

**BIO 226N**  
**STUDY GUIDE**  
**CONTROL OF MICROBES**

**I. Physical Methods**

**A. High temperature**

1. Dry heat - Sterilization - 160 - 170° C - 2 hours

2. Moist heat:

a. Autoclave 121° C, 15 psi, 15-20 minutes

b. Pasteurization - mild heating 63° C, 30 minutes

milk, dairy food and cheese; kills most pathogens

without damaging taste. Cannot kill endospores.

72° C, 15 sec - HTST - high temperature, short time pasteurization

140° C, 1 sec - UHT - ultra high temperature pasteurization

C. Low temperature 4° C - food preservation

D. Freeze-drying - lyophilization

E. Desiccation - drying

F. Osmotic pressure - high concentrations of salts & sugars can preserve food

G. Radiation: UV, x-ray, gamma rays used for sterilization of pharmaceutical and disposable dental & medical supplies; plastic syringes, surgical gloves - replacing gases.

H. Filtration can be used to sterilize liquid media

**II. Chemical Methods**

Sterilization, disinfection, antisepsis, bacteriocidal, bacteriostatic

A. Acids: Propionic acid, Glutamic acid, Benzoic acid:

Calcium propionate and sodium glutamate

B. Alcohols: Ethanol, Isopropanol

C. Phenol (Carbolic acid): Phenolics (Cresol)

D. Halogens

1. Cl<sub>2</sub> - Chlorine



2. Iodine - 2% in alcohol is tincture of iodine

E. Heavy metals, AgNO<sub>3</sub> Silver Nitrate

F. H<sub>2</sub>O<sub>2</sub> - Hydrogen Peroxide

G. Ethylene oxide                    C



H. Formaldehyde    HC = O Formalin

H

# CHEMOTHERAPY

Synthetic drugs, drugs produced by bacteria and fungi called antibiotics

Selective toxicity

- I. Ehrlich 1906 - Chemotherapy idea
- II. Sulfonamides 1930 - Sulfanilamide - PABA analog  
PABA → FOLIC ACID (VITAMIN)  
*Streptococcus pyogenes* and urinary tract infections
- III. Antibiotics
  - A. Penicillin - Fleming - *Penicillium notatum*  
Inhibitor of cell wall peptidoglycan synthesis
  - B. Streptomycin - Waksman - *Streptomyces griseus*  
*Mycobacterium tuberculosis*  
protein synthesis inhibitor on 70S ribosomes  
others: Tetracycline, Erythromycin, Chloramphenicol

## IV. Drug Mechanisms

- A. Cell wall synthesis inhibition
- B. Effects on membranes
- C. Protein synthesis inhibition
- D. Nucleic acid synthesis inhibition

## V. Anti-viral Drugs

## VI. Complications of Drug Use

- A. Hypersensitivity - Penicillin
- B. Toxicity - Streptomycin - Otic nerve damage  
Chloramphenicol - pernicious anemia
- C. Normal flora destruction -  
Microbial antagonism  
Prolonged use of antibiotic  
Opportunistic pathogen  
*Candida albicans* - Thrush, Vaginitis
- D. Spread of multiple drug resistance  
Pencillinase - *S. aureus*  
Resistance plasmids - resistance factors  
RTF (plasmid replication, plasmid transfer, drug resistance)  
Multiple drug resistance - Japan - resistance to Sulfonamide, Streptomycin, Chloramphenicol, and Tetracycline

% Shigella with multiple drug resistance

	<u>1954</u>	<u>1964</u>
Japan	0%	50%
London	<u>1962</u> 3%	<u>1965</u> 61%

## VII. Transposons

Mobile genetic elements - jumping genes  
Carry antibiotic resistance genes