

جامعة الانبار

قسم التقنيات الاحيائية

كلية العلوم

المادة: الاحياء المجهرية

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المرحلة: الثانية

Energy Production

Oxidation-Reduction Reactions

1. Oxidation is the removal of one or more electrons from a substrate. Protons (H^+) are often removed with the electrons.
2. Reduction of a substrate refers to its gain of one or more electrons.
3. Each time a substance is oxidized, another is simultaneously reduced.
4. NAD^+ is the oxidized form; $NADH$ is the reduced form.
5. Glucose is a reduced molecule; energy is released during a cell's oxidation of glucose.

The Generation of ATP

6. Energy released during certain metabolic reactions can be trapped to form ATP from ADP and P (phosphate). Addition of a P to a molecule is called phosphorylation.
7. During substrate-level phosphorylation, a high-energy P from an intermediate in catabolism is added to ADP.
8. During oxidative phosphorylation, energy is released as electrons are passed to a series of electron acceptors (an electron transport chain) and finally to O_2 or another inorganic compound.
9. During photophosphorylation, energy from light is trapped by chlorophyll, and electrons are passed through a series of electron acceptors. The electron transfer releases energy used for the synthesis of ATP.

Metabolic Pathways of Energy Production

10. A series of enzymatically catalyzed chemical reactions called metabolic pathways store energy in and release energy from organic molecules.

Carbohydrate Catabolism

1. Most of a cell's energy is produced from the oxidation of carbohydrates.
2. Glucose is the most commonly used carbohydrate.
3. The two major types of glucose catabolism are respiration, in which glucose is completely broken down, and fermentation, in which it is partially broken down.

Glycolysis

4. The most common pathway for the oxidation of glucose is glycolysis. Pyruvic acid is the end-product.
5. Two ATP and two NADH molecules are produced from one glucose molecule.

Alternatives to Glycolysis

6. The pentose phosphate pathway is used to metabolize five-carbon sugars; one ATP and 12 NADPH molecules are produced from one glucose molecule.
7. The Entner-Doudoroff pathway yields one ATP and two NADPH molecules from one glucose molecule.

Cellular Respiration

8. During respiration, organic molecules are oxidized. Energy is generated from the electron transport chain.
9. In aerobic respiration, O₂ functions as the final electron acceptor.
10. In anaerobic respiration, the final electron acceptor is usually an inorganic molecule other than O₂,

Aerobic Respiration

The Krebs Cycle

11. Decarboxylation of pyruvic acid produces one CO₂ molecule and one acetyl group.
12. Two-carbon acetyl groups are oxidized in the Krebs cycle. Electrons are picked up by NAD⁺ and FAD for the electron transport chain.
13. From one molecule of glucose, oxidation produces six molecules of NADH, two molecules of FADH₂, and two molecules of ATP.
14. Decarboxylation produces six molecules of CO₂,

The Electron Transport Chain (System)

15. Electrons are brought to the electron transport chain by NADH.

16. The electron transport chain consists of carriers, including flavoproteins, cytochromes, and ubiquinones.

References': 1- Microbiology an introduction TWELFTH EDITION. Gerard. Tortora.2016.

2- Microbiology an introduction TENTH EDITION. Gerard. Tortora.2010.