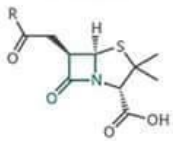
DIFFERENT CLASSES OF ANTIBIOTICS - AN OVERVIEW

Key: COMMONLY ACT AS BACTERIOSTATIC AGENTS, RESTRICTING GROWTH & REPRODUCTION — COMMONLY ACT AS BACTERICIDAL AGENTS, CAUSING BACTERIAL CELL DEATH

ß-LACTAMS

MOST WIDELY USED ANTIBIOTICS IN THE NHS



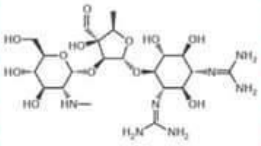
All contain a beta-lactam ring

EXAMPLES
Penicillins (shown) such as amoxicillin and flucloxacillin; *Cephalosporins* such as cefalexin.

MODE OF ACTION
Inhibit bacteria cell wall biosynthesis.

AMINOGLYCOSIDES

FAMILY OF OVER 20 ANTIBIOTICS



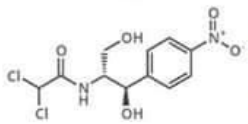
All contain aminosugar substructures

EXAMPLES
Streptomycin (shown), neomycin, kanamycin, paromomycin.

MODE OF ACTION
Inhibit the synthesis of proteins by bacteria, leading to cell death.

CHLORAMPHENICOL

COMMONLY USED IN LOW INCOME COUNTRIES



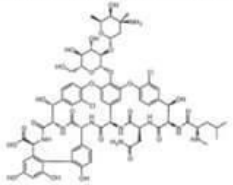
Distinct individual compound

MODE OF ACTION
Inhibit synthesis of proteins, preventing growth.

No longer a first line drug in any developed nation due to increased resistance and worries about safety.

GLYCOPEPTIDES

COMMON 'DRUGS OF LAST RESORT'



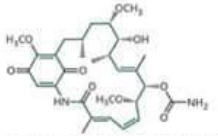
Consist of carbohydrate linked to a peptide formed of amino acids

EXAMPLES
Vancomycin (shown), teicoplanin.

MODE OF ACTION
Inhibit bacteria cell wall biosynthesis.

ANSAMYCINS

CAN ALSO DEMONSTRATE ANTIVIRAL ACTIVITY



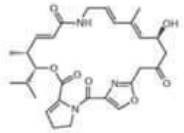
All contain an aromatic ring bridged by an aliphatic chain.

EXAMPLES
Geldanamycin (shown), rifamycin, naphthomycin.

MODE OF ACTION
Inhibit the synthesis of RNA by bacteria, leading to cell death.

STREPTOGRAMINS

TWO GROUPS OF ANTIBIOTICS THAT ACT SYNERGISTICALLY



Combination of two structurally differing compounds, from groups denoted A & B

EXAMPLES
Pristinamycin IIA (shown), Pristinamycin IA.

MODE OF ACTION
Inhibit the synthesis of proteins by bacteria, leading to cell death.

1930 — 1940 — 1950 — 1960 — 1970 — 1980

SULFONAMIDES

FIRST COMMERCIAL ANTIBIOTICS WERE SULFONAMIDES

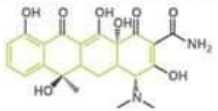
All contain the sulfonamide group

EXAMPLES
Prontosil, sulfanilamide (shown), sulfadiazine, sulfisoxazole.

MODE OF ACTION
Do not kill bacteria but prevent their growth and multiplication. Cause allergic reactions in some patients.

TETRACYCLINES

BECOMING LESS POPULAR DUE TO DEVELOPMENT OF RESISTANCE



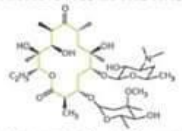
All contain 4 adjacent cyclic hydrocarbon rings

EXAMPLES
Tetracycline (shown), doxycycline, limecycline, oxytetracycline.

MODE OF ACTION
Inhibit synthesis of proteins by bacteria, preventing growth.

