

Chapter 4

Review of Metabolism
and
Photosynthesis
and
Carbohydrates, Fats (Lipids) & Proteins

GLCE's

L.OL.07.61:Recognize the need for light to provide energy for the production of carbohydrates, proteins, and fats.

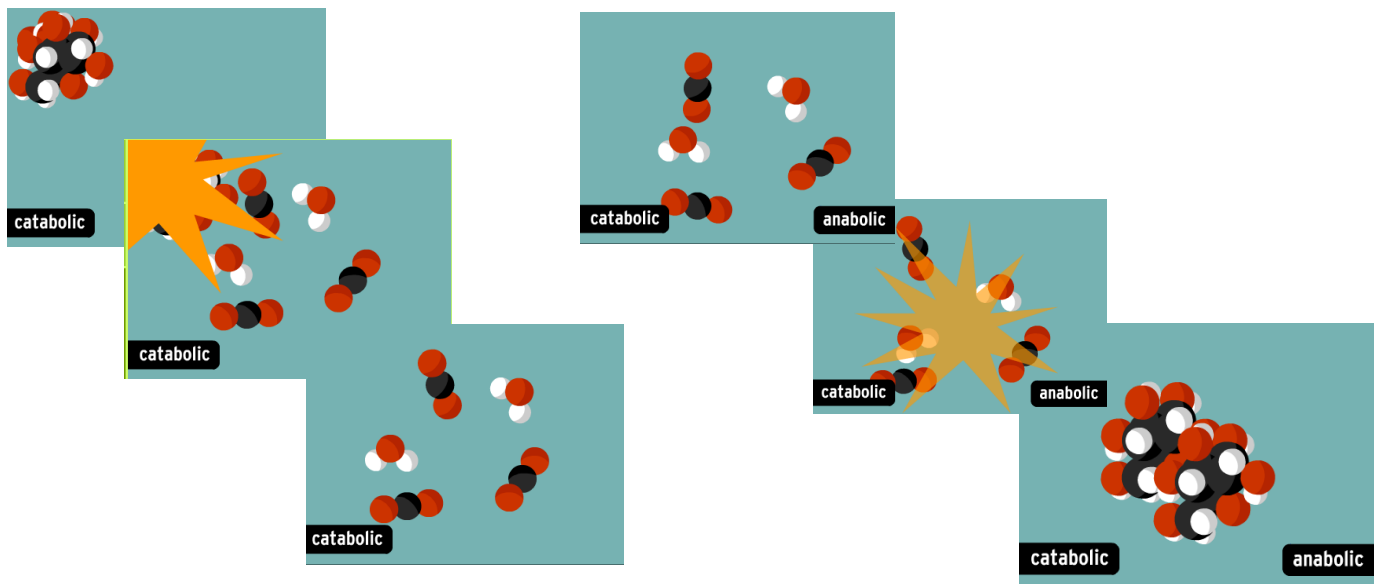
L.OL.07.62:Explain that carbon dioxide and water are used to produce carbohydrates, proteins & fat

L.OL.07.63:Describe evidence that plants make, use and store food.

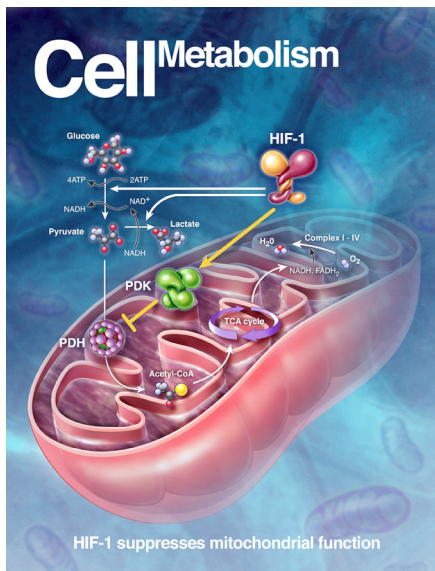
Metabolic Reaction

Catabolic: Complex molecules are broken down into simple molecules. It release energy during the process.

