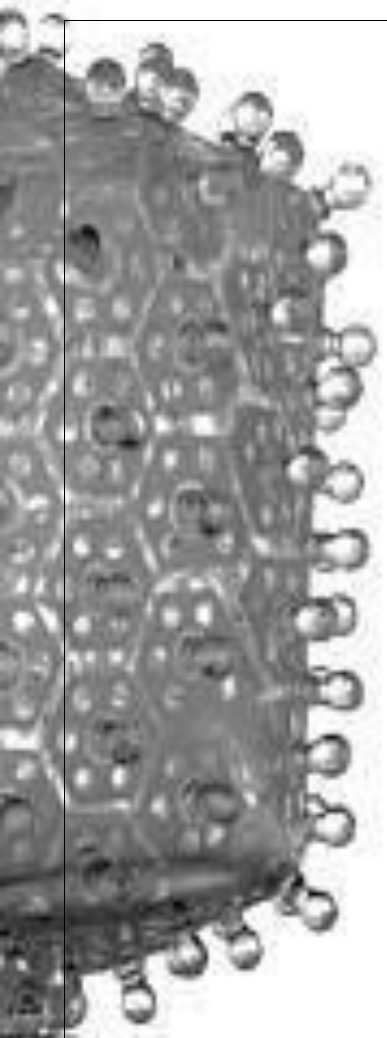


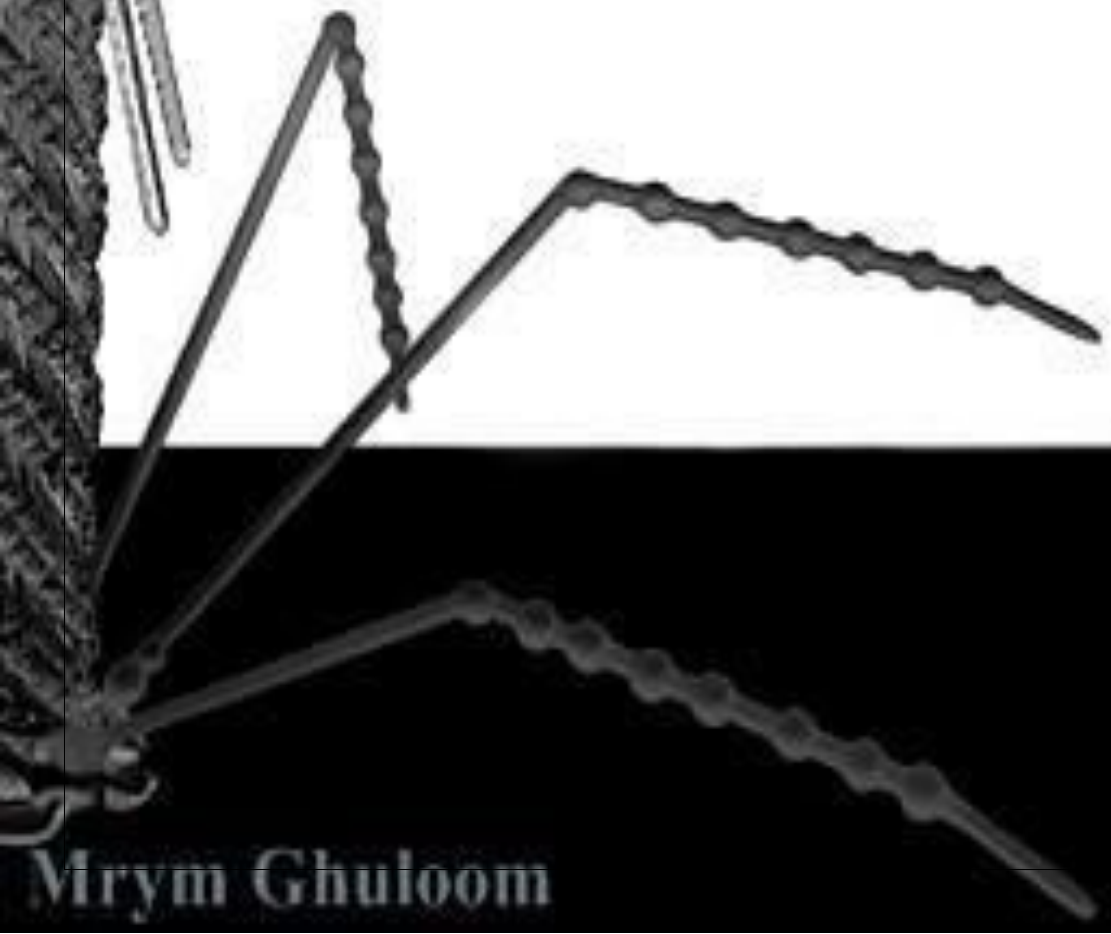
Microbiology

Lecture No:....10.....

Dr Name:....Asem Shehabi...

Done by:..Marah Qasem.....

Sheet ■ Slide □



Mrym Ghuloom

بسم الله الرحمن الرحيم

أخلاقنا تحدد شخصياتنا و قرارتنا هي قدرنا ، و إذا اتخذنا قرارات خاطئة فالرجوع عنها مشروع . ما نؤمن به هو قيمتنا لذا يجب أن لا نفقده و إن فقدناه سنفقد أنفسنا .

This lecture is divided into two parts. The first part talks about (Sterilization and Disinfectant) and the second part talks about (Antimicrobial drugs).

SO...Lets begin

FIRST PART

(The doctor said that because the shortage of time he will not explain all the details)

*Firstly, we have many methods to prevent contamination of our body

especially during operation and preparation of skin for injection..etc.

***HOW can I protect myself from getting infected and prevent transmitting infection through contacting other person?**

The problem will be discussed by explaining the methods which must be used in order to control the spread of certain types of infections especially bacterial infection or viral infection.

*WE HAVE MANY METHODS,

-some are related to using gases **(Sterilization Gases)**

Example: **Ethylene Oxide**

-using of direct chemical reagents to prepare skin of the patient and to decontaminate the hands of a surgeon or any person in the community who feels he can acquire infection **(Antiseptics)**

-**Antiseptic** is using of chemical agents in relation to living tissues.

(like our skin and oral cavity) and not to decontaminate objects like the surface of the table and instruments. The more accurate term for the sterilization of objects is (**Disinfection**).

