Plant Parts and Their Diseases

Purpose:

This exercise is designed for young children (K to 3) to teach the different parts of a plant (root, stems, leaves, flowers, fruit, and seeds), the basic functions of each part, and to show that tiny microscopic organisms ("germs") can cause each part of a plant to become diseased. The lesson provides the opportunity to instruct children about different "germs" that infect plants. The laboratory section highlights the lesson by having the children eat different parts of a plant, i.e. a root (carrot), a stem (celery), a leaf (lettuce), a flower (broccoli floret), a fruit (cucumber), and a seed (popcorn) (Figures 1 & 2). The lesson shows children the importance of understanding what causes plants to be sick and the need for scientists called plant pathologists to keep plants healthy. The lesson should last approximately 20 min followed by a 20 min laboratory.


Figures 1 & 2. First grade children eating different plant parts. (Courtesy W. Elmer) Click images for a larger view.

Background information:

Animal life on planet earth would not exist were it not for plants. Plants make oxygen that is needed by almost all animals. Mankind has used plants to provide food, medicines, clothing, flowers, recreation, and building materials. Plants, like people, can catch diseases. Plants become sick and diseased when they are infected with organisms called pathogens. These organisms fall into groups called fungi, bacteria, nematodes, and viruses. Most are so small that they can only be seen with a microscope. When plants that are very important to people become diseased, scientists, called plant pathologists, are trained to help growers protect their crops.

Like people doctors, plant pathologists help growers protect their plants by:

1. Helping growers to determine what disease their plants have and how to avoid the disease.

2. Helping growers recognize the diseased plants early in the season so they can stop the disease before it spreads.

3. Showing growers which types plants they can grow that will be more resistant to disease.

4. Showing growers which plant "medicines" can protect their plants.

Materials and Methods

Materials Needed for Lesson:

1. Edible examples. Choose common and uncommon examples of each plant part as suggested in Table 1.

Table 1. Typical and atypical examples of plant parts and examples of disease that each plant gets.

	Examples			
Plant Part	**Typical**	**Atypical**	**Comments**	**Color Photos of Diseased Plant Part**
Roots	carrot, radish	sweet potato	Roots do not turn green if left in the sun.	Fig. 3 Healthy carrots and carrot infected with root-knot nematodes (*Meloidogyne* spp.)
Stems	celery, asparagus	potato	Potatoes are tubers or underground stems and not roots. Potatoes turn green when left in the sun and have buds in their "eyes."	Fig. 4. Pink stem rot of celery caused by *Sclerotinia sclerotiorum*
Leaves	lettuce, spinach	onion, garlic	Show the thickened basal leaves of onions and garlic.	Fig. 5. Soft rot of lettuce caused by *Erwinia* spp.
Flowers	rose hip (tea)	broccoli	Point out the small flowers on the florets.	Fig. 6. Downy mildew of broccoli caused by *Pseudoperonospora* spp.
Fruits	apple, orange	cucumber, tomato	Fruits have seeds inside.	Fig. 7. Belly rot of cucumber caused by *Rhizoctonia* spp.
Seeds[1]	pumpkin seeds	popcorn, cereals	Nuts[1] and grains are also seeds	Fig. 8. Common smut of corn caused by *Ustilago maydis*

[1] **Caution! Nuts should NOT be brought into the classroom. Some children have severe allergies to nuts and nut products.**

2. Photographs of the diseased plant parts. Examples are available on-line in the final section of this lesson and can be printed out for this intended use only. Live diseased plants will improve the presentation. Check the Mentor list in this website (http://www.apsnet.org/education/K-12PlantPathways/Mentors.html) for a plant pathologist near you who may be able to provide materials.

3. Paper plates, napkins, bite-sized sliced carrots, celery, lettuce, broccoli, cucumbers and popcorn (each in separate containers), salad dressing (Ranch dressing is best received by this age group).

4. Classroom "room parents" or teaching assistants are excellent resources for providing these items.

Lesson Plan

Part I: Why plants are important

The objectives for Part I are:

1. To show how certain plants are very important to us.

2. To show that healthy plants are important to keep people healthy.

The instructor can ask children why plants are important to people. Six areas can be discussed:

1. **Food**: Children can be asked what they had for breakfast. Example: If a child says "Pop Tarts," explain that flour comes from grains and jam comes from fruits. Example: If a child says "ham and eggs," explain that these animals were fed corn, oats, etc.

2. **Air**: Ask the children where the oxygen that we breathe comes from. When leaves make their food with sunlight, they release oxygen.

3. **Building Materials**: Ask the children what pencils, desks, and houses are made of. Wood comes from trees (plants).

4. **Clothing**: Ask a child wearing a cotton shirt if s/he knows what it is made of. Ask a child what linen sheets are made from (flax). Many dyes originally came from plants.

5. **Gifts, Beauty, Recreation:** Ask the children if they give flowers or plants on Mother's Day, or enjoy planting flower gardens, or playing in parks or sports fields.

6. **Medicines**: Many medicines come from plants. Example: Aspirin was first found in the bark of willow trees.

Part II: **Plant Parts - their function and diseases**

The objectives for Part II are:

1. To teach the major parts of a plant (root, stems, leaves, flowers, fruit and seeds) and their basic functions.

2. To teach that each part of a plant can become diseased.

3. To show that plant pathologists are needed to keep plants healthy.

The instructor should discuss the six major parts of a plant. Roots, stems, leaves, flowers, fruits, and seeds.