Anabolic: Use the released energy to build complex molecules from simple molecules.



Catabolism powers Anabolism

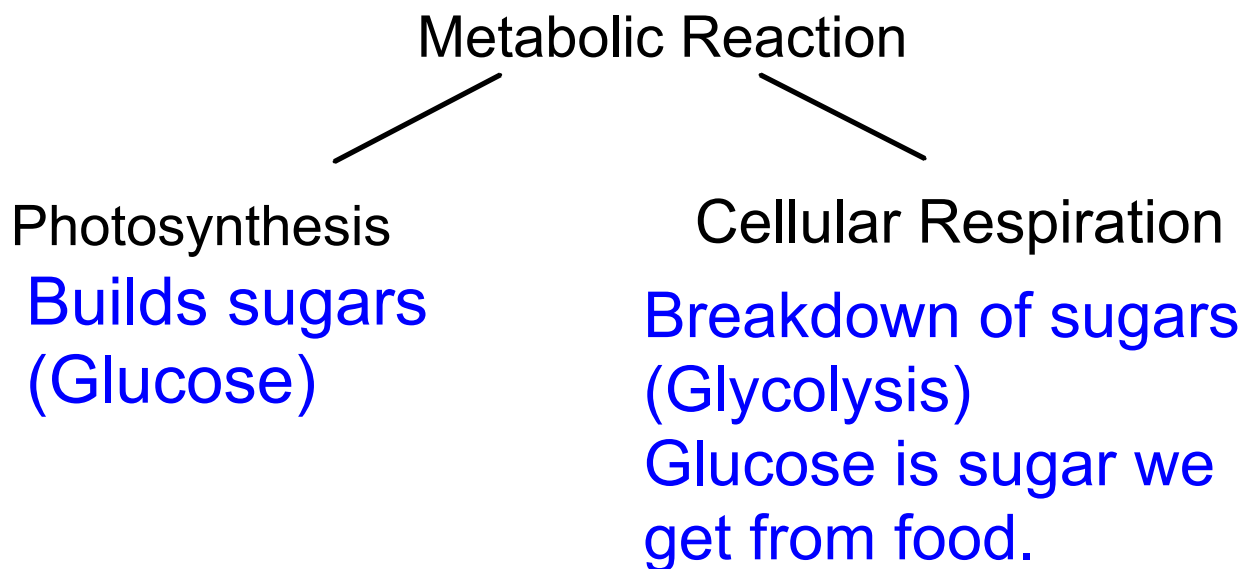


Cells need **energy** to grow and function

Humans and animals get energy through **food**

Food is processed through a series of chemical reactions called **metabolism**.

Metabolism: All the chemical reactions that occur in a living thing.



Glucose ($C_6H_{12}O_6$) is created by photosynthesis and used in cellular respiration

Example of Metabolic Reaction

Photosynthesis: A process in which organisms use energy from sunlight to make their own food.

Plants have metabolism but don't need to eat food for energy. They make their own food. Autotrophs

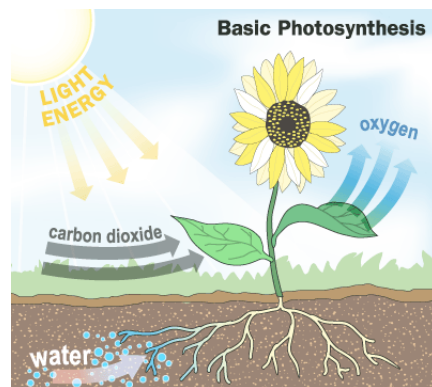
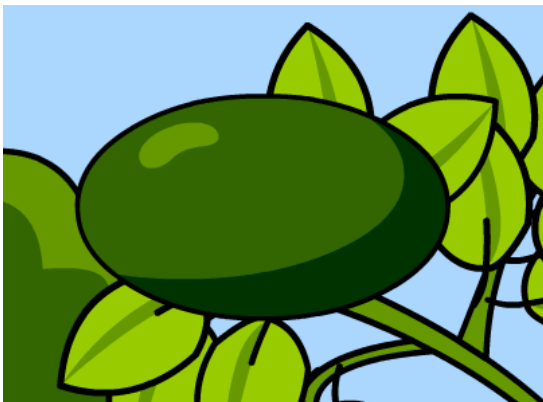
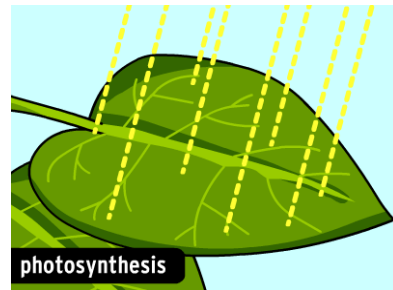