MACROLIDES

SECOND MOST PRESCRIBED ANTIBIOTICS IN THE NHS



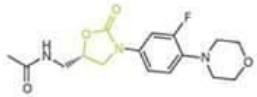
All contain a 14-, 15-, or 16-membered macrolide ring

EXAMPLES
Erythromycin (shown), clarithromycin, azithromycin.

MODE OF ACTION
Inhibit protein synthesis by bacteria, occasionally leading to cell death.

OXAZOLIDINONES

POTENT ANTIBIOTICS COMMONLY USED AS 'DRUGS OF LAST RESORT'



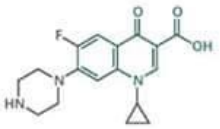
All contain 2-oxazolidone somewhere in their structure

EXAMPLES
Linezolid (shown), posizolid, tedizolid, cycloserine.

MODE OF ACTION
Inhibit synthesis of proteins by bacteria, preventing growth.

QUINOLONES

RESISTANCE EVOLVES RAPIDLY



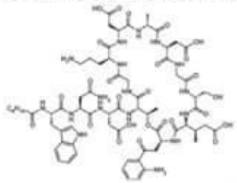
All contain fused aromatic rings with a carboxylic acid group attached

EXAMPLES
Ciprofloxacin (shown), levofloxacin, trovafloxacin.

MODE OF ACTION
Interfere with bacteria DNA replication and transcription.

LIPOPEPTIDES

INSTANCES OF RESISTANCE RARE



All contain a lipid bonded to a peptide

EXAMPLES
Daptomycin (shown), surfactin.

MODE OF ACTION
Disrupt multiple cell membrane functions, leading to cell death.

