



Structures and Functions of Living Organisms



6.L.1 Understand the structures, processes and behaviors of plants that enable them to survive and reproduce.

6.L.1.1 Summarize the basic structures and functions of flowering plants required for survival, reproduction and defense.

6.L.1.2 Explain the significance of the processes of photosynthesis, respiration and transpiration to the survival of green plants and other organisms.

Plants Alive



What are the characteristics of plants?

- All plants are multicellular, which means their bodies are made up of more than one cell.
- Plants are eukaryotes, which means their cells contain membrane-bound organelles, including a nucleus with the cell's DNA.

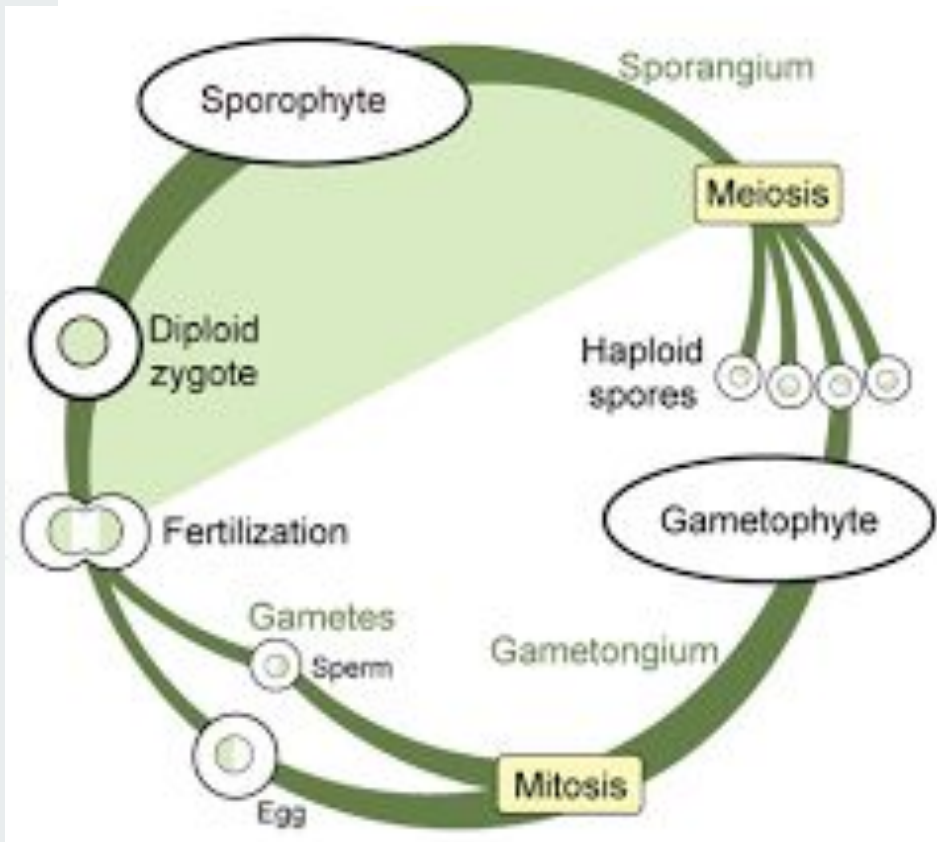


What are the characteristics of plants?

- All plants have a life cycle made up of two stages: *sporophyte* and *gametophyte*.
- In the sporophyte stage, plants make spores that are genetically identical to the parent plant.
- In the gametophyte stage, plants produce gametes. Female gametophytes produce eggs and male gametophytes produce sperm.



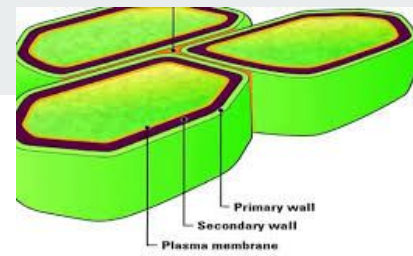
Plant Life Cycle





What are the characteristics of plants?

- Eggs and sperm are sex cells.
- For a new plant to be produced, a sperm cell must fuse with, or fertilize, an egg. This is called sexual reproduction.
- The fertilized egg can grow into a sporophyte, and the cycle can begin again.



What are the characteristics of plants?