photo- means light

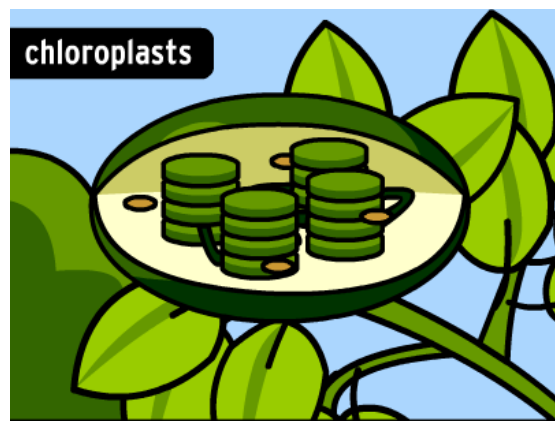
-synthesis means putting together

Steps of Photosynthesis

1. Energy from sunlight is captured by chlorophyll in a chloroplast.



Energy is stored in [chloroplasts](#)



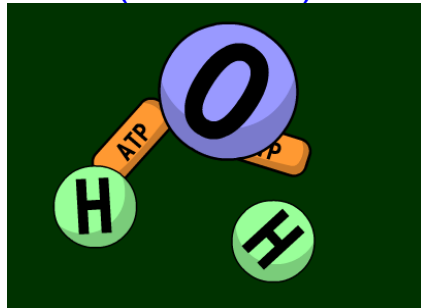
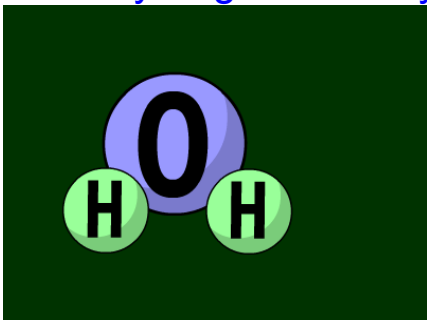
Chloroplast contains [chlorophyll](#) which traps the energy from the sunlight and stores it as [chemical energy](#).

Steps of Photosynthesis

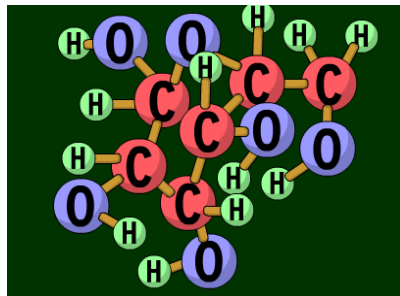
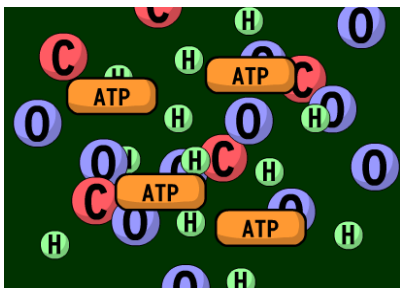
- Energy that has been captured is converted into energy found in food.

How does *this* energy create food?

Water (H_2O) molecules are split into hydrogen and oxygen atoms (Catabolic).