-IN other words:

Antiseptic: process used to destroy microorganisms on living tissues. **LIKE: skin , mucosa, wound**.

Disinfectant: used for Non-living objects to destroy microorganisms **(99% killing effect).**

Sterilization: 100% killing effect against all microorganisms.

Keep in mind the importance of using the specific right term

Sterilization Gases Only what the doctor has mentioned is required)

EXAMPLES OF STERILIZING GASES:

-Ethylene Oxide

-Formaldehyde Gas

-Aqueous Glutaraldehyde

We use these gases to disinfect rooms

And instruments

Written by Marah Qasem

Antiseptics and Disinfectant

-The disinfection method consists of two steps and the first one is the most important one because without this step we can't apply the disinfectant.

First step:

Washing the hands with water.

- Before applying the disinfectant we should wash our hands. That will reduce the level of microorganisms which might attach to the hand.
- The same will be applied to the patient. We should clean the surface skin by using a simple method like water with a type of sterilizing agent.

Second step:

Applying the disinfectant.

-After washing the hands with water, now we can apply the disinfectant through 2 stages:

*stage 1 ⟶ **using alcohol**. (we use diluted alcohol with sterile water usually within the range 70%to 90% but mostly 70% and we NEVER use absolute alcohol . **WHY??**)

ANSWER: Because if we use 100% alcohol it wouldn't be effective; because the contact time with the skin is less than 1 minute then it will evaporate and it will not kill & inactivate the same number microorganisms that would the diluted alcohol kill.