- Plant cells are surrounded by a rigid cell wall that lies outside the cell membrane. The cell wall supports and protects the plant cell.
- The cell wall determines the size and shape of a plant cell. A carbohydrate called *cellulose* is the main component of plant cell walls.
- The strength of a cell wall helps plants stand upright. *Secondary cell walls* form in some plant cells after the cells are mature. These secondary cell walls give wood its strength.

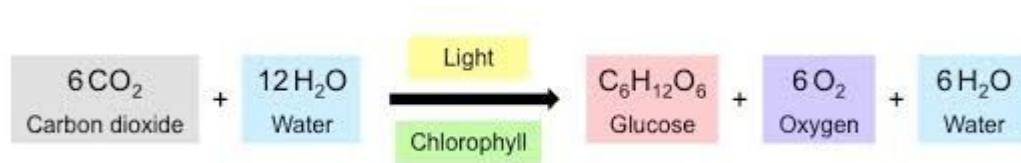
What are the characteristics of plants?

- Inside a plant cell is a large central vacuole, a membrane-bound organelle that stores water and helps to keep the plant upright.
- If the vacuole loses water, the plant begins to wilt.



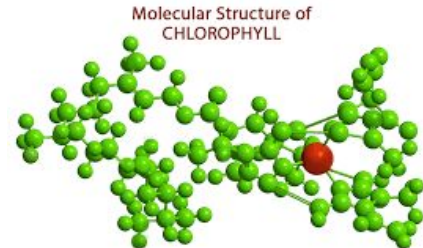
What are the characteristics of plants?

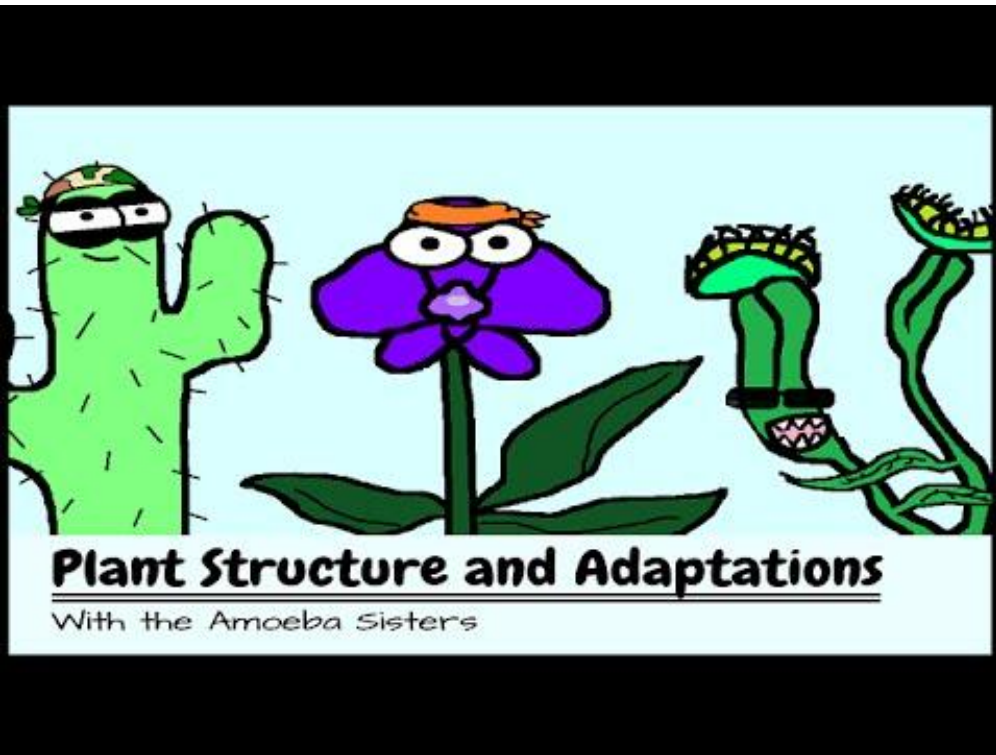
- Almost all plants are **producers**. Producers make their own food by using energy from their surroundings.
- The process that plants and other organisms use to convert solar energy to chemical energy is called **photosynthesis**.



What are the characteristics of plants?

