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# كلية التمريض - جامعة تكريت المرحلة الثانية \ أدوية

## أ د حسام الدين النجار

**2024-2025 \ First Term**

**ANTISEPTICS AND DISINFECTANTS**

**المعقمات والمطهرات**

# ANTISEPTICS AND DISINFECTANTS

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# General information

- They have specific use and their selectivity is very low.
- **Disinfectants are strong chemical agents that inhibit or kill microorganisms**
- **Antiseptics are disinfecting agents with sufficiently low toxicity for host cells → can be used directly on skin, mucous membranes, or wounds**
- **Sterilants kill both vegetative cells and spores when applied to materials for appropriate times and temperatures**
- **Antiseptic, disinfectant and sterilant users should be aware of their short-term and long-term toxicity since they may have general biocidal activity and may accumulate in the environment or in the patient's or caregiver's body.**

# Disinfection

**DISINFECTANTS** are chemical agents that inhibit or kill microorganisms (surgical apparatus, periphery of the patient, and the objects used by the patient).

**Disinfection** It is the application of chemicals to destroy most pathogenic organisms on inanimate surfaces, Can be accomplished by application of chemical agents, use of physical agents (ionizing radiation) dry or moist heat, superheated steam (autoclave, 120°C)

# IDEAL DISINFECTANT

- effective at room temperature,
- Non-corrosive and nontoxic,
- inexpensive,
- capable of killing the vegetative form of all pathogenic organisms,
- require limited time of exposure

# PROCESS OF DISINFECTION

Prevents infection by reducing the number of potentially infective organisms either by killing, removing or diluting them.

- Application of chemical agent
- Use of ionizing irradiation, dry or moist heat or superheated steam (autoclave, 120° C)

(PHYSICAL)

**ANTISEPTICS** are disinfecting agents with sufficiently low toxicity for host cells that they can be used directly on skin, mucous membranes or wounds.

**ANTISEPSIS** It is the use of chemicals to destroy most pathogenic organisms on animate surfaces.

The ideal antiseptic has to have similar properties as an ideal disinfectant. But the primary importance for antiseptics is the selective toxicity which means toxicity to microorganisms but not to human cells. The degree of selectivity of the antiseptic agents can change depending on the tissues they contact.

# Antiseptics



- Alcohol : protein denaturation and membrane damage
  - evaporate quickly
  - ethanol and isopropanol
  - [not effective if taken internally]



# Antiseptic drugs are used in:

- The treatment of skin infections
- Prevention of infections in cuts and wounds
- Cleaning the skin area of surgery from microorganisms
- Prophylaxis and treatment of infections in mucosal areas such as mouth, nose and vagina that are open to environment
- As a scrub for surgeons and the medical personnel

# STERILANTS

- Sterilants kill both vegetative cells and spores when applied to materials for appropriate times and temperatures.



The ideal way and our goal in patient care is the sterilization of all contaminated equipment and surfaces.

But unfortunately, this is not so practical.

So they have to be cleaned and disinfected or covered with disposable barriers.

**Handwashing** is the most important means of preventing transmission of infectious agents from person to person or from regions of high microbial load such as mouth, nose, or gut to potential sites of infection.

REGULAR HANDWASHING IS BEST DONE WITHOUT DISINFECTANTS TO MINIMIZE DRYING, IRRITATION OR SENSITIZATION OF SKIN.



