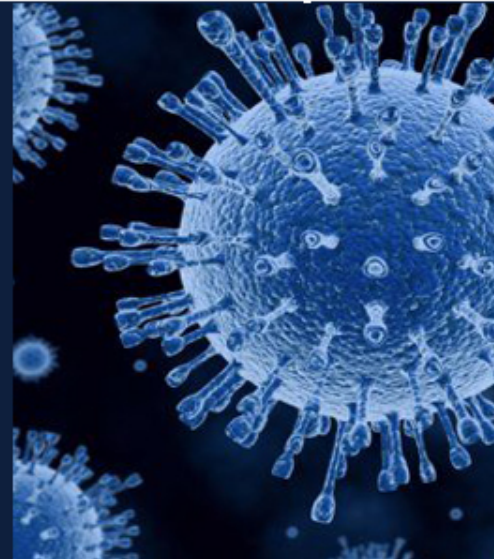
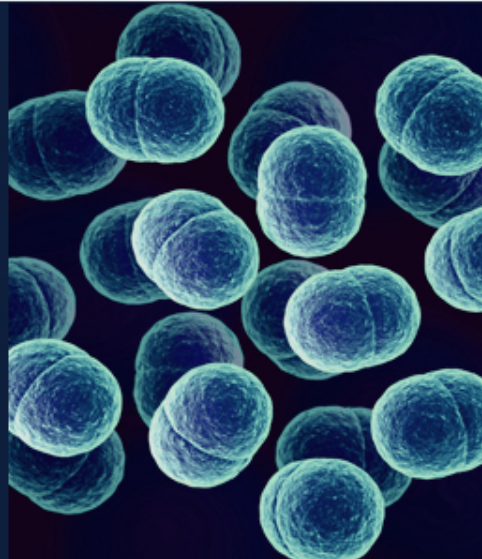


# MICRObiology

TEAM 435

هذا العمل لا يغني عن المرجع الأساسي للمذاكرة



## Lecture 7

# Sterilization & Disinfection

● Important

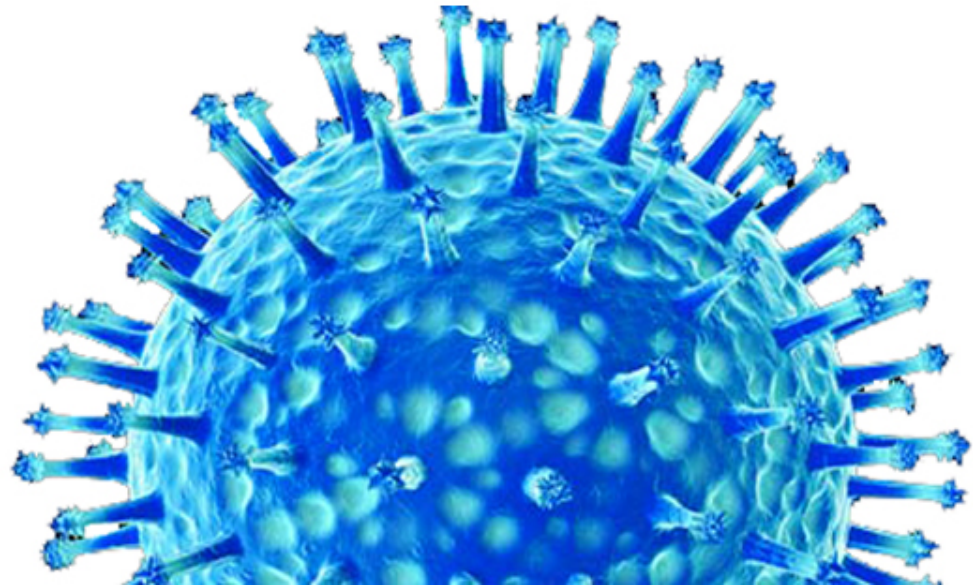
● Term

● Extra explanation

● Additional notes

# Objectives

- Define the terms **sterilization**, **disinfectant** and **antiseptic**.
- Classify the different methods of sterilization (**physical** and **chemical** methods).
- Know and realizes that **heat is the most important method of sterilization** and its application in medical practice.
- Know **dry heat** as applied in hot air oven and moist heat as applied in autoclaves.
- Know the **principles** of autoclave **function** and **monitoring** methods of sterilization.
- Know the **importance of non heat sterilization methods** and their use for **sterilization** of heat sensitive objects.
- Know the **difference** between **antiseptics** and **disinfectants**.
- Classify the **disinfectants** and **antiseptics** and know factors affecting their functions.
- Know **different applications** for different disinfections and antiseptics.