- In plants, photosynthesis occurs in an organelle called a chloroplast. Chloroplasts contain special pigments called chlorophyll.
- **Chlorophyll** is a green pigment that captures energy from sunlight.
- Chloroplasts use this energy, along with carbon dioxide and water, to make food in the form of a sugar called *glucose*.





Plant Structure and Adaptations

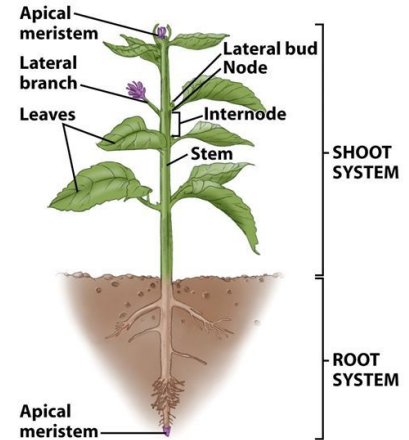
With the Amoeba Sisters

Parts of a Vascular Plant...

- The root system is made of roots and other underground structures.
- The above-ground structures, such as stems, leaves, and flowers, make up the shoot system.
- The three major organs of vascular plants are roots, stems, and leaves.
- Vascular tissue transports water and materials between roots and shoots.

Organs of Vascular Plants

- Roots
- Stems
- Leaves



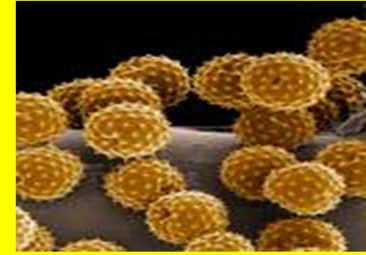
Seeds of Success

How are seed plants classified?

- Seed plants are vascular plants that reproduce by making seeds. A **seed** is a plant embryo enclosed in a protective coating.
- Seed plants produce **pollen**, a tiny structure in which sperm forms. The sperm cell fertilizes an egg cell, which develops into an embryo inside a seed.
- Seed plants are classified based on whether or not their seeds are enclosed in a fruit.

pollen

The tiny granules that contain the male gametes of seed plants.



How are seed plants classified?



- **Gymnosperms** are plants that produce seeds that are not enclosed in a fruit. This includes cyads, ginkgoes, and conifers.
- Cyads produce seeds in large, woody structures called *cones* that grow in a thick trunk.
- Ginkgoes produce round, grape-like seeds not covered by a cone.
- Conifers, such as pine trees, also produce cones.

How are seed plants classified?

- **Angiosperms** are vascular plants that produce flowers and fruits that surround and protect seeds. Flowers are reproductive structures of angiosperms.

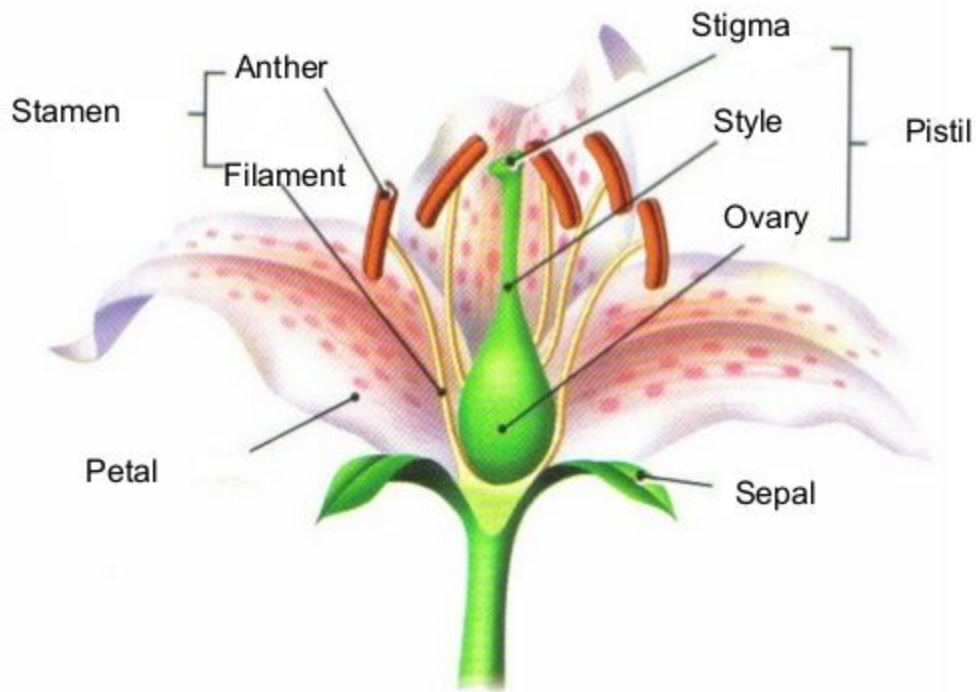




How are seed plants classified?

