Photosynthesis and Respiration

a. Photosynthesis Equation: \(6\text{CO}_2 + 6\text{H}_2\text{O} \rightarrow \text{C}_6\text{H}_12\text{O}_6 + 6\text{O}_2\)

Photosynthesis takes place in an organelle of plant cells called chloroplast (containing chlorophyll) in 2 steps:

1. Step one: light reactions or light-dependent reaction, water is split and ATP’S (unit of energy) and NADPH’S (coenzymes- helpers of enzymes) are formed.
2. Step two: dark reactions or light-independent reactions or Calvin cycle or carbon fixation.

In this process, carbon dioxide is used and with the energy from ATP and hydrogens from NADPH’S, sugar (\(\text{C}_6\text{H}_12\text{O}_6\)) is formed.

How animals use foods:

1. Ingestion: eating.
2. Digestion: from macromolecules to small molecules e.g. from proteins to amino acids.
3. Absorption: small molecules entering the gut (entering blood).
4. Distribution: from liver to all other organs.
5. Metabolism: all chemical reactions within cells.

Aerobic respiration

In this process, sugar (\(\text{C}_6\text{H}_12\text{O}_6\)) is burnt and carbon dioxide and water is formed:

\(\text{C}_6\text{H}_12\text{O}_6 + 6\text{O}_2 \rightarrow 6\text{CO}_2 + 6\text{H}_2\text{O}\)

In this process, energy is released, 20% as ATP, and 80% as heat, keeping the organism warmer than ambient temperature. This process is done when oxygen is present, so called: aerobic.

Anaerobic fermentation:

When oxygen concentration in cells goes down, the aerobic respiration does not take place anymore. The product of glycolysis (breakdown of sugar), pyruvic acid, which has 3 carbons, changes to other products.

1. Lactic acid fermentation: in our muscles and some microorganisms producing yogurt, pyruvic acid changes into lactic acid.
2. Ethyl alcohol fermentation: in yeast, pyruvic acid (3 carbons) turns into ethyl alcohol (2 carbons) and one carbon dioxide (like wine and beer).

There are many other types of fermentation such as propionic acid fermentation, which gives us Swiss cheese. Also, spoiling of food is all fermentation.
Energy obtained from respiration results in:

a. Formation of macromolecules from small molecules such as joining amino acids to form proteins.
b. Formation of new cells or tissues.
c. Other processes which need energy such as active transport. Only small portions of food ingested by consumers are assimilated into body growth, maintenance, movement, repair, and other functions.

A larger amount of cell respiration is used to provide heat energy to keep the organism warm or as wasted energy. Waste products are carbon dioxide and water. A portion that is not digested passes through, becoming fecal waste.