Botany: Flower Investigation

Grade Range: High School

Lesson Time: 35 minutes

Key Terms

<table>
<thead>
<tr>
<th>Term</th>
<th>Definition</th>
</tr>
</thead>
<tbody>
<tr>
<td>Angiosperm</td>
<td>Petal</td>
</tr>
<tr>
<td>Anther</td>
<td>Pistil</td>
</tr>
<tr>
<td>Complete flower</td>
<td>Pollen</td>
</tr>
<tr>
<td>Fertilization</td>
<td>Pollination</td>
</tr>
<tr>
<td>Gymnosperm</td>
<td>Pteridophyta</td>
</tr>
<tr>
<td>Imperfect flower</td>
<td>Self-fertilization</td>
</tr>
<tr>
<td>Incomplete flower</td>
<td>Self-pollination</td>
</tr>
<tr>
<td>Ovary</td>
<td>Stamen</td>
</tr>
<tr>
<td>Ovule</td>
<td>Stigma</td>
</tr>
<tr>
<td>Perfect flower</td>
<td>Style</td>
</tr>
</tbody>
</table>

Materials and Resources

Real flowers or pictures of flowers

Activity Overview

Exactly when flowers first appeared on Earth is unknown, but they have been beautifying our world, and causing hay fever, ever since. Students will investigate the structure of flowers in detail and describe how specific adaptations permit angiosperms the reproductive success to become the most prolific plant group on the planet.

Essential Questions

1. What makes a flower complete?
2. Why are plant structures important?

Objectives

- Observe a complete flower
- Identify the structures of a complete flower
- Identify the functions of each part of a complete flower

Introduction

Prior to beginning this activity, review the evolution of plants with the students, covering bryophytes, tracheophytes, gymnosperms, and angiosperms. Also, review the terms “perfect flower” and “complete flower.” Ask the students why they think flowers are so successful. Explain that flowers have intricate structures that allow them to attract pollinators to help ensure the reproductive success of angiosperms.
zSpace Activity

Activity Questions Provided in StudioA3
Answers may vary. Sample answers are provided below.

1. Scientists estimate that there are at least 400,000 plant species on Earth. These producers are the basis of food webs across the planet. Ferns belong to a group of plants called Pteridophyta. These plants were the first to develop vascular tissue. Predict how vascular tissue provides advantages for plants.

   Vascular tissue allowed plants to transport water and nutrients throughout the plant. This evolutionary advantage meant that plants could grow further away from water and colonize new niches.

2. Gymnosperms, like this redwood tree, were the first group of plants to develop seeds. In addition to the evolution of seeds, gymnosperms, such as pine, spruce, fir, and redwood trees, produce cones to protect their developing seeds. Predict how seeds provide advantages for plants.

   A seed provides a protective package complete with food and nutrients for the growing embryo. Cones provide another layer of protection for the developing seed.

3. Pteridophytes and gymnosperms have been successfully reproducing for over 350 million years! About 125 million years ago, another type of plant evolved, and it has become the dominant plant group on Earth. These plants developed an innovation that uses wind, water, and other organisms as pollinators. Which plants are the most successful today?

   Angiosperms, or flowering plants, are the most successful group of plants.

4. Angiosperms are an evolutionary success story. Flowering plants represent at least 352,000 of the total species of plants on Earth! From tiny wildflowers to majestic flowering trees, the innovation of the flower improved the ability of angiosperms to reproduce, allowing this group of plants to diversify and colonize ecosystems around the world. Let’s investigate the structures of this flower and learn about the functions of each part.

5. The stem connects the flower to the rest of the plant. Just like your circulatory system, the vascular tissue inside the stem provides food and water to the flower. The stem also provides support for the flower.

6. Many flowers produce sepals that surround and protect the bud of the flower and open as the flower grows larger and matures. In addition, sepals often provide support for the petals. Usually the most visible parts of a flower are the petals. What are the functions of the petals?

   Petals function to attract pollinators and protect the reproductive structures.

7. Petals come in a vast array of shapes, sizes, and colors, all designed to attract specific organisms as pollinators. Petals also protect the reproductive structures found within the flower.