Each plant part has major functions:

1. Roots absorb minerals and water, and anchor the plants. Show examples of edible roots: carrots, radishes, turnips, or sweet potatoes. Show photographs of how roots can become diseased and not grow well (Figure 3).

Figure 3. Root-knot nematode damage on carrots. (Pathogen = nematodes; nematodes are microscopic parasitic worms that can attack plants.) Click image for an enlarged printout view.

2. Stems carry nutrients and water up and down the plant, and support the leaves. Show examples of edible stems: asparagus, celery, or rhubarb. Stems may become diseased (Figure 4).

Figure 4. Sclerotinia pink rot of celery. (Pathogen = fungus; fungi are usually microscopic multicellular organisms that can be beneficial or harmful to plants.) Click image for an enlarged printout view.

3. Leaves make food (energy from the sun + CO_2 + H_2O = sugar). Show examples of edible leaves: lettuce, spinach, onion, garlic, or cabbage. Leaves may become diseased (Figure 5).

Figure 5. Bacterial soft rot of lettuce. (Pathogen = bacterium; bacteria are single-celled microscopic organisms.) Click image for an enlarged printout view.

4. Flowers provide nectar, attract insects, and produce fruits and seeds. Show examples of edible flowers: rose hips, broccoli florets and artichokes. Flowers may become diseased (Figure 6).

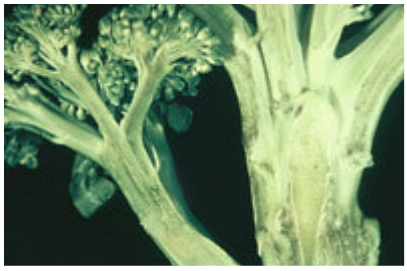

Figure 6. Downy mildew of broccoli. (Pathogen = fungus; fungi are microscopic multicellular organisms that can be beneficial or harmful to plants.) Click image for an enlarged printout view.

5. Fruits have the seeds inside. Show examples of edible fruits: apples, oranges, green peppers, or cucumbers. Explain that although cucumbers, tomatoes, green peppers and pumpkins are grown and sold as vegetables, they are actually fruits because they are produced from flowers and contain seeds. Fruits may become diseased (Figure 7).

Figure 7. Cucumber belly rot. (Pathogen = fungus; fungi are microscopic multicellular organisms that can be beneficial or harmful to plants.) Click image for an enlarged printout view.

6. Seeds are produced by plants in order to make new plants for the next generation. Show examples of edible seeds. Sunflower seeds, popcorn (avoid nuts). Seeds may become diseased (Figure 8).

Figure 8. Common smut of corn. (Pathogen = fungus; fungi are microscopic multicellular organisms that can be beneficial or harmful to plants.) Click image for an enlarged printout view.

Lab exercise

The lesson objectives for the lab exercise are:

1. To become familiar with the various parts of plants by eating samples of each.

2. To appreciate the value of different plant parts as food.

3. To appreciate how the world would be different if plant pathologists did not keep plants healthy.

Ask children to line up and receive a piece of carrot (root), celery (stem), lettuce (leaf), broccoli (flower and stem), cucumber (fruit), and popcorn (seed). Provide Ranch dressing and have the children return to their seats and eat each plant part. While they are eating, the instructor can ask what plant part they are eating. Ask the children how their lives would be different if there were no plant pathologists to keep their food healthy.

Discussion Questions

1. Why are plants important to people?

2. Name a root, stem, leaf, flower, fruit, and seed that you like to eat.

3. Do plants get diseased? Why?

4. Why is a tomato a fruit?

5. What are plant pathologists and what do they do?

6. What would happen if we could not prevent plant diseases?

Answers to Discussion Questions

1. Why are plants important to people?

They provide air, food, medicines, clothing, flowers, recreation, and building materials.

2. Name a root, stem, leaf, flower, fruit, and seed that you like to eat.

Carrot, celery, lettuce, broccoli, cucumber, and popcorn, respectively or other suggestions.

3. Do plants get diseased? Why?

Yes, they get diseases, just as people do, because organisms called pathogens infect them.

4. Why is a tomato a fruit? Fruits have seeds inside even though they are sold as vegetables.

5. What are plant pathologists and what do they do?

Plant pathologists are scientists who study plant diseases. They help growers prevent and treat diseases on their plants.

6. What would happen if we could not prevent plant diseases?

The amount and quality of food, building materials, clothing, ornamentals, and medicines would be reduced.

Supplementary Information and References

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1. Numerous age appropriate books are available for children that discuss plants and how they grow.

2. The American Phytopathological Society publishes a storybook book for children. The publication can be downloaded without charge in English or Spanish using Adobe Acrobat Reader. In addition, an age-appropriate, colorful classroom poster entitled "Healthy Plants - Healthy People" is also available free of charge as a download. Find these materials and additional resources in the K-12 Resource Catalog in this site: http://www.apsnet.org/education/K-12PlantPathways/ResourceCatalogue/Top.html

3. Dale Seymour Publications. Pearson Learning. www.pearsonlearning.com

4. Although written at an advanced level, there is a set of Plant Disease Lessons in this website that includes many more photographs of plant diseases on various kinds of plants that might interest your students. http://www.apsnet.org/education/LessonsPlantPath/Top.html

For the Instructor

Note: Images in the last column link to printable pages.

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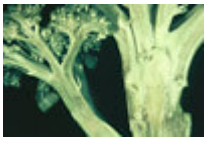
Flowers	rose hip (tea)	broccoli	Point out the small flowers on the florets.	 Fig. 6. Downy mildew of broccoli caused by *Pseudoperonospora* spp.
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