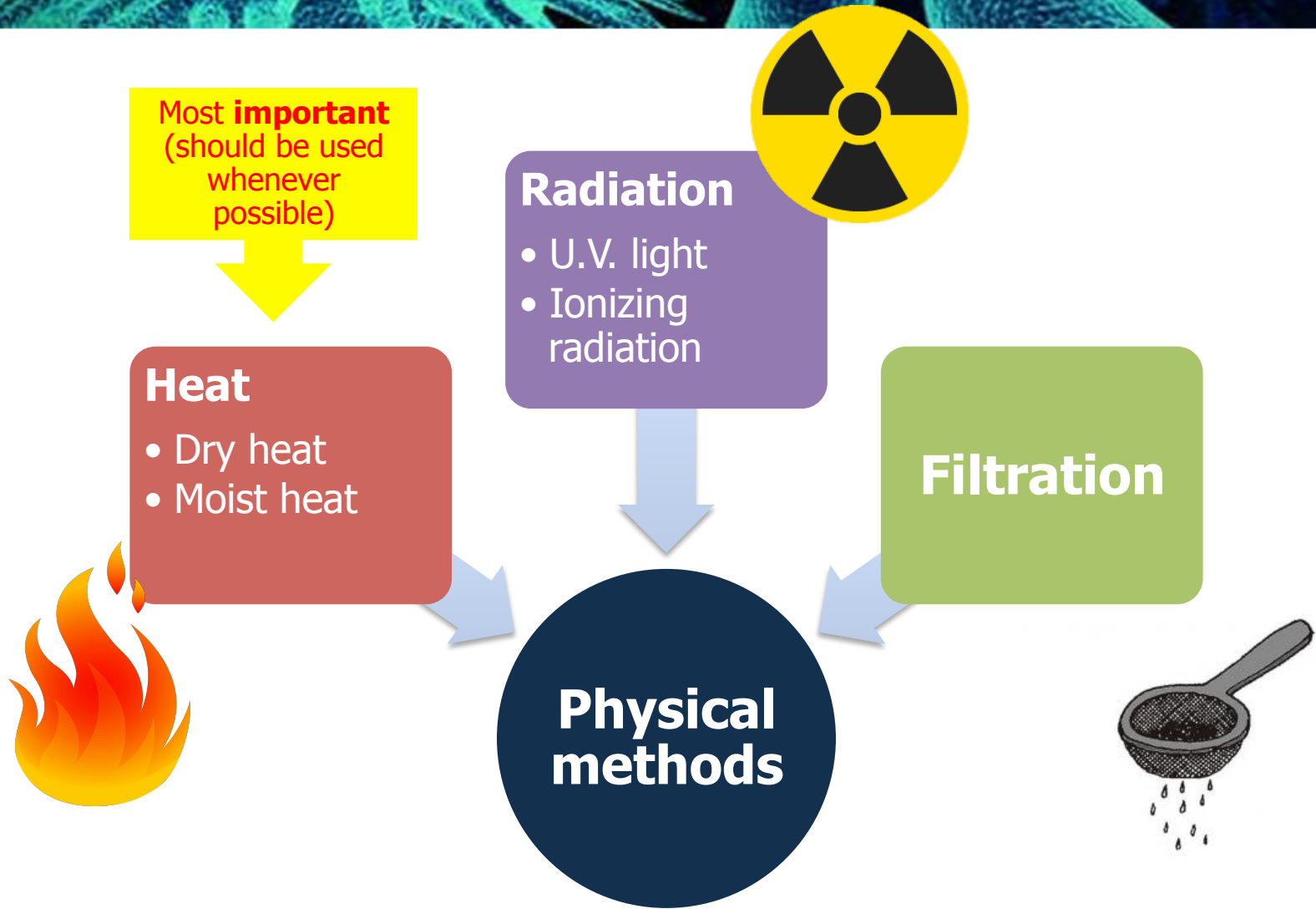
# Definitions & Sterilization Methods

Term	Definitions
<b>Sterilization</b>	<b>Complete</b> killing of <b>all forms</b> of microorganisms, including bacterial <b>spores</b> .
<b>Disinfection</b>	<b>Killing</b> or <b>removing</b> of <b>harmful</b> vegetative microorganisms.
<b>Disinfectant</b>	Chemical <b>substance</b> used to achieve <b>disinfection</b> .
<b>Antiseptic</b>	<b>Disinfectant</b> that can be <b>safely</b> used on <b>living tissues</b> .

## Methods of Sterilization

<b>1- Physical methods</b>	<b>Heat</b> (dry heat+moist heat)
	U.V. Light
	Ionizing Radiation
	Filtration
<b>2-Chemical method (Used for heat sensitive equipment)</b>	<b>Ethylene oxide</b>
	<b>Gluteraldehyde</b>

# Sterilization: Physical Methods





# Sterilization: Physical Methods

## Sterilization by Heat Common methods

### Dry Heat:

- \* kills microorganisms by destroying their **oxidative processes**.
- \* Simplest method is **exposing item to be sterilized to the naked flame**
- \* Hot air oven expose items to **160 °C for 1 hour**
- \* Has **electric element** in chamber as source of heat
- \* Has **fan** to circulate air for even distribution of heat in chamber(. Oven without fan is **dangerous**)

Used for items that are **lacking water** such as: **Metals, Glassware, Ointment / Oils/ Waxes /Powder**

### Moist Heat:

- \* Uses hot water. Moist heat kills microorganisms **by denaturing proteins**.
- \* **Autoclaving** – standard sterilization method in hospitals. **Autoclave** works under the same principle as the **pressure cooker** because of **increase pressure** the boiling point of water is **>100 °C**.



# Sterilization: Physical Methods



## Autoclave

is a tough **double** walled chamber in which air is replaced by pure saturated **steam** under pressure.

## Advantages of Autoclave

1-Temp. > **100 °C**. Therefore spore killing

2-Condensation of steam generated extra heat so The condensation also allows the steam to **penetrate** rapidly into porous materials.

3-The usual temperature achieved is 121 °C , exposure time of only 15 mins..

## Monitoring of Autoclaves

### Physical

Use of **thermocouple** to accurately measure the temperature.

### Chemical

It consists of heat sensitive chemical that **changes color** at the right temperature and exposure time.  
e.g. a)- **Autoclave tape** b)- **Browne's tube**.

