What We Eat - Part 2

Subjects Taught: Science, Nutrition, Language Arts

Grade Levels: 3th-5th Grade with extensions for 6th-12th Grade

Brief Description: Students will sort fruits and vegetables (by examining plants grown in the school garden, purchased in the market, or featured in models or pictures) into the parts of the plant eaten as food, identify a serving size, and locate where on *MyPlate* the food belongs. Understanding the food storage function of a specific plant part will aid in understanding the nutrition provided by that plant part.

Objectives: Students will:

1. Identify the parts of the plant.
2. Sort fruits and vegetables by plant part.
3. Place sorted fruits and vegetables on *MyPlate*.
4. Describe and provide a general explanation of the nutrients provided by fruits and vegetables.

Life Skills: Analyzing, applying, collaborating, comparing similarities and differences, contrasting, categorizing, identifying, observing, sharing observations, sorting and understanding cause and effect

Materials Needed:

- Fruits and vegetables from the school garden, pictures of fruits and vegetables, models of fruits and vegetables and/or purchased fruits and vegetables
- Copies of student handout *Parts of the Plant* – one per student
- Copies of student handout *What We Eat 1* – one per student
- Nuts in the Shell and a Nut Cracker
- Paper towels, newsprint, craft paper or brown paper such as that of a paper shopping bag
- Large wooden dowel, wooden mallet or rolling pin
- White flour (Optional: whole wheat flour)
- Water
- Grocery store advertisements with fruits and vegetables listed and pictured

Time:

Activity One: 45 minutes, plus time for student work
Activity Two: 45 minutes
Activity Three: 30 -40 minutes
Activity Four: 30 minutes
Extensions: 45 minutes each activity

Preparation:

1. Decide what portion of the background information is appropriate for your students.
2. Make copies of student handouts.
3. Collect grocery store flyers and seed catalogs for pictures.

Florida Standards Met At-A-Glance

National Next Generation Science	(Extensions: MS-LS1-j., MS-LS2-f., MS-LS2-b., HS-ESS3-a.)
English/Language Arts	3.W.3.7, 4.W.3.7, 5.W.3.7, 3.W.3.8, 4.W.3.8, 5.W.3.8, 68.WHST.2.4, 68.WHST.3.7, 68.WHST.3.8, 68.WHST.3.9, 3.SL.2.4 , 4.SL.1.2 , 4.SL.2.4, 5.SL.1.1, 5.SL.1.2, 5.SL.2.5, 6.SL.1.1
Physical Education	PE.1.L.2.8, PE.2.L.2.11

Vocabulary:

Carbohydrate, flower, fruit, leaf, leaf petiole, minerals, oils, protein, root, starch, stem, sugar, vitamin

Background Information:

What are we eating? Is it a root? Is it a stem? Is it a leaf? Is it a fruit? Is it a seed? Is it actually a vegetable? Few adults could answer correctly. Some of the confusion is due to common use terminology versus the correct scientific designation between what a fruit is and what a vegetable is. If a food is sweet or served as dessert, we have considered it a fruit. Actually there is a scientific botanical designation of fruits. In laymen's terms, if it has a seed or is a seed, it is, botanically, the fruit of the plant. So, grains are plant fruits. Tomatoes are plant fruits. Cucumbers, squash, and pumpkins are all plant fruits.

So what are vegetables? Vegetables are the vegetative and reproductive part of the plant before they bloom and set fruit and seed.

Vegetables are:

Leaves: Head lettuce, leaf lettuce, cabbage, spinach, bay leaves, oregano, sage, parsley flakes, basil, rosemary, thyme, tea, dill weed, cilantro, mint
Modified Leaves: Onions, celery, Brussel sprouts, garlic
Flowers: Broccoli, cauliflower, artichoke, cloves, saffron
Stems: cinnamon, asparagus
Modified Stems: Potatoes, turnips, ginger
Roots: Carrot, beets, parsnips, sweet potatoes, radish, turmeric

Botanical Fruits are:

Almonds, apples, bananas, barley, beans, black walnuts, blueberries, Brazil nuts, cacao (source of chocolate), cantaloupes, cashews, cherries, coconuts, cola nuts, corn, cucumbers, currents, dates, figs, gooseberries, grapes, hazelnuts, hickory nuts, lemons, limes, mangoes, oats, oranges, peaches, peanuts, peas, pecans, peppers, plums, pumpkins, raspberries, rye, snow peas, sorghum, squash, sweet corn, strawberries, tomatoes, walnuts, watermelons, wheat

Spices from Botanical Fruits:

Allspice, chili powder, caraway, cardamom, coriander, dill seed, mace, mustard, nutmeg, paprika, pepper, vanilla

Of course, it isn't always so simple. Strawberries, commonly considered a fruit, are the one major exception from a scientific perspective. The fruit is actually the seed on the outside of the strawberry. The sweet, juicy portion we eat is actually a vegetative holder of the seeds and not truly a fruit.

