

Lesson 51: Photosynthesis/Cellular Respiration Biology with Lab

Converting stored chemical energy into usable ATP energy

Cellular respiration – the process of using oxygen in the mitochondria to chemically break down organic molecules such as glucose to release the energy stored in its bonds

Adenosine triphosphate (ATP) – from combining Adenosine diphosphate and phosphate; ATP is the main energy currency of cells.

Cellular respiration equation – $C_6H_{12}O_6 + 6O_2 \rightarrow 6CO_2 + 6H_2O$ (+ ATP ENERGY)

Glycolysis – a process in which one molecule of glucose is broken in half by enzymes in the cytoplasm, producing 2 molecules of pyruvic acid and only 2 molecules of ATP.

Aerobic respiration – all processes that require oxygen are described as “aerobic”

Fermentation – if sufficient oxygen is not present in the cell, glycolysis is followed by a different pathway called fermentation that produces very little energy and either alcohol or lactic acid depending on the organism

Anaerobic respiration – Processes that do not require oxygen are “anaerobic”

Mitochondria – organelle where cellular respiration occurs

Krebs cycle – also known as the Citric Acid Cycle, occurs in the mitochondrion after glycolysis and is the second of three phases of cellular respiration; it produces 2 ATP molecules, 10 energy carrier molecules, and CO_2 from each glucose molecule

Electron Transport Chain (ETC) – a series of chemical reactions that produces 34 ATP molecules and H_2O from the carrier molecules that were produced in the Krebs cycle

Lactic acid fermentation – occurs in animal cells when there is no oxygen available; pyruvic acid is converted into a waste product called lactic acid

Alcoholic fermentation – occurs in some plants and unicellular organisms such as yeast and bacteria; the process converts pyruvic acid into ethyl alcohol and a carrier compound (giving off CO_2), which allows glycolysis to continue

Oxygen debt – occurs during anaerobic respiration because oxygen must be “paid back” to the cells to remove the lactic acid

Glucose – a six carbon sugar produced by photosynthesis

Heterotrophs (consumers) – organisms that cannot make their own food

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Chemosynthesis – process by which organisms use inorganic compounds as their energy supply

Photosynthesis

Photosynthesis equation – $6\text{CO}_2 + 6\text{H}_2\text{O} + (\text{LIGHT ENERGY}) \rightarrow \text{C}_6\text{H}_{12}\text{O}_6 + 6\text{O}_2$

Autotrophs (producers) – use photosynthesis, to convert the energy in sunlight, carbon dioxide and water into chemical energy or food (glucose)

Visible spectrum – the resulting array of colors, ranging from red at one end to violet at the other; each color of light has different wavelengths, and a different amount of energy

Pigment – a molecule that absorbs certain wavelengths of light and reflects or transmits others

Chloroplast – organelle in plant cells where photosynthesis takes place

Chlorophyll a – directly involved in the light reactions of photosynthesis

Chlorophyll b – assists Chlorophyll a in capturing light energy

Accessory pigment – absorbs colors that chlorophyll a CANNOT absorb, the accessory pigments enable plants to capture more of the energy in light

Carotenoids – accessory pigments that include yellow, red, and orange pigments that color carrots, bananas, squash, flowers, and autumn leaves

Thylakoids – disk-shaped structures that contain photosynthetic pigments

Stroma – gel-like material that surrounds thylakoids

Grana – neatly folded layers of the thylakoids that resemble stacks of pancakes

Light dependent reactions – occur in the thylakoids; energy is captured from sunlight, water is split into hydrogen ions, electrons, and Oxygen (O_2). Photolysis is the splitting of a water molecule; light energy is converted to chemical energy, which is temporarily stored in ATP and NADPH. The electrons that absorbed the energy are passed along the electron transport chain (ETC) and store energy in ATP. NADP picks off the H^+ to form NADPH^+ and electrons from photolysis and stores it for later use.

Light independent reactions – occur in the stroma; a series of reactions referred to as the Calvin Cycle - the chemical energy stored in ATP and NADPH powers the formation of Organic Compounds (sugars), using carbon dioxide, CO_2 and the H^+ from the NADPH^+

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Stromata – tiny holes underneath leaves where the exchange of gasses may occur from outside the leaf to inside the leaf

Photosynthesis – a complex series of chemical reactions that occurs in plants and some algae and bacteria whereby carbon dioxide and water are combined to form glucose and oxygen; the process requires the presence of both light and chlorophyll to occur

Energy

Endergonic chemical reaction – one in which free energy is required in order to proceed

Exergonic chemical reaction – one in which free energy is released

Energy – the ability to do work or cause change

Work – the ability to change or move matter against other forces