

What parts of a plant do we eat? -- Teacher Preparation Notes

© 2009 Dr. Jennifer Doherty and Dr. Lori Spindler, Department of Biology, University of Pennsylvania¹

Supplies and Teaching Suggestions

Paper plates (1 for each fruit or vegetable for each group)

Plastic knives for dissection (or metal depending on your students) (1 per group)

Fruits and vegetables for students to identify (5 different kinds per group)

Hand lens (optional; 1 per group)

Each student group should identify the part of the plant for around 5 fruits/vegetables. This small number will allow ample time for students to closely observe each specimen and debate within their group what type of plant part it is and what evidence they used to make their decision. You can use 5 unique fruits or vegetables for each student group or, more practically, purchase large quantities of 10-15 types and replicate sets.

Within their groups, students should be guided to use evidence and scientific argument (debate) to identify each plant part. To collect the best evidence, students need to cut open each plant part (e.g. cutting open a green pepper allows students to observe the seeds, cutting a celery bunch in half allows students to observe that all the stalks are growing out of a single short branch). If supplies allow, it can sometimes be useful to cut the specimen in several ways, e.g. cross sectional and longitudinally. If you do not want to provide a cutting instrument, you can pre-cut each specimen.

After each group has finished you may choose to have each student group report their findings to the class. If you have chosen to include replicate sets you may also choose to have students from groups that identified the same types confer with one another before presenting to the class. We recommend you finish the activity by having students participate in a class discussion summarizing what they have learned about plant parts from the activity.

Background on Fruits and Vegetables and Plant Parts

Each part of a plant has characteristic features that students can use for identification. Many plant parts have been modified by natural selection or artificial selection and no longer serve their original purpose, but still resemble the original parts in most ways and can be identified with careful observation.

Stems can be located either above or below ground. They have segments which consist of nodes and internodes. Lateral buds are located at the nodes and can give rise to lateral branches or leaves. The main purpose of stems is to connect leaves and roots and to support the above ground part of the plant so leaves can capture sunlight. Some underground stems, such as white potatoes, have been modified for storage and can be quite fat and fleshy. The presence of branches or leaves emerging from nodes (eyes) indicates that the structure is a stem. The internodes in some root vegetables can be very compressed leading to extremely short stems, but small leaves can sometimes be seen protruding. In onions and garlic the stem is reduced into a flat plate below the bulb which connects the leaves which form the bulb to the stringy roots below.

Leaves can be located either above or below ground. If they are above ground, their primary purpose is photosynthesis and they will be green. Developing leaves emerge from the stem at lateral buds which occur at the nodes. Most of the leaves we eat as vegetables come from dicot plants which have a wide flat portion called a blade and a stalk-like part called the petiole. In monocot plants such as onions, garlic and scallions, some leaves located underground are modified for storage and may be fleshy, while others aboveground are green and slender. A conspicuous feature in all leaves is the presence of veins.

¹These Teacher Preparation Notes and the related student handout are available at http://serendip.brynmawr.edu/sci_edu/waldron/.

Roots are primarily located below ground. Their two main functions for plants are anchorage and absorption of water and nutrients, but many root vegetables are important storage organs. Sugars manufactured above ground through photosynthesis are stored in large taproots such as sugarbeets, carrots and sweet potatoes. Do not confuse yams, which are underground stems similar to white potatoes, with the sweet potatoes they resemble. Large taproots can have lateral roots and root hairs, but they do not have nodes and internodes like stems.

Flowers and flowerbuds are located above ground. They are the reproductive structures of the plant designed to attract pollinators. They are often, but not always attached to the terminal ends of branches. In broccoli and cauliflower small round buds are clustered tightly together. If these buds are opened, the small pistils and stamens of flowers can be seen with a hand lens. An artichoke is the bud of a larger flower and the pistils and stamens can be found in the central choke portion.

Fruits are located above ground. They are reproductive structures of the plant designed for seed dispersal. A common way for plants to disperse their seeds is to attract animal dispersers by making their fruit sweet and colorful. The animals will then eat the fruit and disperse the seeds later in their feces. The same qualities that attract animal dispersers also make fruit attractive and tasty to humans. Botanically, a fruit is defined by the presence of seeds. If a plant part has seeds it is a fruit.