For some food plants, both the fruit and vegetative portions are used. This is true with dill. The leaves are used as dill weed, the immature flower heads are used as a flavoring in dill pickles. Thus, these are vegetative. The dill seed (fruit) are also used in making dill pickles and as a spice. The leaves of the cilantro plant are used in Mexican cooking as an herb (vegetative) but when the plant develops seed (fruit) it is used as a spice and known as coriander.

And even politics or the law sometimes intervenes causing more confusion. In 1883, the Supreme Court ruled that tomatoes should be considered a vegetable for tax purposes. The U.S. Congress passed the Tariff Act of 1883 which imposed a 10 percent tariff on all imported vegetables. So, the tax collector in New York harbor was collecting tax on tomatoes as a vegetable. Fruit importers, the Nix brothers, sued to retrieve back taxes claiming that tomatoes should be considered fruit and therefore not taxed. The court denied the claim and tomatoes were legally determined to be vegetables regardless of science. Tax is still paid today on imported tomatoes. This lesson will be straightforward in most applications and will only explore the more confusing aspects of this topic as an enhancement for older students.

The nutrition of various fruits and vegetables is directly related to the plant structure and purpose of that portion of the plant. For example, seeds need a great deal of energy to sprout and push through the soil to reach the light. Concurrently, each seed produces roots that reach down into the soil seeking moisture and nutrients. In order to accomplish these feats, the seed must be a storehouse of energy. So seeds store carbohydrates and lipids (fats and oils). Fats and oils contain more than twice the calories of carbohydrates and protein, gram for gram. A gram of protein or a gram of carbohydrate contains 4 calories. While a gram of lipid (either fat or oil) contains about 9 calories. That extra energy is needed for germination. Seeds also need protein to form the structure of the new plant prior to it being able to conduct photosynthesis and create new protein. So, a seed contains oil or fat, protein, and carbohydrates in the form of starch and cellulose. All of our major grain crops are seeds - corn, wheat, rice, oats, barley, rye, quinoa and soybeans. Some crops are raised primarily for oil production such as rapeseed used to produce canola oil. All of our nuts are seeds.

Vegetative parts of the plant contain cellulose or in some cases lignin, which provides strength to the structure of the plant. Humans cannot digest cellulose or lignin so this provides us with fiber. The vegetative parts of the plant are the operation centers. Photosynthesis takes place in the leaves and stem.

Transportation occurs in the roots and stem. Venation take places in the leaves. Food storage happens in the leaves, stem and roots, depending on plant, which is where sugars, starches, vitamins and minerals are found.

Introduction

1. Review with students the parts of the seed and the process of seed germination. If this hasn't been taught, a good website to use is the Arizona Cooperative Extension Master Gardener's site at *www.ag.arizona.edu/pubs/garden/mg/botany/seeds.htm*l.
2. Review photosynthesis as appropriate. At minimum, younger students should be able to explain that plants produce food by capturing the energy of sunlight and that all food begin with plants.
3. Either collect grocery store flyers or ask students to bring in grocery store flyers that contain fruits and vegetables from the newspaper.