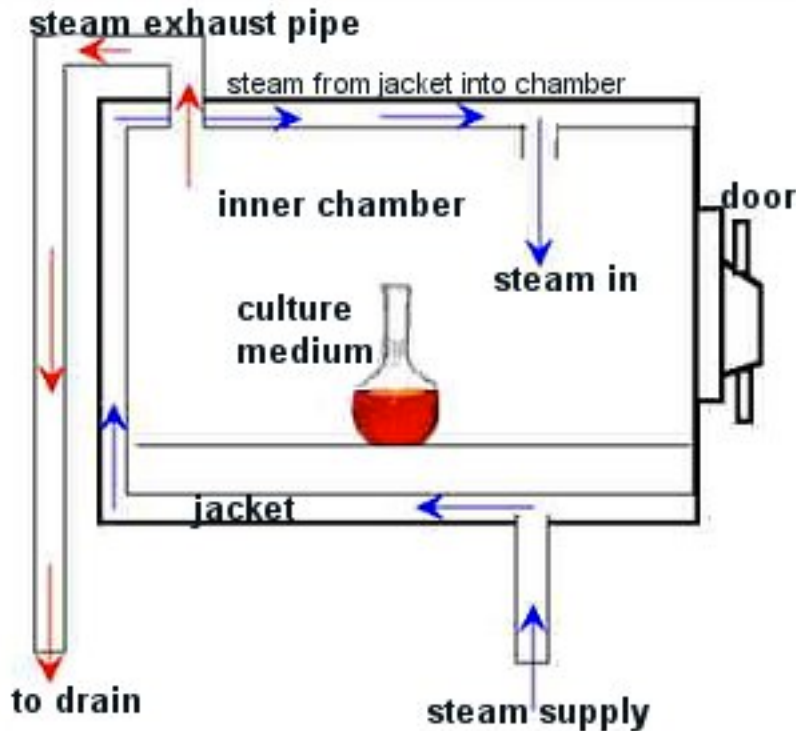
### Biological

Where a spore-bearing organism is added during the sterilization process and then cultured later to ensure that it has been killed.

**Note:** for all invasive procedures at operating room or clinics, autoclavable equipments should be used.

# Sterilization: Physical Methods

الصورة للتوضيح فقط



## How do autoclaves work?

The **air** in the chamber is **evacuated** and **filled** with **saturated steam**. The chamber is closed tightly the steam keeps on filling into it and the **pressure** gradually **increases**. The items to be sterilized get completely surrounded by saturated steam (**moist heat**) which on contact with the surface of material to be sterilized condenses to release its latent heat of condensation which **adds to already raised temperature of steam** so that eventually **all the microorganisms in what ever form are killed**.

The **usual temperature** achieved is **121 °C** , exposure time of only **15 mins** .



## Moist Heat: Other Applications

### Pasteurization

\*Used heat at temperatures sufficient to inactivate harmful organism in **milk**.

\* The temperatures of sterilization is **not** achieved.

Temperature may:

74°C, for 3-5 seconds  
( **Flash methods** )

62°C for 30 minutes  
( **Conventional method** )

\*Pasteurization to prevent diseases like:

**Typhoid fever, Brucellosis,  
Tuberculosis, Q fever.**

### Boiling

Quite common especially in **domestic circumstances.**



# Sterilization: Physical Methods

## U.V. light

-Has **limited** sterilizing power because of **poor penetration** into most materials.

-Generally used in **irradiation of air** in certain areas such as **operating rooms** and **tuberculosis** labs.

## Ionizing radiation

-e.g. **Gamma radiation**: has greater energy than U.V. light, therefore **more effective**.

-Used mainly in **industrial facilities** e.g. sterilization of **disposable plastic syringes, gloves, specimens containers and Petri dishes**.

## Radiation

## Filtration

-May be done under either **negative** or **positive pressure**.

-Example ; **membrane filter** made of cellulose acetate.

-Generally removes most bacteria **but** viruses and some small bacteria e.g. *Chlamydia* & *Mycoplasma* may pass through.

-Thus filtration does not technically sterilize items but is **adequate for circumstances** under which is used.

-Main use: **heat labile substances** e.g. **sera, antibiotics**.

# Sterilization: Chemical Methods

## Chemical methods:

Useful for **heat sensitive materials**  
e.g. **plastics** and **lensed endoscopes**.  
and they are:

Non-sterilized endoscopes can transmit virulent pathogens, such as: HIV and hepatitis A, B and C.

### Ethylene Oxide Chamber

1- Ethylene oxide alkylates DNA molecules and there by inactivates microorganisms.

2- it may cause explosion if used pure so it is mixed with an inert gas.

3- it requires:

- 1.high humidity (50-60%)
2. Temperature : 55-60°C.
3. Exposure period 4-6 hours.

### Disinfectants / Antiseptics

eg. phenolics,  
chlorhexidine, alcohol,  
etc..

### Activated alkaline Gluteraldehyde 2%

Immerse item in solution for about 20 mintues.

If ***Mycobacterium tuberculosis*** or spores present then immersion period **2-3 hours**.