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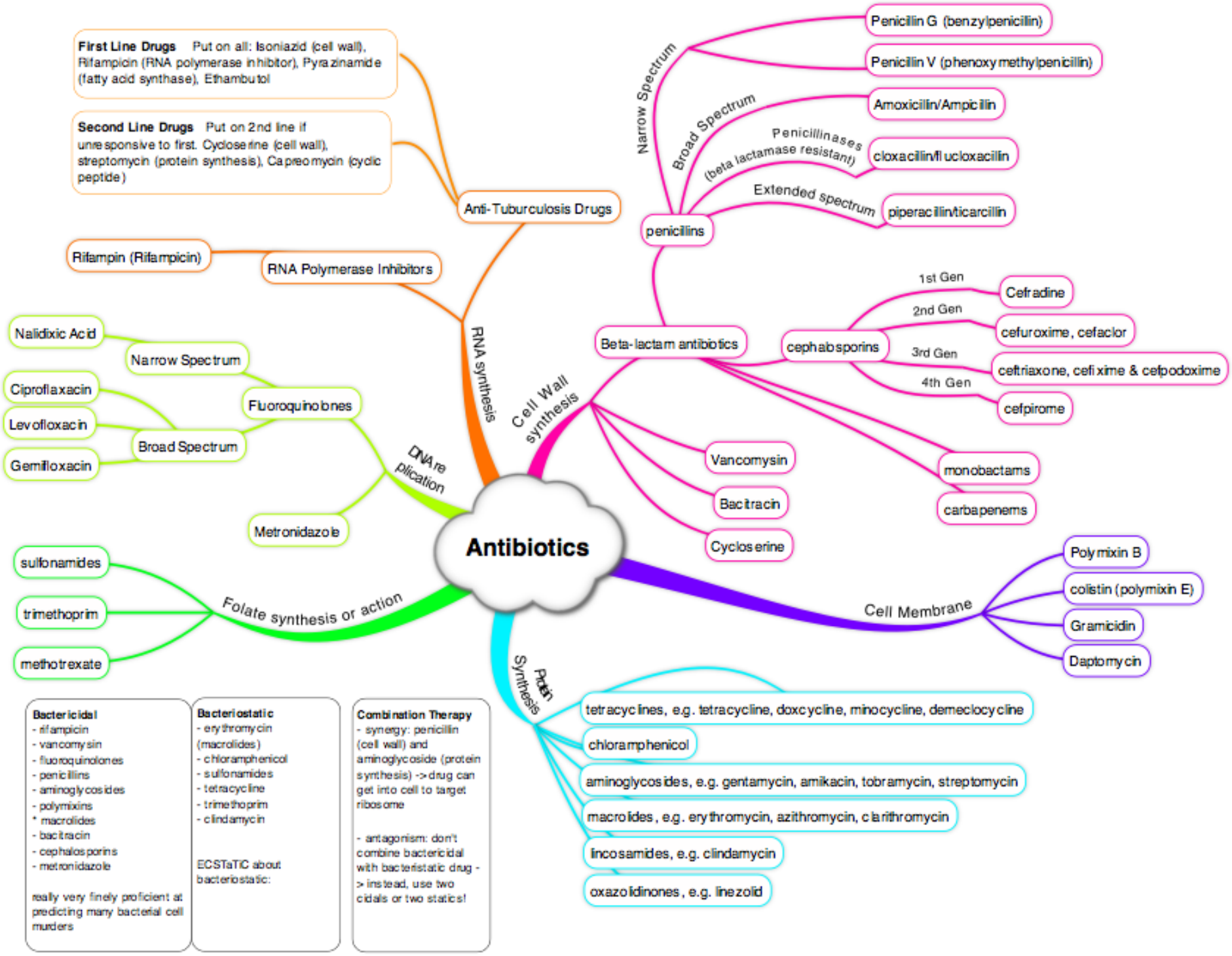
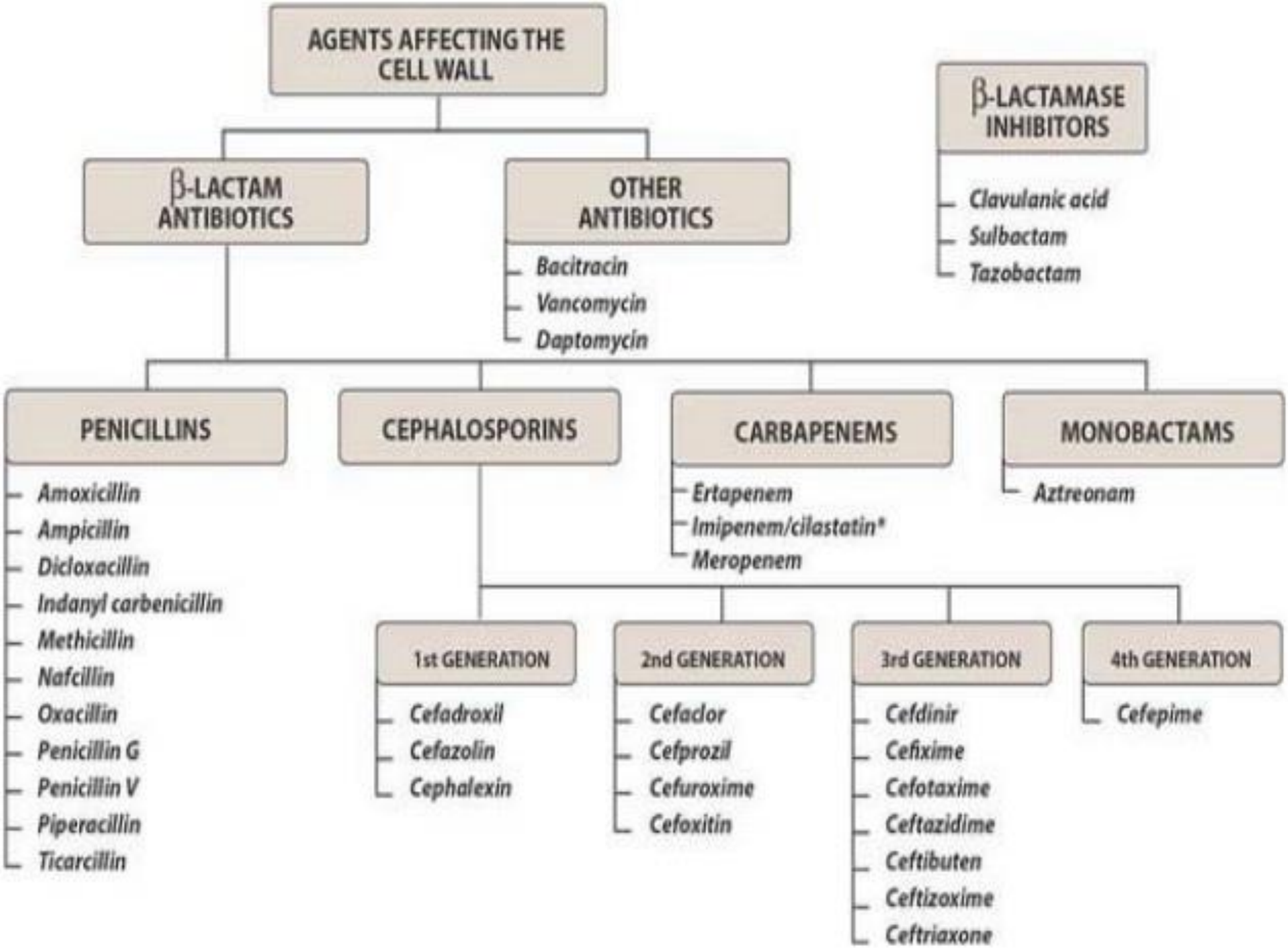