Activity One:

1. Read the book *Tops and Bottoms* by Janet Stevens. Ask: "What difference would it have made if bear knew more about the plants in the garden?" Explain that this is the exploration we will be conducting.
2. Provide students a copy of the handout *Parts of the Plant* and using plants in the school garden, have students label the roots, leaves, flowers, and stem.
3. Explain that the roots take in water and nutrients, the stem helps transport those nutrients and water up to the leaves and flowers, the leaves take in sunlight and air (CO_2 during the day and O_2 at night) and produce first sugar and then that sugar is converted into starch, protein, fats, cellulose and lignin. Those byproducts are where food begins.
4. Explain that plants store food for the following reasons: survive a dormant period such as winter; survive a dry time of year if the plant lives many years; store food for the following season; produce offspring through seeds; or produce offspring by another structure such as a rhizome, tuber or corm. Explain that how plants store food affects what nutrients are in that food.
5. Have students brainstorm all fruits and vegetables or foods made with fruits and vegetables that they can think of and make a list in a visible place. They may need assistance with this. Begin with the fruits and vegetables grown in the school garden. Make a "T chart" with fruits on one side and vegetables on the other and place fruits and vegetable on the chart where students believe they belong.
6. Explain that true vegetables are the vegetative part of the plant – leaves, roots, stem and flowers. From a scientific perspective, if it has seeds or it is a seed it is the plant fruit – even if it is commonly called a vegetable. This means that sweet corn, beans, squash, cucumbers, eggplants, peppers, peas, watermelon, cantaloupe and pumpkins are, scientifically speaking, all fruits.
7. Using copies of student handout *What We Eat 1,* help students place foods into the categories for leaf or leaves, stem, roots, and flowers. (For younger students, roots will serve as tubers, rhizomes, corms and bulbs. For older students, only true roots should be placed here.) Use the list found in the background information.
8. Move items on the "T chart" to represent where they truly belong by asking students what part of the plant the fruits and vegetables represent from a scientific point of view.
9. Examine plants from the garden to view food storage.

Activity Two:

1. Read a seed book such as the *Carrot Seed* by Ruth Krauss to the class.
2. Show students the nuts in a shell (almonds walnuts, hazelnuts, etc). Explain that these are the seeds of specific trees and the seed would have to germinate through the shell to grow. Have students see if they can break apart the nuts with their bare hands.
3. Discuss how hard the nut shells are and ask how much energy it would take to germinate.
4. Using the nut cracker, break open the nuts, show students the nut meat (seed) inside. Using either a mallet or large wooden dowel or rolling pin crush the nut meat on the brown paper or paper towel. Have the students feel the oil and view the oil stain on the paper.
5. Explain that the seed contains oil and that oil has a lot of energy. The same is true with other seeds but to a lesser degree.
6. Ask what else the seed has. It has starch. Show students white flour and explain that it comes from a wheat seed and much of what they see is starch. But there is more.
7. Make a thick paste using about ¼ - ½ cup of flour and three teaspoons of water –add more water as needed by single tablespoon. Work it into dough until it is very stretchy. This takes time. Stretch it out and explain that the part of the flour (from wheat seed) that makes the dough stretchy is gluten, which is the protein part of the wheat seed. Some people have trouble eating wheat products such as bread and it is the gluten that they cannot digest.
8. Ask: "Now we know that seeds contain oils, starches and protein, how many seeds or foods from the seeds can we name?" Have students brainstorm all of seeds or foods

from seeds they can think of and make a list in a visible place. Younger students may work together as a class or in small groups.
Wheat: *bread, egg noodles, pizza crust, crackers, cereals, spaghetti, muffins, cakes, cupcakes*
Corn: *corn tortillas, corn chips, corn flakes, corn puffs, corn cereals like Captain Crunch; corn oil*
Oats: *oatmeal, Cheerios, Honey Bunches of Oats, Granola, oat cakes*
Soybeans: *Edamame, tofu, soy nuts, soymilk, vegetable oil*
Rice: *rice, puffed rice cakes, Rice Krispies, many of the Chex cereals, Rice-a-Roni, rice pudding*
Coconut *(can be a fruit, nut or seed, but botanically it's a one-seeded drupe)*
Cacao *(chocolate) (seed of the fruit thought of as a culinary nut)*
Nuts in a shell *(botanically defined as a fruit composed of a hard shell and a seed)*
Peanuts *(botanically defined as a seed from a legume plant)*

9. Ask: "Where do these foods fit in *MyPlate*?"
10. Have the students count the number of seed crops that are grown in the school garden or if none, count the number of foods eaten during a day that come from or are products of seed crops (flour, oil, seeds, flavorings, etc.)
11. Have students create their own diorama, poster or illustration depicting their favorite vegetables including one from each part of the plant.