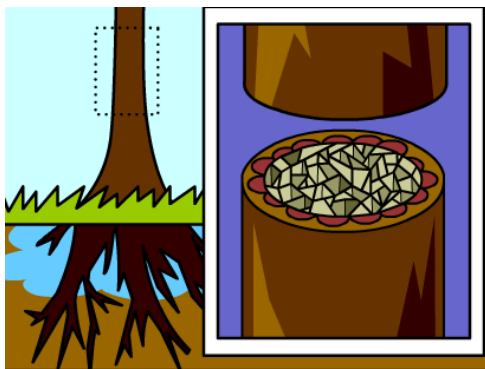


Glucose is created from hydrogen and carbon dioxide using chemical energy released from splitting H_2O and stored sunlight energy (Anabolic).



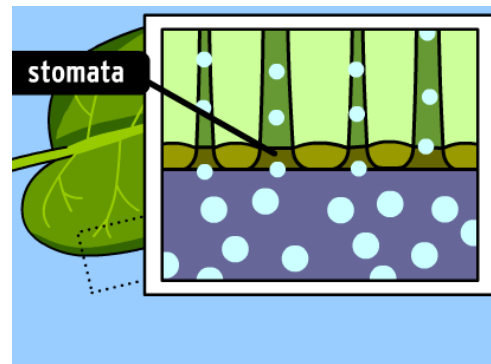
But wait!!!
Where does the carbon come from????

Where do these molecules of water and carbon dioxide come from?



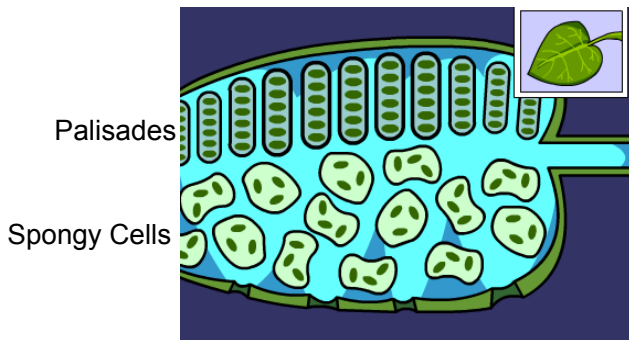
Water

Water travels from roots to leaves through a transport tissue called xylem



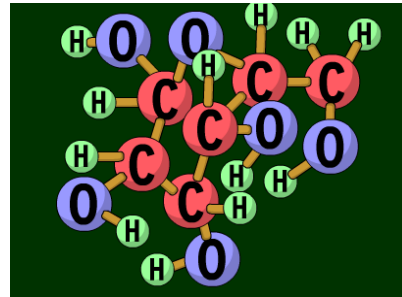
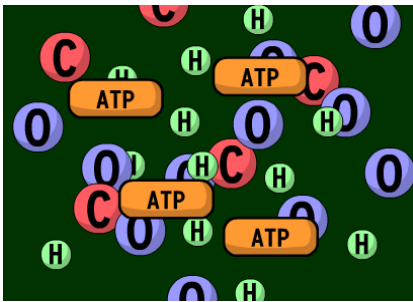
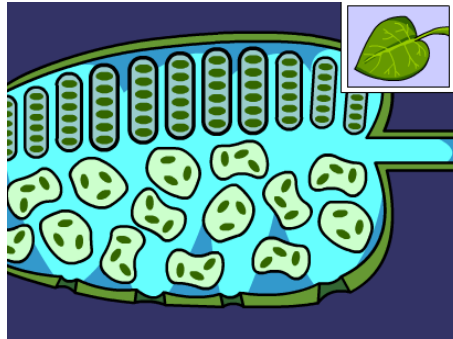
Carbon Dioxide

Leaves absorb carbon dioxide from the air through openings called stomata



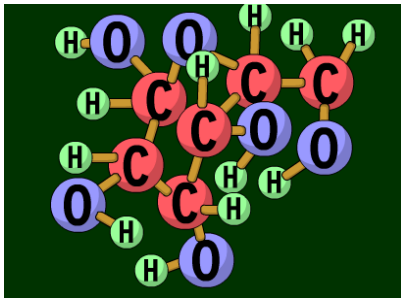
Water and carbon dioxide spreads into the leaves.