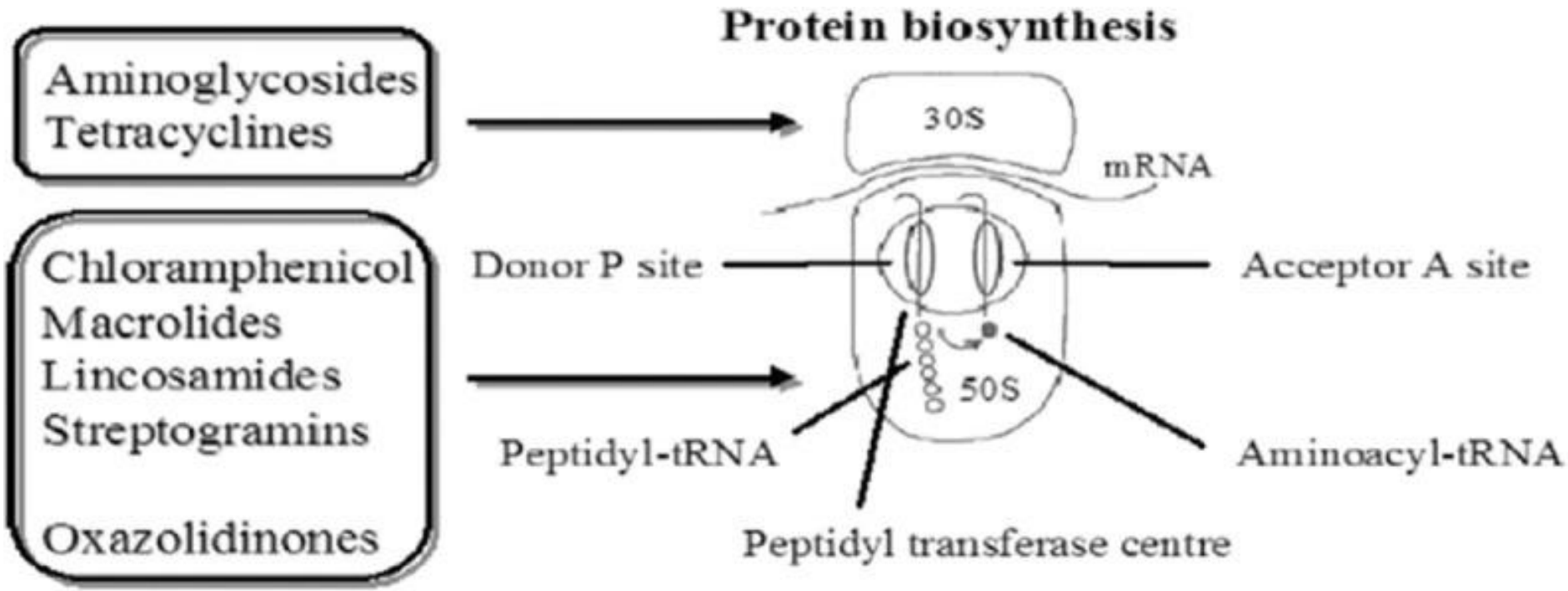
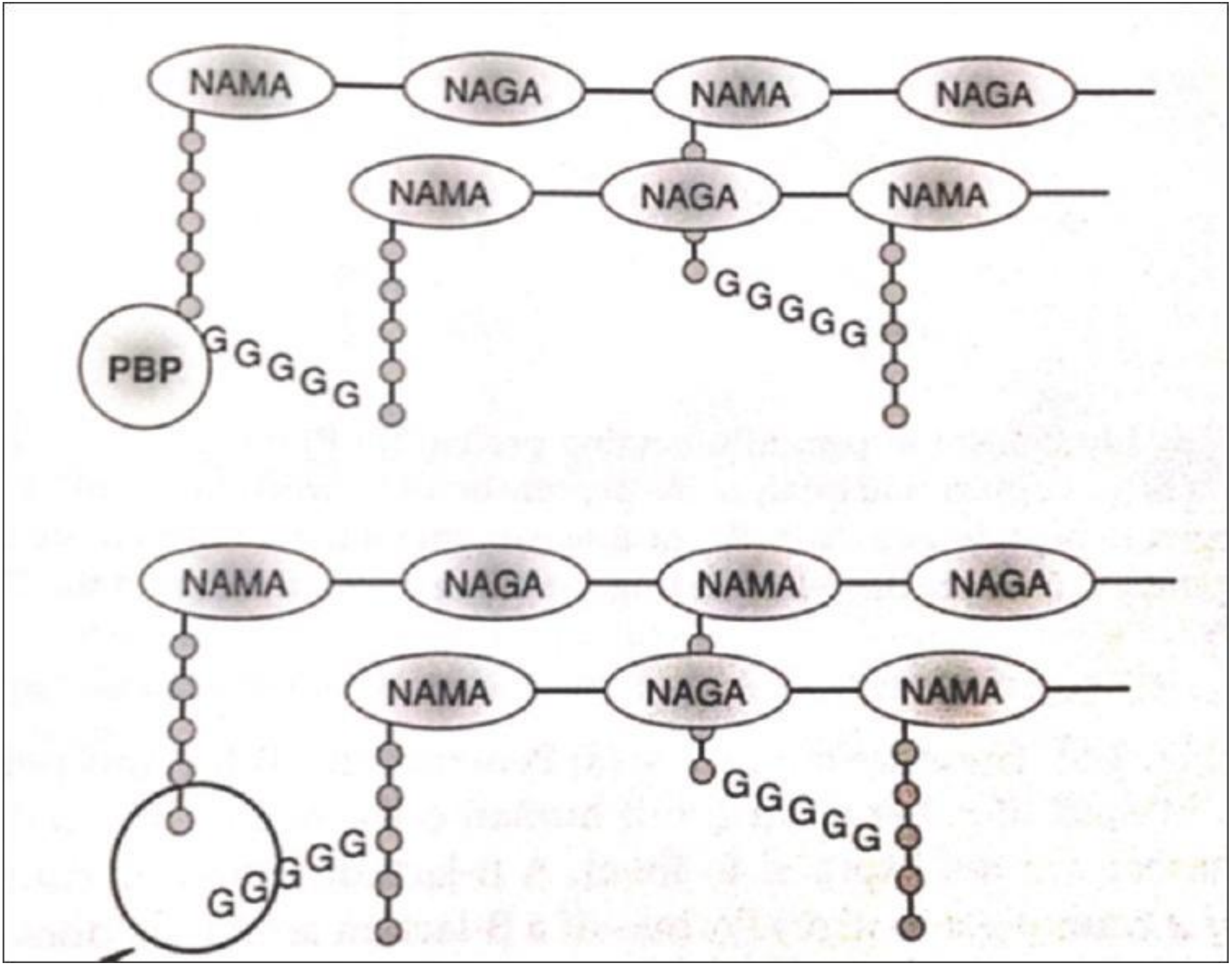