Activity Three:

1. Now that we know what part of the plant specific foods come from, let's discuss how that impacts nutrition. We already know that seeds have oils, starches and protein.
2. Vegetative parts of the plant – leaves, stems, immature flowers, leaf petiole – all true vegetables – contain fiber (cellulose), water, vitamins and minerals.
3. Storage structures that are vegetative – tubers, true roots, modified leaves, corms and rhizomes have to store energy. But unlike seeds these plant parts store energy as starch or sugar. So potatoes (tuber-a modified stem); carrot, beets, sugar beets, parsnips, sweet potatoes (true roots); and onions, Brussels sprouts, garlic (modified leaves) provide carbohydrates as nutrients. They also provide vitamins and minerals.
4. Ask: "Where do these foods fit in *MyPlate*?" Have the students place foods.
5. Ask: "What is a serving size for fruits, vegetables, and a food made from seed such as bread?" Discuss using the recommendations at www.choosemyplate.gov/

Evaluation Options:

1. Assess student work on the two handouts for accuracy and completion.
2. Using grocery store flyers, have students create their own *MyPlate* meal that includes fruits and vegetables, and carbohydrate foods such as bread, pasta, rice, or noodles, meat, and milk. In addition, have students identify serving sizes and cost to purchase the food.
3. Have students identify foods from leaves, roots, flowers, and/or stems that are grown in the school garden and place them into categories for leaves, stems, roots, flowers and seeds.
4. After lunch, have the students categorize the foods in the school lunch into parts of the plant.

Extensions and Variations:

1. Enlist the assistance of the school cafeteria to include kid-friendly vegetables in the school meal. Ideas can be found at www.choosemyplate.gov/food-groups/downloads/TenTips/DGTipsheet11KidFriendlyVeggiesAndFruits.pdf.
2. During Activity One, step 1, explain that some leaves attach directly to a plant stem and other leaves have another stem that connects the leaf to the stem and that this is called the leaf petiole. This is important to explain why some vegetables are not actually plant stems but actually leaf petioles such as stalks of celery. Use the second, more detailed chart *What We Eat 2* to complete this activity.
3. Have students create a food web using the plants in the garden that include humans and organisms from both above ground and below, decomposers, pollinators and consumers. Have them create labels indicating each, flow of energy, flow of nutrients, etc.
4. Have students play the interactive Blast off On-Line at www.fns.usda.gov/multimedia/Games/Blastoff/BlastOff_Game.html.
5. Use the lesson *Fruits or Veggies* from *Project Food, Land & People's Resources for Learning*, which is available at www.faitc.org.

Extensions for Middle and High School students:

1. Use the lesson specifically developed for teaching biology to middle school and high school students *What Part of the Plant Do We Eat?* at *www.serendip.brynmawr.edu/sci_edu/waldron/*.
2. Use the lesson *Lunchtime Favorites* from *Project Food, Land & People's Resources for Learning*.
3. Have high school students research the composition of flax seeds (amount of fats and composition of fatty

acid make up of those fats) at www.flaxasia.net/new_nutritional%20makeup%20of%20flaxseed.html.

4. For challenging vegetables that are not readily identified as modified leaves or stems, have the students dissect celery and green onions. When celery stalks are stripped away, the center of the plant can easily be seen as the stem and the stalks of celery seen as the leaf petioles. And if an onion, green onion is best, is dissected in half lengthwise it is easy to see that the bulb of the onion is made of leaves.
5. Take the *Nutrition Voyage: The Quest to be Our Best* at www.fns.usda.gov/tn/Resources/nutritionvoyage.htm.
6. Have students research origins of food, impact of climate on the types of foods produced and the subsequent influence on culture and foods associated with that culture. (For example: cold, wet, Northern climates are unable to grow many crops. They can produce an abundance of cabbage, beets, cauliflower, and early spring grains such as barley, rye and oats. Eastern European cultures developed sauerkraut, borscht and rye bread. While warm, wet, tropical climates can produce tea, coffee, cocoa, rice, sugar, most of our spices and citrus. Indian and southern Asian cultures developed spicy foods, sweet and sour dishes, rice dishes, and most of the beverages commonly consumed around the world – tea, coffee, cola, chocolate.) A good source of information for student research is the Food Timeline at www.foodtimeline.org/index.html.

