

## **Study Guide: Highlights and Themes from Final Material Lecture Series**

### **Lecture Series 9 – Cellular Pathways That Harvest Chemical Energy**

#### Energy and Energy Conversions

- The two laws of thermodynamics

- Endergonic vs. Exergonic reactions

#### ATP: Transferring Energy in Cells

- Baby Steps!

#### Obtaining Energy and Electrons from Glucose

- Glyco-lysis: 10 step program

- Redox Rxns: Transfer Electrons AND Energy

#### An Overview: Releasing Energy from Glucose

- Glycolysis, Pyruvate Oxidation, CAC, Respiratory Chain

- Where do each of these occur in the cell?

#### Glycolysis: From Glucose to Pyruvate

- Substrate-level phosphorylation

#### Pyruvate Oxidation

- Three step process

#### The Citric Acid Cycle

- Follow the electrons, carbon, and energy

#### The Respiratory Chain: Electrons, Proton Pumping, and ATP

- At last the big pay off...

- $\text{NADH} + \text{H}^+$  vs.  $\text{FADH}_2$

- Oxphos via PMF

#### Fermentation: ATP from Glucose, without $\text{O}_2$

- Must recycle that  $\text{NADH} + \text{H}^+$

#### Contrasting Energy Yields

- 2 vs. 38 (max)

#### Metabolic Pathways

- Anabolic and Catabolic pathways all flow through Glucose to  $\text{CO}_2$

## Regulating Energy Pathways

Phosphofructokinase and isocitrate dehydrogenase are key

### **Concepts to Ponder:**

Metabolic Disequilibrium, Good: True Equilibrium, Bad

Glycolysis – Carbon Count, ATP & NADH considerations

Fermentation....why do it at all?

Pyruvate Oxidation....what tax?

Citric Acid Cycle – Carbon Count, ATP & NADH considerations

Substrate level vs. OxPhos: What difference does it make?

Electron Transport Chain: e- donors and acceptors

Energy Yields in Gross and Net ATP

Regulation of Metabolic pathways: Anabolic & Catabolic

Key Enzymes involved in Metabolic Pathways in terms of Regulation

Location, Location, Location

## **Lecture Series 10 – Photosynthesis: Energy from the Sun**

Identifying Photosynthetic Reactants and Products

CO<sub>2</sub> and H<sub>2</sub>O to Glucose and O<sub>2</sub> (and H<sub>2</sub>O)

The Two Pathways of Photosynthesis: An Overview

Light and “Dark” Reactions

Properties of Light and Pigments

Action Spectrum vs. Absorption Spectra

Electron Flow, Photophosphorylation, and Reductions

Cyclic and Noncyclic electron flow

The Z-scheme

Making Sugar from CO<sub>2</sub>: The Calvin–Benson Cycle

Wait, 54 ATP??? What the...

Three step process

Photorespiration and Its Consequences

Impact of Global Warming, not good...

## **Concepts to Ponder:**

Autotrophy

Electromagnetic Spectrum

Reaction Center and Accessory Pigments

Light Independent vs. Light Dependent Reactions

Cyclic vs. Noncyclic: Why bother with two possible outcomes?

Substrate level Phos, OxPhos & now PhotoPhos: Compare & Contrast

What are the three stages of the Calvin Cycle

Photorespiration: What a drag/tax to Carbon Fixation