

BIO 226N - STUDY GUIDE  
NUTRITION and METABOLISM

I. INTRODUCTION

- A. SYNTHESIS REACTIONS - ANABOLIC  
ENERGY INPUT
- B. BREAKDOWN REACTIONS - CATABOLIC  
ENERGY USES
  - 1. CHEMICAL WORK
  - 2. MOTILITY
  - 3. LIGHT PRODUCTION

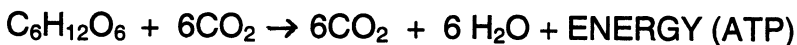
- II. NUTRIENTS - HOLOPHYTIC  
CARBON AND ENERGY SOURCE;  
NITROGEN, PHOSPHORUS, INORGANIC IONS, WATER;  
OTHER ESSENTIAL COMPOUNDS

- III. ENZYMES - BIOLOGICAL CATALYSTS; PROTEINS; ACTIVATION ENERGY;  
TURN OVER NUMBER; SPECIFICITY;

- A. INCREASE FREQUENCY OF COLLISIONS
- B. HOLD REACTANTS IN PROPER ORIENTATION
- C. LOWER ACTIVATION ENERGY

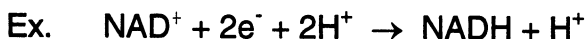
COENZYME (IONS, VITAMINS)  
APOENZYME + COENZYME = HOLOENZYME

- IV. ENERGY PRODUCTION AND STORAGE  
OXIDATION OF FOOD; GLUCOSE OXIDATION



- A. ATP PRODUCTION (GENERATION) FROM FOOD OXIDATION
  - 1. SUBSTRATE LEVEL PHOSPHORYLATION
  - 2. OXIDATIVE PHOSPHORYLATION

OXIDATION / REDUCTION REACTIONS  
Loss of  $e^-$  electrons / Gain of  $e^-$  electrons



NICOTINAMIDE ADENINE DINUCLEOTIDE  
ELECTRON TRANSPORT CHAIN

- B. ATP PRODUCTION IN PHOTOSYNTHESIS / PHOTOPHOSPHORYLATION
- C. CHEMIOSMOSIS - THEORY FOR ATP PRODUCTION
  - 1. ETC (ELECTRON TRANSPORT CHAIN) - OXIDATION / REDUCTION



2.  $\frac{1}{2} \text{O}_2 + 2\text{e}^- + 2\text{H}^+ \rightarrow \text{H}_2\text{O}$
3. ETC SPLITS  $\text{H}_2\text{O}$ ; PUMPS  $\text{H}^+$  OUTSIDE
4. GRADIENT:  $\text{H}^+$  OUTSIDE;  $\text{OH}^-$  INSIDE
5. ENERGIZED MEMBRANE - PROTON MOTIVE FORCE
6.  $\text{H}^+$  ATP-ase PUMPS  $\text{H}^+$  INSIDE
7.  $\text{H}^+$  MOVEMENT ACROSS ENERGIZED MEMBRANE PROVIDES ENERGY TO CONVERT ADP TO ATP

V. GLYCOLYSIS - CATABOLIC BREAKDOWN OF COMPOUNDS

GLUCOSE  $\rightarrow$  2 PYRUVATES + ENERGY

INPUT: 2 ATP

YIELD: 4 ATP + 2NADH + 2H<sup>+</sup>

NET: 2 ATP + 2 NADH + 2H<sup>+</sup> (EACH NADH GIVES 3 MOLECULES OF ATP IN

ETC)

VI. RESPIRATION - CATABOLIC

PYRUVATE  $\rightarrow$   $\text{CO}_2 + \text{H}_2\text{O} + \text{ENERGY}$

ACETYL CoA; KREBS CYCLE

SUMMARY OF GLYCOLYSIS & RESPIRATION

GLUCOSE + 6O<sub>2</sub>  $\rightarrow$  6CO<sub>2</sub> + 6H<sub>2</sub>O + ENERGY

INPUT 2 ATP: YIELD 40 ATP

VII. FERMENTATION

YEAST: PYRUVATE  $\rightarrow$  ETHANOL

LACTIC ACID BACTERIA: LACTIC ACID

VIII. ANABOLISM - SYNTHESIS

LOW MOLECULAR WEIGHT COMPOUNDS

POLYMERIZED INTO HIGH MOLECULAR WEIGHT COMPOUNDS