

Life Science – Grade 3

Plant Structure and Function

Standards:

- Differentiate between inherited characteristics of plants and those that are not
- Recognize plant behaviors
- Demonstrates an understanding of the plant life cycle
- Identifies the basic plant parts
- Demonstrate an understanding of photosynthesis

Teacher Background

- **Differentiate between inherited characteristics of plants and those that are not**

A website on plant adaptations

<http://www.mbgnet.net/bioplants/adapt.html>

Examples of **inherited characteristics** in plants that can vary and change over time (these are traits that are consistent for the plant year to year)

Leaf shape (points to shed water)
Growth rate (alpine plants grow quickly)
Poison (milkweed-goat, red maple-horse)
Bark thickness (dry vs. wet)
Bad taste (greens, acorns, walnuts)
Seed cover shape (for travel)
Waxy leaf coating (wet vs. dry)
Leaf drop (northern climates)
Flower shape and color (pollinators)

Examples of **non-inherited characteristics** in plants that vary based upon that years environmental conditions (how much sunlight, minerals and water are available)

Leaf size	Fruit size
Total plant size	Fruit amount
Growth rate	Total plant shape (think trees)

- **Recognize plant behaviors**

Plant behaviors are called Tropisms. These are the ways that plants respond to their environment. Below is a list of different plant tropisms. You may choose to use this term or not. Plant behavior is fine for 3rd grade.

- **Geotropism** – response to gravity- Plant roots grow in the direction of gravity and plant stems grow opposite to the pull of gravity
 - **Phototropism** – response to light – Plant leaves and stems grow in the direction of the strongest light.
 - **Chemotropism** – response to chemicals – Plants roots will grow toward minerals that they need and away from others that are harmful, such as salt.
 - **Thigmotropism** – response to touch – Some plants are able to respond to touch, such as the Venus flytrap, morning glory, pea and squash family tendrils (when they touch something they grow in that direction and grab on to it)
- **Demonstrates an understanding of the plant life cycle**

Plants have a distinct life cycle. It goes as follows:

Seed
 Seedling – germination is the name of this process
 Adult plant
 Flowering – pollination occurs here
 Seeds form
 Seed

Web site diagram of **plant life cycle** and **germination** plant videos

<http://www.the-simple-homeschool.com/plant-life-cycle.html>

Pollination - description

<http://www.plantadvice.co.uk/blogs/59/>

video slideshow

<http://www.youtube.com/watch?v=J1VnJuL7kT4&feature=related>

- **Identifies the basic plant parts**

Plant parts and functions

Roots	Structure - Tap root, lateral root, Root hairs, root cap Function - anchor plant – absorb nutrients – absorb water
Stems	Structure - Microscopic tubes Phloem- carries the food (sap) (2 way flow) – living tissue Xylem – carries the water (one way flow – up) – dead tissue (inside of the stem) Function - support leaves and flowers – transport between roots and leaves

Leaves	<p>Structure – Macro parts - petiole, midrib, margin, tip, Microscopic parts – cuticle, epidermis, stomata, chloroplast</p> <p>Function - Collect sunlight Photosynthesis – (put together with light) Produce sugar in the chloroplasts by collecting sunlight and using it to combine CO₂ and water to form glucose (sugar)</p>
Flower	<p>Structure – protective parts – receptacle, sepal, petal Female parts - Pistil (stigma, style, ovary, ovule) Male parts - Stamen (anther, filament, pollen)</p> <p>Function - Produces fruit, but most important is seeds</p>

▪ **Demonstrate an understanding of photosynthesis**

Photosynthesis is a very difficult topic for children (and adults) to understand, but the gist of it is that plants use sunlight to make sugar from Carbon dioxide and Water. Plants use sunlight for energy in a similar way that we use heat to change a cake batter into a cake (or sugar cookie batter into a sugar cookie)

Leaves contain structures in their cells called chloroplasts. Chloroplasts contain the chemical chlorophyll which through a rather involved process converts sunlight into an unstable chemical form of energy. This chemical (ATP) is then used to rearrange water and carbon dioxide so that it becomes glucose or sugar, which is used by the plant for energy (eaten if you will). The sugar can be stored for a long time and more importantly, can be eaten by animals. (Thus we are all eating different forms of sunshine!)

This trick is the beginning of almost all food chains on Earth. It is really an amazing feat and one that should cause students to be full of wonder. You can trigger a student's curiosity by asking how plants eat food. Where is their mouth? How does it get food? Once you get to the answer that plants make their own food you can explain that if they could do this, then instead of going to the cafeteria for lunch, we would all march outside, lay down in the sun and make lunch. Then all the food we would need would be stored in our body.

There are many videos on photosynthesis, but most are too complicated. If students can understand that

1. Plants make food by using sunlight, carbon dioxide and water
2. This is the beginning of almost all food chains on Earth
3. Humans depend upon plant photosynthesis for all our food.

