

# Antibiotics



عملنا هذه المحاضرة على اساس شرح دكتور الصميلي والاشياء اللي طلبها في المحاضرة ولكن هذه المحاضرة ليست مضمونة ١٠٠% لان لم تراجع مع الدكتور (لأنه مشغول اليومين) يوم الاحد راح ابلاغكم اذا هي مقبولة او اذا في تعديل او نقص . هذه المحاضرة شملت كل اللي قالها الدكتور من المهم ولكن ليست معتمده لحد الان

## LECTURE

## 13

Color index

**\*Important**

\*Further explanations

❖ **Antibiotics:** Natural compounds made by microorganisms that stop or inhibit the growth of other microorganisms.

❖ **Chemotherapy (new term for antibiotics) Types:**

- a) Synthetic
- b) Antimicrobial agents

❖ **Bacterial Activity:**

- a) Bactericidal: Kills bacteria
- b) Bacteriostatic: Prevents multiplication

❖ **Spectrum of Bacterial Activity:**

- a) Broad spectrum (kills gram + **and** -)
- b) Narrow spectrum (Kills gram + **or** -)

❖ **Selective Toxicity:** The ability to kill a microorganism (or inhibit its growth) without damaging the host cell.

**CELL WALL**

Penicillin  
Cephalosporin  
Bacitracin  
Carbapenems

**NUCLEIC ACID**

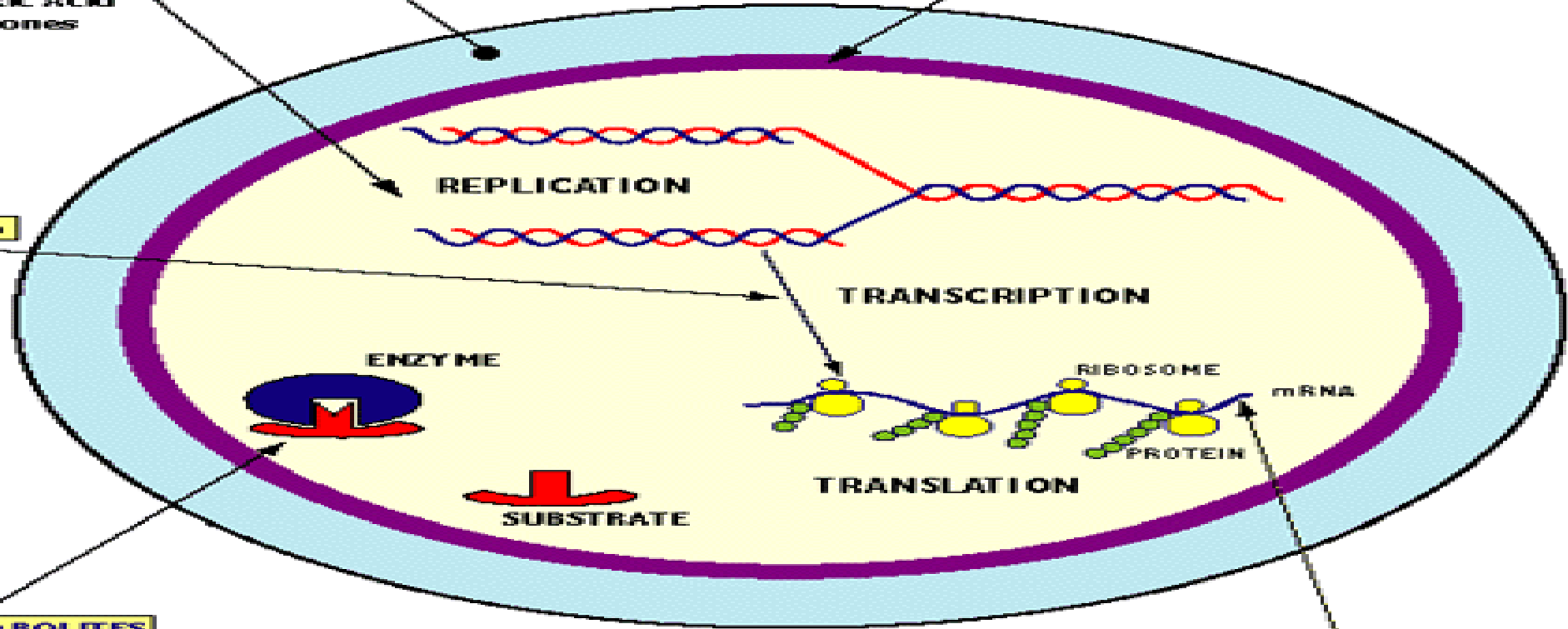
Nalidixic Acid  
Quinolones

**NUCLEIC ACID**

Rifampin  
Flucytosine

**CELL MEMBRANE**

Amphotericin B  
Nystatin  
Condicidin  
Polymixin E & B  
Miconazole  
Clotrimazole  
Ketoconazole