## Hand washing steps



**Wet your hands with clean, running water.**



**Apply soap and rub your hands together for at least 20 seconds.**



**Rinse your hands until all the soap is gone.**



**Turn off the faucet with a paper towel or your elbow.**



**Dry your hands with a clean paper towel or hand towel.**

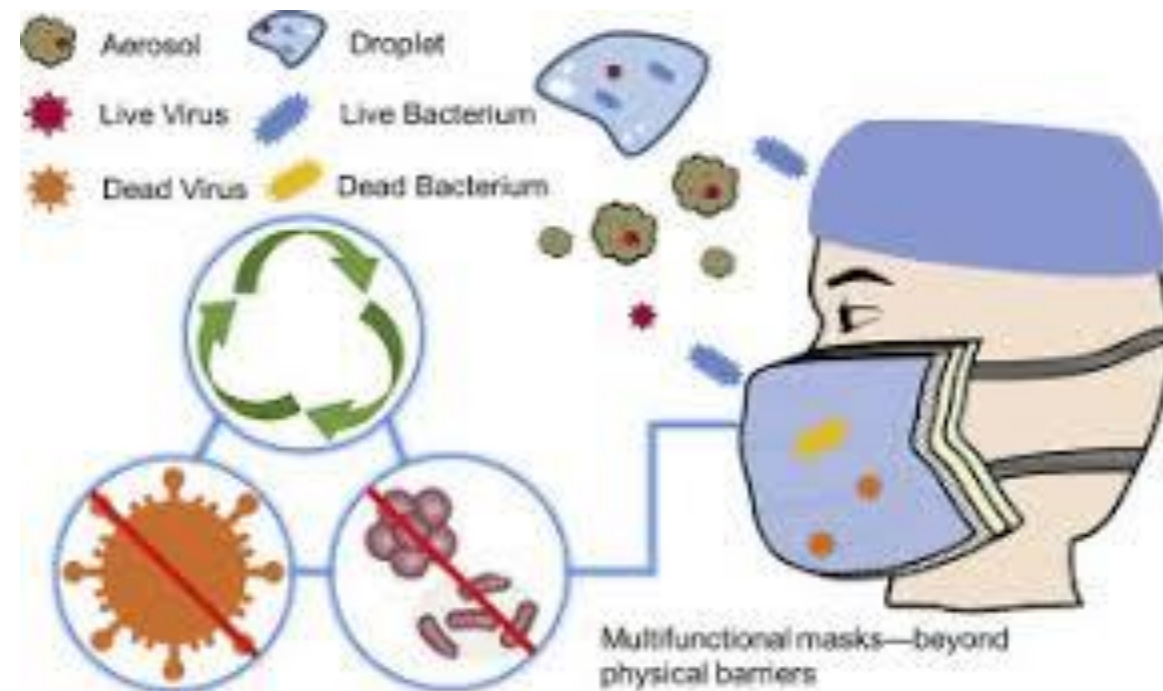
SKIN DISINFECTANTS ALONG WITH DETERGENT AND WATER ARE USUALLY USED PREOPERATIVELY AS A SURGICAL SCRUB FOR SURGEON'S HANDS AND THE PATIENT'S SURGICAL INCISION.

## THE PATHOGENS THAT CAN BE TRANSMITTED:

- ❖ Human Immunodeficiency Virus ( HIV )
- ❖ Herpes Simplex Virus types 1 and 2
- ❖ Hepatitis B Virus ( HBV ) and C Virus (HCV)
- ❖ Streptococci
- ❖ Staphylococci
- ❖ Mycobacterium tuberculosis
- ❖ Cytomegalovirus
- ❖ some upper respiratory tract viruses

Disinfectants and antiseptics may be contaminated by resistant spores, *Pseudomonas aeruginosa* *Serratia marcescens* and may transmit infection.

- Effective infection control protocols include disinfection of nonsterilizable surfaces and equipment and heat sterilization of all compatible equipment, handwashing techniques with appropriate antiseptics combined with appropriate barrier techniques such as masks, gloves and eye protection.



# FACE MASKS 101

## TYPES OF MASKS

### GOOD

Scarves & Fabric Masks



#### PROS

Make your own, washable, comfortable, blocks coarse droplets

#### CONS

One protective layer, doesn't block fine or ultrafine droplets

### BETTER

Surgical Masks (Spit Masks)



#### PROS

Two protective layers, comfortable, blocks coarse and fine droplets

#### CONS

Only one use, doesn't block ultrafine droplets

### BEST

KN95 / N95 / FFP2 Respirators



#### PROS

Several protective layers, seals tight to block coarse, fine, & ultrafine droplets

#### CONS

Must seal tight, save for medical workers and immunocompromised

# CLASSIFICATIONS OF ANTISEPTICS AND DISINFECTANTS

1. Those that denature proteins,
  2. Those that cause osmotic disruption of the cell
  3. Those that interfere with specific metabolic processes.
- The first and second classifications are tend to kill the organisms.
  - The third one affects cell growth and reproduction without killing the cell.



