LiveWell Kids
Garden and Nutrition Program

Lesson 4: Pollination and Seeds

OBJECTIVES

By the end of this lesson, students will:

- Learn about the function of a plant's seeds.
- Understand seed dispersal.
- Dissect a fruit and/or pod and a flower.
- Identify what types of foods are seeds and why they are healthy to eat.
- Learn about the role of pollinators.
- Observe pollination in the school garden.
- Gain a better understanding of the role of protein, fats, and carbohydrates in the body.
- Increase knowledge of the Nutrition Facts Label.

SUPPLIES

- Supplies to bring from the shed to the garden:
  - 8 laminates:
    - *The Life Cycle of a Plant*
    - *Anatomy of a Flower*
    - *Flower to Fruit Process*
    - *How Seeds Travel*
    - *Diagram of a Seed*
    - *Nutrition Facts: Carbohydrates* (Whole Wheat Pasta and Fruity Cereal)
    - *Nutrition Facts: Protein* (Black Beans and Hot Dog)
    - *Nutrition Facts: Fats* (Walnuts and Pecan Pie)
  - 2 Cafeteria trays
  - Knife
  - Cutting Board
  - Magnifying lenses
  - Optional: Whiteboard and dry erase marker

- Supplies to bring from classroom to garden - *arrange with the teacher ahead of time*:
  - Paper - one piece per student
  - Writing tools such as crayons, colored pencils, markers

- For this lesson, we ask that **you supply** the following for dissection:
  - One or more flowers (Variety helps.)
    - Examples: Morning Glory, Lily, Nasturtium
  - One or more pieces of fruit or pods (Variety helps.)
    - Examples: Lemon, Tomato, Milkweed Pod
  - Please refrigerate the flowers and fruit/pods when gathering prior to lesson delivery.

PREPARATION

- Refer to the "Background and Preparation" document for details about preparing for this lesson one week prior and the day of. It is posted on the website and on the inside of the shed door.
- Allow 30 minutes for set-up and preparation on the day of the lesson.
- Since this lesson includes searching for pollinators (e.g., bees), it is **important to check with the teacher about students with allergies**.

SET-UP INSTRUCTIONS

1. SET UP THE INTRODUCTION AREA:
   - Set out 2 laminates: *The Life Cycle of a Plant* and *How Seeds Travel*.

2. SET UP THE FLOWER ACTIVITY:
   - Use the knife and cutting board to cut a flower exactly in half and set it on a tray.
   - Place any other flowers around it, uncut, if you have additional ones.
   - Cut the fruit/pod in half and set one half of it on the tray.
   - Place the laminates (*Flower to Fruit Process* and *Anatomy of a Flower)* and the box of magnifying lenses next to the tray.

3. SET UP THE SEED ACTIVITY:
   - Place the other half of the cut fruit/pod on the other tray.
   - Place the *Diagram of a Seed* laminate next to the tray.
   - Set out 3 laminates:
     - *Nutrition Facts: Carbohydrates* (Whole Wheat Pasta and Fruity Cereal)
     - *Nutrition Facts: Protein* (Black Beans and Hot Dog)
     - *Nutrition Facts: Fats* (Walnuts and Pecan Pie)

Optional: Use the whiteboard and dry-erase markers to aid you in teaching the topic.

INTRODUCTION & MINDFUL BREATHING (1 MINUTE)

- Introduce yourself and other volunteers.
- Guide students through a mindful breathing exercise.
- Explain the purpose of this fourth lesson is to better understand the life cycle of plants and pollination, as well as gain a better understanding of how proteins, fats, and carbohydrates work in our bodies.

SEEDS & POLLINATION (8 MINUTES)

This section has three discussion parts:

1. Life Cycle of a Plant
2. Seed Dispersal
3. Pollination

Grades	**LIFE CYCLE OF A PLANT[1],[2]** Laminate - *The Life Cycle of a Plant*
K-5th	• All plants start out as a tiny seed. • Once the seed is planted in the soil, given water, nutrients, and sun, it grows roots and sprouts. • The plant grows larger until it is ready to **reproduce** (make more plants.) • Then it makes flowers that, if pollinated, develop fruit or seed pods. • In general, plants fall into two categories: ○ Annual Plants - Once an annual plant's fruit/pod is mature, it releases seeds to grow new plants, and the old plant dies. ○ Perennial Plants – These plants follow the same cycle, but do not die after they disperse their seeds.

