**Module 5**

**Chapter 7 The Control of Microbial Growth**

**The Terminology of Microbial Control**

* **\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_** refers to microbial \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
* **\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_** is the \_\_\_\_\_\_\_\_\_\_\_\_ of significant contamination
* Aseptic surgery techniques \_\_\_\_\_\_\_\_\_\_\_\_\_ microbial contamination of wounds
* **\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_**: \_\_\_\_\_\_\_\_\_\_\_\_ microbes
* **\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_**: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_, not \_\_\_\_\_\_\_\_\_\_\_\_\_\_, microbes
* Sterilization: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ microbial life
  + \_\_\_\_\_\_\_\_\_\_\_\_ is most common method
  + \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ is sterilizing agent
* Food products are not sterilized
  + Sterilizing would \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
* \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ sterilization: killing *C. botulinum* \_\_\_\_\_\_\_\_\_\_\_\_\_\_
  + \_\_\_\_\_\_\_\_\_\_\_\_ heat treatment
  + Attempts to retain \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ of food product
* Disinfection: removing \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
* Antisepsis: removing \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ from \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
  + A chemical can be \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
* Degerming: removing microbes from \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
* Sanitization: lowering \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
  + Commonly used when \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

**The Rate of Microbial Death**

* \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ treatments \_\_\_\_\_\_ bacteria
* Bacterial populations die at a constant \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ rate
* Effectiveness of Treatment depends on:
  + - More microbes, \_\_\_\_\_\_\_\_\_\_\_\_\_\_ to kill
    - Presence of some \_\_\_\_\_\_\_\_\_\_\_\_\_\_ can inhibit \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
    - Longer exposure, \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

**Actions of microbial control agents**

* Alteration of membrane \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
  + Results in \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
* Damage to \_\_\_\_\_\_\_\_\_\_\_\_
  + Alters or inhibits \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
* Damage to \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
  + Prevents \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ and/or \_\_\_\_\_\_\_\_\_\_\_\_\_ synthesis

**Physical Methods of Microbial Control**

*Heat*

* Heat \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ – kills microbes
* Thermal death point (TDP) – lowest temp at which \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ in a culture are \_\_\_\_\_\_\_\_\_\_\_\_\_\_
* Thermal death time (TDT) –time during which \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ in a culture \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
* Decimal reduction time (DRT) – time to kill \_\_\_\_\_\_\_\_\_ of a population
* All three are indications of \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ required to kill a population of bacteria

*Moist Heat*

* Moist heat \_\_\_\_\_\_\_\_\_\_\_\_\_\_ than dry heat
* Kills by \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ of proteins
  + Breaks \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ that hold structure
* \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ kills much faster than \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ heat
* \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

*Steam Sterilization*

* Steam \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ sterilant
  + Steam \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ item’s surface

*Pasteurization*

* \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ to reduce \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ and \_\_\_\_\_\_\_\_\_\_\_\_
* Equivalent treatments
* Does not significantly \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

*Dry heat sterilization*

* Kills by \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

*Filtration*

* Liquids can be sterilized by \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ microbes
* Used on \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
  + Antibiotics, enzymes, vaccines
* High-efficiency particulate air (HEPA) filters remove microbes larger than \_\_\_\_\_\_ m
* Membrane filters made of cellulose, plastic polymers
  + Common pore sizes \_\_\_\_ m
  + Filter out \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ microbes

*Other treatments*

* Low \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ microbial growth
* High \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ proteins
* \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ prevents \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
* Osmotic pressure causes \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

*Radiation*

* Wavelengths of \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ than visible light
* \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ radiation (\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_)
  + Ionizes \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ to release \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ radicals
  + Damages \_\_\_\_\_\_\_\_\_\_\_\_
* \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ radiation (\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_)
  + Damages \_\_\_\_\_\_\_\_\_\_\_
  + Not very \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_, microbes must be on \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
* \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ kill by \_\_\_\_\_\_\_\_\_\_\_; \_\_\_\_\_\_\_\_ especially antimicrobial

**Chemical Methods of Microbial Control**

* Chemical agents are used on living tissue (as \_\_\_\_\_\_\_\_\_\_\_\_\_) and on inanimate objects (as \_\_\_\_\_\_\_\_\_\_\_\_\_\_)
* Few chemical agents \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_, but can disinfect
* No single disinfectant is \_\_\_\_\_\_\_\_\_\_\_\_\_\_ for \_\_\_\_\_\_\_ circumstances

*Principles of effective disinfection*

* + \_\_\_\_\_\_\_\_ concentration, more \_\_\_\_\_\_\_\_\_\_\_\_\_
* pH
* Time
  + Longer \_\_\_\_\_\_\_\_\_\_\_\_\_\_, more \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
  + \_\_\_\_\_\_\_\_\_\_\_ exposure times can compensate for \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

*Disk-diffusion Method*

* Disk-diffusion method - \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ is soaked with chemical and placed on inoculated agar plate
  + A \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ indicates effectiveness
* Can perform test on \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ test bacteria
  + Determine \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ for inhibiting specific microbe
* Chemical disinfectans and antiseptics do not show \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
  + Cannot be used \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
* Disrupt \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
* Iodine
  + \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ in aqueous \_\_\_\_\_\_\_\_\_\_\_\_
  + \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_: iodine in \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ molecules
  + Alter \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ and \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
* Chlorine
  + Bleach: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
  + Chloramine: \_\_\_\_\_\_\_\_\_\_\_\_\_\_ and \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
  + \_\_\_\_\_\_\_\_\_\_\_\_ agents
* Ethanol, isopropanol
  + \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ proteins, \_\_\_\_\_\_\_\_\_\_\_\_\_\_ lipids
  + Require \_\_\_\_\_\_\_\_\_\_\_\_\_
* Heavy Metals
* \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
  + Silver sulfadiazine used as a \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ on burns
  + Copper sulfate is an \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
* Work via \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ action
  + Mechanism not clear, but bind to and react with \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
  + Causes \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

*Surface-Active Agents, or \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_*

* \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ molecules
  + Both \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ and \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
  + \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ particles, rinsed away with \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
* \_\_\_\_\_\_\_\_\_\_\_\_ works via \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

*Chemical Food Preservatives*

* Organic \_\_\_\_\_\_\_\_\_\_\_
  + Inhibit \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
  + Sorbic acid, benzoic acid, and calcium propionate
  + Control molds and bacteria in \_\_\_\_\_\_\_\_\_\_ and \_\_\_\_\_\_\_\_\_\_\_
* \_\_\_\_\_\_\_\_ prevents \_\_\_\_\_\_\_\_\_\_\_\_\_\_ germination
* Antibiotics
  + Nisin and natamycin \_\_\_\_\_\_\_\_\_\_\_\_\_ spoilage of cheese

**Microbial Characteristics and Microbial Control**

* Different microbes have \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ to types of disinfectants and antiseptics
* Biocides tend to be more effective against gram-\_\_\_\_\_\_\_\_\_ than gram-\_\_\_\_\_\_\_\_\_\_
  + \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ helps provide resistance
* Within gram-negative *\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_* unusually resistant
  + Contain \_\_\_\_\_\_\_\_\_\_\_\_ in OM, effective at keeping away chemicals from inner membrane
* \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_, \_\_\_\_\_\_\_\_\_\_\_\_\_ cell wall have major effects on treatments
* In general, characteristics of specific bacterial species offer different levels of resistance to disinfectant, antibiotics.
  + ***Biocides are not uniformly effective against all microbes***