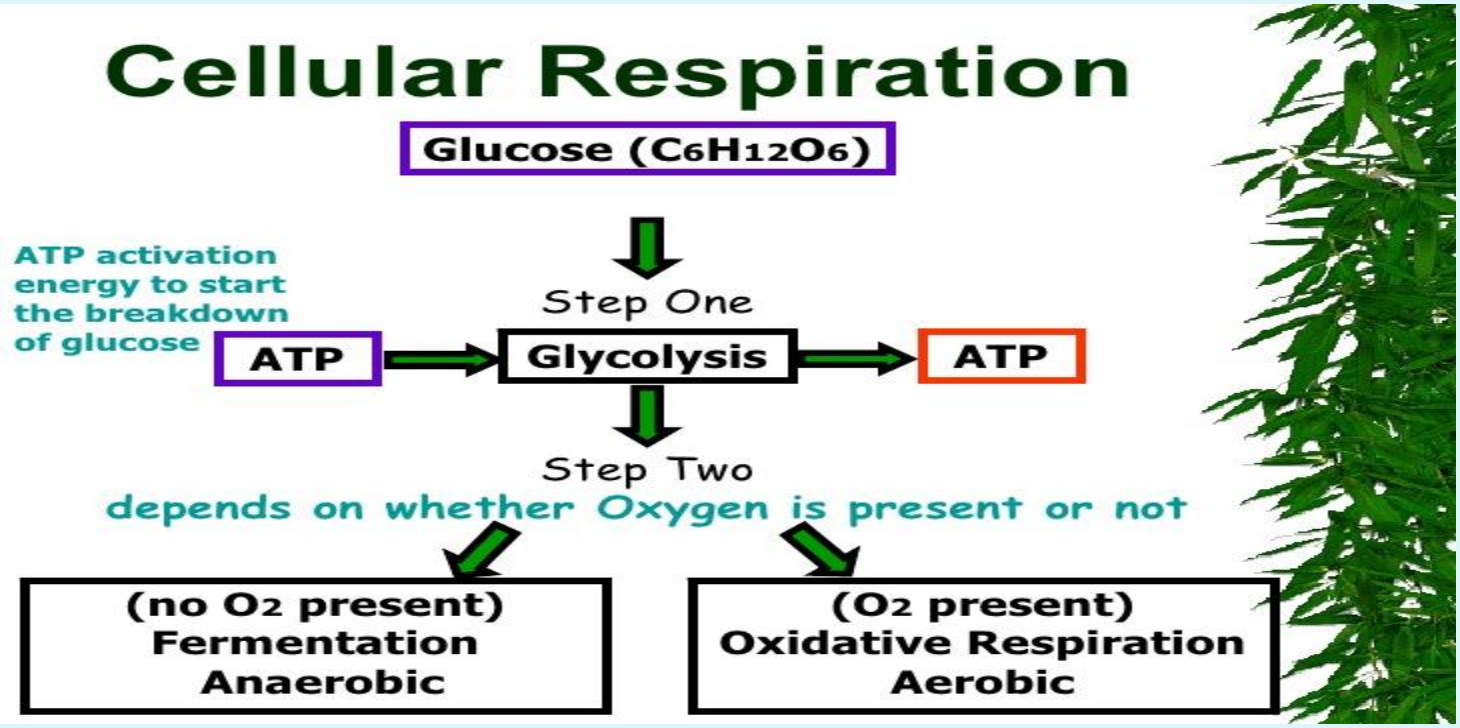
Cellular Respiration

Cellular respiration is the process of breaking down food molecules to obtain energy and store it in the form of adenosine triphosphate (ATP) molecules.



Process of Cellular Respiration

- Food (glucose) is broken down into CO_2 and H_2O and energy is **released**
- $C_6H_{12}O_6 + 6\,O_2 \rightarrow 6\,CO_2 + 6\,H_2O$ + **energy** (ATP)
- This energy can be used for:
  - Keeping a constant **body temperature**
  - **Storage** (ATP) - to be u

Overview of Cellular Respiration

- If oxygen is available, organisms can obtain energy from food by a process called **cellular respiration**
- **= the process that releases energy from food in the presence of oxygen**

<u>In symbols:</u>

$6\ O_2 + C_6H_{12}O_6 \rightarrow 6\ CO_2 + 6\ H_2O + \text{Energy}$

<u>In words:</u>

Oxygen + Glucose → Carbon dioxide + Water + Energy

- The cell has to release the chemical energy in food molecules (like glucose) **gradually**, otherwise most of the energy would be lost in the form of heat and light.
  - Ex: Marshmallow catching fire, it's energy but not as useful.

