

II. General Microbiology – Session 2

A. Chemical and Functional Anatomy

1. Eucaryotic Cells
2. Procaryotic Cells
 - a. Cell membrane
 - b. Cell walls:
 - Gram (+): e.g. *Streptococcus* sp.
 - Gram (-): e.g. *Salmonella* sp.
 - c. Nucleoid: DNA
 - d. Ribosomes: 70S
 - e. Flagella: e.g. *Proteus* sp.
 - f. Pili: e.g. *Neisseria gonorrhoeae*
 - g. Capsules: e.g. *Klebsiella pneumonia*
 - h. Endospores: e.g.

B. Microbial Nutrition and Growth

1. Microbial Replication: Reproduction and Generation Time
2. Physical Requirements for Growth
 - a. Temperature
 - b. pH
 - c. Osmotic pressure: Water
 - d. Atmospheric Oxygen:
 - Obligate aerobes
 - Obligate anaerobes
 - Facultative anaerobes
3. Chemical Requirements for Growth
 - a. Bulk Elements: C H N O P S
 - b. Trace minerals: Fe Cu Co Zn Mg
 - c. Growth factors: Vitamins, etc.
4. Population Growth
 - a. Growth
 - b. The growth curve:
 - Lag phase
 - Log Phase
 - Stationary Phase
 - Death Phase
5. Culture Media
 - a. Liquid vs solid
 - b. Complex vs chemically defined
 - c. Aerobic vs anaerobic
 - d. Selective vs differential
 - e. Cell culture
6. Control of Microbial Growth
 - a. Historical perspective
 - Semmelweis & "childbirth fever"
 - Lister & surgical infection
 - b. Basic terminology
 - Sterilization
 - Disinfectants vs Antiseptics,
 - Static vs cidal effects,
 - Sepsis, asepsis & aseptic technique
 - c. Physical methods to control growth
 - 1) Heat:
 - Dry, Moist, Autoclaving, Pasteurization
 - 2) Radiation:
 - Ionizing, Non-ionizing

- 3) Miscellaneous:
 - Cold, Dehydration, Osmotic pressure
- d. Chemical methods to control growth:
 - 1) Phenols:
 - Phenol, Hexachlorophene
 - 2) Halogens:
 - Iodine, Chlorine (OCl⁻)
 - 3) Alcohols:
 - Ethyl (CH₃CH₂OH), Isopropyl
 - 4) Heavy metals:
 - Arsenic (Salvarsan)
 - Silver (1% Ag NO₃)
 - Copper (CuSO₄)
 - Mercury
 - Organic vs inorganic
 - 5) Detergents:
 - Soaps, Quaternary ammonium compounds (Quats)
 - 6) Gasses: Ethylene oxide
 - 7) Peroxides: Benzoyl peroxide

C. Microbial Metabolism

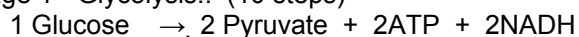
1. Introductory Concepts

- a. Metabolism: Anabolism vs Catabolism
- b. Function of ATP
- c. Enzymes and coenzymes
- d. Nutritional patterns of mo's:
 - Phototrophs vs chemotrophs
 - Autotrophs vs heterotrophs
- e. Oxidation - Reduction reactions
- f. Phosphorylation reactions
 - Substrate level phosphorylation (SLP)
 - Oxidative phosphorylation (OP)

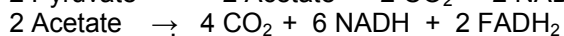
2. Energy Trapping Metabolic Pathways

a. Catabolism

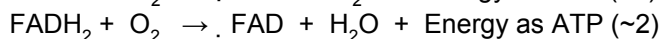
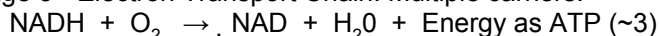
Stage 1 - Glycolysis: (10 steps)



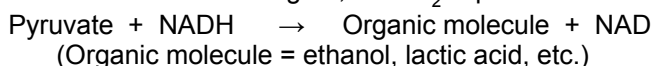
Stage 2 - TCA Cycle: (1 + 8 steps)



Stage 3 - Electron Transport Chain: Multiple carriers:



b. Fermentations. After Stage 1, if no O₂ is present:



3. Biosynthesis: Overview of Anabolism

Intermediates from Glycolysis or TCA cycle +
 Energy (as ATP) from Electron Transport Chain =
 Biomolecules (Lipids, CHO's, Proteins, NA's) for growth