Antibiotics
Anti-Tuburculosis Drugs
First Line Drugs Put on all: Isoniazid (cell wall), Rifampicin (RNA polymerase inhibitor), Pyrazinamide (fatty acid synthase), Ethambutol
Second Line Drugs Put on 2nd line if unresponsive to first. Cycloserine (cell wall), streptomycin (protein synthesis), Capreomycin (cyclic peptide)
RNA synthesis
RNA Polymerase Inhibitors
Rifampin (Rifampicin)
DNA replication
Fluoroquinolones
Narrow Spectrum
Nalidixic Acid
Broad Spectrum
Ciprofloxacin
Levofloxacin
Gemifloxacin
Metronidazole
Cell Wall synthesis
Beta-lactam antibiotics
penicillins
Narrow Spectrum
Penicillin G (benzylpenicillin)
Penicillin V (phenoxymethylpenicillin)
Broad Spectrum
Amoxicillin/Ampicillin
Penicillinases (beta lactamase resistant)
cloxacillin/flucloxacillin
Extended spectrum
piperacillin/ticarcillin
cephabsporins
1st Gen
Cefradine
2nd Gen
cefuroxime, cefaclor
3rd Gen
ceftriaxone, cefixime & cefpodoxime
4th Gen
cefpirome
monobactams
carbapenems
Vancomysin
Bacitracin
Cycloserine
Folate synthesis or action
sulfonamides
trimethoprim
methotrexate
Cell Membrane
Polymixin B
colistin (polymixin E)
Gramicidin
Daptomycin
Protein Synthesis
tetracyclines, e.g. tetracycline, doxcycline, minocycline, demeclocycline
chloramphenicol
aminoglycosides, e.g. gentamycin, amikacin, tobramycin, streptomycin
macrolides, e.g. erythromycin, azithromycin, clarithromycin
lincosamides, e.g. clindamycin
oxazolidinones, e.g. linezolid
Bactericidal
- rifampicin
- vancomysin
- fluoroquinolones
- penicillins
- aminoglycosides
- polymixins
* macrolides
- bacitracin
- cephalosporins
- metronidazole
really very finely proficient at predicting many bacterial cell murders
Bacteriostatic
- erythromycin (macrolides)
- chloramphenicol
- sulfonamides
- tetracycline
- trimethoprim
- clindamycin
ECSTaTiC about bacteriostatic:
Combination Therapy
- synergy: penicillin (cell wall) and aminoglycoside (protein synthesis) -> drug can get into cell to target ribosome
- antagonism: don't combine bactericidal with bacteristatic drug -> instead, use two cidals or two statics!


