

THINKING AND ACTING LIKE A SCIENTIST

TEACHER'S GUIDE

Plant Structures

How does the structure of a flower support the plant's reproduction?

GRADE 4

Life Science





Plant Structures

Grade Level/Content	4/Life Science
Lesson Summary	In this investigation students will examine flower structures and determine how these structures support reproduction.
Estimated Time	2, 45-minute class periods
Materials	variety of flowers, dissection probe (or sharp pencil), Observation Form , Investigation Plan , Flower Structures Diagram , journal
Secondary Resources	Flowers Are Calling by Rita Gray What Is Pollination? by Bobbie Kalman The Reason for a Flower by Ruth Heller Animal Pollination Plant Pollination Strategies Pollinator Traits Table
NGSS Connection	4-LS1-1 Construct an argument that plants and animals have internal and external structures that function to support survival, growth, behavior, and reproduction.
Learning Objectives	<ul style="list-style-type: none"> • Students examine and identify various structures of a flower. • Students describe how plants use pollination to support reproduction. • Students provide an explanation that describes how the structures of a flower support reproduction.
Cross-Curricular Project Connections	Bee Keeper, Where Have All the Flowers Gone?

How does the structure of a flower support the plant's reproduction?

Plants are all around us. Plants are a vital part of our biosphere and serve multiple purposes. They help regulate the water cycle through transpiration and provide a life-sustaining, oxygen-rich atmosphere through photosynthesis. Plants are also used for decoration, medicines, wood, food, and so much more.

According to the United States Department of Agriculture, one third of all our agricultural output depends on pollinators. Insects and other animals are essential in the reproduction of plants. Plants usually rely on animals or wind to pollinate. Animals are not intentionally pollinating the plant but rather using the plant as a food source and can “accidentally” transfer pollen to the stigma of another plant (cross-pollination) or within the same plant (self-pollination). In this investigation, students will examine the structures of a flower and determine how these structures support plant reproduction.

Investigation is based on the Van Andel Education Institute (VAEI) Instructional Model for Inquiry-Based Science.

In all investigations:



Students don't know the “answer” they are supposed to get.



Students play a driving role in determining the process for learning.



Teachers and students construct meaning together by journaling.



Students are working as hard as the teacher.

Part 1

INVESTIGATION SETUP

- Flowers* in a variety of colors (blue, red/orange, blue/purple, white, green/brown) and a variety of shapes (tube-like, funnel-like, bowl-shaped, round)
 - Possible flowers: lilies, alstroemerias, gladiolus, daisies, iris, tulips, daffodils, aster, thistle
- Dissection probe or sharp pencil
- [Flower Structures Diagram](#)
- [Observation Form](#)
- [Investigation Plan](#)
- Journal

* Consider calling your local florist or grocer to inquire if they are willing to donate any flowers.

Part 2

INVESTIGATION FACILITATION



Question

Introduce the investigation question.

How do the structures of a flower support the plant's reproduction?

RICH LANGUAGE

Students may not be familiar with the term *structures*. Discuss this as being the distinct parts of the plant. This is a word that can be added to your Word Wall next to examples of plant structures (stamen, sepal, stigma, etc.).



Personal Knowledge

Students communicate what they already know about flowers, parts of flowers, and pollination.

- Students capture what they already know in their journals.
- Have students share their prior knowledge to generate a class list.

COLLABORATION

Conduct a *Think, Draw, Pair, Share* to encourage student participation. Have students think about what they know about flowers, parts of flowers, and pollination. Then, have students capture their thinking as a drawing. Challenge them to include labels and descriptions. After a designated time, they share their drawings with a partner. Choose a few groups to share with the class.

Investigation Plan

Students examine and identify the various structures of a chosen flower.

- Have each student choose the flower they would like to investigate. Distribute the rest of the materials they will need.
- Discuss Part 1 of the [Investigation Plan](#) as a class.
- Have students draw and color their flower in Part 1 of the [Observation Form](#). Challenge them to use the [Flower Structures Diagram](#) to identify and label parts of their flower on their drawing.
- Ask students to follow the **Investigation Plan** carefully. You may choose to model how to locate and identify the parts of the flower by using a flower different from the students' flowers as an example.
- Have students collect both qualitative (descriptions) and quantitative (measurements) data. Decide as a class how many observations are appropriate.