Teaching points:

- Reviewing the basic parts of a plant and their functions: specifically roots, stems, branches, lateral buds, leaves, flowers, fruits, and seeds
- Seeing the diversity of adaptations of the plant form
- Understanding that biologists use some terms differently from everyday English
- Practicing evidence-based reasoning and scientific argumentation

Name	Plant Part	Evidence students could cite
Artichokes	<u>Flower</u> : The artichoke we eat is a flower. The interior choke portion is where you will find the multiple anthers and pistils.	Flower parts, the shape looks like a bud or flower
Broccoli	<u>Flowers</u> supported by branched stems; the head of broccoli is composed of unopened flower buds.	Green, looks like a stem, has leaves on stem, tips of stem have buds
Cauliflower	<u>Flowers</u> supported by branched stems; the head of cauliflower is composed of unopened flower buds.	looks like a stem, has leaves on stem, tips of stem have buds
Apple	<u>Fruit</u> : The apple is a swollen ovary and another modified organ called the receptacle. Some flower parts may be found at the base of the fruit.	Seeds inside, remnant flower parts, sweet flesh
Banana	<u>Fruit</u> : A fruit with small unfertilized seeds inside.	small unfertilized seeds inside, sweet flesh
Citrus	<u>Fruit</u>	Seeds, sweet flesh, juicy
Corn	<u>Fruit</u> : Each kernel is an individual seed. The tassels are pistils. Each tassel connects to a single kernel. The seeds are attached to a stem which we call the cob.	Seeds inside, sweet flesh
Peas/Beans	<u>Fruit</u> : The pod is the entire fruit and individual peas and beans are seeds.	Seeds, flower parts (sepals)

Name	Plant Part	Evidence students could cite
Prickly Pear	Fruit: The fruit of the prickly pear cactus which is enclosed in a portion of the stem.	Seeds inside, sweet flesh
Tomato	Fruit	Seeds, brightly colored, sweet and juicy, flower parts (sepals)
Strawberry	Fruits with seeds on the outside	Seeds, brightly colored, sweet and juicy
Brussel Sprout	Leaf: Each individual sprout is composed of tightly folded leaves centered around a short stem which forms a side branch on the plant.	Leaves coming from stem
Celery	Leaf: A celery stalk is technically a petiole, not a stem. The petiole connects the stem to the leaves. The stem of the celery is the solid core that connects the petioles to the roots	Green, leaves, no branches coming off the stalk as might be expected from a stem; stalks come out from the stem
Garlic	Leaf: Each garlic clove is a group of modified leaves centered on a short stem base.	Has stem inside swollen leaves, roots coming down from base, leaf veins
Lettuce	Leaf	Leaves coming out from stem
Onion	Leaf: Onions are a group of modified leaves centered on a short stem base.	Has stem inside swollen leaves, roots coming down from base, leaf veins
Spinach	Leaf	Green and shaped like a leaf
Carrot	Root: An underground storage organ. Sometimes has lateral roots extending from the main root.	Root hairs, leaves grow up out of the top
Parsnip	Root: Parsnip is a root much like a carrot.	Root hairs, leaves grow up out of the top
Radish	Root:	Root hairs, leaves grow up out of the top
Sweet Potato	Root	Root hairs, not green
Asparagus	Stem	Lateral buds, green,
Cinnamon	Stem: The bark of a tree.	Brown, hard
Ginger	Stem: A modified stem that functions as an underground storage organ.	No root hairs→stem White and branched→roots
Turnip	Stem: A modified stem that functions as an underground storage organ. The slender taproot on the bottom is a true root.	Leaves come out in rings from stem→stem; Roots hairs, not green→root
White Potato	Stem: A modified stem that functions as an underground storage organ. Each bud (eye) can sprout into a new stem.	Stems come out of multiple “eyes”; roots only come out of one place on potato
Yam	Stem: A modified stem that functions as an underground storage organ.	Stems come out of multiple “eyes”; these may not be as obvious as in the white potato.