**ANTIMETABOLITES**

Sulfonamides  
Trimethoprim  
Ethambutol  
Isoniazid

**PROTEIN SYNTHESIS**

Streptomycin  
Neomycin  
Kanamycin  
Gentamicin  
Tetracyclines  
Erythromycin  
Lincomycin  
Chloramphenicol

# Mechanisms of Antimicrobial Action

- 1) INHIBITION OF CELL WALL SYNTHESIS.
- 2) ALTERATION OF CELL MEMBRANE
- 3) INHIBITION OF PROTEIN SYNTHESIS
- 4) INHIBITION OF NUCLEIC ACID SYNTHESIS
- 5) ANTI-METABOLITE OR COMPETITIVE ANTAGONISM.

(MEMORIZE THE ANTIMICROBIALS ASSOCIATED WITH EACH ACTION)

# Inhibition of Cell Wall Synthesis

## Beta-Lactam antimicrobial agents

## Vancomycin

- Contain Beta-Lactam ring & organic acid.
- Natural & Semi-synthetic
- Bactericidal
- Side Effect: hypersensitivity

- Glycopeptides
- Narrow Spectrum (Gram+ Bac.)
- Side Effect: Hypersensitive, Red man syndrome

Penicillins

Cephalosporins

Cephameycins

Carbapenems

Monobactams

Beta-lactamase inhibitors

Has different Generation (Each with different spectrum)

$\beta$ -Lactams with no antibacterial activity  
Irreversibly bind to  $\beta$ -lactamase enzyme

## ***ANTIBIOTICS THAT ALTER CELL MEMBRANES:***

- Polymyxin B and Colistin
- polymyxin b is used topically or locally
- causes nephrotoxicity(a narrow therapeutic window).
- Colistin used for the treatment of multi resistant organisms.

## ***ANTIBIOTICS THAT INHIBIT PROTEIN SYNTHESIS: (works on the ribosomes)***

- AMINOGLYCOSIDES
- TETRACYCLINE
- CHLORAMPHENICOL
- MACROLIDES

## ***ANTIMICROBIALS THAT ACT ON NUCLEIC ACID: the most important is Quinolones.***

### ***AMINOGLYCOSIDES:***

- Bactericidal(because they bind so efficiently to the ribosome).
- Acts only on Gram negative bacteria.
- Given by injection.
- Nephrotoxic and Ototoxic

***TETRACYCLINES:*** has a broad spectrum, bacteriostatic.

- side effects :Teeth discoloration(children less than 8), Destruction of the bone.
- cant be used on pregnant woman(IMP!!)

***CHLORAMPHENICOL:*** has a broad spectrum, bactericidal

- cause aplastic anemia

***MACROLIDES:*** has a broad spectrum

### Antibiotics acting on nucleic acid:

- Bacteria's NA is single circular supercoiled double stranded DNA.
- The bacteria contains gyrase enzyme which is responsible for the uncoiling and separation of the DNA. Antibiotics inhibit the enzyme (explanation).

Rifampicin: used for tuberculosis.

- ✓ If used for gram positive or negative it will develop resistance quickly
- ✓ Side effect : hepatotoxicity

Quinolones: bacteriostatic, narrow spectrum used against gram negative bacteria.  
- Side effect: cartilage damage in neonate (embryo) and children less than 18 years old

Metronidazole: broad spectrum used against clostridium defficile ,all anaerobes (both gram positive and negative) and parasite (protozoa)