CRITICAL THINKING

Identifying the structures of their unique flower may be challenging. Encourage students to persevere and provide them with other diagrams if necessary. Remind students that scientists have to think critically in order to answer questions and solve problems and seek out additional information when necessary.

STUDENT CHOICE

Let students decide what flower they would like to investigate and the types of qualitative and quantitative observations they will make. Offering students choices within set parameters lets them take a leadership role in their learning without losing focus of your learning objectives.

INVESTIGATION PLAN
PLANT STRUCTURES

Part 1: Flower Structures

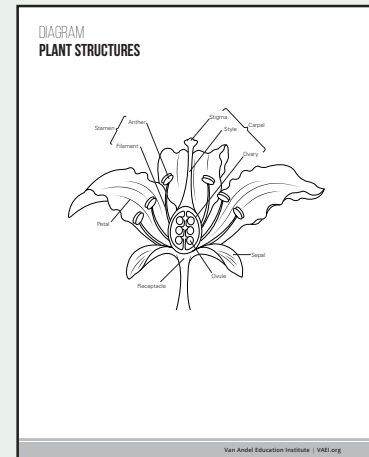
1. Examine your flower carefully. Make a drawing of the flower and color the parts accurately in Part 1 of the **Observation Form**. Use the **Flower Structures Diagram** to find all the parts of the flower and label them on your drawing.
2. Continue examining your flower. Identify the color, odor, shape, and if there is pollen present. Record additional qualitative observations (descriptions of your flower using your senses).
3. Record quantitative observations (measurements) such as, the number of petals, height of the flower, number of sepals, number of stamens, etc.
4. Carefully dissect your flower using a probe or a very sharp pencil.
5. Find and make a drawing (including labels) of the following parts:
 - Stigma, Style, Ovary (carpel)
 - Anther and Filament (stamen)
 - Sepal
 - Petal
6. Using the tip of the probe or a pencil, cut into the ovary. How many seeds do you see? Record your observations.

Part 2: Pollinators

1. Use the **Pollinator Traits Table** to determine a possible pollinator for your flower.
2. Clearly draw and describe the flower characteristics that lead to that possible pollinator.
3. Record your observations in Part 2 of the **Observation Form**.

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Investigation Plan



Flower Structures Diagram

Observation

Students record their findings.

- Have students document their flower observations in Part 1 of the **Observation Form**.
- They may choose to take pictures of their flower structures.
- Ask students to share their observations with two other classmates and highlight any similarities.

OBSERVATION FORM
PLANT STRUCTURES

NAME: _____
DATE: _____

Observations of My Flower: _____ name of flower _____

Part 1: My Flower's Structures

Drawing of My Flower:

Color	
Odor	
Shape	
Pollen (yes/no)	
Qualitative Observations	
Quantitative Observations	

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Observation Form



Secondary Knowledge

Students use secondary sources to understand pollination.

Use the following secondary sources (or your own) to help students understand how flowers reproduce through pollination.

Flowers Are Calling by Rita Gray

What Is Pollination? by Bobbie Kalman

The Reason for a Flower by Ruth Heller

Animal Pollination

Plant Pollination Strategies

Students will learn that pollination leads to the creation of new seeds that grow into new plants. For a plant to be pollinated, the pollen produced in the stamen (male part of the plant) must be moved to the stigma (the female part of the plant) and seeds are then made in the ovule. Plants usually rely on animals or wind to pollinate. Animals are not intentionally pollinating the plant but rather using the plant as a food source and can “accidentally” transfer pollen to the stigma of another plant (cross-pollination) or within the same plant (self-pollination).

COLLABORATION

Have students conduct a *Jigsaw* as they gather secondary information. Have students work in a group of 4. Each student chooses one of the articles or books to read and lists a minimum of 3 things they learned from their reading. Students share their lists within their group and the group provides a summary for the whole class.



Investigation Plan

Students examine the parts of their flower to determine the possible pollinator.

- Have each student complete Part 2 of the **Investigation Plan**.
- Challenge students to use the [Pollinator Traits Table](#) to determine their possible pollinator based on their flowers’ structure and characteristics.



Observation

Students record their findings.

- Have students document their findings on the **Observation Form**.
- Students may choose to take pictures or tape/glue their structures on their observation forms.



