# 12

# Pharmacology

Doctor 2017 | Medicine | JU

Sheet ○ Slides


DONE BY

Dima Batarseh

CONTRIBUTED IN THE SCIENTIFIC CORRECTION

Saba massimi

CONTRIBUTED IN THE GRAMMATICAL CORRECTION

DOCTOR

Munir

# Antimicrobial Agents

first , here are some definitions that should be understood well :

**Chemotherapeutic agents :** chemical compounds that selectively act on microbes or cancer cells.

**Antimicrobial agents :** agents that selectively kill microbes or slow down its growth in vitro and in vivo.

**Antibacterial agents :** agents that selectively kill bacteria or slow down its growth in vitro and in vivo.

**NOTE : every antimicrobial agent is a chemotherapeutic agent , but not every chemotherapeutic agent is an antimicrobial.**

**NOTE: every antibacterial agent is an antimicrobial agent , but not every antimicrobial agent is antibacterial so , what are antibiotics??**

Natural substances produced by a microbe to kill another one

**importance of antimicrobial agents :**

1)Helped control, treat, eradicate, and prevent many serious and very common diseases

2) Military importance

3) Enhanced the outcomes of many aggressive or new surgical and instrumental procedures(heart surgery, laparoscopy) with no fear of infections that causes harmful effects.

**historical examples of antimicrobial agents**

1) Arsenic: 1800s for syphilis : arsenic is a metal unlike drugs used nowadays which are chemical compounds ( iron that is used for iron deficiency is an exeption )

2) Sulfonamides: 1935

3) Penicillin( Antibiotics in 1940 ) : the story behind pencillin discovery is interesting actually

(once apun a time a crazy scientist left a plate where fungus grow opened some of fungus that is in the air ( yeah there is fungus in the air ) grew there . Then , hooppaaaa it is pencillin)

^_^this information is taken from wikipedia

**hopefully that was funny , but here is the important thing to know : scientists then grew many kinds of fungus (from different cities so they got different species of fungus ) and each kind produces certain antimicrobial agent.**

4) Antimicrobials have revolutionized the treatment of bacterial infections as well as enhanced the advancement of medical and surgical
treatment

** Patient's natural resistance plays a major role in antimicrobial revolution.

Now , let us go back to microbiology with these 2 important definitions

1) disinfectants : Agents that kill bacteria on the surface of objects like surgical instruments or floors

(A) Chemical: e.g. phenol which is too toxic for skin surfaces

B) Physical: ionizing radiation or high heat sterilization and pasteurization)

2) Antiseptics: Agents used topically to affect bacteria on the surface of the skin, or mouth cavity. e.g. iodine or 70% alcohol

(tired from pharmacology ! just take a look at what is written here )


NOTE : antimicrobial agents can not kill 100% of bacteria , actually the strongest one can kill 1000000000 microbes from 1000000000000 microbes exist so 1000 microbes are left to be defeated by human immune system

SO, people with immune system problems should take special strong treatment for long time so we make sure that larger number of microbes are defeated because they have weak immune system.

**Classification of antimicrobial agents** according

to :

1)Chemical Structures : this is the most important method of classification

Beta lactams, Aminoglycosides, Sulphonamides, Quinolones

2) Mechanism of Action

3) Type of Action : Bacteriostatic or Bactericidial

4) Spectrum of Activity :Antistaph, Anti TB, Anti Richetsia

5) Width of the Spectrum :it is related to the number of microbes that are susceptible to action of drug

(examples are not important , no need to memorize them )

**Narrow spectrum vs. wide spectrum :**

**first things first ,** narrow spectrum drug means that this drug is specific to 1 -->3 types of microbes while wide spectrum drug means that this drug can affect larger groups of microbes

**examples : penecillin affects gram(+) only so it is considered to be narrow spectrum drug unlike tetracyclin which affects both gram (+) and (-)**

**SO , which one of them is stronger , superior or more favourable ?**

if your answer is wide spectrum , you are wrong unfortunately . being wide or narrow spectrum drug is not related to the strength , efficacy and potency of the drug . Each one of them is used for specific purpose . wide spectrum drugs are used when the reason of some strong infections ( such as septicaemia) is not known so you can not wait until you get lab results

How ever , wide spectrum drugs can cause some problems too . for example , the over growth of resisting bacteria that is part of normal flora which leads to superinfections .

**to make sure that you got the idea try to answer this question :

1) drugs are classified to wide and narrow spectrum drugs , which one of the following is considered true

A) just A

B) just B

C) B

D) all of the above exept B

E) take a look at next question

2) drugs are classified to wide and narrow spectrum drugs , which one of the following is considered true

A) wide spectrum drugs are less specific than narrow spectrum drugs

B) wide spectrum drugs are used for cases like septicaemia

C) narrow spectrum drugs affects normal flora and causes very serios infections

D) A+B

E) all of the above

**Mechanisms of action**

**1) inhibition of cell wall synthesis**

Most bacteria possess a relatively rigid cell wall to protect from osmotic changes ---> When bacteria divide, a new cell wall is synthesized --->Interruption of this synthesis **(the interruption occurs during synthesis of new cell wall in binary vision)** , leads to new microbes which are susceptible(vulnerable) to external osmotic influences, causing cell rupture and death

- **Examples:** Penicillins, cephalosporins , vancomycin and bacitracin

**2) disruption of cell membrane**

effects on cell membrane mechanisms of transportation leading to increased permeability of membranes, and consequently external influences will have greater effects leading to death of the bacteria

- **Examples:** Polymyxin, Colistin

**Note: These agents are more toxic systemically than agents that inhibit cell wall synthesis because human cells have cell membrane too so they can be affected . however, human cells don't have cell wall so that**
**they are not affected by drugs that works on cell wall**

**3) inhibition of protein synthesis**

These drugs act either at

1) Site of protein synthesis (Ribosomes)

2) Within the nucleus by inhibiting synthesis of nucleic acids

( DNA replication / RNA synthesis = TRANSCRIPTION)

Examples: Tetracyclines, aminoglycosides and macrolides (erythromycin)

NOTE : Drugs in this group exploit structural differences between microbial and human cells ---> inhibits growth, but does not lead to deaths ---> High dose can lead to toxicity

**4) Interference with Metabolic Processes**

A) Agents working through this mechanism are structurally similar to Para-aminobenzoic acid (PABA) which is a precursor of folic acid, which is necessary for nucleic acid and protein synthesis and consequently, bacterial growth.

B) Drugs in this group exploit microbial dependence on synthesizing their own folic acid, whilst humans get it from diet. C)

**Examples: Sulphonamides, Trimethoprim**

**Finally , here are some notes mentioned by doctor in the lecture :**

1. **Antibiotics are highly abused and misused by the public (abuse refers to addiction )**

2. **TB cases in Jordan are imported cases ( they are people who live in other countries and travelled to Jordan )**

**3. Antimicrobial agents development is dwindling . However, other drugs like cardiovascular drugs and antidepressants are used widely .**