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Biology 111 – Section 520

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The Aerobic Respiration Experiment

Introduction: All Eukaryotic cells require oxygen for aerobic respiration. Oxygen is mainly used near the end of cellular respiration, where most of ATP is produced (oxidative phosphorylation). Glycolysis (occurs in the cytosol) starts off cellular respiration by oxidizing a glucose molecule in a series of ten enzyme facilitated steps into two pyruvate, a net of two ATP, two NADH plus two hydrogen ions, and two water molecules. The pyruvate then enters the mitochondria and a carboxyl group is removed creating carbon dioxide as a waste product. Acetate is then formed by the remaining two-carbon group and NAD is reduced to NADH. Acetyl CoA is formed when coenzyme A (an organic cofactor) bonds to acetate. Acetyl CoA enters the Krebs cycle (known as citric acid cycle) and forms citrate when added to oxaloacetate. FADH2 and NADH (both electron carriers) facilitate the reaction cycling back to oxaloacetate. The citric acid cycle has an output of four carbon dioxide, two FADH2, two ATP, six NADH plus six hydrogen ions, and two coenzyme A. All the FADH2 and NADH from the Krebs cycle and glycolysis transport electrons to the electron transport chain. While electrons go towards oxygen (at the end of the chain), hydrogen ions get pumped into the intermembrane space. These hydrogen ions are then pushed through ATP synthase, making a net of around 32 to 34 ATP (majority percent of ATP produced during cellular respiration). This last step is called chemiosmosis. The output of oxidative phosphorylation is around thirty-four ATP, two FAD, one water molecule, and two NAD. The spectrophotometer measures transmittance or absorbance of light. The level of absorbance facilitates in measuring the concentration of a solution.

Purpose: The main purpose of this experiment was to study aerobic respiration by using different chemical indicators and a spectrophotometer to measure absorbance. These indicators change color during the electron transport chain and during the citric acid cycle. The purpose was also to see the effects of limiting enzymes or adding inhibitors on the rate and efficiency of cellular respiration under different conditions.

Procedure: Five cuvettes were set up like the following:

Tube	Enzyme	[illegible]	[illegible]	Inhibitor	Substrate
	Bean Extract	DPIP	Phosphate Buffer	Malonate	Succinate – Wait for Steps 6 and 7
1	200 ul	200 ul	4.3 ml	-	60 ul
2	200 ul	200 ul	4.3 ml	-	60 ul