8. Most flowers contain both male and female reproductive structures, as shown in this model. This is called a perfect flower. How might producing perfect flowers be an advantage to the plant? Hint: How might producing male and female gametes in the same area increase reproductive success?

   Producing perfect flowers increases the possibility of self-pollination, which would guarantee reproduction.

9. Some plants produce two types of incomplete flowers, flowers with female parts and other flowers with male parts. How might this adaptation be an advantage to the plant? Hint: If male gametes and female gametes are produced in different areas, how might this impact genetic diversity?

   Self-fertilization decreases genetic diversity. Having imperfect flowers decreases the possibility of self-fertilization.

10. The main male reproductive structure of the flower is called the stamen. The stamen has two parts: the anther and the filament. The anther is where pollen grains are produced. The filament is the stalk that holds the anther. Add Notes to label the male parts of the flower. Then take a photo.

   Photo.
11. The main female reproductive structure of the flower is called the pistil. The pistil has three parts: the stigma, the style, and the ovary. Add Notes to label the female parts of the flower. Then take a photo.

Photo.

12. The stigma is the top of the pistil. A sticky liquid is secreted to help ensure that pollen blown by the wind, moved by raindrops, or carried from flower to flower by an animal will stick to the pistil.

13. There could be hundreds of different types of pollen moving around in an area. Only pollen from a compatible plant will cause a chain reaction. Pollination occurs when a compatible pollen grain lands on the stigma. A chemical reaction occurs that triggers the development of a pollen tube. The pollen tube will grow down the style, carrying the male gametes to the ovary at the base of the pistil.

14. The female gametes in a plant are called ovules. Ovules are produced inside the ovary. Fertilization occurs inside the ovary when the male and female gametes fuse.

15. Add Notes to label the female parts of the flower. Then take a photo. What curious question(s) do you have about flowers or plant reproduction?

Photo.

Closing

Complete and Incomplete Flowers
Research complete and incomplete flowers. Develop a hypothesis to explain why some plants produce complete flowers and others produce incomplete flowers.

Compare Structures and Functions of Flowers
Provide pictures of flowers or actual flowers and allow students to examine them to compare structures and functions. Guide the class to discuss the adaptations of each flower that help ensure reproductive success. Have students investigate double fertilization in plants. There are many useful videos on the Internet that can help explain this intricate process.

Questions for Discussion

1. What is a perfect flower?
   Perfect flowers have both male and female reproductive structures.

2. What is an imperfect flower?
   Imperfect flowers have only male or female reproductive structures.

3. Name each of the structures of a complete flower.
   The structures found in a complete flower include: stem, sepals, petals, stamen (anther and filament), pistil (stigma, style, and ovary), and ovules.

4. Describe the function of each part of a complete flower.
   The stem holds up the flower. The sepals protect the developing bud and provide support to the flower. The petals attract pollinators. The stamen is the male reproductive structure of the flower. The anther produces the pollen. The filament holds up the anther. The pistil is the female reproductive structure of the flower. The stigma produces a sticky substance to collect pollen. The style forms a tube to carry the pollen to the ovary. The ovary protects the ovules. The ovules are the female gametes.

Teacher Note: If time permits, ask students to share their curious questions. The opportunity to ask curious questions encourages the students to develop questions about things they are eager to know and learn. Students can make connections between previous knowledge and experience and what they are learning in the classroom. Allow time for
students to research answers to their questions, either in class or as a homework assignment, and then share and discuss the curious questions with a partner, with a small group, or as a class.

Differentiation

- Group students heterogeneously to allow students with a strong command of the English language to assist in reading or interpreting questions
- Provide paper copies of diagrams for students to use as a reference
- Provide a handout with a list of vocabulary terms and definitions that will appear in the activity
- Allow students to provide answers that are handwritten, typed, or verbal
- Give students a variety of presentation styles to choose from (using charts/graphs, PowerPoint, making 3D presentations, creating videos/movies, making posters)
- Have students work as partners or in small groups (younger children could partner with older buddies)
- Enrichment: Students could change an additional variable in the activity and look for patterns
- Enrichment: Students could find real-world problems involving the concept and design solutions to those problems
- Enrichment: Students could research similar topics and create presentations
- Enrichment: Students could build a model of a key concept