- Sepals cover and protect the flower while it is budding. Petals attract pollinators.
- A stamen is the male reproductive structure. The stamen is made up of an anther, which produces pollen, attached to a filament.
- A pistil is the female reproductive structure. The seed develops in the ovary at the base of the pistil. The ovary matures into a fruit covering the seed.

Structure of Flowers



Pharmaceuticals and Plants

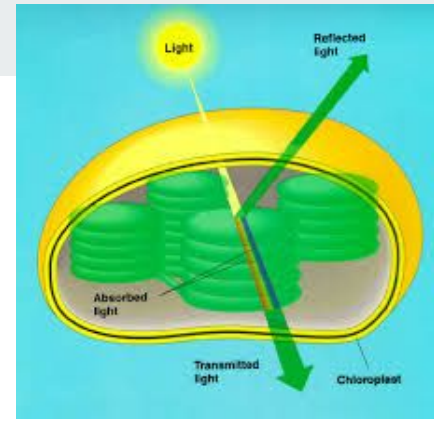
- Many modern medicines are derived from chemicals found in plants. Tropical rain forests are a source of many potential medicinal plants.
- The white willow tree's bark has a compound called salicin that led to the development of aspirin.
- Foxglove is a flowering plant that produces compounds used to make medicine for the heart.



Plant Processes



Fueled By the Sun



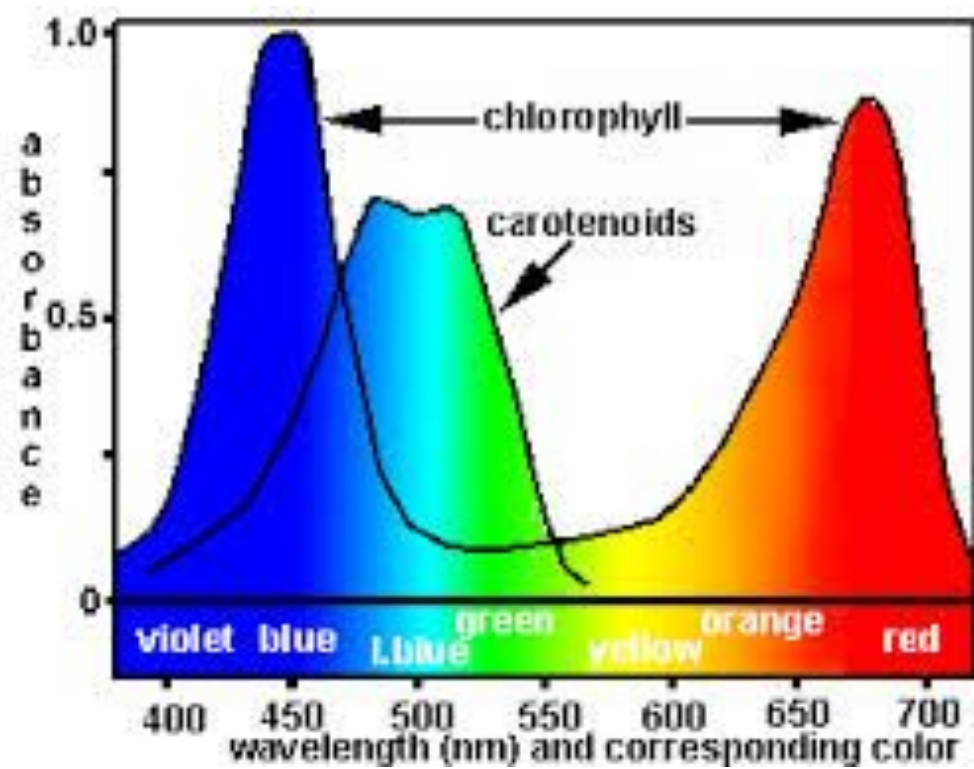
How do plants obtain and use energy?