Resources:

Arizona Master Gardeners, Arizona Cooperative Extension, www.ag.arizona.edu/pubs/garden/mg/botany/seeds.html

Florida Master Gardeners, University of Florida Cooperative Extension, www.gardeningsolutions.ifas.ufl.edu/giam/index.html

Food Timeline. www.foodtimeline.org/index.html

Krauss, Ruth. *The Carrot Seed*. HarperCollins. 2004 (60th anniversary edition) ISBN-13: 9780064432108

MyPlate, United States Department of Agriculture, www.choosemyplate.gov/

Stevens, Janet. *Tops and Bottoms*. Houghton Mifflin Hartcourt. 1995. ISBN-13: 978015292513.

What We Eat

Sample Pre-Post Assessment

1. Name one vegetable that we eat that is a root:

2. Name a leaf that we eat:

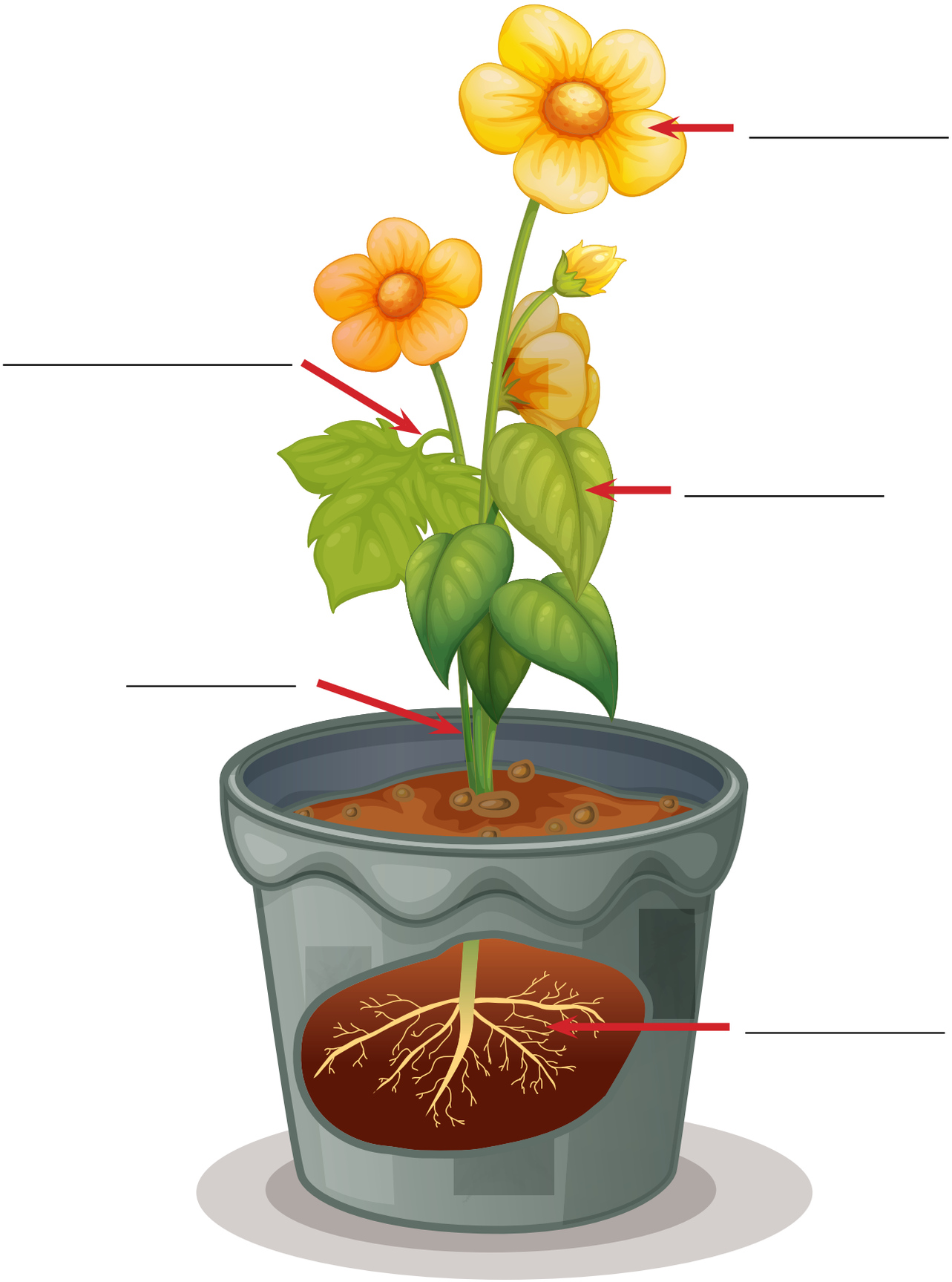
3. What are three foods made from seeds?