Energy that has been captured is converted into energy found in food.





What happens to the glucose?



It dissolves into the unused water molecules to give the plant food.

What happens to the oxygen?



The leaves release the oxygen through the stomata as a waste product.

Writing Tracker

What is photosynthesis?

Explain it a cellular level how it is a catabolic and anabolic changes.

Domain specific words needed:

- Photosynthesis
- Catabolic and Anabolic
- Chlorophyll and Chloroplast
- Water, Glucose, Carbon Dioxide and Oxygen

Metabolic Reaction

Photosynthesis
Builds sugars
(Glucolsis)

Autotrophs

Organisms that can
produce their own food.



Cellular Respiration
Breakdown of sugars
(Glycolysis)

Heterotrophs

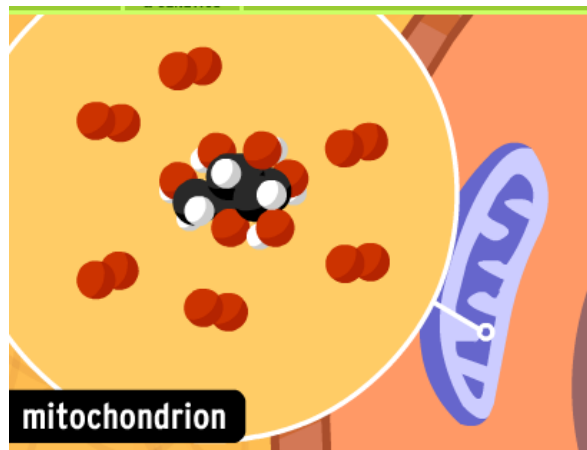
Organisms that can not
produce their own food and
thus must eat other
organism to obtain energy.



Example of Metabolic Reaction

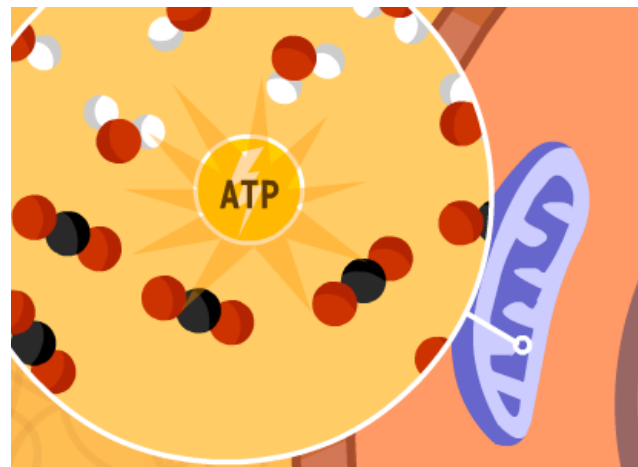
Cellular Respiration

Breakdown of sugar (Glycolysis) using oxygen. and the energy they contained is released.



Complex glucose molecules are broken down into simpler carbon dioxide, water and ATP molecules in chemical reaction called cellular respiration.

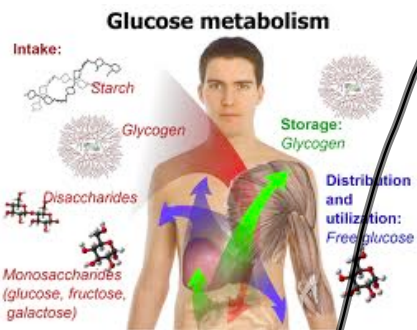
Catabolic



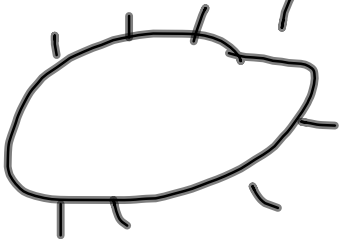
Energy is released. This energy is used to keep cells health and grow new cells (Mitosis). It builds up molecules so cells can multiply and promotes bones and muscle growth.

