Antibiotics definition, classification and production

Definition of the Antibiotics:

The antibiotic: are chemical substance produced by a living organisms, generally a microorganisms, that is killing or inhibition growth of other microorganisms.

General terms associated with antibiotics study:

1. **Antimicrobials**: are substances used to kill microorganisms or to stop them from growing and multiplying.
2. **Antimicrobial resistance (AMR):** occurs when microbes develop or use mechanisms that protect them from the effects of antimicrobials.
3. **Multiple drug resistance (MDR):** is the capacity of bacteria or microorganisms species to resistant more than one type of antibiotic.

The most important uses of antibiotics:

1. Treatment of the Infections.
2. Prevent of the Infections (Prophylaxis).
3. Growth Promotion (Food storage).

Characterization of antibiotics:

1. Selectively toxicity (antibiotics must be toxic to the microbe, but not to host).
2. No or few adverse effects.
3. Reach to the site of infection.
4. Oral/IV formulation .
5. Long half-life (infrequent dosing).
6. No interference with other drugs.

Antibiotics can be taken in different ways:

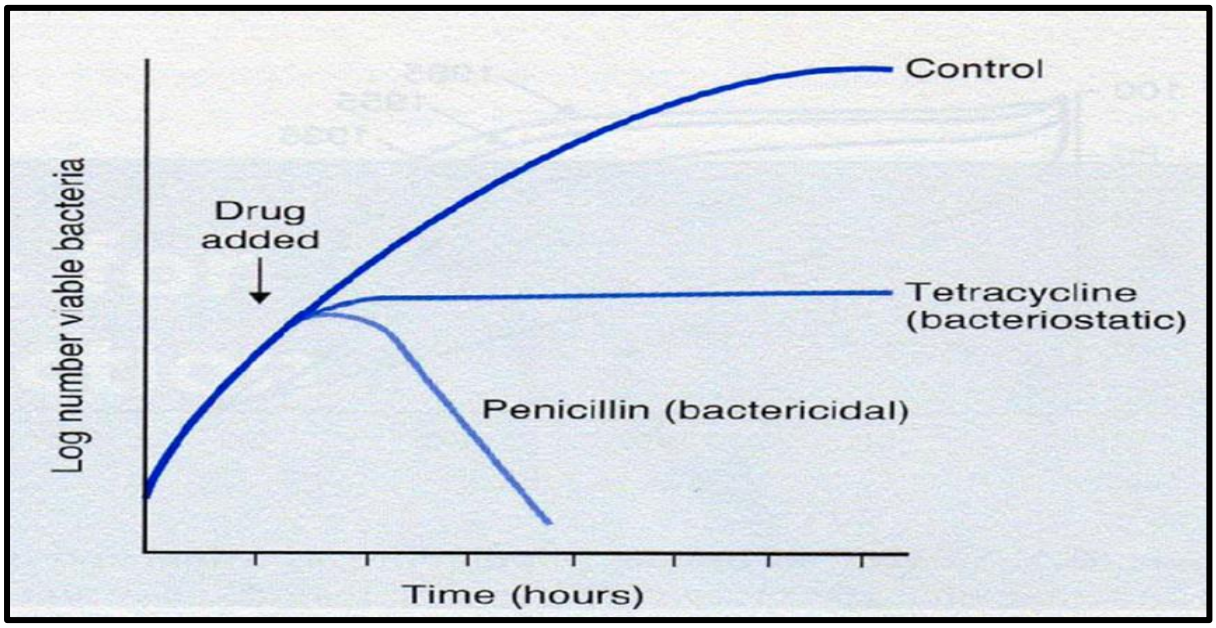
1. **Orally:** This could be pills (tablets), capsules, or liquids taken by mouth.
2. **Topically:** This might be a cream, spray, or ointment that you put on your skin. It could also be eye ointment, eye drops, or ear drops.
3. **Injection intramuscular (I.M) or intravenously (I.V):** This is usually for more serious infections.

Classification of antibiotics according therapeutic use:

1. **Chemotherapeutic agent:** Its synthetic agent with antimicrobial and cytotoxic effects.
2. **Chemotherapeutic antibiotic:** Its chemical antibiotic use in medical practice.
3. **Chemotherapy:** Its use of any chemical agent in the treatment of disease.

Classification of antibiotic according to action mode:

1. **Bacteriostatic antibiotic:** acts by stops bacterial growth, and help immune system to remove the infected bacteria, **Ex: Tetracycline.**
2. **Bactericidal antibiotic:** acts by kills the bacteria. These antibiotics usually interfere with either the formation of the bacterial cell wall or its cell contents, **Ex: Penicillin.**



Classification of antibiotics according to spectrum action:

Antibiotic spectrum: is the means the range of microorganisms it can killing or inhibition by antibiotics.

Antibiotics can be divided into:

1. **Broad-spectrum antibiotics:** can killing or inhibition a wide range of gram positive and gram negative bacteria, **Ex: Ciprofloxacin.**
2. **Extended-spectrum antibiotic:** can killing or inhibition gram positive bacteria and some gram negative bacteria, **Ex: Ampicillin.**
3. **Narrow-spectrum antibiotic:** can only killing or inhibition limited species of bacteria, **Ex: Vancomycin.**

Classification of antibiotics by several ways; as following:

1. According to their preparation method (fermentation technique):

- Biosynthetic (by Natural fermentation) natural method, **Ex. Penicillin.** Industrial microbiology can be used to produce antibiotics via the process of fermentation, where the source microorganism is grown in large containers (100,000–150,000 liters or more) containing a liquid growth medium. Oxygen concentration, temperature, pH and nutrient are closely

controlled. As Penicillin antibiotics are secondary metabolites, the population size must be controlled very carefully to ensure that maximum yield is obtained before the cells die.