The contact time of the diluted alcohol 1-3 minutes so it will inactivate lager number of microorganisms than the absolute alcohol.

Contact time :the time of contact between alcohol and the surface skin.

Keep in mind that we have influencing factors which might interact with these disinfectants and antiseptic agents, especially if there is contamination with the patient blood or saliva or contamination from any other source.

*stage 2 ⟶ **using one of the available iodine solutions.**

We have AQUEOUS Iodine, Tincture Iodine (Alcohol-Iodine), Betadine and poviodine.

These should be used after the first use of alcohol In order to have 99% level of protection, after that the surgeon should be able to perform the operation or the injections.

Summary

The Disinfection Method

Washing hands using water

Using diluted alcohol

(70%-90%)

Using one of the available Iodine

Solutions

concerning chlorhexidine , cetrimide and savlon

-these are mainly used in small percentage in hospitals and in our homes because they are not enough to prepare skin or to perform surgical procedure .

-Therefore they are not considered alone as Antiseptic agents.

water Disinfection

-In our country we drink what we call it (Tap Water) which is originated from the surface water of from Al-Desi water.

- This transported water from remote areas to our cities or villages might be contaminated by bacteria and viruses.

-The polluted water is one of the major reasons in developing Diarrheal Diseases, so this water should be safe to drink and to use as it is could be easily contaminated.

***Water should be with high disinfection level** (meaning that water should be free from any type contamination and organisms that could cause infection).

*HOW CAN WE ACHIVE THESE HIGHLY DISINFECTION LEVEL?

1-This can be achieved by using active chlorine (the cheapest way) in the form of a compound of active chlorine like **Na-Hypochlorite** OR using **gaseous chlorine** which can interact with the cell membrane of all types of bacteria and many types of viruses and produce certain oxidation which inhibits the effect of any type of organisms.

-Level of chlorination should not exceed 2-3(part per million). Otherwise, chlorine might produce side effects like allergic response; so we have to control the amount of the chlorine.

-Usually chlorine amount in the water which is founded in our houses don't exceed 0.5 (part per million) and this is enough to control all types of pathogenic organisms within water.

2-We can disinfection water by using oxidizing agent like **OZONE (O3)**. This method is very effective but it has very expensive coast; it is used in certain European countries. (not used in our country because of the high coast).

3- Hydrogen Peroxide (H2O2)

-It can't be used as a disinfectant; unfortunately there is a certain idea that H2O2 can be used to do the antiseptic process BUT it can produce pain during treatment as an antiseptic agent.

-But it can be used sometimes to reduce the level of contamination.

4-Other organic compounds which are used in disinfectant :

-Phenol compounds ⟶ Dettol.

-**Organic Acid** ⟶ Sorbic acid & Benzoic acid.

-**Detergents** ⟶ Soaps & hair shampoo.

(All these organic compounds are considered as disinfectant agents and should be used according in recommended concentrations in our houses and hospitals to decontaminate all departments and floors …. Ect.)

** At the end of this fragment which talks about disinfection **Don't Forget To Wash Your Hands** before contacting any patient or any food and after finishing your activity.

Washing hands with water is the **simplest & cheapest procedure to prevent infection and transmitting of infection.

VERY SIMPLE … VERY EFFECTIVE … And help to reduce thee levels of disinfectant agents and to reduce the side effects of certain detergents.

Keep In Mind: we misuse detergents in our houses . we use huge amounts which contribute in enhancing the side effect and contribute indirectly in developing of antimicrobial resistance.

"Be good … stay good ….share good"

SECOND PART

(Antimicrobial Drugs)

- This topic is one of the most important topics. It's not easily understood in 1 or 2 or even 3 lectures. Your information will be built up by progressive learning. Step by step you will acquire more and more details.
- We will discuss this topic in relation with the interaction between the bacterial cell and the antimicrobial drug and we will mention some side effects and we will not go through the pharmacology of the drug .
- We will know the main types of antibiotics and How each one affects its specific target. Some work on the cell wall, on cell membrane ,on protein synthesis or on DNA synthesis.