Grades	**SEED DISPERSAL[3]** Laminate – *How Seeds Travel*
K – 5th	• **Seed dispersal** is the process of moving seeds from one place to another. • Through seed dispersal, plants get spread around the world giving us a large variety of vegetation. • There are many ways that seeds end up where they do. • Sometimes plants drop their seeds and new plants grow right under the old plant. • Other times, we find the new plants far away from the plant. ○ Question: How do seeds travel away from the plant?

K – 3rd	• Answer (Allow students to first answer on their own.) 1. Nature has ways of moving seeds to a new spot: a. Wind blows them away. b. Water carries them away. c. Seeds stick to clothing or animal fur and get carried away. d. Animals eat seeds and poop them out somewhere else. 2. Sometimes people take the seeds and plant them where they want.
4th – 5th	• Answer (Allow students to first answer on their own.) • Reference answers for K – 3rd, but also refer to the laminate, *How Seeds Travel*, and add: o Seeds have a variety of mechanisms to help them travel distances. 1. Some seeds have parachutes, or feathery structures, to catch the wind and sail through the air. 2. Others have stickers that get them stuck in an animal's fur or our clothing. 3. Lots of seeds are surrounded by fruit to get eaten by animals, who will deposit them wherever they travel. 4. Some are designed to float in water. 5. There are even some that explode open like a confetti popper, sending seeds scattering around the area.

Grades	**POLLINATION[4]** Laminate - *Anatomy of a Flower*
K – 5th	• Once a plant is ready to reproduce, it puts out flowers to attract pollinators and begins the process of **pollination** or making new seeds. • Using the laminate, *Anatomy of a* Flower: o Explain that male flowers make a powdery substance called pollen. o Show that during pollination, the pollen moves from an **anther filament** (the orange section) of a plant to the **stigma** (the yellow section) of a plant so that it can make a seed. • Most plants need pollinators to move the pollen from an anther to the stigma. • Examples of pollinators are (you can ask students here to share examples) bees, butterflies, bats, hummingbirds, moths and even flies. • Pollinators are responsible for pollinating 80-90% of the plants in the world. • They have a very important job because without them most plants wouldn't be able to make seeds – and seeds make new plants! • How it works: o When a pollinator meets a flower, it is looking for nectar to drink. o Nectar is a liquid that is made by a plant's flower. o While looking for the nectar, the pollinator accidentally rubs against the powdery pollen (on the anthers), which sticks to its body. o The pollen rubs off on the flower's stigma (or on the stigma of the next flower it visits) as the pollinator moves from flower to flower. NOTE: More detail will be provided during the lesson's Flower Dissection Activity.

Divide Class into Two Groups

Split the students into two groups. Send one group with your co-volunteer/teacher to the fruit/pod dissection activity and keep the other group with you for the flower dissection activity. Both activities will run simultaneously. Switch groups after 10 to 18 minutes depending on the time allotted.

FLOWER DISSECTION ACTIVITY (10 - 18 MINUTES, depending on grade)

Grades	Activity: Flower Dissection Laminates - *Anatomy of a Flower* and *Flower to Fruit Process*

K – 5th	Part 1: Using Laminate *Anatomy of a Flower*
	• Bring students to the Flower Activity area.
	• Inform the students that they will look at the different parts of a flower to understand how pollinators move the pollen to the stigma to make seeds, as well as see where seeds are formed.[5]
	• K – 3rd
	  ○ Start by showing the *Anatomy of a Flower* laminate and point out that flowers have many parts.
	  ○ Point out some parts such as **anther**, **stigma, pistil** and **ovary**.
	  ○ Each part has an important job to do! (Depending on the age group and time, use your discretion to add more detail about the function of some parts.)
	• 4th – 5th - Same as above, but also:
	  ○ Ask students if they can see that the anthers are on the ends of long wire-like structures. These are called **filaments**.
	  ○ Filament means "thread-like" structure.
	  ○ Together the anther and filament make up the **stamen**.