Anabolic

Cells use the energy released for:



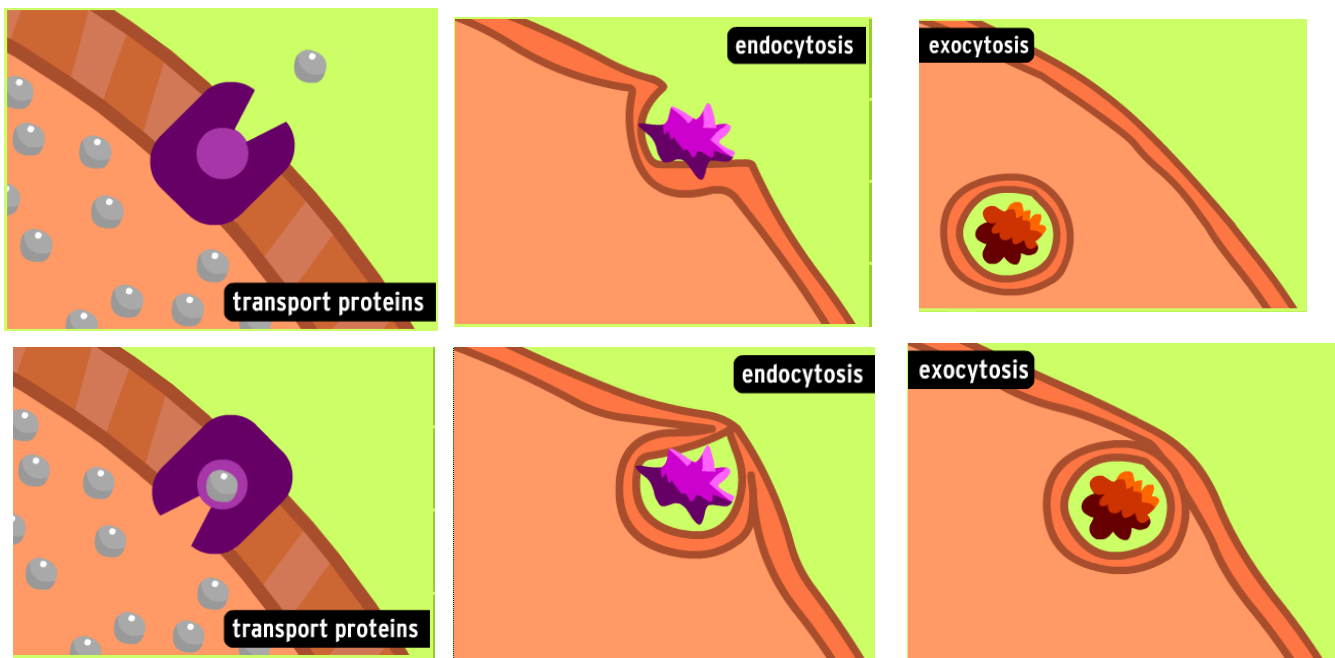
1. Mechanical energy in muscles, cilia, flagella, heart beating....
2. Electrical work: Electric eel, nerve cells
3. Active transport
4. Heat for warm blooded animals
5. Building storage molecules (Anabolism)



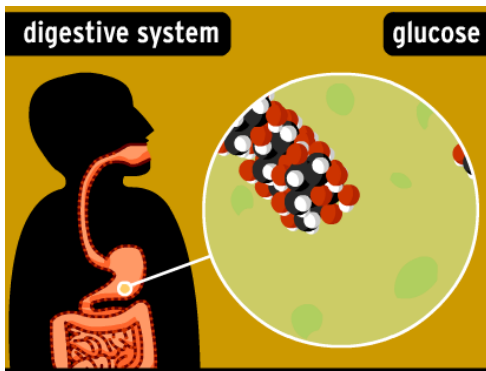
Active Transport:

If the substance is not permeable or the levels of concentration do not allow diffusion, then active transport is used.

Requires cell to use own energy to move materials in and out of cell.