- ✓ Side effect: flush and vomiting in case of alcohol drinking

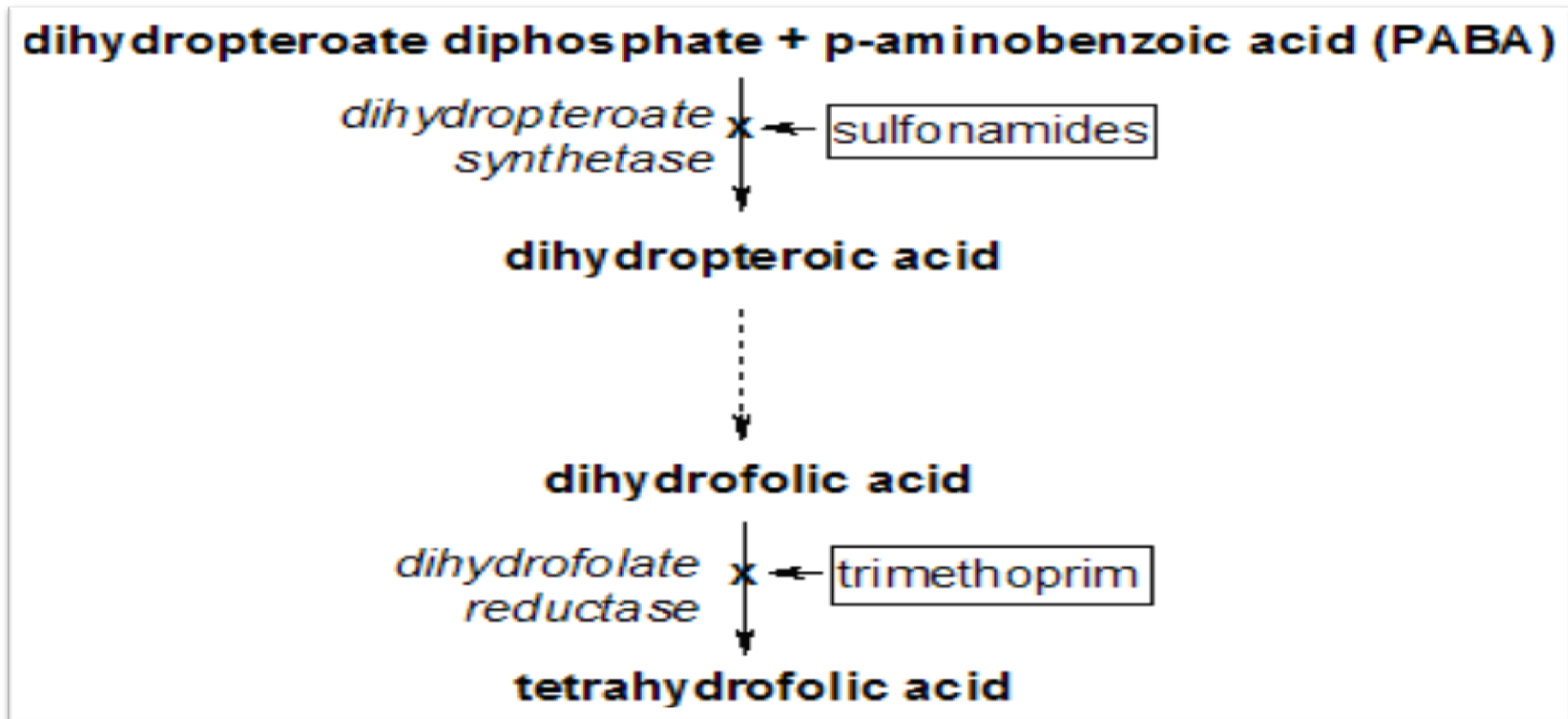
### Antimetabolites (folate inhibitor):

Trimethoprim-Sulfamethoxazole ( TMP-SMX): narrow spectrum kills gram -ve bacteria. They work together to interfere with folic acid synthesis in the bacteria at two different sites

❖ Folic acid is important bacteria growth and multiplication (explanation)

- ❖ Anti tuberculosis agent your not required to memorize them

Improve understanding only:





- INDISCRIMINATE USE OF ANTIMICROBIALS
- SELECTIVE ADVANTAGE OF ANTIBIOTICS

## TYPES OF RESISTANCE:

### ◆ Acquired resistance :

- 1- **MUTATION**: MTB RESISTANT TO STRIPTOMYCIN
- 2- **GENE TRANSFER**: plasmid mediated or through transposons

### ◆ Cross resistance :

- Resistance to one group confer resistance to other drug of the same group . Eg. (Resistance to **erythromycin** and **clindamycin** )

### ◆ Dissociate resistance:

- resistance to **gentamicin** does not confer
- resistance to **tobramycin** .

## MECHANISMS OR RESISTANCE:

1-Permeability changed

2- modification of site of action, eg.  
**MUTATION**

3- inactivation by enzymes . eg. Beta-Lactamase & aminoglycoside inactivating enzymes.

4- passing blocked metabolic reaction eg. *PABA* ~~~~~~folic acid , plasmid mediated.

1) Which one of the following its side effects are Teeth discoloration:

- a) Aminoglycosides
- b) Chloramphenicol
- c) Tetracyclines

(4) C  
(3) B  
(2) A  
(1) C

2) Broad spectrum kills gram +ve and gram -ve:

- a) True
- b) False

3) Narrow spectrum Kills gram +ve and gram -ve:

- a) True
- b) false

4) Which one of the following is narrow spectrum:

- a) Tetracyclines
- b) macrolides
- c) Quinolones

Done By:

- حنان خشيم
- منال الحمدان
- وجدا الهذلان
- جواهر العمران
- أمل أفراح
- الهنوف المهنا

- ظاهرة الجهني
- الجوهرة الدهش
- روى العوهلي
- نوف المسعود
- ريما الحماد
- ريما هزازي
- آيه الدايل

- عبد العزيز المانع
- ناصر القحطاني
- محمد الرويتع
- أسامة عبدالقادر
- فراس السويداء
- عبدالعزيز النويبت
- سعيد النصر
- يزيد السعدان
- خليل الهنداس