Some strong chemical substances may be used to achieve sterilization ( kill spores) e.g. Gluteraldehyde and Ethylene oxide. Used for heat sensitive equipments.

# Factors Influencing Activity of Disinfectants

## Factors influencing activity of disinfectants

**temperature**  
(directly proportional)

**concentration**  
Directly proportional up to a point. (optimum concentration)  
After this level no advantage in further increases in concentration

We should wash before sterilizing to avoid inactivation by dirt or non-organic molecules.

**Disinfectants** may be inactivated by :  
1/Dirt 2/Organic matter:( Proteins, Pus, Blood, Mucus and Feces). 3/Non organic: (Cork, Hard water and Some plastics).

**Time:** Disinfectants need time to work.

Range of action:  
(affects what type of bacteria?)

**Range of Action:** Disinfectants not equally effective against the whole spectrum of microbes.  
e.g. Chlorhexidine less active against Gram negative bacteria than Gram positive cocci.  
Hypochlorites and Gluteraldehyde are more active against hepatitis viruses than most other disinfectants.



# Hospital Disinfection Methods

Chlorine is a disinfectant, its uses include: Clorox (diluted form), small portions are added to drinking water and different forms of it are used in swimming pools (especially public ones)

## Important points

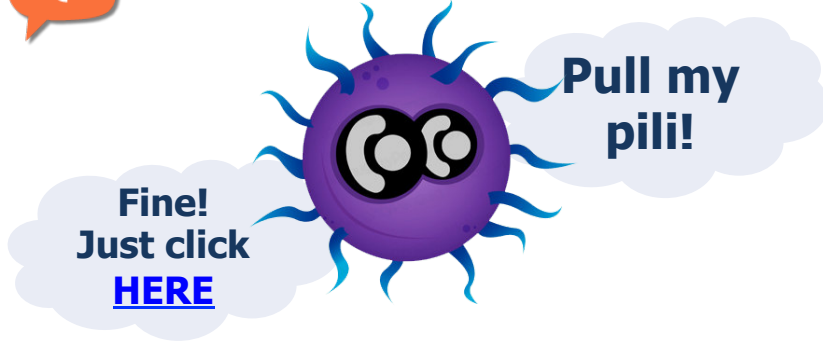
Article	Disinfectant
Floors, walls	Phenolics fluids 1-2%
Surfaces tables	Hypochlorite, Alcohol <b>Surface sterilizers are used in laboratories</b>
Endoscopes	Gluteraldehyde 2% (Cidex), subatmospheric steam
Thermometers	70% Alcohol
<b>Skin</b>	
Surgeons' hands	Chlorhexidine, Iodine alcohol <b>Examples of chlorhexidine include hand sanitizers and sterilizers used by surgeons before surgery</b>
Patient skin	70% Alcohol, Iodine

instruments or items used for sterile body site should be sterile

Any instrument or item used for non-sterile body site can be disinfected.

Hand washing is the most important to prevent hospital acquired infection

# Online Quiz



## Videos

[https://www.youtube.com/watch?v=JUp4n\\_r5s2w](https://www.youtube.com/watch?v=JUp4n_r5s2w)

<https://www.youtube.com/watch?v=GAOCDMbDvRQ>

## Books that could help you

**Microbiology Made Ridiculously Simple**



# MICRObiology

TEAM 435

We do things better

## Boys Team

- Ali Alzahrani
- Khalid Sharahily
- Ahmad Alzahrani
- Zeyad Alsalem
- Muhammad Dossary
- Meshal Alhazmy
- Hamzah Alfiar

## Girls Team

- Lamya Alsaghan
- Nojood Alhaidri
- Monera Alayuni
- Alanoud AlOmair
- Shahad Alenezi
- Aisha Al-Sabbagh
- Bodour Julaidan
- Noura ALTawil
- Deema AlFaris
- Sara Al-Hussein
- Suha Alenezy
- Latifah Alsukait
- Dalal Alhuzaimi
- Reema Allhaidan

Girls power!

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