****KEEP IN MIND:** you will pass through some dates (dates which are related to the discovery of the antibiotics) these dates are important for understanding the history of a developing antimicrobial drug (not for memorization).

- The term **UNTIMICROBIAL DRUG** means all types of drugs which can effect bacteria, fungi, viruses and parasites.
- In relation with Bacteria we have **antibacterial drugs.**
- There is no drug available which can affect all types of microorganisms. We might have one or two drugs which might affect bacteria and certain parasites.
- Generally , Antimicrobial drug are separated
  Example: antibacterial drugs _ usually affect bacteria and have no effect on viruses**. Antiviral drugs** – usually affect viruses and have no effect on bacteria.

****KEEP IN MIND**: Even there is no simple antibacterial drug that can affect all types of bacteria and there is no simple antiviral drug that can affect all types of viruses.

- The short history of antimicrobial drugs started at the beginning of the **19th century** by producing chemical drug.
- This first produced drug was composed mainly of sulfur and that drug was highly toxic. At the same time of killing the microorganisms this drug was damaging the central nervous system of the patient. (not useful drug)
- In order to select the proper type of drug we have to consider that this drug should be **effective with minimum side effect.**
- There is no drug which is not associated with side effects and that depends on the patient. Certain side effect may appear in one patient and not in the other.
- We might use one of the safest drugs but it could cause an allergic response to certain percentage of the population (up to 2-3%). this can be very dangerous and kill the patient when used in large doses (toxic effect).
- Each drug relatively has side effects. We can compare between the side effects of drugs; Some have small effect on the lever, on the GI tract, on kidneys or we can say both….. Etc.
- There are certain drugs we shouldn't be use them except if we have 100% necessity to use them because they cause toxicity. (we use them in severe infections)
- Number of drugs which are available in clinical practice and used commonly is about 100 drugs. From those 100 only 15 are spread widely and used the most to treat majority of infections and there are certain types of drugs used in special conditions.

** following in the **20th** century **SULFONAMIDE** antibiotic had been invented. (very simple drug – Introduced at **1934** – managed to cover certain types of organisms specially gram +ve bacteria in relation with cell wall and urinary tract mainly – later on they have developed the effectiveness of it and they have produced combinations) .

** After sulfonamide, **Penicillin G** was discovered **by** chance in **1941** and in short period introduced for trial**.**

- Penicillin is very effective against certain types of bacterial specially gram +ve like **(staph – strep).**
- The first penicillin drug was not orally taken, it was **injectable** penicillin in the form of **Penicillin G.**
- Penicillin G wasn't be given in the form of tablets because giving it orally inactivated it.
- Penicillin G was developed later on to oral penicillin drug and later they there become many types of penicillin drug by certain modification in the structure of penicillin.
- Penicillin drug is not a chemical drug (meaning it isn't produced by chemical synthesis methods in the laborites**) it's originated from organism called *penicillium notatum ***
- ***penicillium notatum *** this organism is widely distributed in our community, it can be easily recognized in relation to white cheese or others.
- **So the name of these antibiotic drugs is related to the living organism that is originated from.**

following Penicillin we have a very important group of drugs called **(Amino glycosides)

- Examples on Amino glycosides **(streptomycin – kanamycin)**
- This group was discovered between **1945** and **1960.**
- Amino glycosides are originated from different soil bacteria.
- There are a lot of organisms might produce antibiotic-like substances which can be isolated and later used to treatment of infections

KEEP IN MIND: Use a drug which has the specific effect on the organism and not on the body of the patient or the living tissue.