Cellular Respiration Equation

$$C_6H_{12}O_6 + 6O_2 \longrightarrow 6CO_2 + 6H_2O + \text{energy}$$

Glucose made in **photosynthesis** by plants or **consumed** by animals

Used in **Glycolysis**

Oxygen from the **atmosphere**
Used in **Electron Transport Chain**

Carbon Dioxide – **waste** product of the **Krebs cycle**

Water – released from **Electron Transport Chain**

ATP released from Glycolysis, Krebs Cycle, & Electron Transport Chain

Up to 38 ATP molecules are made from the breakdown of one glucose molecule: 2 from glycolysis & up to 36 from aerobic respiration.

Most of the energy released by respiration, that is not used to make ATP, is released in the form of heat.

Overview of photosynthesis and respiration

SUN

RADIANT ENERGY

PHOTOSYNTHESIS → RESPIRATION → CELL ACTIVITIES

GLUCOSE

ATP(ENERGY)

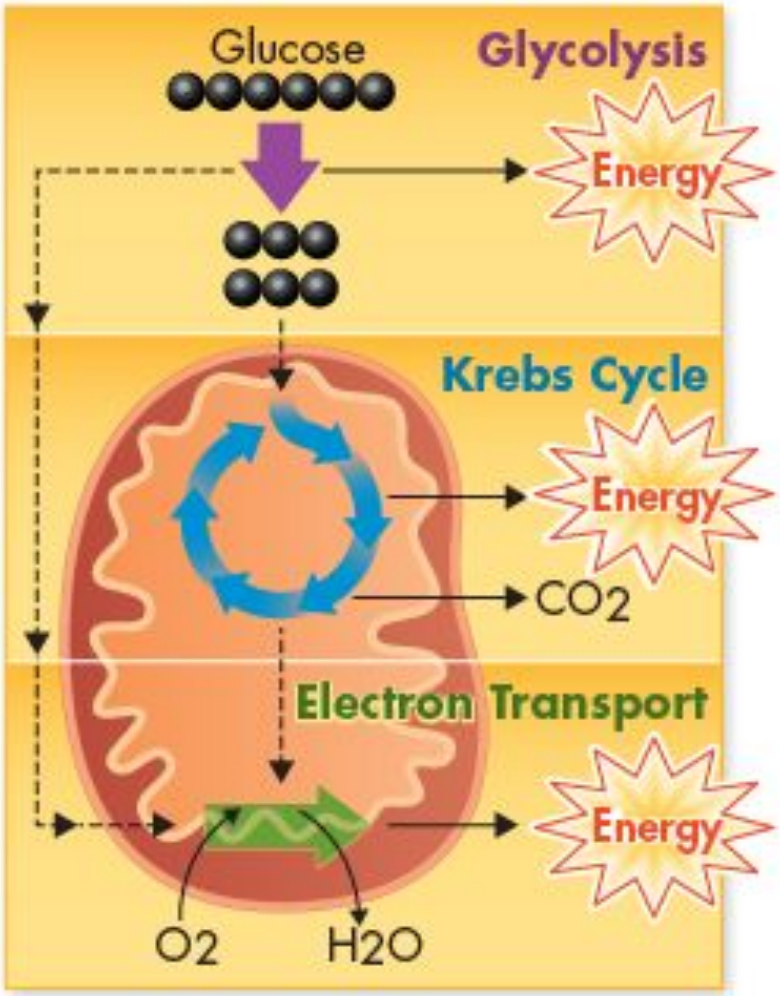
Types of Cellular Respiration

- Aerobic ("with air") aero = air
  - Requires OXYGEN
  - More efficient, many ATP produced

- Anaerobic ("without air")
  - Does NOT require OXYGEN
  - Less Efficient, fewer ATP produced