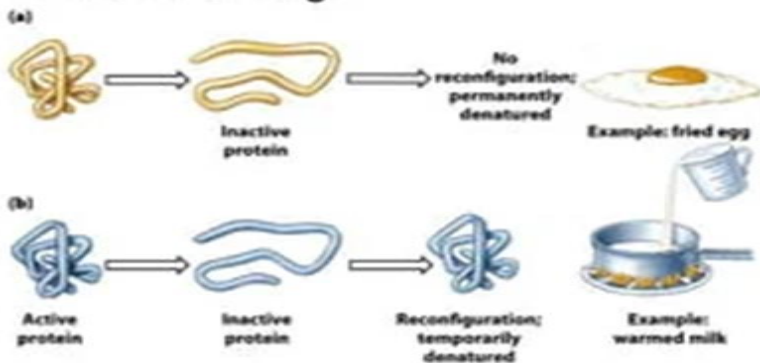
# MECHANISM OF ACTION

Phenols, iodine, alcohols, aldehydes and metallic compounds denature proteins and DNA bases.

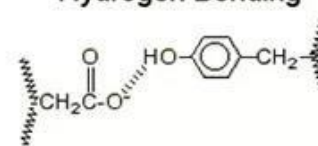
During the denaturation of proteins, the secondary and tertiary structures get destroyed and only the primary structure is retained. Covalent bonds are broken and interaction between amino-acid chains gets disrupted. This results in the loss of biological activity of the proteins.

## Mechanisms of Action

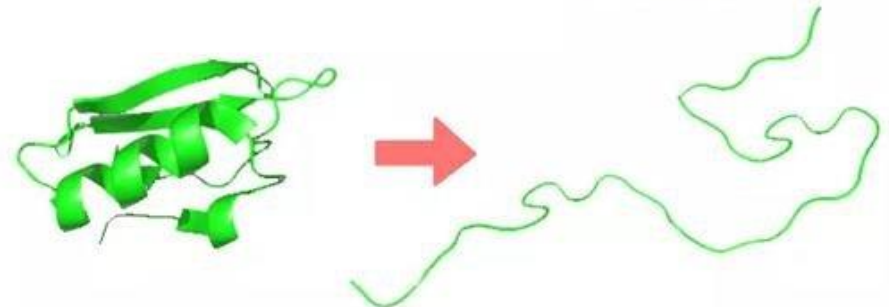
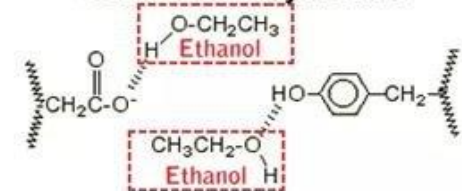
### • Protein damage