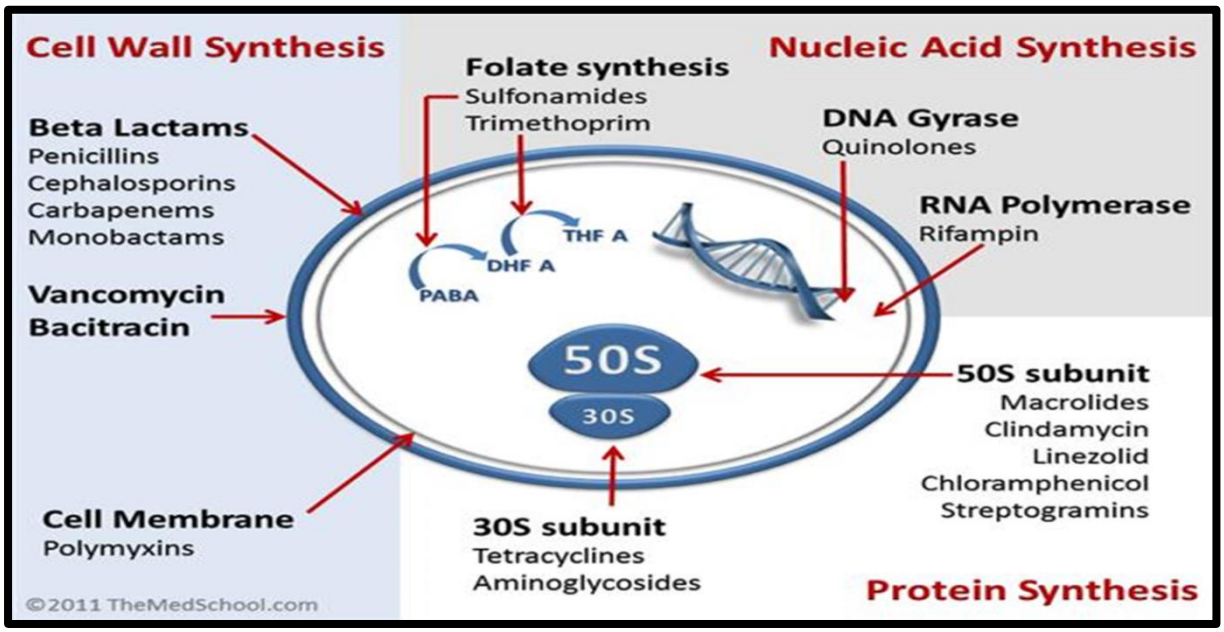
- Semisynthetic method, **Ex. Ampicillin.**
  A common form of antibiotic production in modern times is semi-synthetic. Semi-synthetic production of antibiotics is a combination of natural fermentation and laboratory work to maximize the antibiotic activity; Like Ampicillin. A beta lactam antibiotic just like Ampicillin was developed by adding an addition amino group (NH2) to the R group of Penicillin.
- Synthetic method, **Ex. Quinolone.**
  This some antibiotics are made completely synthetically in the lab. These include the Quinolone class, of which is often credited as the first to be discovered.

2. According to their application (Activity):

- Antibiotics use against of fungi (antifungal).
- Antibiotics use against of bacteria (antibacterial).
- Antibiotics use against of virus (antiviral).
- Antibiotics use against of protozoa (antiprotozoal).

3. According to their mechanism of action:

- Antibiotics inhibition the cell wall: **Ex: ß-lactames as Penicillins and Cephalosporins; also Vancomycin.**
- Antibiotics inhibition the synthesis of nucleic acids: **Ex: Rifamycines.**
- Antibiotics prevent the protein synthesis: **Ex: Aminoglycosides Tetracyclines, Chloramphenicol, Macrolides and Clindamycin.**
- Antibiotics interfering with the synthesis of the cytoplasmic membrane **Ex: Nystatin and Polymixin.**
- Antibiotics act as antimetabolite which inhibits bacterial folic acid synthesis, **Ex: Sulfonamides and trimethoprim.**



4. According to their physical and chemical properties:

- Hydrophobic antibiotics.
- Hydrophilic antibiotics.
- Acidic antibiotics.
- Basic antibiotics.
- Amphoteric antibiotics.

5. According to their structure:

- ß- Lactame antibiotics; **Ex: Penicillins ; Cephalosporins.**
- Aminoglycosides; **Ex: Streptomycin.**
- Macrolides; **Ex: Erythromycin.**
- Tetracyclines; **Ex: Oxytetracyclin.**
- Polyenes; **Ex: Nystatin.**
- Anzamycines; **Ex: Rifamycin.**
- Lincosaminides; **Ex: Lincomycin.**
- Nucleotide antibiotics; **Ex: Puromycin.**
- Polyethers; **Ex: Monensin.**
- Other antibiotcs; **Ex: Fusfungin ; Phosphonomycin.**