- Plants use photosynthesis to change light energy to chemical energy in the form of sugar.
- Plant cells have organelles called *chloroplasts* where photosynthesis takes place.
- Chloroplasts are made up of two membranes that surround stacks of smaller, circular membranes that contain chlorophyll, a green pigment.



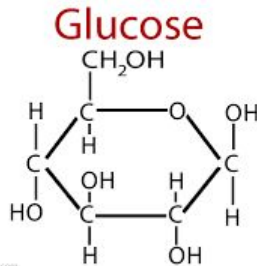
How do plants obtain and use energy?

- Chlorophyll absorbs light energy from the sun.
- Sunlight is made up of various wavelengths of light. Different wavelengths of visible light are seen as different colors.
- Chlorophyll absorbs many wavelengths, but it reflects more green light than it reflects other colors of light. As a result, most plants look green.



How do plants obtain and use energy?

- The light energy captured in chloroplasts is changed and stored in the bonds of a sugar called glucose.
- In the same process, oxygen gas is released.





How do plants obtain and use energy?

- In plants, extra glucose is stored as starch or changed to other types of sugar such as fructose or sucrose.
- In **cellular respiration**, cells use oxygen to release stored energy from the bonds of sugar molecules. This occurs in organelles called mitochondria.
- Cellular respiration also produces carbon dioxide and water.

Glucose + Oxygen → Carbon Dioxide + Water + ATP





How do seedless plants reproduce?

- In seedless plants, sperm, which have tails and swim to eggs to fertilize them, are released in the presence of water.
- The fertilized eggs grow into sporophytes.
- Some seedless plants, such as mosses, have a visible gametophyte phase.



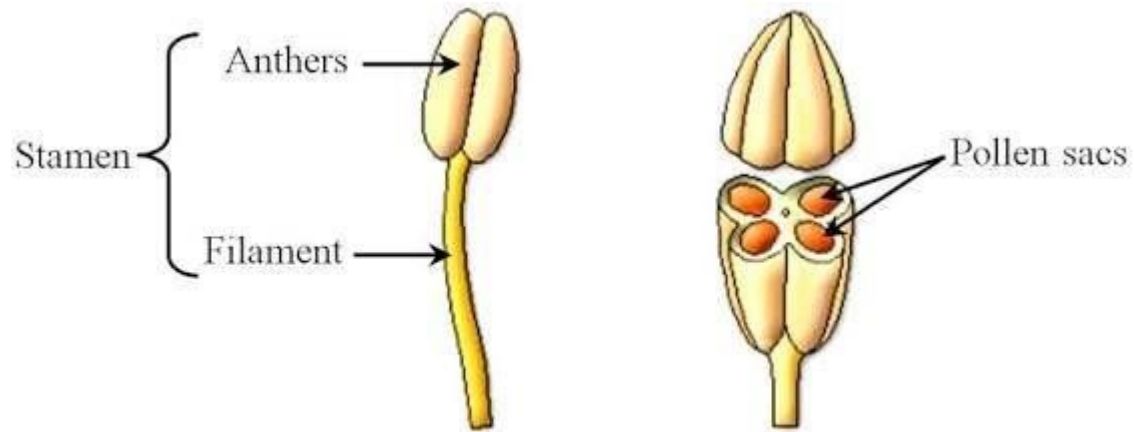
How do seed plants reproduce?

- In most seed plants, the sporophyte makes two types of spores, male and female, that grow into microscopic male and female gametophytes.
- The male gametophyte is pollen, a tiny structure where sperm forms, which can be carried by wind, water, or animals.
- The female gametophyte produces eggs. **Pollination** happens when pollen lands on and fertilizes the female plant reproductive structure.

