

Metabolism and Cellular Energy

Metabolism- a set of life-sustaining chemical transformations within the cells of living organisms.

Biochemical Conversion The changing of organic matter into other chemical forms such as fuels.

Energy Transformation A process in which energy changes from one form to another form while some of the energy is lost to the environment.

Adenosine Triphosphate (ATP) A molecule that provides energy for cellular reactions and processes. ATP releases energy when one of its high-energy bonds is broken to release a phosphate group.

Bioenergetics The study of energy flow (energy transformations) into and within living systems.

chemical energy in the bonds of "food" molecules is released and partially captured in the bonds of adenosine triphosphate (ATP) molecules.

Plants:

- Autotrophs – they make their own sugars during photosynthesis = Producers - Produce food for all other organisms

Animals:

- Heterotrophs – must get their sugars (carbohydrates) for energy from other sources = Consumers – Consume the food provided by plants

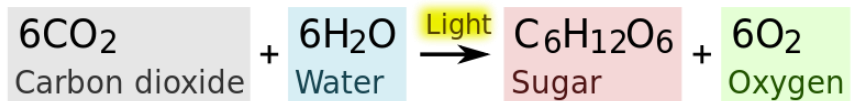
Sun

Ultimate source of energy because it provides the energy for the plants which is then passed down to other organisms

Chemosynthesis

The synthesis of organic compounds within an organism with chemical reactions providing the energy source.

Photosynthesis



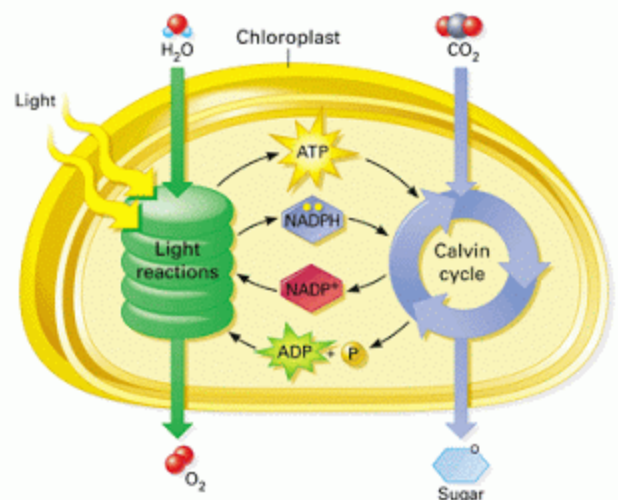
Chloroplast An organelle found in plant cells and the cells of other eukaryotic photosynthetic organisms where photosynthesis occurs.

Photosynthesis

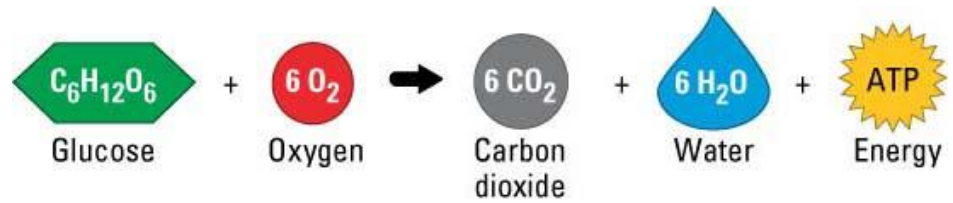
- Takes place in the chloroplasts
- Chlorophyll is the molecule that receives the sun's energy
- Solar radiation is chemically captured by chlorophyll molecules and through a set of controlled chemical reactions resulting in the potential chemical energy in the bonds of carbohydrate molecules.

There are two major reactions in photosynthesis

1. Light Dependent reactions (photolysis) (Light Reactions)
 - a. Light energy is absorbed by chlorophyll, which uses the energy to split water. Oxygen is released to the outside of the cell, the "H" part of H₂O is carried to the dark reactions with **NADPH**
 - b. Some ATP (energy) is made here—will be used up in Light Independent reaction
2. Light Independent reactions (Dark Reactions)(Calvin Cycle)
 - a. CO₂ from the outside is combined with the "H" part of **NADPH** to make sugars for the cell
 - i. NADP⁺ goes back to light dependent reactions
 - b. ATP is used to combine the CO₂ and H to form sugar
 - i. ADP goes back to light dependent reactions



Respiration



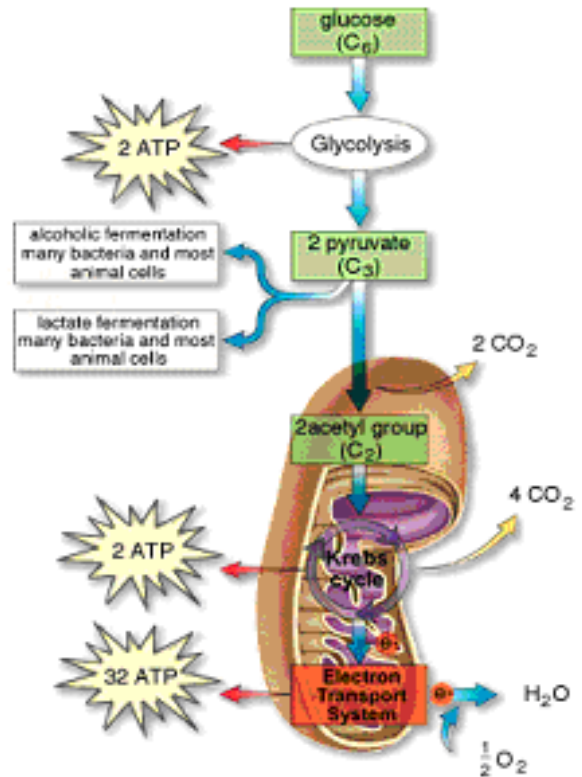
Mitochondrion A membrane-bound organelle found in most eukaryotic cells; site of cellular respiration.

Steps of Cellular Respiration

1. Glycolysis -- glucose is split into 2 3-carbon compounds and a small amount of energy is released.
 - a. Cytoplasm of all cells

2. Kreb's cycle – takes 3-carbon compounds and breaks them down into carbon dioxide
 - a. Inner part of mitochondria (matrix)

3. Electron transport chain – takes electron carriers and materials to create a concentration gradient that ultimately creates ATP
 - a. Inner folds of mitochondria (cristae)
 - b.



In the absence of oxygen, some organisms will use the products of glycolysis and go through fermentation.

- A. Alcoholic fermentation—makes alcohol and CO₂ as the byproducts. Creates no ATP, but “refreshes” carriers so glycolysis can continue
- B. Lactic acid fermentation—makes lactic acid as the byproduct. Creates no ATP, but “refreshes” carriers so glycolysis can continue

