

5-3 Cellular Respiration

Overview Of Cellular Respiration

- The food we eat contains NRG
- NRG must be transferred to ATP for use by cells
- Example of aerobic respiration (uses oxygen)
- Metabolic processes that don't use oxygen are called

Glycolysis

- 1st Stage of cellular respiration
- Enzyme assisted anaerobic process that breaks down one 6-carbon glucose molecules into two 3-carbon pyruvates

Steps to Glycolysis

- Step 1 – Phosphate groups from two ATP molecules are transferred to a glucose molecule
- Step 2 – The resulting 6-carbon molecule is broken into two 3-carbon compounds each with a phosphate group

- Step 3 – Two NADH molecules are produced, and one more phosphate group is transferred to each 3-carbon compound
- Step 4 – Each 3-carbon compound is converted into 3-carbon pyruvate, producing 4 ATP molecules in the process

Overview of Glycolysis

- Uses 2 ATP
- Produces 4 ATP
- Net gain of 2 ATP
- Net Gain of 2 NADH

Stage 2 Pre-Krebs Cycle

- When oxygen is present, pyruvate enters a mitochondria and is converted into a two carbon compound
- This reaction produces a carbon dioxide molecule, a NADH, and a two carbon acetyl group

- The acetyl group attaches to an enzyme called coenzyme A
- This forms acetyl-CoA

Krebs Cycle

- Step 1 – Acetyl-CoA combines with a four carbon compound, forming a six carbon compound and releasing coenzyme A

- Step 2 – Carbon Dioxide is released from the six carbon compound, forming a five carbon compound.
- Electrons are transferred to a NAD⁺, making a molecule of NADH

- Step 3 –Carbon Dioxide is released from the five carbon compound, forming a four carbon compound.
- A molecule of ATP is made, and a molecule of NADH is made

- Step 4 – The four carbon compound is converted to a new four carbon compound
- Electrons are transferred to a FAD molecule, creating FADH₂ (Electron Carrier)

- Step 5 – The new four carbon compound is then converted to the four carbon compound that began the cycle
- Another molecule of NADH is created

- Krebs Cycle takes the NRG from pyruvate and converts it into NADH and FADH₂

Electron Transport Chain

- In aerobic respiration, electrons from NADH and FADH₂ are passed through an electron transport chain
- Occurs in the inner membrane of the mitochondria
- This NRG pumps Hydrogen Ions out of the inner membrane space to the outer space

- Creates a concentration gradient
- Hydrogen Ions then diffuse back into the inner space through a carrier protein
- It adds a P group to ADP molecule
- At the end of the etc, Hydrogen Ions and spent electrons form O₂, and H₂O

NRG Break Down

- Glycolysis – 2 ATP
- Krebs Cycle – 2 ATP
- ETC – Up to 34 ATP

Fermentation

- Fermentation follows glycolysis in the absence of oxygen
- Fermentation is the recycling of NAD^+ using an organic hydrogen acceptor
- Not very efficient at extracting NRG from glucose

Lactic Acid Fermentation

- Conversion of pyruvate into a 3 carbon lactic acid
- Happens in muscle cells when enough oxygen is not present
- Allows glycolysis to occur as long as glucose is present
- Lactate can build up in muscle cells causing soreness

Alcoholic Fermentation

- Pyruvate is broken down into ethanol and carbon dioxide
- Pyruvate converted into a two carbon compound, releasing carbon dioxide
- Then, electrons from NADH transfer to the two carbon compound
- This creates ethanol

- Yeast, a single celled fungus do this
- Used in baking (bread rises caused by carbon dioxide)
- Used to create beer and wine
- Yeast die when alcohol content reaches 12%