4. What plant part used for food contains oils and protein?

5. From how many plants in the school garden will plant fruits be harvested for food?

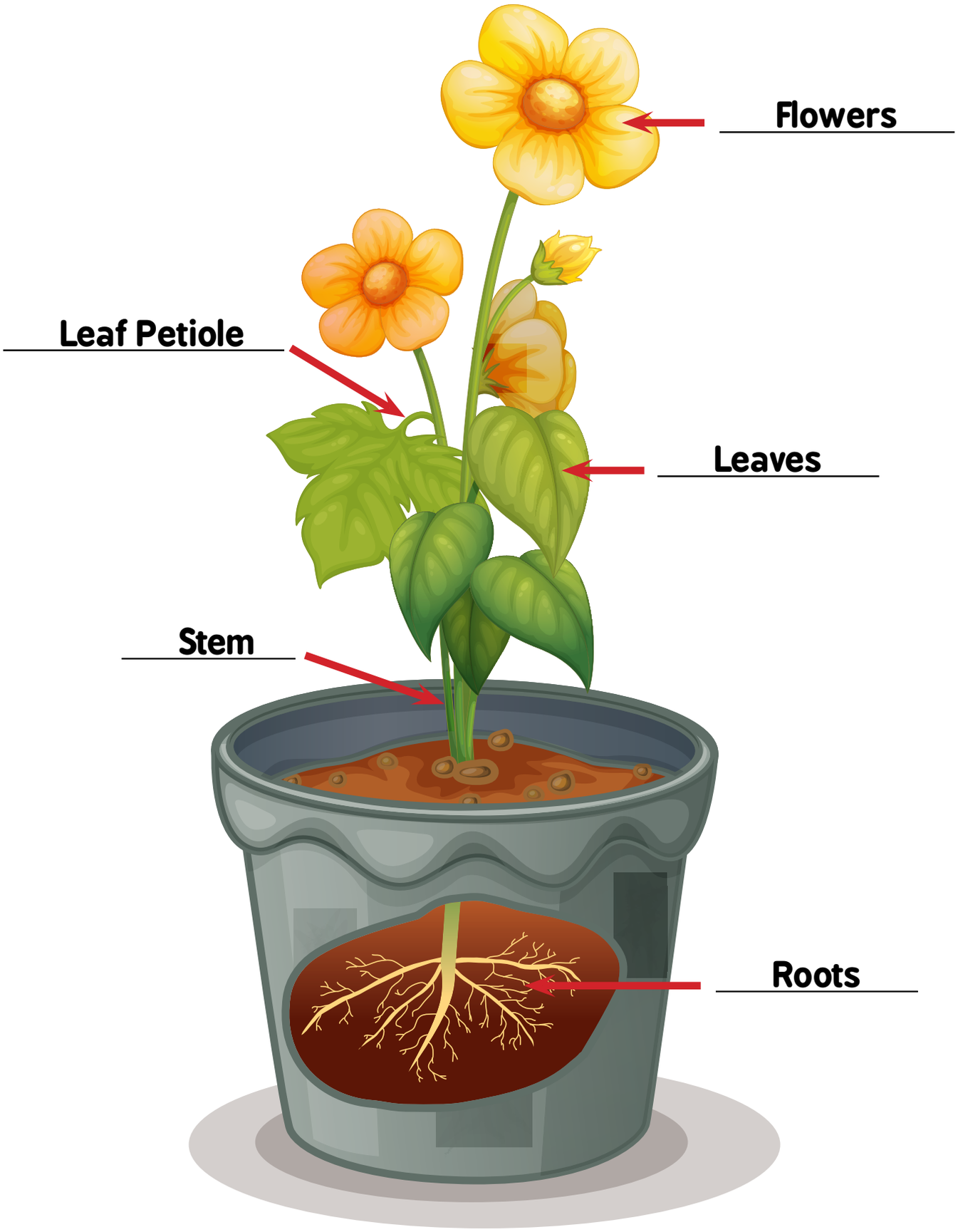
Parts of the Plant

Name:_____



Parts of the Plant

Name: Answer Key



What We Eat 1