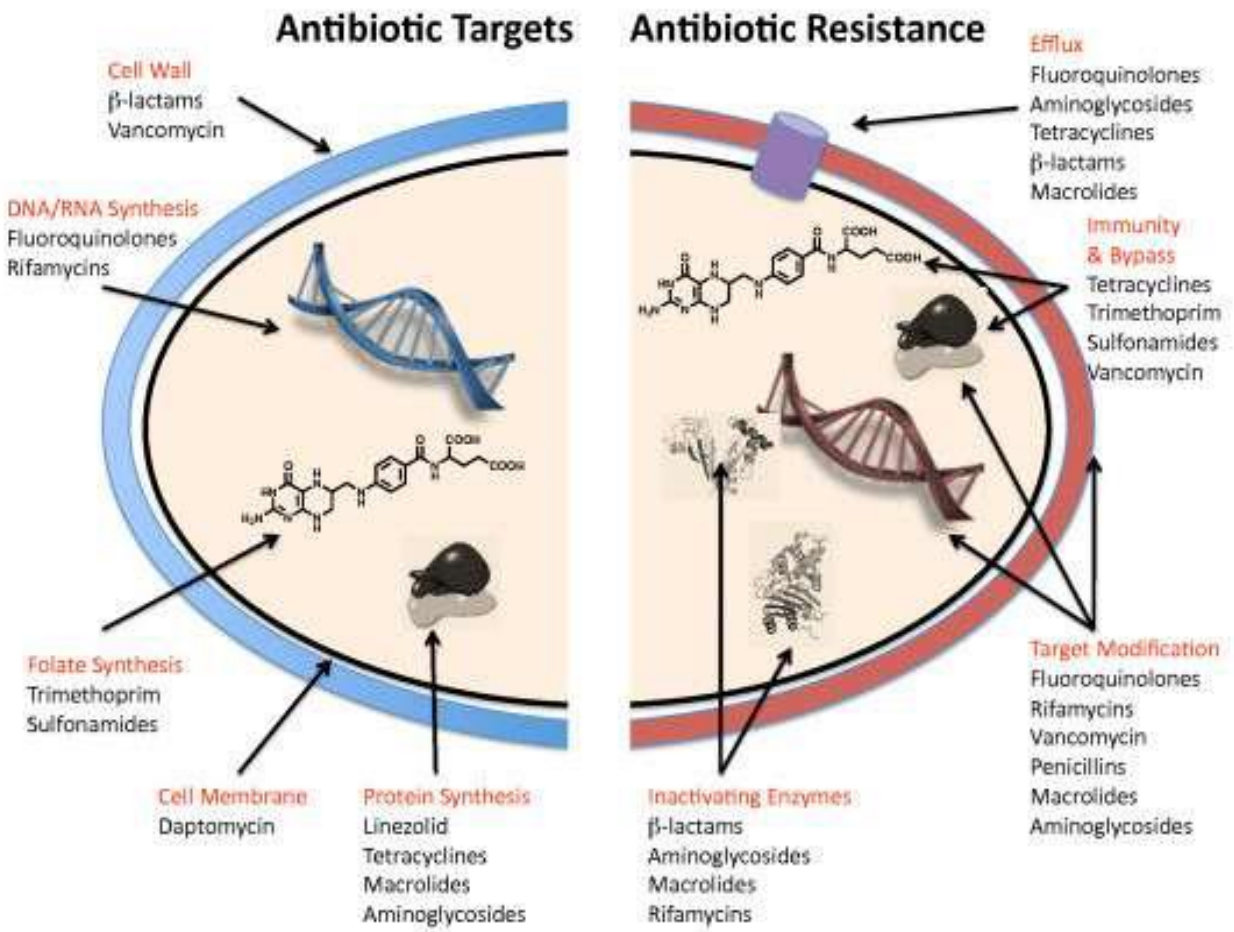
SELECTIVE TOXICTY means the specifity of the drug to attack specific target of the bacterial cells; and there is no single drug which can affect the cell wall, cell membrane, protein synthesis...etc together.

****We have differences between antibiotics in relation to effectiveness against bacterial.**

- We use two different terms: depends on relation to pharmacology.