Data Analysis

Students make sense of their data by organizing it and representing it visually.

Have students analyze their data. They may wish to use the [Data Analysis](#) prompt as a guide.

- Have students **evaluate** their data for trustworthiness. Ask students: *Are you confident in your data? Is there any data you wonder about?*
- Then, have them analyze their data to find patterns and trends. They may **organize** the data to clearly show the structures that are involved in the plant's reproduction.
- Challenge students to **represent** their data by showing the interaction of the reproductive parts they identified and how a potential pollinator would help the process. A diagram or drawing may work very well to show this.
- Have students share their representations with the class. As a class, use this information to **interpret** what the identified patterns and trends mean.
- Ensure they have enough data that it can be used as evidence to support a class claim.



Explanation

Students write a claim and provide evidence and reasoning to support it.

- Have students use what they've discovered from their analyzed data to write an explanation that answers their investigation question. Students may wish to use the [Explanation](#) prompt as a guide. Have them write their explanation in their journal. Consider creating a class explanation as a Shared Writing Activity.
- Have students develop a **Claim** to answer the question: How do the structures of a flower support the plant's reproduction?
- Then, have them add **Evidence** (the analyzed data) to support their claim.
- Finally, have them add **Reasoning** to their claim. Reasoning should include the information obtained from this investigation as well as science principles they have learned.

Claim

We claim that the pollen from the stamen is transported to the stigma to make seeds.

Evidence

In our class data, we found that all of our flowers had 1 stigma and many stamen. Stamen were all at different heights. The flowers were colorful and smelled good.

Reasoning

Investigation: We followed the investigation plan carefully. We used reliable sources and shared our data.

Science: In our reading and class discussions, we learned that pollen is made in the stamen and must be moved to the stigma of a plant for seeds to be made in the ovule. Animals are important pollinators. When they are attracted to a flower by color, smell, and nectar, they can get pollen on them that can be transferred to the stigma of the same flower or the stigma of another flower. My daffodil was yellow, smelled sweet, and had six stamen to produce pollen. According to the pollinator chart, a bee would be a possible pollinator for the daffodil.



Evaluation

Students reflect on the investigation.

Ask students:

- What surprised you in this investigation?
- What question would you like to investigate next?

Part 4

INVESTIGATION ASSESSMENT AND EXTENSION



Application

Students demonstrate understanding of how the structures of a plant support reproduction.

Have students examine the external structures of a pollinator (bee, fly, or butterfly) to identify how pollen would be transferred by this animal. A microscope or hand lens would be ideal, however an image would do fine as well.

Assessment

Evaluate how well students:

- examine and identify various structures of a flower.
- describe how plants use pollination to support reproduction.
- write an explanation (**claim**, **evidence**, and **reasoning**) that describes how the structures of a flower support its reproduction.

Take This Lesson Across the Curriculum

Bee Keeper

You would like to start up bee keeping as a hobby. To do so, you need bees! Use your knowledge of pollinators and what attracts bees to flowers to help with your new adventure.

Reading/Language Arts	Math	Science	Social Studies
Bee Friendly Write a letter from a bee's perspective requesting the environment you need. CCSS.ELA-LITERACY.W.4.3	How Many? You have \$150 to buy plants to attract bees. How many different plants can you buy? CCSS.MATH.CONTENT.4.OA.A.3	Plant Structures Use your knowledge of flowers and pollinators to determine what flowers to plant to attract bees. NGSS: 4-LS1-1	Budget Planning Research the local cost of the plants and use that to create a budget for your garden. NCSS: D2.Eco.1.3-5

Where Have All the Flowers Gone?

Oh no! Something has happened to your flower garden at school. All the flowers are gone! You will need to devise a plan for a new flower garden and how to properly care for the garden to make sure this does not happen again.

Reading/Language Arts	Math	Science	Social Studies
Reading to Grow Read and discuss <i>How Does My Garden Grow?</i> by Gerda Muller. Discuss how Sophie learns to take care of a garden and the importance of animals to the health of the garden. CCSS.ELA-LITERACY.RL.4.1	The Votes Are In! Count the votes from your school and determine the top 5 flowers that should go in the new garden. CCSS.MATH.CONTENT.4.NBT.A.2	Plant Structures Use your knowledge of flowers and pollinators to determine what flowers to plant in your new garden. NGSS: 4-LS1-1	Picking Flowers Using your knowledge of flowers, conduct research at local greenhouses to determine what flowers would be best to plant in your garden at school. Share your information and have a school-wide vote. NCSS: D2.Civ.7.3-5

For additional lessons or to customize this lesson, go to www.nexgeninquiry.org.