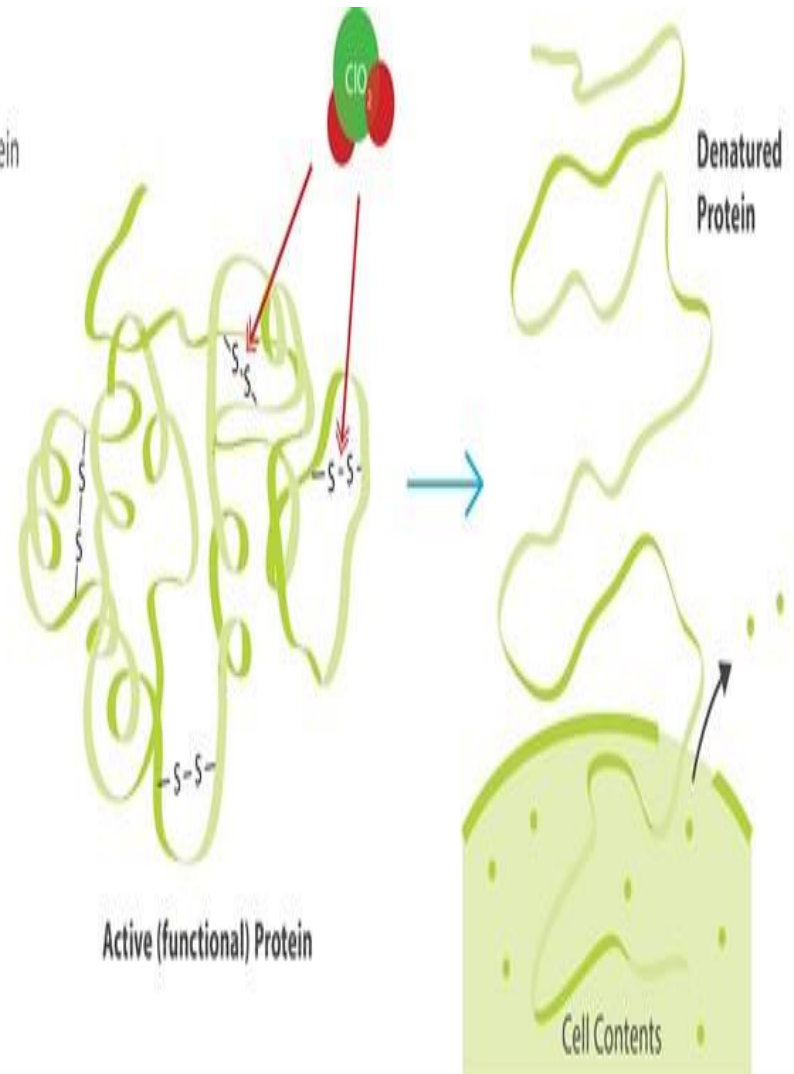
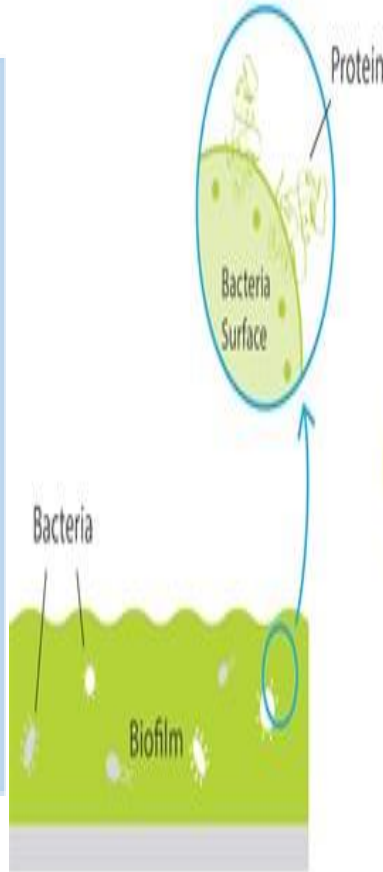
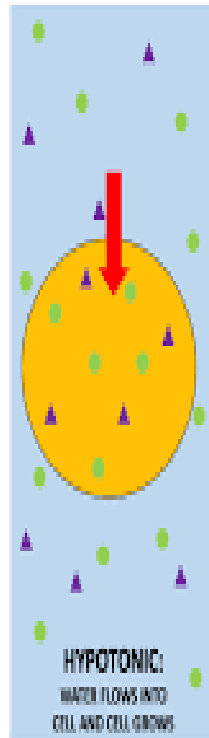
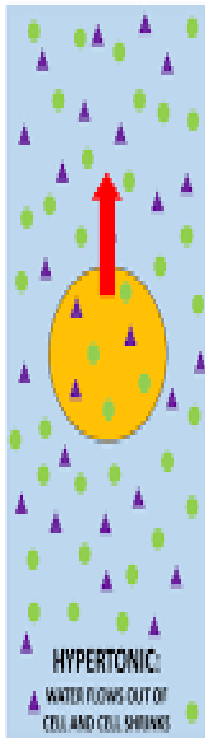
### Tertiary Structure - Hydrogen Bonding



### Denaturation by Alcohol





Cationic detergents interfere with plasma membrane's permeability and cause leakage of enzyme, coenzyme and metabolites.