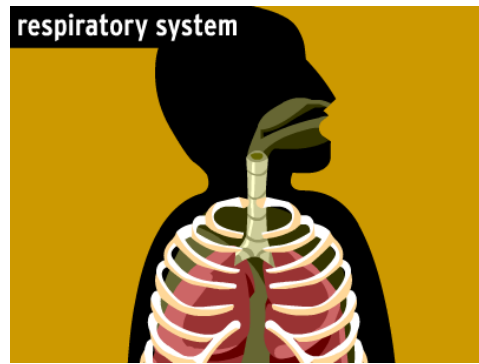


How does this happens?



Glucose

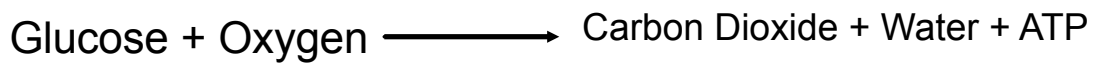
The digestive system breaks down food into glucose.



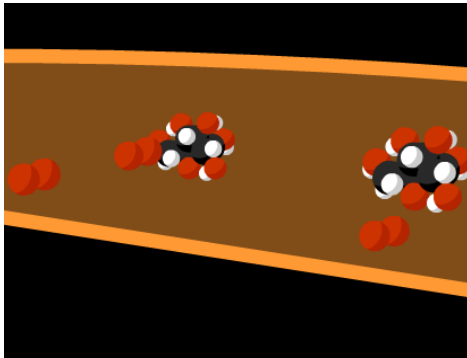
Oxygen

Oxygen from the lungs in the respiratory system.

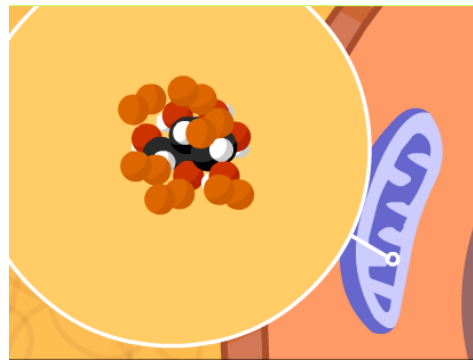
How does this happens?



Yields: Connects the raw material to the product



Glucose and Oxygen delivered to cells through your blood stream



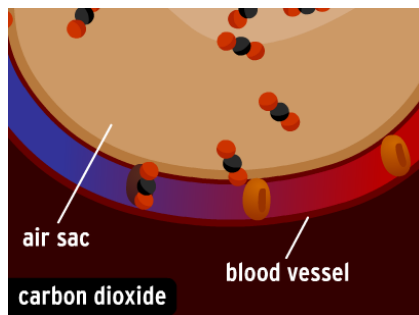
Glucose and oxygen molecules are broken down in chemical reaction called cellular respiration.
Anabolic

How does this happens?

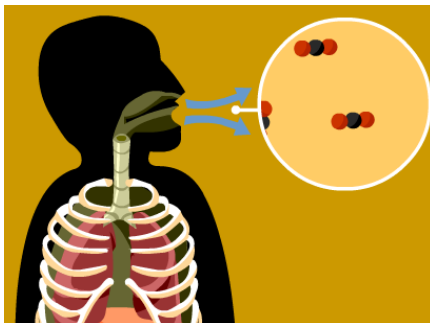
Glucose + Oxygen \longrightarrow Carbon Dioxide + Water + ATP

Carbon Dioxide + Water + ATP

(Waste product)



Cells expel carbon dioxide into blood, your blood carries it to lungs.



You breath out carbon dioxide.
If you do not, you will die.

How does this happens?

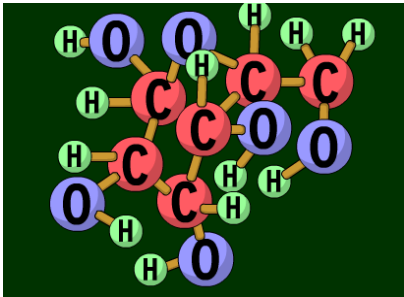
Glucose + Oxygen \longrightarrow Carbon Dioxide + Water + ATP

Carbon Dioxide + Water + ATP



ATP is a chemical substance that can be used to store energy

Energy from ATP is used by cells to make DNA, RNA, proteins.