K – 5th	Part 2: Using Fresh Flowers and Laminate
	• Now you're going to show the students a cut flower so they can see the structures that you just talked about.
	• It is important that the kids take turns just looking at (not touching) the flower because it has been cut open and is very fragile.
	  ○ Leave the cut flower on the tray and have a few kids at a time look at it.
	  ○ If you have multiple flowers, you can leave some uncut so they can gently handle them to look for the different structures that are highlighted on the laminate.
	• Ask if anyone can identify the parts that they saw on the laminate. Allow for a few answers.
	• Using the laminate, point out the **anthers** covered in pollen.
	• Next, on the laminate, point out the **pistil**.
	• Have students find the anthers and pistil on the real flowers and imagine the pollinator moving inside, covering itself in pollen and spreading it around.

K – 3rd	• Using *Anatomy of a Flower*, point out the little bump that is called the **ovule**. • Tell the students that the ovule will become one or more seeds after the pollen travels down this tube, known as the **style**, to reach it. • Look for the ovule and style in the cut flower.

4th – 5th	• Using *Anatomy of a Flower*, point out the **stigma.** ○ Show the students that the stigma is just the tip of the tube-like structure which is called a **style**. • Explain that when the pollen lands on the stigma, it travels down inside the tube, called style, until it ends up inside the **ovary**. • Together the stigma and the ovary make up the **pistil**. • Inside the ovary is the **ovule**, or the seed eggs, which are waiting to combine with the pollen. • Once they combine, the ovule develops into a seed. • Ask the students if they could recognize these parts in the cut flower.
K – 5th	Part Three: Using Laminate *Flower to Fruit Process* • Show the piece of fruit that is cut in half. • Point out that the **ovary** and **ovum** have grown into the fruit and seeds.[6] ○ Show them the corresponding structures on the *Flower to Fruit Process* laminate and see if they can identify them in the fruit.

PROTEIN, FAT & CARBOHYDRATE (10 - 18 MINUTES, depending on grade)

This section has four parts:

1. Activity: Fruit/Pod Dissection
2. Proteins
3. Fats
4. Carbohydrates

Grades	**ACTIVITY: FRUIT/POD DISSECTION** Laminate - *Diagram of a Seed*

K – 5th	• Seeds have all the needed nutrients for a plant to grow healthy and strong. Think of a seed as a tiny package of nutrition.
	• Show laminate, *Diagram of a Seed*, and mention that a seed has many parts.
	  ○ Point out the seeds in the cut piece of fruit/pod so the class can see how the seeds are arranged before they are released.
	• All seeds, whether in a fruit or seed pod, formed from a flower that was pollinated.
	• When the fruit or pod is mature, it will release the seeds so that they will make new plants.
	• People eat seeds as a healthy snack or part of a meal.
	  ○ Seeds have nutrients that people, like plants, need to live.
	  ▪ A **nutrient** is something found in food that our bodies use to grow and stay healthy.[7]
	  ▪ Foods can have many different nutrients and each nutrient does different things.
	  ○ Some nutrients found in seeds that we'll learn more about today are protein, fat and carbohydrates.[8]
	  ○ By the end of this lesson, you'll be able to teach your friends and family about different foods that are high in these nutrients and good for you.

Grades	**PROTEIN** Laminate – *Nutrition Facts: Protein* (Black Beans and Hot Dog)

K – 5th	• Protein is a nutrient that is found in plants and animals.[9]
	• Your body gets protein when you eat seeds, nuts, beans, eggs, lean meat, chicken and seafood.
	• Eating protein can help build strong muscles, give you energy to play sports and help you focus in school.
	• Protein can also help your body fight infection.[10]
	• Use laminate to compare different proteins.
	  ○ Black beans are a plant-based source of protein while hot dogs are animal-based.
	  ○ When you eat protein, you also eat everything else that comes with it.[11]
	  ○ Note the ingredients list for both food items.
	  ▪ Beans are only ingredient.
	  ▪ Hot dog contains many ingredients. (Depending on age group, use your discretion to discuss ingredients, including sodium.)