Bactericidal antibiotics	Bacteriostatic antibiotics
- killing only actively growing Microorganisms. -more associated with side effects. Used for septic conditions like blood sepsis, Meningitis, certain severe infections...etc.	-Inhibit the growth of microorganisms. - if we have as an example respiratory or skin infection we prefer to use bacteriostatic antibiotic like **(tetracycline and Sulfonamides).** Ex: If a you give an infected patient a bacteriostatic drug you inhibit the multiplication of the organism then the body will get rid of it by developing immune response and specific antibodies.

**You can't give a patient a drug and expect that your work is done and the patient is safe, this is not enough; you should rely on the immune response of the body because our body must complete the action of the drug and to eliminate its byproducts.



** In the previous picture you can see the component of the bacterial cell structure and the antibiotic which effect each part of the cell.

Most of the antibiotic available for clinical practice can be classified according to their action to one of these targets.

Knowing each part and the drugs which has effect on it helps you in combining drugs.

****Antagonist Action**: using two or more drugs which effect the same part of the microorganism.

- **Competition between two drugs (**this will not benefit the patient **)**

****Additive Action**: using two or more drugs which effect different parts of the microorganism.

- **Using of drugs in order to kill or inhibit bacterial cell.**

EXAMPLE: if we have a patient who is infected with certain bacteria instead of using two drugs which effect the cell wall we use a drug that effect the cell wall and the other effect the DNA synthesis.

****Another classification of antibiotic is according to the gram stain**

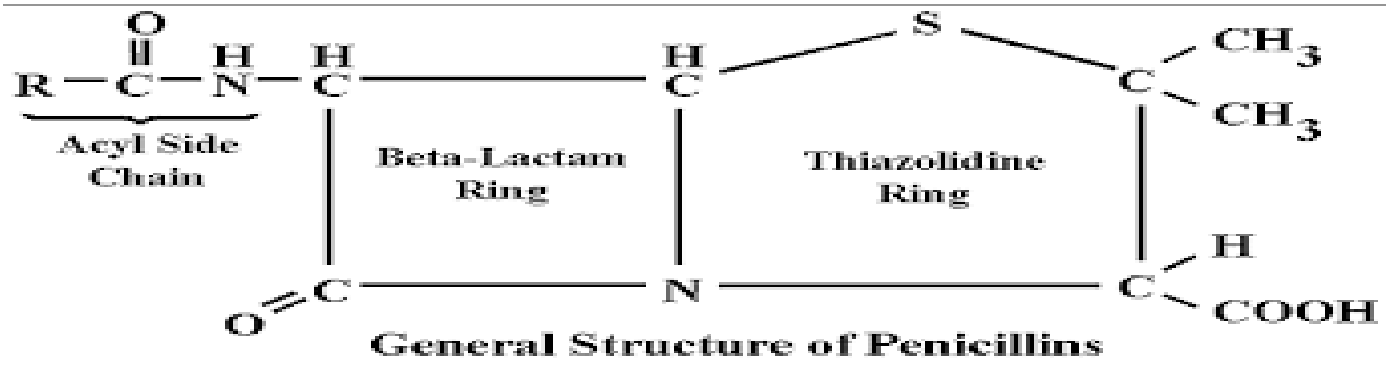
- We have drugs only effect gram +ev bacteria, and others effect gram -ev and some effect the both.
  It is important sometimes, if you don't know the causative agent of a disease to select a drug which cover the most probable types of organisms which may be involved in infection.

  We rarely have a drug that affect at the same time the cell wall and the nucleic acid, the drugs have specific targets.