AGENTS AFFECTING THE CELL WALL
β-LACTAM ANTIBIOTICS
OTHER ANTIBIOTICS
Bacitracin
Vancomycin
Daptomycin
β-LACTAMASE INHIBITORS
Clavulanic acid
Sulbactam
Tazobactam
PENICILLINS
Amoxicillin
Ampicillin
Dicloxacillin
Indanyl carbenicillin
Methicillin
Nafcillin
Oxacillin
Penicillin G
Penicillin V
Piperacillin
Ticarcillin
CEPHALOSPORINS
1st GENERATION
Cefadroxil
Cefazolin
Cephalexin
2nd GENERATION
Cefaclor
Cefprozil
Cefuroxime
Cefoxitin
3rd GENERATION
Cefdinir
Cefixime
Cefotaxime
Ceftazidime
Ceftibuten
Ceftizoxime
Ceftriaxone
4th GENERATION
Cefepime
CARBAPENEMS
Ertapenem
Imipenem/cilastatin*
Meropenem
MONOBACTAMS
Aztreonam


Protein biosynthesis
Aminoglycosides
Tetracyclines
Chloramphenicol
Macrolides
Lincosamides
Streptogramins
Oxazolidinones
30S
mRNA
Donor P site
Acceptor A site
50S
Peptidyl-tRNA
Aminoacyl-tRNA
Peptidyl transferase centre