4th – 5th	• Proteins are made up of microscopic amino acids.[12] ○ Think of amino acids as building blocks, which they are often called. • After eating protein, digestion breaks this nutrient down into amino acids. • The amino acids travel to different parts of your body, like the heart and brain, to keep them healthy.

Grades	**FATS**[13] Laminate – *Nutrition Facts: Fats* (Walnuts and Pecan Pie)
K – 5th	• Fat is an important part of a healthy diet that gives you energy. • It is also used in your body as insulation to keep you warm, protect your organs (e.g., kidneys and lungs) and help you feel full after eating. • Some fats are healthier than others. • Healthy fats mostly come from plant sources, like nuts, seeds and fatty fruits like avocados and olives. • Some fish, such as salmon, also have healthy fat.

4th – 5th	• Unsaturated and saturated fats are two types of fats found in foods.
	  ○ Note: There are also trans fats, but not including details here due to limited time, complexity and because many companies have removed trans fats from their products.
	• **Unsaturated fats** are often called healthy fats because they can help reduce heart disease and lower cholesterol levels.
	  ○ There are two types of unsaturated fats, polyunsaturated and monounsaturated.
	  ○ Unsaturated fats tend to be liquid at room temperature.
	  ○ These fats are found in plant foods and fish and are good for your heart.
	  ○ Some foods with these fats include:

	▪ **Monounsaturated fats** are found in olive oil, canola oil, avocados and butter. ▪ **Polyunsaturated fats** are found in some nuts (walnuts), pumpkin seeds, sunflower and soybean oil, fish and eggs. ▪ **Omega-3 fatty acids** are a type of polyunsaturated fat found in salmon, walnuts and flax seeds. • **Saturated fat** is a type of fat that can be unhealthy when eaten in large amounts. o Saturated fats can raise cholesterol and damage your heart. o These fats are solid at room temperature. o This type of fat can be found in higher-fat meats, butter, cream and some processed foods like cakes, cookies and fried foods.

Grades	**CARBOHYDRATES** Laminate – *Nutrition Facts: Carbohydrates* (Whole Wheat Pasta and Fruity Cereal)
K – 5th	• Our bodies need carbohydrates for energy.[14] • Protein and fat can't do their jobs unless we have enough carbohydrates. • It is important for children to get enough carbohydrates for energy because they are very active and still growing. • Healthy sources of carbohydrates include different vegetables, fruits, seeds, beans, and whole grain products like wheat bread, brown rice, beans, quinoa and oats. o These foods have **fiber**, a type of carbohydrate that is found in plant-based foods.[15] o Eating foods high in fiber has many health benefits.
4th – 5th	• There are two types of carbohydrates, simple and complex.[16] • **Simple carbohydrates** are also called simple sugars. o An example is white sugar, which you may have seen used for baking. o Candy, like lollipops, and maple syrup have simple carbohydrates. o These sugars break down inside your body quickly, so they give your body a quick boost of energy. o A person can also get simple sugars from eating fruits. ▪ This sugar is more natural, meaning it is part of the fruit and not added like it is in candy. ▪ Plus, fruit has other nutrients, such as vitamins, minerals, and fiber. • **Complex carbohydrates** are also called starches. o Complex carbohydrates come from grains, like cereal, pasta, bread and rice. o Through digestion, your body breaks down complex carbohydrates into simple sugars. o Complex carbohydrates give you energy over a longer period of time because it takes longer for your body to break them down due to the high fiber content. o Some complex carbohydrate foods are better choices than others. o Although white flour/bread and white rice are complex carbohydrates, they have been processed so their nutrients and fiber have been removed. o Whenever possible, choose whole grains so you get fiber, vitamins and other nutrients.

Gather Class Together

CLOSING (1 MINUTE)

- Bring students together to close the lesson and thank the students, teacher and other volunteers.
- If time allows, have students participate in the optional activity, "Observing Pollination." (See below)
  - If you do not have time for this optional activity, then encourage the students to observe flowering plants around them and look for pollinators.
- Recap what students learned in the lesson.
- If time allows, have students draw/write a "Reflection Page" after the lesson, either in the garden or with the teacher when they return to class.
- Thank the students for joining you today and dismiss them.