**** Drugs which interact with the cell wall:**

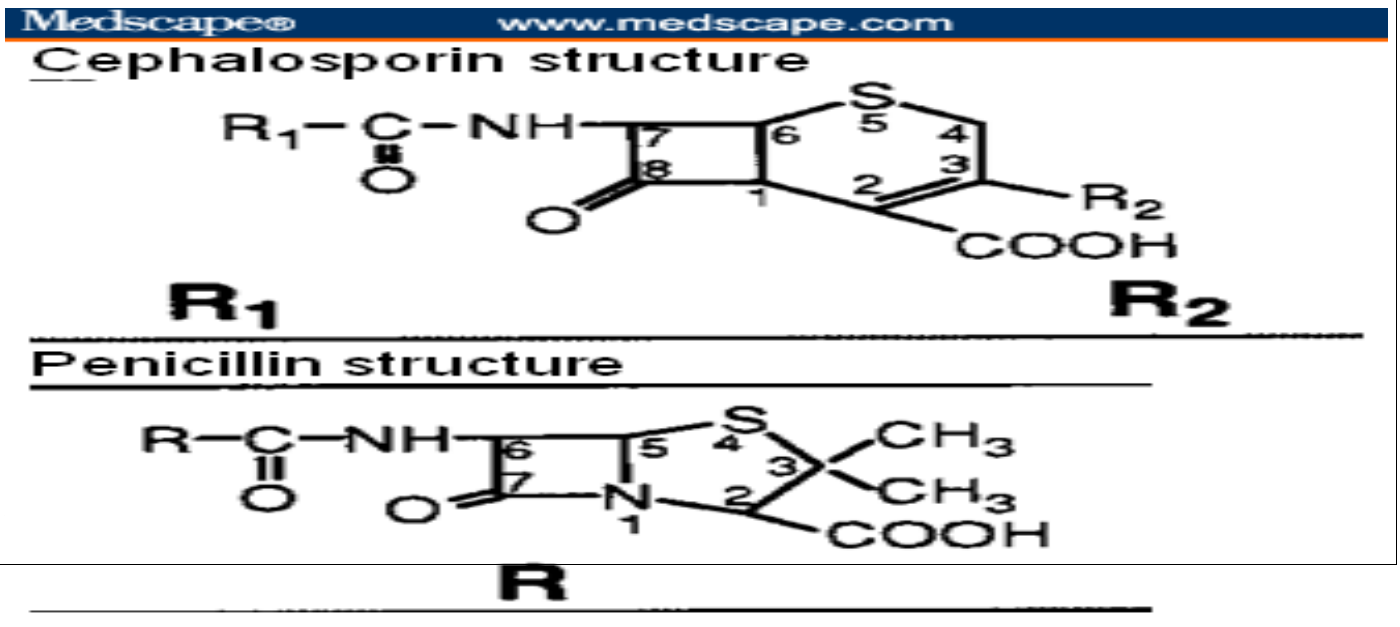
- These drugs inhibit the synthesis of cell wall components and damage the structure of it. That will lead to stopping the multiplication of the bacteria.
- The cell wall is important for the survival of the bacterial cell; without the solid fixed cell wall bacteria can't not survive in the body.
- That will lead for the bacteria to be easily damaged by physiological conditions in our bodies like saliva, acids, phagocytosis, antibodies .....Etc.

- Drugs which affect the cell wall synthesis are presented from a group called **(6-Amino penicillanic acid)**
- All penicillin drugs consist of the simple penicillin structure with some modification.
- The penicillin structure consist of two rings **(beta lactam ring & thazolidine ring)**



General Structure of Penicillins

- The Carboxyl group can be replaced with others to give the ability to penetrate the cell wall.
- The importance of this structure is related to the bond between the carbon and the nitrogen. Once this bond is effected by specific enzyme like (penicillinase enzyme – Beta lactamase enzyme)it will inhibit the cell wall synthesis
- The bacteria is very intelligent; the genetic apparatus of bacteria can manage during contact to any chemical compound to sense how to protect itself from these compunds.
- We have two examples on **Beta-lactam DRUGS**



- **BENZYL PENICILLIN:** the difference is the five membered sulfur containing ring. Isolated from penecilium fungi.

- **CEPHALPSOPORIN:** the difference is the six membered sulfur containing ring. Cephalosporium fungi.

(structures are not for memorization)

The end

Written by: **Marah Qasem.**

"be the great meaning of life , be the smile , the light and be the joy"