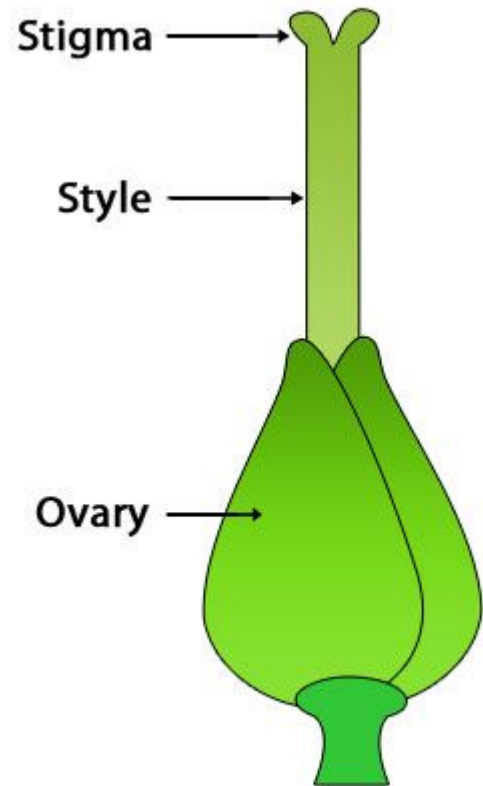


How do flowering plants reproduce?

- Flowers are reproductive structures with specialized leaves called sepals and petals, which can attract animal pollinators such as insects.
- A **stamen** is the male reproductive structure of flowers. At the tip of each is an *anther*, where pollen is produced.
- A **pistil** is the female reproductive structure of flowers. When pollen reaches the tip of a pistil, called the *stigma*, pollination occurs.



Structure of stamen



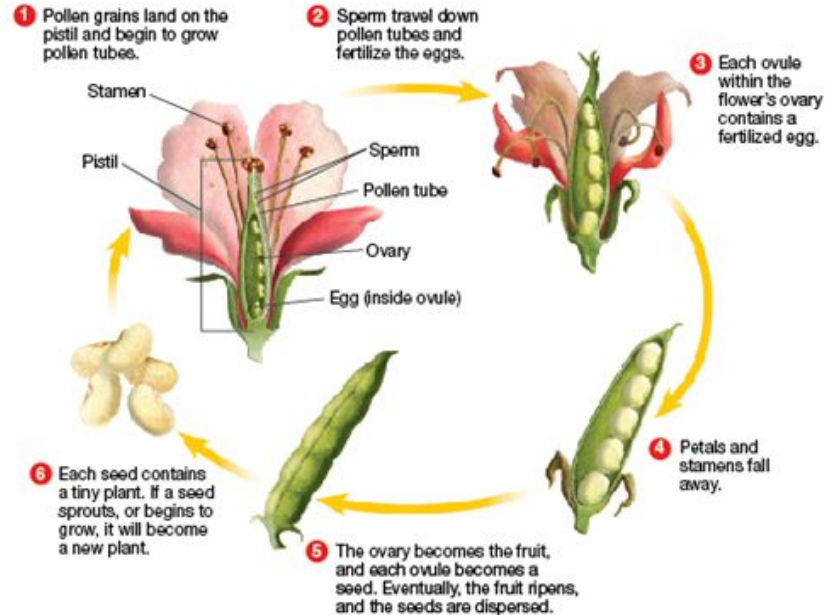
Pistil



How do flowering plants reproduce?

- A pollen tube grows down through the pistil into the ovary, where one or more ovules contain eggs.
- Sperm travel into the ovary and fertilize the eggs, which develop an embryo: a tiny, undeveloped plant.
- The ovule develops into a seed that surrounds and protects the embryo. The ovary becomes a fruit, which protects the seeds and helps them spread.

How do flowering plants reproduce?



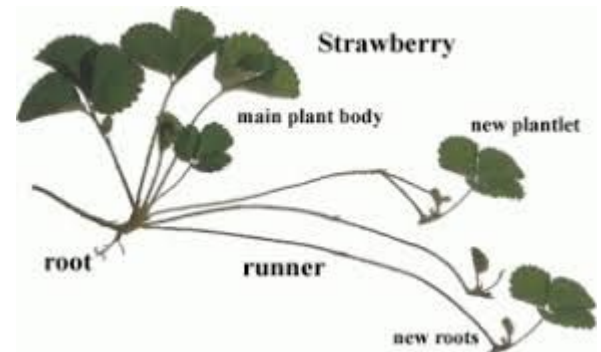
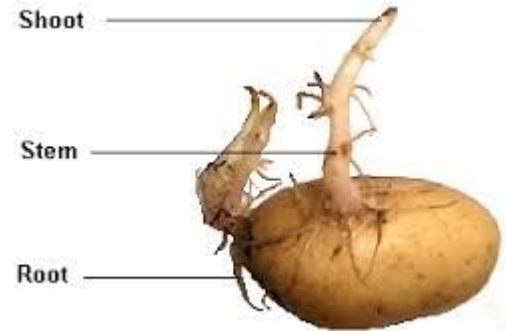


How do plants reproduce asexually?

