Module 8: Cellular Respiration

Keys to Success & Study Guide

Learning Objectives

By the end of this module, you should be able to: 1. **Map** the stages of cellular respiration to their location in the cell/mitochondria. 2. **Calculate** the inputs and outputs (ATP, NADH, FADH2) for each stage of respiration. 3. **Explain** the function of the Electron Transport Chain and Chemiosmosis. 4. **Compare** aerobic respiration, anaerobic respiration, and fermentation.

Key Terminology Checklist

Define these terms in your own words to ensure mastery. - [ ] **Aerobic vs. Anaerobic**: With Oxygen vs. Without Oxygen. - [ ] **Oxidation**: Loss of electrons (Glucose is oxidized). - [ ] **Reduction**: Gain of electrons (Oxygen is reduced). - [ ] **Chemiosmosis**: Using a proton (H+) gradient to drive ATP synthesis. - [ ] **ATP Synthase**: The molecular machine/turbine that makes ATP. - [ ] **Cristae**: The folds of the inner mitochondrial membrane (increases surface area for ETC).

Concept Check

1. The Main Event

- **Question**: What is the role of the Electron Transport Chain (ETC)?
- **Deep Dive**: The ETC doesn't make ATP directly. It pumps protons (H+) to create a "dam" (gradient). It is the flow of protons back through the "turbine" (ATP Synthase) that actually creates the ATP.

2. Oxygen's Job

- **Question**: Why do we breathe?

- **Deep Dive**: We need Oxygen to sit at the end of the chain and catch the tired electrons. If Oxygen isn't there, the chain backs up, the gradient dies, ATP stops, and the cell dies. Oxygen turns into Water (H2O) when it catches electrons.

3. Backup Plan

- **Question**: Why is pyruvate essentially wasted in fermentation?
- **Deep Dive**: In fermentation, we don't fully break down glucose (lots of energy left in alcohol/lactic acid). We dump pyruvate just to clear the "traffic jam" on NAD+ so Glycolysis can keep running and making a tiny bit of ATP (2 vs 30+).

Study Tips

- **The Bank Analogy**:
    - **Glucose**: $100 bill (Too big to spend).
    - **ATP**: $1 bill (Spendable cash).
    - **NADH/FADH2**: Checks (Valuable, but need to go to the bank/ETC to cash them out).
- **Inputs/Outputs Table**: Make a big table.
    - Rows: Glycolysis, Prep, Krebs, ETC.
    - Cols: Location, Reactants, Products, ATP Yield.