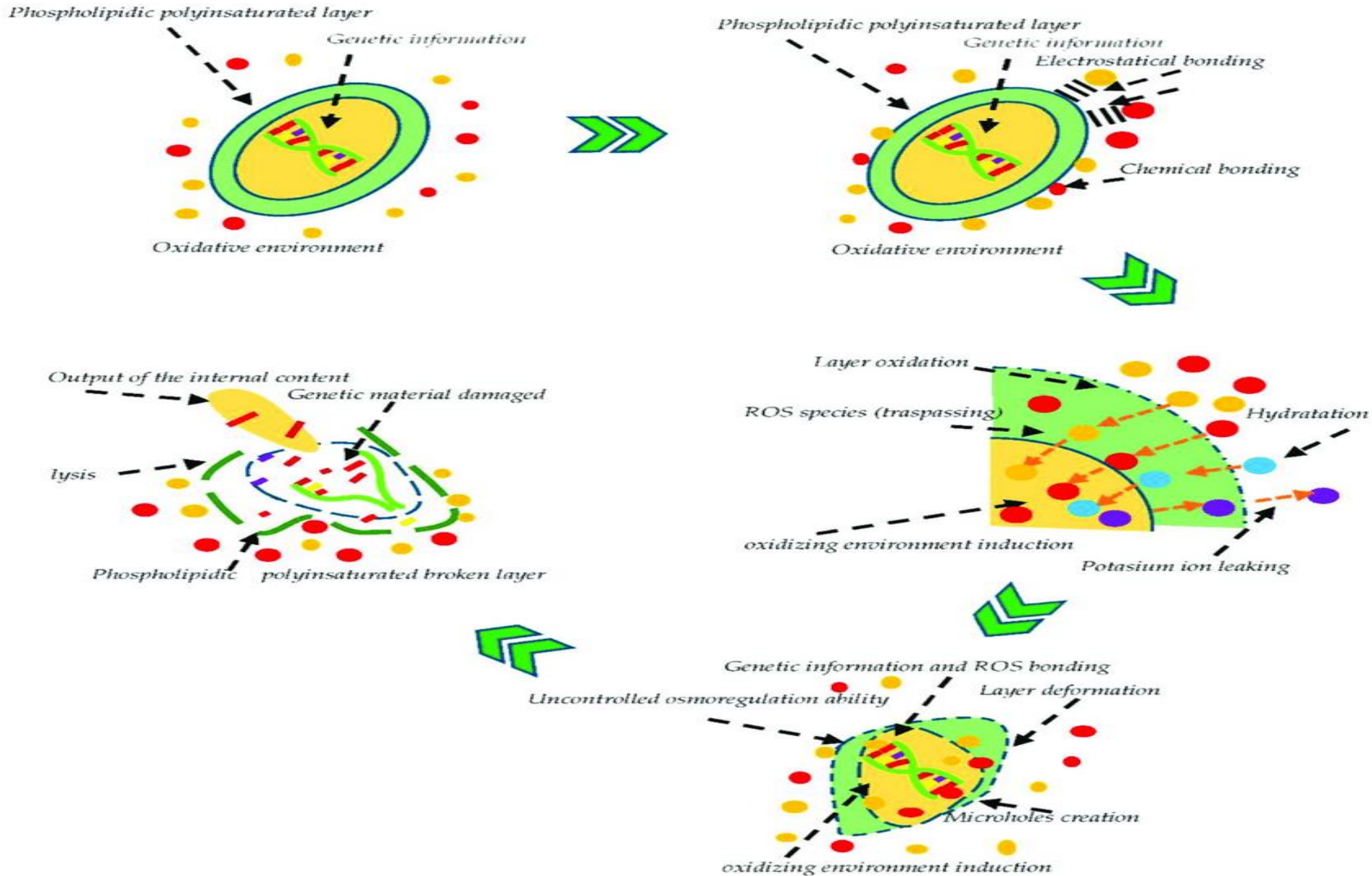


# Oxidizing compounds oxidize functional molecules in the microorganisms.

Reactive Oxygen Species



 Potassium ion  
 Water



# HALOGENS

- The halogens and halogen – releasing compounds include some of the most effective antimicrobial compounds used for disinfection and antiseptics.
- **Iodine and chlorine are the most effective halogens with bromine and fluorine being less active.**
- Because of the irritating nature of the products of **sodium hypochlorite**, it is currently used primarily as a disinfectant.

# IODINE

Tincture of iodine (2g I, 2.5 g NaI and 50% ethanol to 100 mL).

**Powerful antiseptic for intact skin, should avoid contact with mucosas. Can cause serious hypersensitivity reactions, staining of skin and dressing can happen and this limits its use.**

**Povidon iodine (A complex of I with polivinyl pyrrolidone-surface active agent-). Can be used as antiseptics or disinfectants. Kill vegetative bacteria, mycobacteria, fungi, lipid containing viruses. They kill spores as well on prolonged use**

Iodine and other free halogens oxidize the -SH groups of proteins and enzymes and produce -S-S- bonds and disrupts the structure and function of these M.O.