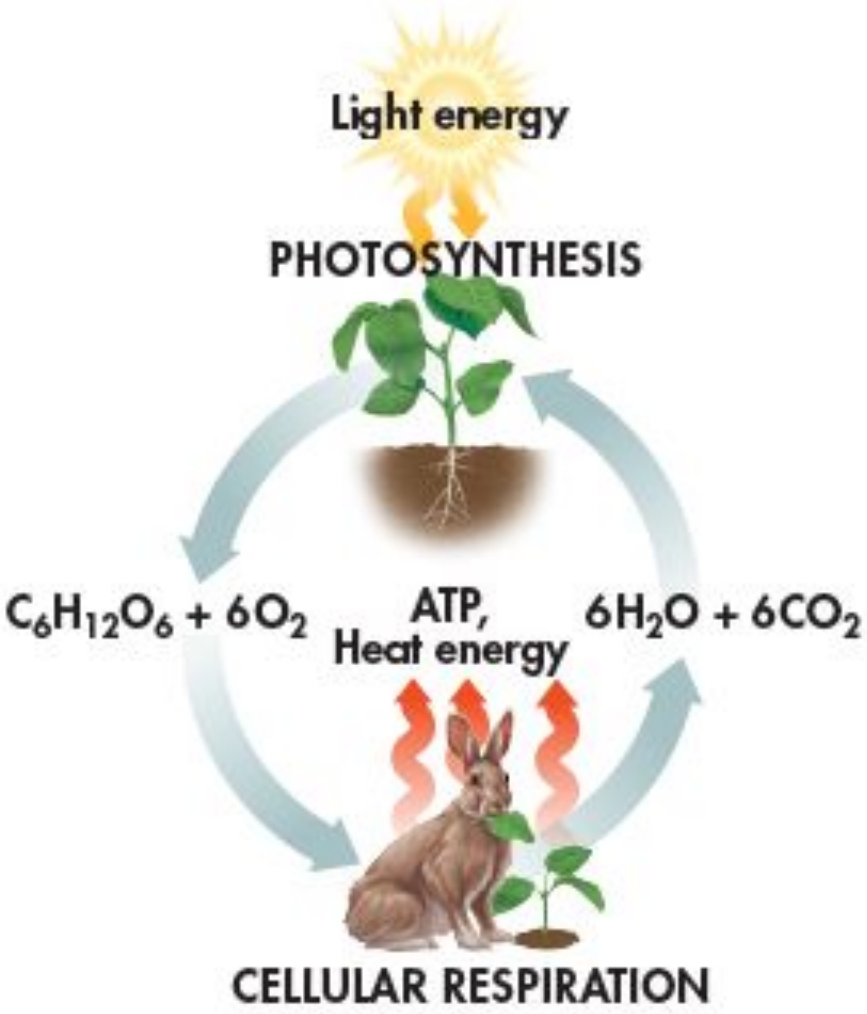
Steps to Cellular Respiration

- Aerobic
  - 1. Glycolysis
  - 2. Krebs Cycle
  - 3. Electron Transport Chain
- Anaerobic
  - 1. Glycolysis
  - 2. Fermentation



Comparing Photosynthesis and Cellular Respiration

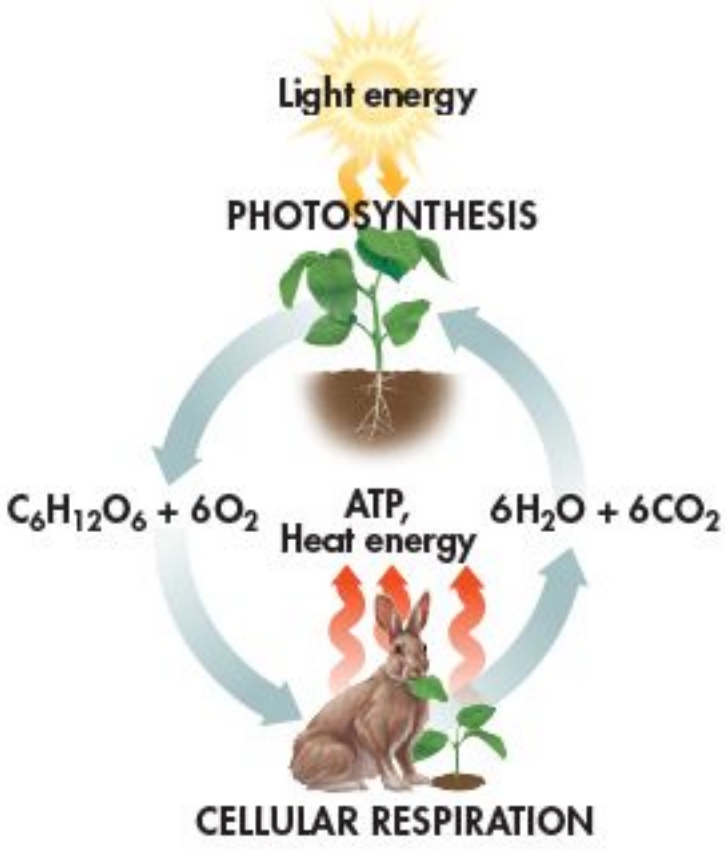
- Photosynthesis and cellular respiration are opposite processes.
- The energy flows in opposite directions.
  - Photosynthesis “deposits” energy, and cellular respiration “withdraws” energy.
- Reactants of cellular respiration are the products of photosynthesis.
- Reactants of photosynthesis are the products of cellular respiration
- = Biochemical Pathways.



Comparing Photosynthesis and Cellular Respiration

- Release of energy by cellular respiration takes place in plants, animals, fungi, protists, and most bacteria.

- Energy capture by **photosynthesis occurs only in** plants, algae, and some bacteria.



Comparing Photosynthesis and Cellular Respiration

- What is the relationship between photosynthesis and cellular respiration?

- Photosynthesis removes carbon dioxide from the atmosphere, and cellular respiration puts it back. Photosynthesis releases oxygen into the atmosphere, and cellular respiration uses that oxygen to release energy from food.