**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***