- Asexual reproduction allows a plant to reproduce without seeds or spores. Part of a parent plant, such as a stem or root, produces a new plant.
- Plantlets, tubers, and runners are examples of structures that plants use to reproduce asexually.

How do plants reproduce asexually?

- Plantlets grow on the edges of a plant's leaves. They fall off and grow on their own.
- Tubers, such as a potato, are underground stems that store nutrients and grow into a new plant.
- Runners, such as strawberries, are above-ground stems that can grow into new plants.



Action, Reaction



What are some ways plants respond to their environment?

- Anything that causes a reaction or change in an organism is a **stimulus**. Plants can respond to internal stimuli, such as water levels in cells.
- A stoma is an opening in the leaf's surface which helps a plant exchange gases and respond to its water levels.
- Stomata are surrounded by two guard cells that open and close the stoma. When open, carbon dioxide enters, and oxygen and water vapor exit.



What are some ways plants respond to their environment?

- The loss of water from leaves is called **transpiration**.
- A plant wilts when it loses more water than it can absorb through roots.
- When a plant is wilting, its stomata close, preventing further water loss.

What are some ways plants respond to their environment?

- Plant growth in response to a stimulus is called a **tropism**.
- Plant tropisms are controlled by plant hormones, which are chemical messengers that cause changes in cells.



What are some ways plants respond to their environment?

- A change in the direction of plant growth in response to light is called phototropism.
- Hormones build up in cells on the shaded side of the stem, causing them to lengthen, which makes the stem bend toward the light.



What are some ways plants respond to their environment?

- A change in the direction of plant growth in response to gravity is called gravitropism.
- Most stems grow upward, away from Earth's gravitational pull, and most roots grow downward, toward the pull of gravity.





What are some ways plants respond to their environment?

- **Dormant** describes the inactive state of a seed or other plant part when conditions are not right for growth.
- Some plants shut down during winter or a dry season, living off of stored sugars.
- Many plants come out of dormancy in the spring, triggered by more direct sunlight, longer days, and increased rain.



In Season

- A plant's growing season occurs when temperature, light, and water conditions favor growth for that type of plant.
- Out-of-season produce is grown in a greenhouse or shipped from other parts of the world.

Photosynthesis





Energize!

How do the cells in an organism function?

- Cells must capture and use energy or they will die.
- Without energy, living things cannot replace cells, build body parts, or reproduce.
- Food contains chemical energy that cells need to carry out life processes.



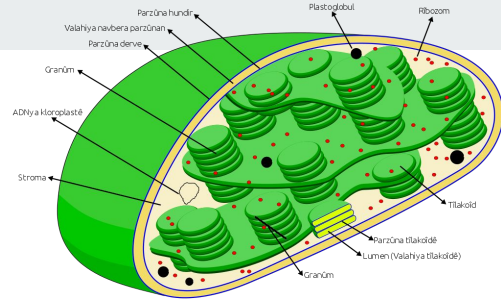
How do the cells in an organism function?

- *Producers* make their own food. Most use energy from the sun. Some use chemicals to make food.
- *Consumers* must eat other living things to get food. They may eat producers or other consumers.
- *Decomposers* get energy by breaking down dead organisms or wastes of other organisms.

Cooking with Chloroplasts

How do plant cells make food?

- **Photosynthesis** is a process by which plants use energy from sunlight, carbon dioxide, and water to make sugars.
- Oxygen is released into the air during photosynthesis.





How do plant cells make food?

- Photosynthesis takes place in organelles called *chloroplasts*.
- A green pigment called **chlorophyll** in chloroplasts captures energy from sunlight.
- This energy is used to combine carbon dioxide and water to form the sugar glucose and oxygen gas.



How do plant cells make food?

- $6\text{CO}_2 + 6\text{H}_2\text{O} + \text{light energy} \rightarrow \text{C}_6\text{H}_{12}\text{O}_6 + 6\text{O}_2$
- Plants store glucose, which is a sugar that stores chemical energy.
- When organisms eat plants, they use the stored sugars for energy.

How do plant cells make food?

What occurs in the organelle shown below?