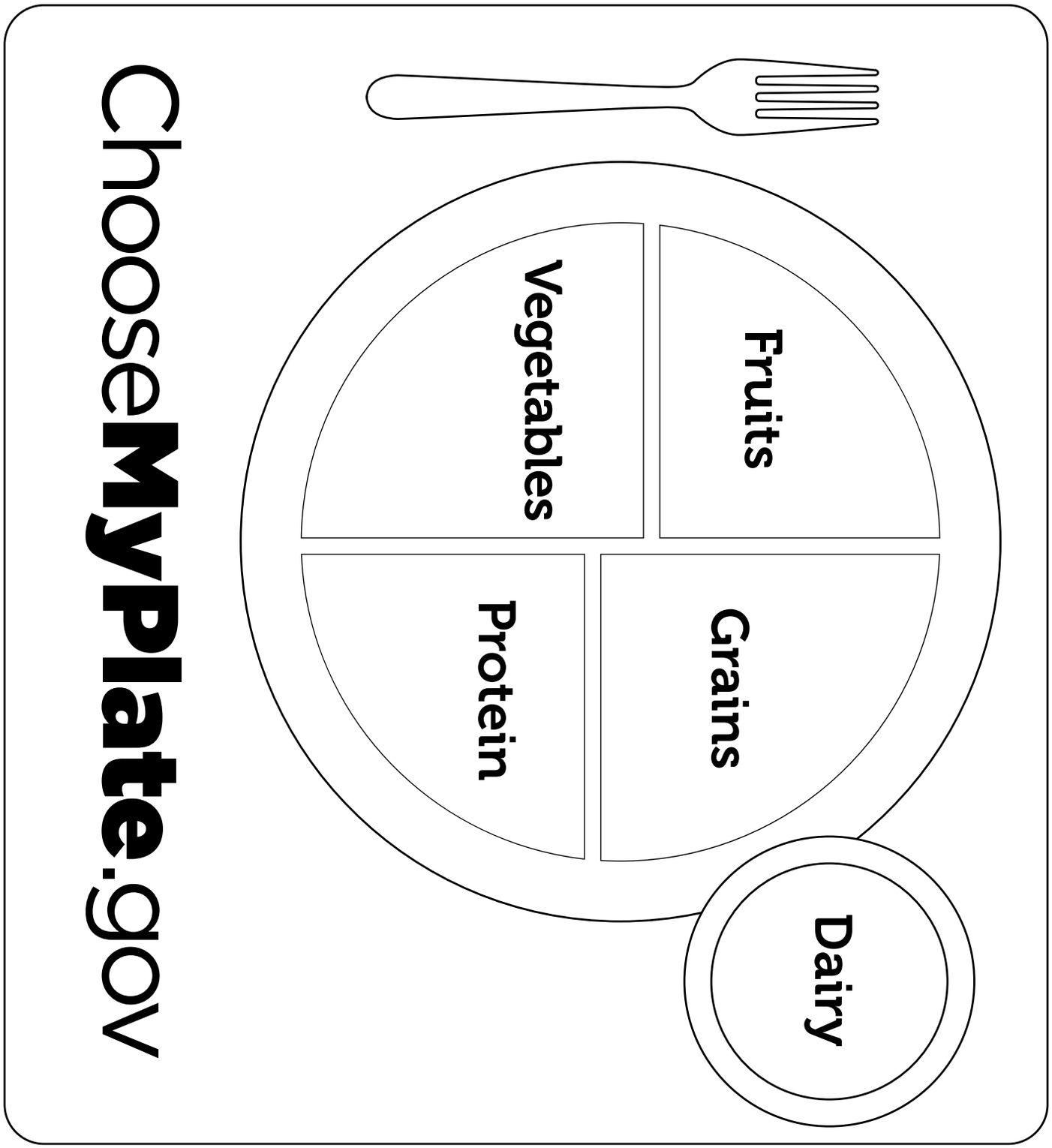
Name _____

Leaf /Leaves	Flowers	Stems	Roots	Seeds

What We Eat 2

Name _____

Leaf /Leaves	Leaf Petiole	Modified Leaves	Flowers
Seeds	**Stems**	**Modified Stems**	**Roots**



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