Then you will have accomplished this objective.

Plant terminology page

<http://grandpacliff.com/Plants/Glossary-Plants.htm>

Lesson 1 - Parts of a Plant

Materials: Roots – strings of ropes that go around the ankles
Stems – a belt of straws that goes around the waist
Leaves – green paper leaves that go on the arms
Flower – a flower that goes on the students head.

Procedure:

1. Select a child to be the plant
2. Invite a student to place a part on the plant.
3. Invite another student to tell it's function
4. Repeat until all the plant parts are on.

Teacher Cheat Sheet:

Roots	Structure - Tap root, lateral root, Root hairs, root cap Function - anchor plant – absorb nutrients – absorb water
Stems	Structure - Microscopic tubes Phloem- carries the food (sap) (2 way flow) – living tissue Xylem – carries the water (one way flow – up) – dead tissue (inside of the stem) Function - support leaves and flowers – transport between roots and leaves
Leaves	Structure – Macro parts - petiole, midrib, margin, tip, Microscopic parts – cuticle, epidermis, stomata, chloroplast Function - Collect sunlight Photosynthesis – (put together with light) Produce sugar in the chloroplasts by collecting sunlight and using it to combine CO ₂ and water to form glucose (sugar)
Flower	Structure – protective parts – receptacle, sepal, petal Female parts - Pistil (stigma, style, ovary, ovule) Male parts - Stamen (anther, filament, pollen) Function - Produces seeds

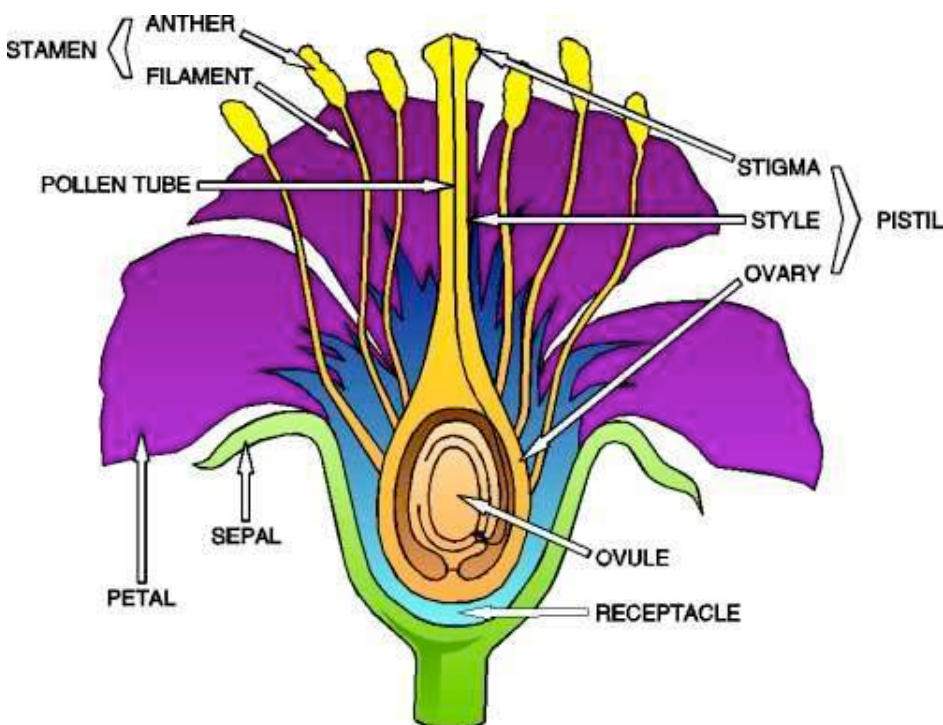
Lesson 2 - Flower Dissection Lab

Objectives:

- ∞ To learn the parts of the flower.
- ∞ To compare male and female flower anatomy

Materials:

Flower paper towel plastic knife flower diagram



Picture from www.madsci.org

Procedure:

1. Each group will be given one flower, one knife and a paper towel.
2. Hold the flower upside down and identify the sepals and petals.
3. Record the number of sepals and petals on the data sheet.
4. Using your knife, very **CAREFULLY** remove each sepal and petal. Arrange them in two piles on your paper towel.
5. Draw what remains of your flower in Drawing #1. Be sure to label: Anther, Stamen, Filament, Stigma, Style, Ovary, & Pistil

6. The anthers may be releasing **pollen**. Tap it a little on a white sheet of paper. The powder is the pollen.

7. Count the number of Anthers. Record it in the data sheet.

8. Count the number of sections in the pistil. Record in the data sheet.

7. Use your knife to cut the pistil in $\frac{1}{2}$ crosswise. Look inside the ovary. See if you can find the **ovules**. They are little, baby seeds. When fertilized, they will become **seeds**. Count the number of sections in the ovary. Record in the data sheet.