Empowering Teachers. Engaging Students.

INVESTIGATION PLAN

PLANT STRUCTURES

Part 1: Flower Structures

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2. Continue examining your flower. Identify the color, odor, shape, and if there is pollen present. Record additional qualitative observations (descriptions of your flower using your senses).
3. Record quantitative observations (measurements) such as, the number of petals, height of the flower, number of sepals, number of stamen, etc.
4. Carefully dissect your flower using a probe or a very sharp pencil.
5. Find and make a drawing (including labels) of the following parts:
 - Stigma, Style, Ovary (carpel)
 - Anther and Filament (stamen)
 - Sepal
 - Petal
6. Using the tip of the probe or a pencil, cut into the ovary. How many seeds do you see? Record your observations.

Part 2: Pollinators

1. Use the [Pollinator Traits Table](#) to determine a possible pollinator for your flower.
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OBSERVATION FORM

PLANT STRUCTURES

NAME: _____

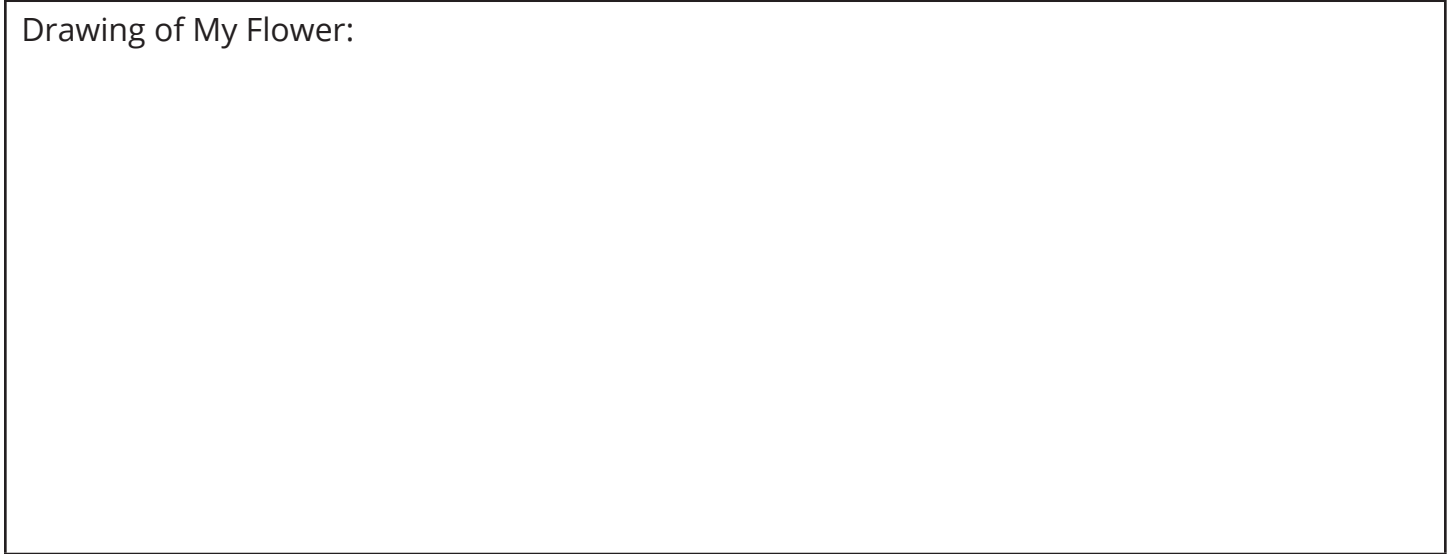
DATE: _____

Observations of My Flower: _____

name of flower

Part 1: My Flower's Structures

Drawing of My Flower:



Color	
Odor	
Shape	
Pollen (yes/no)	
Qualitative Observations	
Quantitative Observations	


OBSERVATION FORM

PLANT STRUCTURES

NAME: _____

DATE: _____

Drawing of My Dissected Flower:



Observations:

OBSERVATION FORM

PLANT STRUCTURES

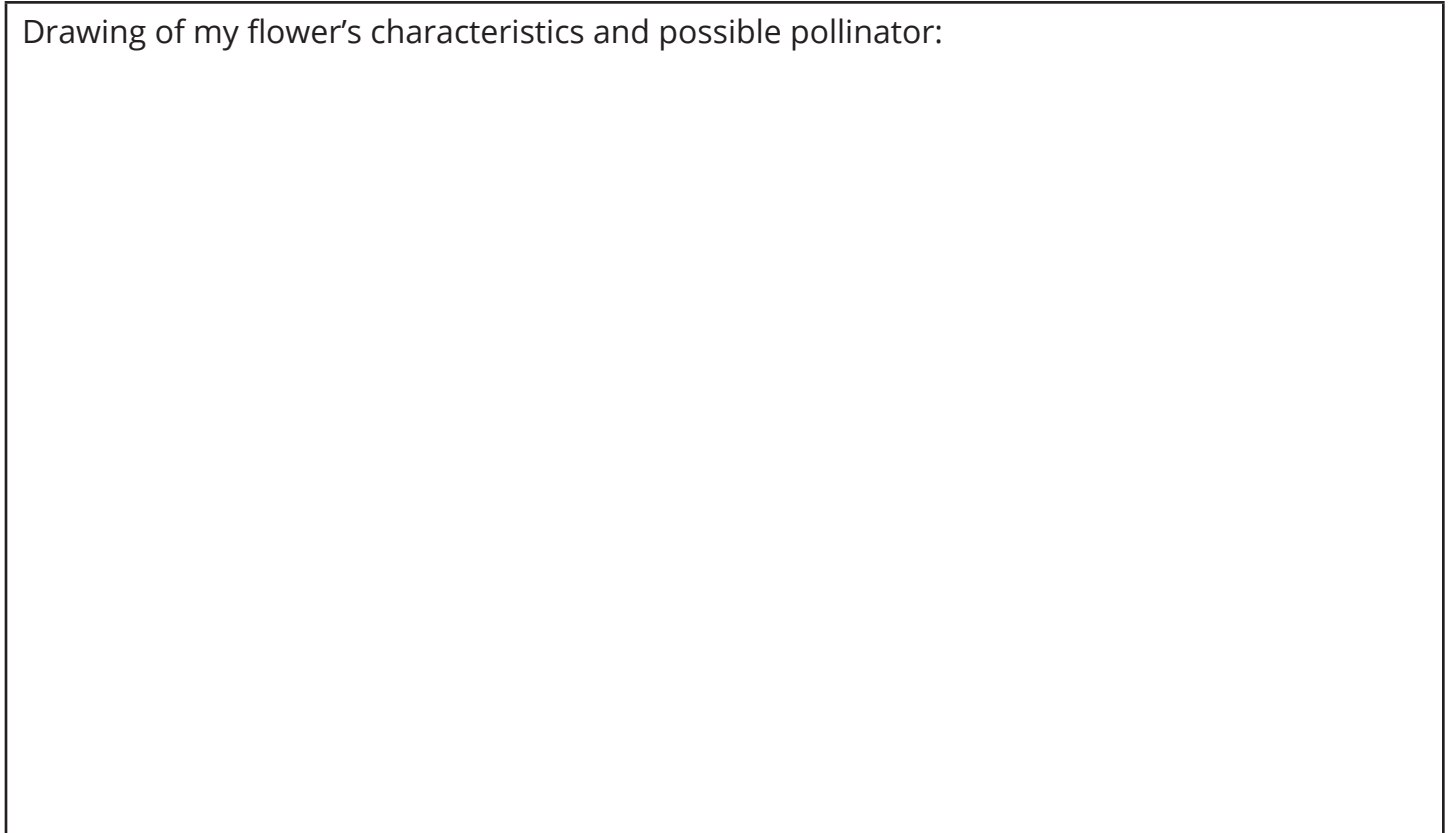
NAME: _____

DATE: _____

Part 2: My Flower's Pollinator

Possible Pollinator: _____

Drawing of my flower's characteristics and possible pollinator:



Description of my flower's characteristics and possible pollinator:

DIAGRAM

PLANT STRUCTURES

