

The Control of Microbial Growth

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- Asepsis is the absence of significant contamination.
- Aseptic surgery techniques prevent microbial contamination of wounds.

Terminology

- Sterilization:
 - Commercial sterilization: Killing *C. botulinum* endospores
 - Disinfection:
 - Antisepsis: Removal of pathogens from living tissue
 - Degerming: Removal of microbes from a limited area
 - Sanitization: Lower microbial counts on eating utensils
 - Biocide/Germicide:
 - Bacteriostasis:
- Bacterial populations die at a constant logarithmic rate

Effectiveness of Antimicrobial Treatment

- Depends on:
 - Environment (organic matter, temperature, biofilms)
 - Microbial characteristics

Actions of Microbial Control Agents

- Alternation of membrane permeability
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- Damage to nucleic acids

Heat

- Moist heat denatures proteins
- Autoclave:

Physical Methods of Microbial Control

- Pasteurization reduces spoilage organisms and pathogens
- Equivalent treatments
 - 63°C for 30 min
 - High temperature, short time:
 - Ultra high temperature:
 - Thermotolerant organisms survive
- Dry heat sterilization kills by oxidation
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 - Hot-air sterilization

	Hot-air	Autoclave
Equivalent treatments	170°C, 2 hr	121°C, 15 min

- Filtration removes microbes
- Low temperature inhibits microbial growth
 - Deep freezing
- High pressure denatures proteins
- Desiccation prevents metabolism
- Osmotic pressure causes plasmolysis

- Radiation damages DNA
 - Ionizing radiation (X rays, gamma rays, electron beams)
 - Nonionizing radiation (_____)
 - (Microwaves kill by heat; not especially antimicrobial)

Chemical Methods of Microbial Control

- Principles of effective disinfection
 - Concentration of disinfectant
 - Organic matter
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- Evaluating a disinfectant
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Types of Disinfectants

- Phenol
- Phenolics:
- Bisphenols: Hexachlorophene, Triclosan
 - Disrupt plasma membranes

- Biguanides: Chlorhexidine
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- Halogens: Iodine, chlorine
 - Bleach is hypochlorous acid (HOCl)

- Alcohols: Ethanol, isopropanol
 - Denature proteins, dissolve lipids

- Heavy metals:
 - Oligodynamic action (toxic effect of metal-ions on living cells)
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- Surface-active agents or surfactants

Soap	Degerming
Acid-anionic detergents	Sanitizing
Quaternary ammonium compounds	Bactericidal, Denature proteins, disrupt
Cationic detergents	plasma membrane

- Quaternary ammonium compounds/cationic detergents - bacteriocidal, fungicidal, amoebicidal, virucidal (enveloped)
 - denature proteins, disrupt plasma membrane
 - ex. Zephiran (benzalkonium chloride; Cepacol (cetylpyridinium chloride)
- Chemical food preservatives
 - Organic acids
 - Sorbic acid, benzoic acid, and calcium propionate
 - Control molds and bacteria in foods and cosmetics
 - Nitrite prevents endospore germination
 - Antibiotics. Nisin and natamycin prevent spoilage of cheese
- Aldehydes
 - Inactivate proteins by cross-linking with functional groups (-NH₂, -OH, -COOH, -SH)
 - Glutaraldehyde, formaldehyde, and orthophthalaldehyde
- Gaseous sterilants
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- Peroxygens
 - O₃, H₂O₂, peracetic acid

Microbial Characteristics and Microbial Control

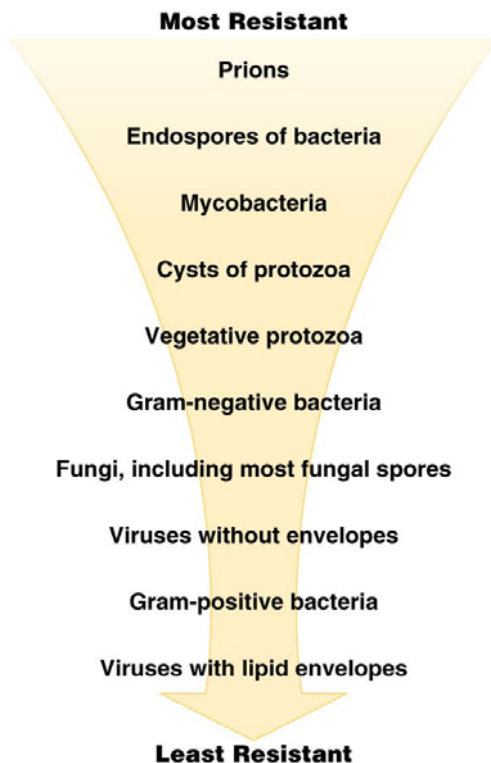


TABLE 7.7		
The Effectiveness of Chemical Antimicrobials Against Endospores and Mycobacteria		
Chemical Agent	Endospores	Mycobacteria
Mercury	No activity	No activity
Phenolics	Poor	Good
Bisphenols	No activity	No activity
Quaternary ammonium compounds	No activity	No activity
Chlorines	Fair	Fair
Iodine	Poor	Good
Alcohols	Poor	Good
Glutaraldehyde	Fair	Good
Chlorhexidine	No activity	Fair

Study Objectives

1. Define: sepsis, asepsis, antisepsis, sterilization, disinfection, degerming, sanitization, germicide, bacteriostasis.
2. Describe the factors influencing the effectiveness of antimicrobial agents.
3. Describe how the physical agents: heat, radiation, filtration, mechanical scrubbing, refrigeration, and osmotic pressure act to control the growth of microorganisms.
4. Describe how the chemical agents: ethylene oxide, aldehydes, the phenolics, quats, chlorine, iodine, alcohols, and heavy metals act to control the growth of microorganisms.