Name _____ Date _____

Flower Part Data Sheet

Flower Part	Number of Parts	Monocot or Dicot
Sepal		
Petal		
Anther		
Pistil		
Ovary		

Drawing #1

Please draw your flower without petals and sepal.

Answer the questions below.

1. Name the female parts of your flower.

2. Name the male parts of your flower.

3. Is your flower a monocot or a dicot?

4. Was your flower releasing pollen? How could you tell?

Conclusion:

Please write 2-3 sentences on what you learned.

Lesson 3 – Inherited Characteristics

Objective: Learn how plants have inherited characteristics that help them live in a particular environment

Materials: research materials

Procedure:

1. Assign students a plant to research, along with its environment and determine how its characteristics fit the environment.
2. Students should present the plant (PowerPoint, podcast, poster, or a presentation style of their choosing) and show three characteristics that help it to live in that environment.

Lesson 4 – Are Leaves on a Tree the Same Size?

Objective: Measure how plants respond to their environment

Materials: journal ruler

Procedure:

1. Choose a tree in the schoolyard
2. Measure the leaf width and petiole length of ten different leaves
3. Record the data.
4. Stand under the tree on a sunny day and notice how much sunlight hits the ground.

Name _____ Date _____

Leaf Data Sheet

Leaf Number	Leaf Width	Petiole Length
1		
2		
3		
4		
5		
6		
7		
8		
9		
10		

Questions

1. Why are some leaves wider than others to catch sunlight?

2. Why are the petioles of the leaves different lengths to catch sunlight?

3. Do you think that the leaves of a tree are the same every year or do the leaves of the tree adapt to the amount of light each year?

Teacher notes: When leaves grow in the spring, they grow into the available sunlight. If no sunlight is near the leaf bud, it will grow a longer petiole (leaf stem) until it finds sunlight. The overall effect of this is that very little sunlight reaches the ground under a tree, as the leaves have captured almost all the available light.

Lesson 5 - Optional Experiment (if unit is done in the spring)

Question: Is soil temperature a factor when different trees begin producing leaves in the spring?

Materials: soil thermometers different tree species

Procedure:

1. Determine at least 4 different species of trees in the school yard and try to find each of two species
2. Measure the soil temperature at a depth of 2” at the base of the tree
3. Record the temperature at the same time and same weather each week
4. Record the development of buds and leaf growth
5. Continue measuring soil temperature until leaves at 2” long.

Lesson 6 – Plant Behaviors

Objective: recognize plant behavior (geotropism)

Materials: seeds
sealed plastic bags
paper towels

Procedure:

1. Wet a paper towel.
2. Fold the paper towel around a few seeds
3. Place the paper towel with seeds into the plastic bag and seal it
4. Tape the plastic bag on a window
5. After the seed sprouts, rotate the bag a $\frac{1}{4}$ turn each week and observe the direction of root growth.
6. Draw the root each week.

Lesson 7 – Plant Behaviors

Objective: recognize plant behavior (phototropism)

Materials: plants (bean, or any tall stem plant)
light source

Procedure:

1. Divide the plants into two groups. Regular, dispersed light and light from one side
2. Treat the plants the same in every other aspect
3. Record the height and shape of the plant each week

Lesson 8 – Plant Behaviors

Objective: recognize plant behavior (chemotropism)

Materials: plants
salt

Procedure:

1. Divide plant into two groups. Water with tap water and salty water (1% salt)
2. Treat the plants the same in every other aspect
3. Record the height of the plants each week.

Teacher note: Lessons 6,7 and 8 can be done simultaneously with several days of no science taught between them.

Lesson 9 - Photosynthesis

Resources

http://www.educationworld.com/a_lesson/lesson/lesson024.shtml

Objective: Demonstrate an understanding of photosynthesis

Materials: aluminum foil plastic baggie living plant

Procedure:

1. Choose a living plant to experiment on.
2. Cut out a shape of aluminum foil. Shine a light on the foil and record how much light gets through.
3. Tape the foil shape along the edges tightly onto a leaf of the plant.
4. Leave the foil on the plant for one month
5. On another leaf, cover it with a Zip-lock baggie and seal tightly.
6. Record any observed changes with the baggie the next day. (where did the water come from?)

7. Remove the foil and record the results on the leaf.

Questions for the foil experiment

1. How much light can get through a piece of aluminum foil?
2. What color was the leaf? What color was the leaf under the aluminum foil?
3. Why did the color change under the foil? (what was the leaf missing?)
4. What does the green color in leaves do for a plant?

Questions for the plastic baggie experiment

1. How did the bag look different from the day it was put on?
2. Where did the water in the bag come from?
3. What was the plant doing that produced water? Hint: what do leaves do in sunlight?