NAMA
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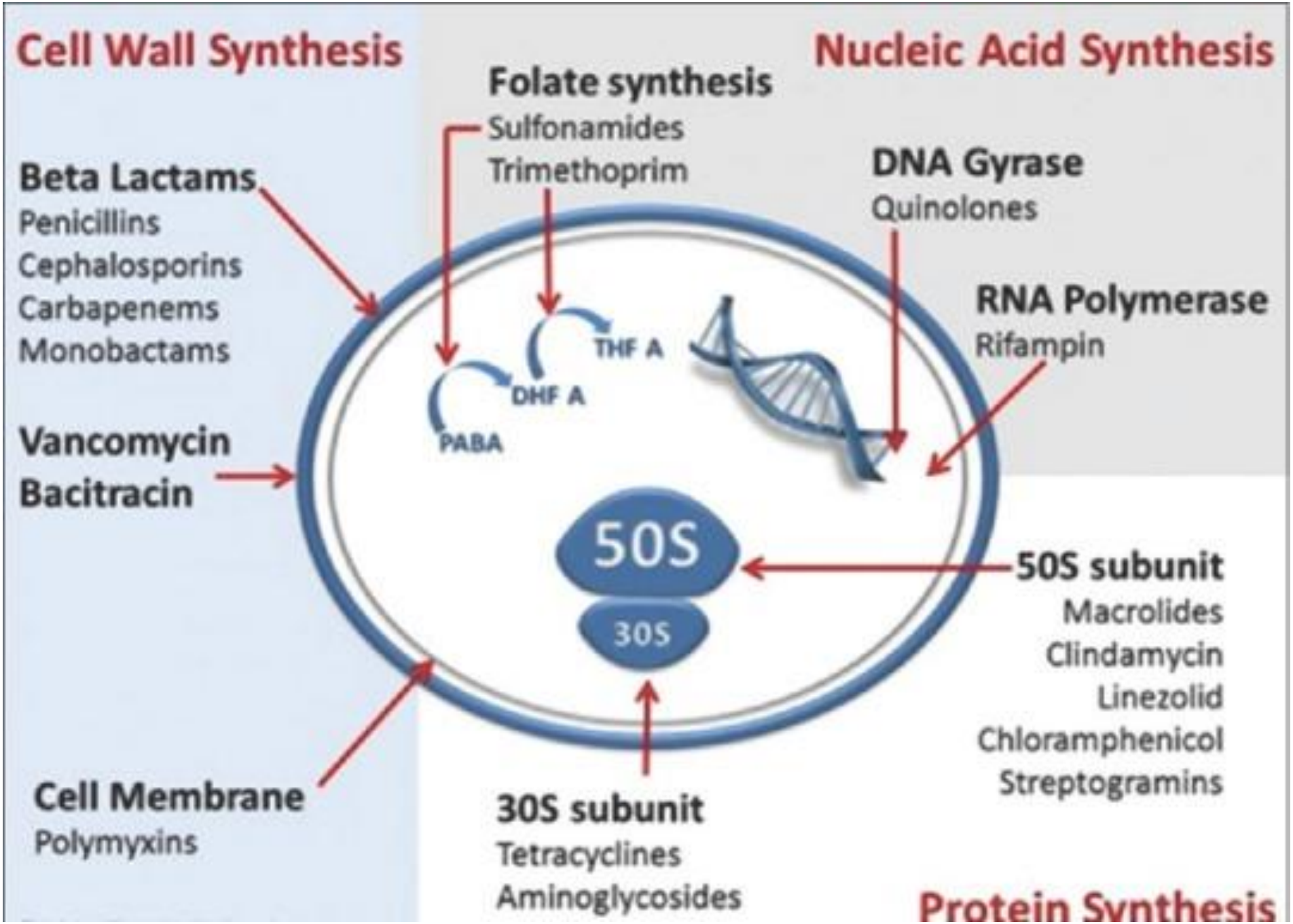
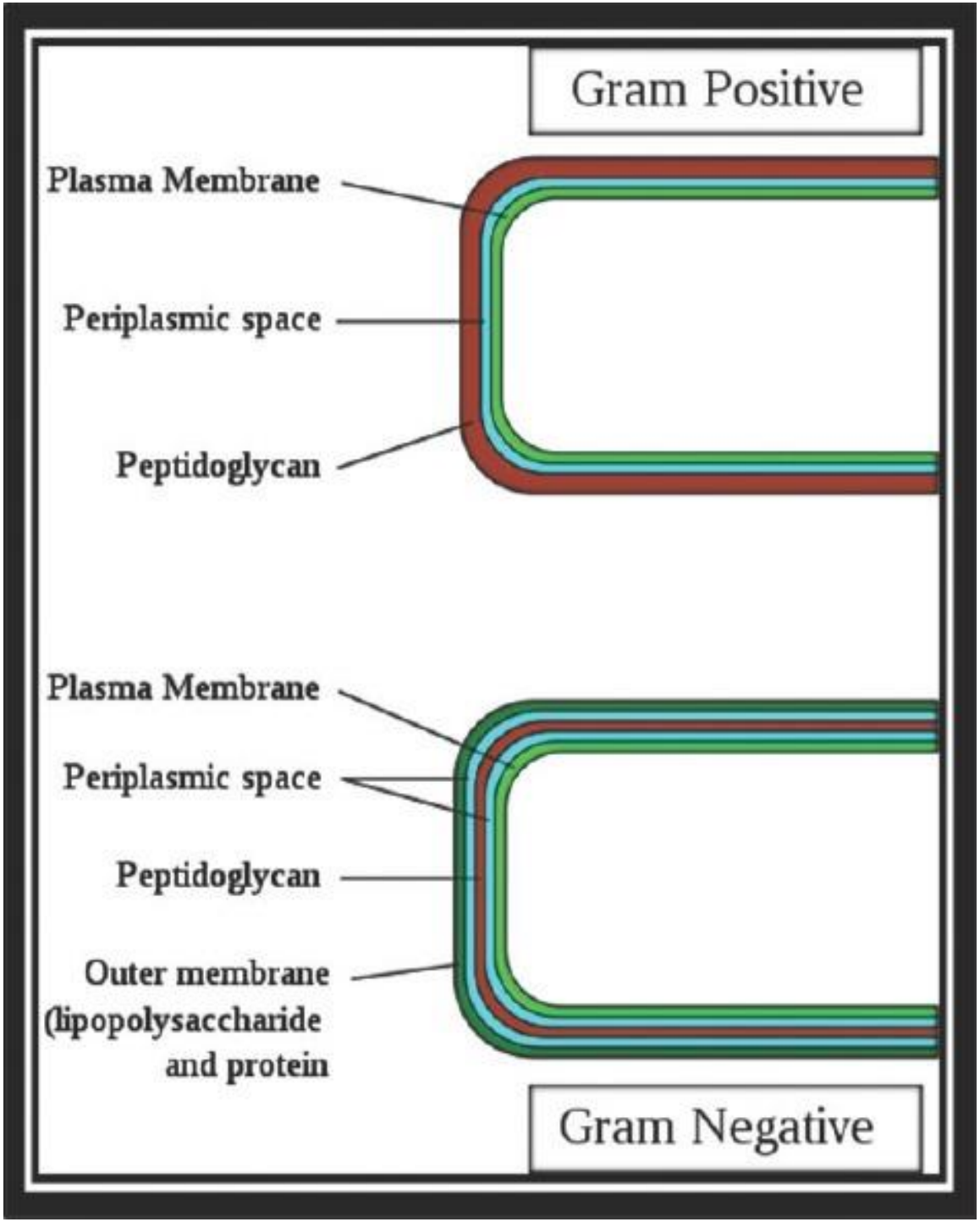

Cell Wall Synthesis
Nucleic Acid Synthesis
Folate synthesis
Sulfonamides
Trimethoprim
Beta Lactams
Penicillins
Cephalosporins
Carbapenems
Monobactams
DNA Gyrase
Quinolones
RNA Polymerase
Rifampin
THF A
DHF A
PABA
Vancomycin
Bacitracin
50S
30S
50S subunit
Macrolides
Clindamycin
Linezolid
Chloramphenicol
Streptogramins
Cell Membrane
Polymyxins
30S subunit
Tetracyclines
Aminoglycosides
Protein Synthesis


Gram Positive
Plasma Membrane
Periplasmic space
Peptidoglycan
Plasma Membrane
Periplasmic space
Peptidoglycan
Outer membrane
(lipopolysaccharide
and protein
Gram Negative