

Pollination- transfer of pollen from plant to plant in order to create new plants

Pollinator - something that spreads pollen from one plant to another

Structure- parts of a plant, animal, or object

Pollination **Life Science** **Grade 2**

Connections to Museum Resources

Museum Resource Information

If you are interested in using museum resources in your classroom to support this unit, review the information below and consider bringing in museum objects and/or specimens based on the suggested recommendations.

***N. W. Harris Learning Collection* at the Field Museum:** From a skunk specimen to SUE's tooth to a ceremonial mask from Cameroon, the *N. W. Harris Learning Collection at The Field Museum* gives educators and parents a chance to take the Museum's collection to their classroom or home. Visit: harris.fieldmuseum.org

Teacher Leadership Center at the Peggy Notebaert Nature Museum: The Teacher Leadership Center's popular loan program includes the following materials which can be borrowed free of charge for two weeks at a time: Inquiry Kits from the Illinois Department of Natural Resources (IDNR) and the Nature Museum, EnviroScapes, and National Geographic Book Packs. Visit: naturemuseum.org

Suggested Recommendations

Lesson 2.2 Animal Pollinators
Item: *Beetles* exhibit case; *Bees and Their Allies* exhibit case; *Monarch Butterfly (Habitat Background)* exhibit case; and *Ruby-Throated Hummingbir*d exhibit case from the *N. W. Harris Learning Collection* at the Field Museum.
Use: Allow students to observe the pollinators inside the various exhibit cases as they engage in the Animal Pollinator lab activity.