Remember that glucose that dissolves into the unused water molecules to give the plant food during photosynthesis?

That glucose (sugar), along with minerals from the soil form:

Carbohydrates

Fats

Proteins

Carbohydrates

Main source of energy
Made during photosynthesis of
carbon, hydrogen, and oxygen

Sugars

Simple Carbohydrate

Sugar (Glucose) is
formed during
photosynthesis in
plants.



Starches

Stored sugar

Excess sugar
(glucose) is stored
in the roots or
seeds of the plants

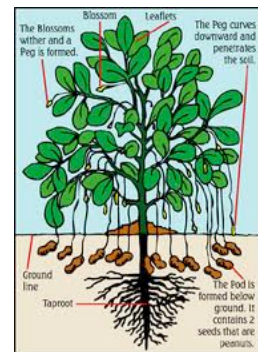


This is why food such as potatoes and
pasta are higher in carbs than a salad.

Fats/Lipids

Fats/Lipids are stored in carbohydrates in plants. As the plant produces seeds, carbohydrates converts to fats/lipids.

Carbohydrates are not as compact as fats/lipids. So as the seeds form, carbs turn into fats/lipids to pack stored glucose/sugar into the seed.



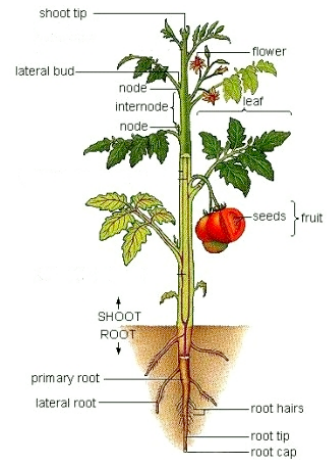
Peanut Plant



Proteins



Plants use a combination of carbohydrates and nutrients from the soil to make protein. These nutrients typically include the elements nitrogen, sulfur and phosphorus.



nitrogen, sulfur and phosphorus

Carbohydrates

(Organic Compound)

Plants make sugar during the food-making process.
Remember: Glucose is created by photosynthesis and used in cellular respiration

When several carbohydrates combine, it is called a **polysaccharide** ("poly" means many).

Simple carbs - sugar

Large or complex carbs: starch

____ 1. Which of the following organisms a the pond system can transform light energy into carbohydrates?

- a. Insect
- b. Frog
- c. Water lily
- d. Small fish

____ 4. Which evidence supports the fact that plantsuse the food they have produced?

- a. Trees provide food for birds by producing seeds and berries.
- b. A tulip begins growing each spring using energy stored in its leaves.
- c. A germinating seed shrivels as the growing seedling uses its stored food.
- d. Tomatoes can be made into sauce, stored in jars, and used for making pizza.

____ 5. Beans have stored energy in the form of starch. Where did **theatoms** come from that form these starch molecules?

- a. From light energy
- b. From water vapor
- c. From nutrients in the soil
- d. From molecules in the atmosphere

___ 9. Which raw material is used by plants to produce carbohydrates, proteins and fats?

- a. Carbon dioxide
- b. Methane
- c. Nitrogen
- d. Oxygen

___ 10. Which of the following observations provides evidence that plants store energy?

- a. A plant will turn yellow and die if left in the dark.
- b. Plants grow better in soil that contains fertilizer
- c. An apple will shrivel if left in the sun
- d. A peanut will burn and give off heat.

___ 20. How do plants use the Sun's energy?

- a. Plants take in molecules of sunlight as food.
- b. Plants obtain food directly from the Sun's light.
- c. Plants produce food using the Sun's light energy.
- d. Plants use the Sun's heat energy to produce food.

___ 22. How do plants get the energy they need to grow and reproduce?

- a. Sunlight provides the energy directly.
- b. Materials from air, water and soil use light to make food.
- c. Heat energy from the sun is used by plants to produce carbohydrates.
- d. Light molecules are combined with air and water to form sugar molecules.

