

Cellular Respiration

Takes place in Mitochondria

starch is broken down into glucose
the major source of fuel

energy harvest Glucose is broken down in steps to harvest energy

ETC A sequence of membrane proteins that shuttle electrons down a series of redox reactions

ETC releases energy used to make ATP

4 Stages: Glycolysis - Pyruvate Oxidation - the citric acid cycle (Krebs Cycle) - Oxidative phosphorylation

Glycolysis

Occurs in the cytosol

Splits glucose (6C) into 2 pyruvates (3C)

Two stages Energy investment stage & Energy payoff stage

Energy investment stage the cell uses ATP to phosphorylate compounds of glucose

Energy payoff stage energy is produced by substrate level phosphorylation

The net energy yield per 1 glucose 2 ATP + 2 NADH

EI stage 2 ATP to 2 ADP + P

EP stage 4 ADP + P to 4 ATP

Net 2 Pyruvate + 2H₂O + 2ATP + 2NADH + 2H⁺

Pyruvate Oxidation and Cotroc Acid Cycle

Pyruvate Oxidation Turns to Acetyl CoA

Citric Acid Cycle AKA Krebs cycle

Pyruvate Oxidation and Cotroc Acid Cycle (cont)

Occurs in the mitochondrial matrix

turns acetyl CoA into citrate releases CO₂, synthesizes ATP, and transfers electrons to NADH and FADH₂

Inputs 2 acetyl CoA

Outputs 2ATP 6NADH 4CO₂ 2FADH₂

Oxidative Phosphorylation

Consists of Electron transport chain and Chemiosmosis

Electron Transport Chain located in the inner membrane of the mitochondria

ETC Collection of proteins

ETC Does not produce ATP directly, BUT Helps manage the release of energy by creating several small steps for "fall" of electrons

The cristae increase the surface area for the reactions to occur

final electron acceptor oxygen

One major function to create a proton (H⁺) gradient across the membrane

As proteins shuttle electrons along the ETC, they also pump H⁺ into the intermembrane space

This gradient will power chemiosmosis Uses hydrogen ions to power cellular work

Chemiosmosis ATP synthase

ATP synthase the enzyme that makes ATP from ADP + P

Oxidative Phosphorylation (cont)

ATP synthase Uses energy from the H⁺ gradient across the membrane

Chemiosmosis H⁺ ions flow down their gradient through ATP synthase

ATP synthase When H⁺ binds the rotor spins -- Activates catalytic sites to turn ADP + P into ATP

Produces 26-28 ATP per glucose

Respiration without Oxygen

Anaerobic Respiration generates ATP using an ETC in the absence of oxygen

Takes place in prokaryotic organisms that live in environments with no oxygen

The final electron acceptors: sulfates or nitrates

Fermentation generates ATP without an ETC

Extension of glycolysis Recycles NAD⁺, Occurs in the cytosol, NO oxygen

Two types Alcohol fermentation and Lactic acid fermentation

Alcohol Fermentation (bacteria, yeast) pyruvate is converted into ethanol

Lactic Acid Fermentation (muscle cells) When muscles run out of oxygen, they can go through lactic acid fermentation to produce ATP

Lactic Acid Fermentation Breakdown of lactate

Ph

Photosynthesis the conversion of light energy to chemical energy

Site of Photosynthesis Chloroplast and Stomata

Chloroplast organelle for the location of photosynthesis

Stomata pores in leaves that allow CO₂ in and O₂ out

Stroma aqueous internal fluid

Thylakoids form stacks known as grana

Chlorophyll green pigment in thylakoid membranes

PS II Light energy (photon) causes an e⁻ to go from an excited state back to a ground state

PS I Electrons go down a second transport chain

Calvin Cycle The calvin cycle is cyclic electron flow

Three phases: 1. Carbon fixation 2. Reduction 3. Regeneration of RuBP



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