# CHLORINE

**Chlorine is a strong oxidizing agent. Hypochloric acid and sodium hypochlorite (household bleach 5.25%) are bactericidal and effective disinfectants can kill bacteria, fungi ,inactivate viruses.**

1:10 dilutions it provides 5000 ppm of chlorine. **This is the concentration recommended for disinfection of blood spills.** Dilutions are made with tap water and when the opaque bottle is tightly closed it preserves its activity.

# ALCOHOLS

**Ethyl alcohol (70% )and isopropyl alcohol are effective antiseptic and disinfectant agents. They reduce the number of bacteria 90% when applied to the skin. They rapidly kill vegetative bacteria, M tuberculosis, many fungi and inactivate lipophilic viruses. They denature proteins and disturb the membrane permeability of bacteria.**

They can damage corneal tissue if directly applied, therefore instruments that will be used in the eye must be free of alcohol before use.



# ALDEHYDES

2-8% of formaldehyde can be used as a sterilizing agent for surgical instruments.

**Not corrosive for metal, plastic or rubber.**

**Broad spectrum of activity against microorganisms and viruses.**

Alkylate chemical groups in proteins and nucleic acids.

**It is especially useful for instruments that can not be autoclaved. (hemodialyzers, dental handpieces, respiratory therapy equipment).**

**Formaldehyde** has a pungent odor and is highly irritating to respiratory mucous membranes and eyes at conc 2-5 ppm is rarely used because of its toxicity and tendency to cause sensitization with repeated contact.

**The relative risk of formaldehyde as a human carcinogen when used as a disinfectant is significant.**

# OXIDIZING AGENTS

Hydrogen peroxide is the most common of a number of oxidizing compounds that have been used as antiseptics. It is also effective in injured skin due to its bubbling effect. 3% solution is effective.

Concentrations potentially useful for antiseptics are effective against vegetative bacteria, higher concentrations are sporicidal.

Disinfection of respirators, acrylic resin implants, plastic eating utensils, soft contact lenses, cartons for milk or juice 10-25% conc is sporicidal.

# Chlorhexidine

Chlorhexidine was approved for use in surgical scrubs

It is highly effective against gram-positive organisms, vegetative bacteria, mycobacteria, moderately active against fungi and viruses, spore germination is also inhibited. Strongly adsorbs to bacterial membranes and causes leakage of small molecules and precipitation of cytoplasmic proteins.

Water soluble chlorhexidine digluconate is used as an antiseptic. Most effective against gram-positive cocci and less active against gram-positive and gram-negative rods, spore germination is also inhibited.

It strongly adsorbs to bacterial membranes and causes leakage of small molecules and precipitation of cytoplasmic proteins. It is resistant to inhibition by blood or organic material.

Used in oral rinses, should not be used during surgery of the middle ear, causes sensorineural deafness.

# Sterilization

It is the way for killing of **all forms** of microorganisms.

- Dry heat
- Steam
- Chemical vapor
- Ethylene oxide gases
- Formaldehyde gases
- Ultraviolet radiation
- Gamma radiation

You have to accept and treat **every** patient as *potentially infectious* in order to reduce the risk of infection.

In an office treating 20 patients a day, it is estimated that workers encounter approximately one active carrier of HBV every 7 days.