OPTIONAL ACTIVITY: OBSERVING POLLINATION

Grades	**Observing Pollination**
K – 5th	Part 1: Explain how to be safe around pollinators. 1. Emphasize to the students that since they are going to be up close to some insects that can sting, it is very important that they observe with just their eyes, not touching any of the pollinators. 2. Let them know that if a stinging pollinator comes near them, they should be still, or step away slowly and calmly. 3. Don't wave your arms around, as this scares them and gives them a reason to sting!
K – 5th	Part 2: Walk through the garden and observe pollination. 1. Tell the students that they're now going to walk through the garden and see if they can mindfully observe pollination in action. 2. This is an activity that they are going to do ALONE. They are "observing," so they'll be paying attention and not talking. It should be very quiet. 3. Since they are going to get up close to insects, they need to move slowly and quietly. 4. Once they see a pollinator that they want to watch, be still, and don't get too close. 5. They can watch to see if they can observe the insect drinking nectar, getting covered in pollen, and moving from flower to flower. 6. When an insect lands on a flower, have them try to see if it rubbed against the stigma. 7. Have them pay attention to the sounds that the pollinators make; some are noisy, and some are silent. 8. Also, have them notice if the flowers they found with a pollinator have a strong smell or not. *If there are no pollinators, discuss different types of pollinators such as butterflies, bees, hummingbirds, and wasps, and how they pollinate flowers. Ask students to be mindful when they are outside to see if they can spot them in the future.

***Don't forget to report your lesson as delivered with the online form – scan here:**

Resources

[1] Bales, Kris. "Introducing Kids to the Plant Life Cycle." *ThoughtCo*, 16 Oct. 2020, www.thoughtco.com/plant-life-cycle-for-kids-4174447.
[2] "Plant Life Cycles." *Penn State Extension*, extension.psu.edu/plant-life-cycles.
[3] "Life Cycle of a Plant | Science & Nature | National Geographic Kids." *National Geographic Kids*, Sept. 2017, www.natgeokids.com/uk/discover/science/nature/the-life-cycle-of-flowering-plants/.
[4] "7 Brilliant Ways Seeds and Fruits Are Dispersed." *Encyclopedia Britannica*, www.britannica.com/list/falling-far-from-the-tree-7-brilliant-ways-seeds-and-fruits-are-dispersed.
[5] "7 Brilliant Ways Seeds and Fruits Are Dispersed." *Encyclopedia Britannica*, www.britannica.com/list/falling-far-from-the-tree-7-brilliant-ways-seeds-and-fruits-are-dispersed.
[6] "7 Brilliant Ways Seeds and Fruits Are Dispersed." *Encyclopedia Britannica*, www.britannica.com/list/falling-far-from-the-tree-7-brilliant-ways-seeds-and-fruits-are-dispersed.
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[9] *Protein Facts for Kids - Interesting Information about Amino Acids*. (n.d.). Www.sciencekids.co.nz. https://www.sciencekids.co.nz/sciencefacts/food/proteins.html
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[12] Copy Marshall Brain "How Cells Work" 1 April 2000. HowStuffWorks.com. <https://science.howstuffworks.com/life/cellular-microscopic/cell.htm> 7 December 2022
[13] KidsHealth.org from Nemours Children's Health. (2017). *Fats (for Parents) - KidsHealth*. Kidshealth.org. https://kidshealth.org/en/parents/fat.html
[14] American Heart Association. (2018, April 16). *Carbohydrates*. Www.heart.org. https://www.heart.org/en/healthy-living/healthy-eating/eat-smart/nutrition-basics/carbohydrates
[15] KidsHealth.org from Nemours Children's Health. (2016). *Fiber (for Teens)*. Kidshealth.org. https://kidshealth.org/en/teens/fiber.html
[16] KidsHealth.org from Nemours Children's Health. (2017). *Learning About Carbohydrates (for Kids) - KidsHealth*. Kidshealth.org. https://kidshealth.org/en/kids/carb.html