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

$$C_6H_{12}O_6 + 6CO_2 \rightarrow 6CO_2 + 6\,H_2O + \text{ENERGY (ATP)}$$

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

Ex. $NAD^+ + 2e^- + 2H^+ \rightarrow NADH + H^+$

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

$NADH + H^+ \rightarrow NAD^+ + 2e^- + 2H^+$
(OR CHLOROPHYLL EXCITED)

2. $1/2\ O_2 + 2e^- + 2H^+ \rightarrow H_2O$
3. ETC SPLITS H_2O; PUMPS H^+ OUTSIDE
4. GRADIENT: H^+ OUTSIDE; OH^- INSIDE
5. ENERGIZED MEMBRANE - PROTON MOTIVE FORCE
6. H^+ ATP-ase PUMPS H^+ INSIDE
7. 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 + $2H^+$
NET: 2 ATP + 2 NADH + $2H^+$ (EACH NADH GIVES 3 MOLECULES OF ATP IN ETC)

VI. RESPIRATION - CATABOLIC
PYRUVATE $\rightarrow$ $CO_2 + H_2O$ + ENERGY
ACETYL CoA; KREBS CYCLE
SUMMARY OF GLYCOLYSIS & RESPIRATION
GLUCOSE + $6O_2 \rightarrow 6CO_2 + 6H_2O$ + 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