# The purpose of infection control programs

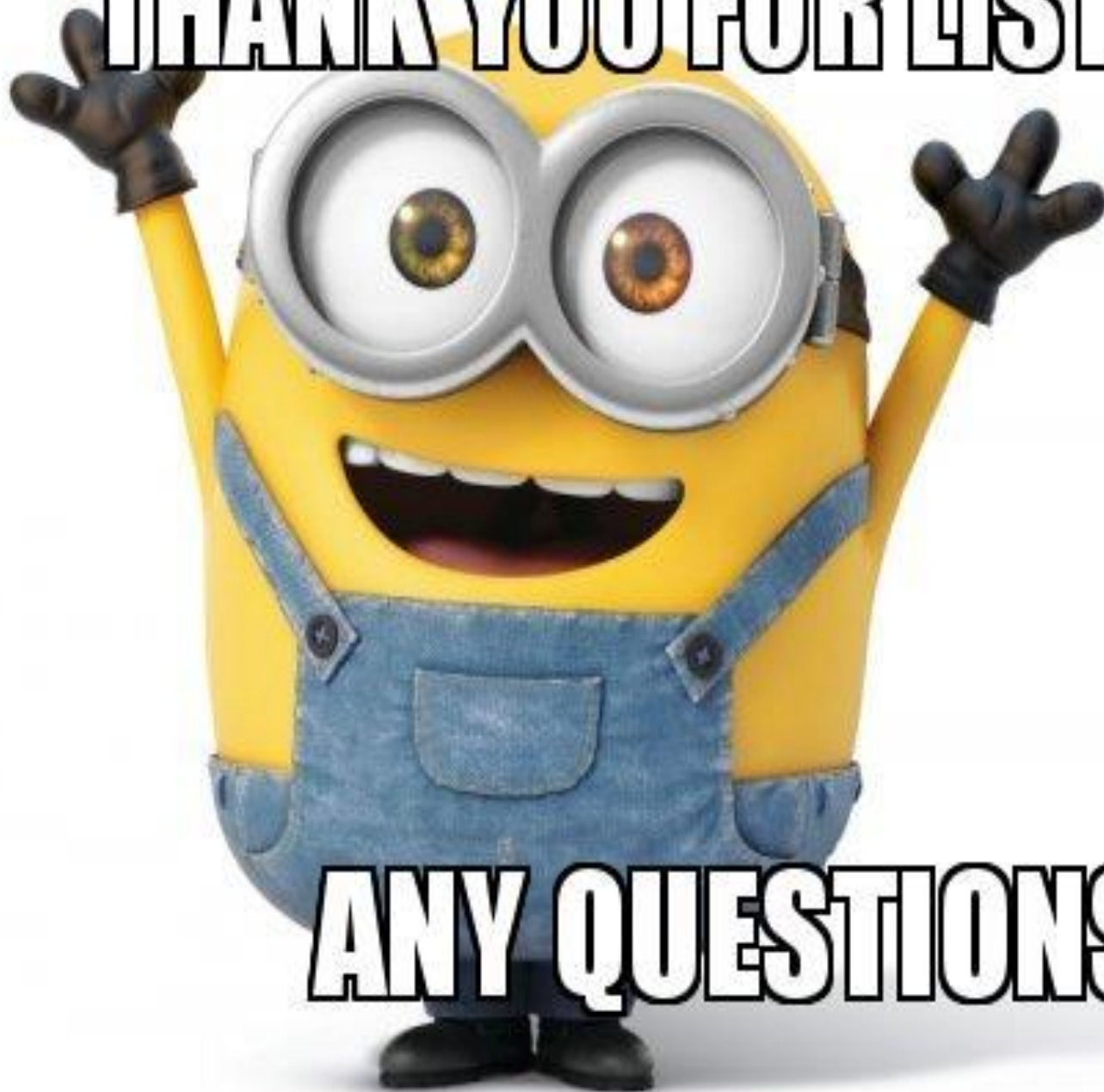
- to treat every patient and instrument (capable of transmitting infectious disease).
- to protect patients and healthcare workers from infection and its results.
- to reduce the numbers of pathogenic microorganisms to levels where patients' normal defence mechanisms can prevent infection.
- to break the cycle of infection and eliminate cross – contamination.

# ACTIVITIES OF DISINFECTANTS

	Bacteria				Viruses		Other		
	Gram-positive	Gram-negative	Acid-fast	Spores	Lipophilic	Hydrophilic	Fungi	Amebic Cysts	Prions
Alcohols (isopropanol, ethanol)	HS	HS	S	R	S	V	—	—	R
Aldehydes (glutaraldehyde, formaldehyde)	HS	HS	MS	S (slow)	S	MS	S	—	R
Chlorhexidine gluconate	HS	MS	R	R	V	R	—	—	R
Sodium hypochlorite, chlorine dioxide	HS	HS	MS	S (pH 7.6)	S	S (at high conc)	MS	S	MS (at high conc)
Hexachlorophene	S (slow)	R	R	R	R	R	R	R	R
Povidone, iodine	HS	HS	S	S (at high conc)	S	R	S	S	R
Phenols, quaternary ammonium compounds	HS	HS	±	R	S	R	—	—	R
Strong oxidizing agents, cresols	HS	MS to R	R	R	S	R	R	R	R

**Key:** HS, highly susceptible; S, susceptible; MS, moderately susceptible; R, resistant; V, variable; —, no data.

**THANK YOU FOR LISTENING.**



**ANY QUESTIONS?**