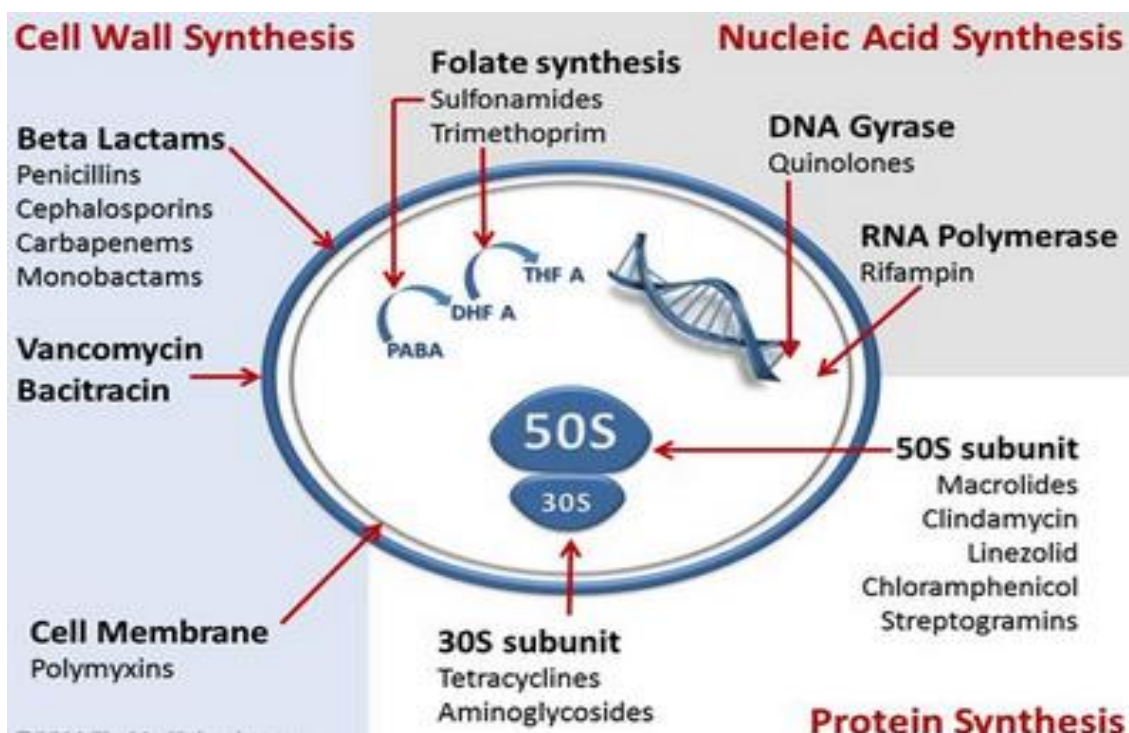


Antibiotic Pharmacology Mechanisms



Antibiotic Grouping By Mechanism

Cell Wall Synthesis	Penicillins Cephalosporins Vancomycin Beta-lactamase Inhibitors Carbapenems Aztreonam Polymyxin Bacitracin
Protein Synthesis Inhibitors	<u>Inhibit 30s Subunit:</u> Aminoglycosides (e.g. gentamicin) Tetracyclines <u>Inhibit 50s Subunit:</u> Macrolides Chloramphenicol Clindamycin Linezolid Streptogramins
DNA Synthesis Inhibitors	Fluoroquinolones (e.g. ciprofloxacin) Metronidazole
RNA synthesis Inhibitors	Rifampin
Mycolic Acid synthesis inhibitors	Isoniazid
Folic Acid synthesis inhibitors	Sulfonamides Trimethoprim

Inhibit Cell Wall Synthesis

Penicillins

(penicillin binding proteins block cross linking via competitive inhibition of the transpeptidase enzyme)

<i>Class/Mechanism</i>	<i>Antibiotic</i>	<i>Indications</i> (* <i>drug of choice</i>)	<i>Toxicity</i> <i>includes</i>
Penicillin	Penicillin G Aqueous penicillin G Procaine penicillin G Benzathine penicillin G Penicillin V (good oral)	<i>Strep. pyogenes (Grp.A)**</i> <i>Strep. agalactiae (Grp.B)**</i> <i>C. perfringens**</i> <i>Actinomyces**</i>	Hypersensitivity reaction Haemolytic anaemia
Aminopenicillins	Ampicillin Amoxicillin (good oral)	Above + : ↑ Gram-negative activity <i>E. faecalis**</i> ? <i>E. coli</i>	Above
Penicillinase-resistant-penicillins	Methicillin Nafcillin Oxacillin Cloxacillin Dicloxacillin	<i>Staph. aureus</i> But NOT MRSA with <i>mecA</i> gene producing penicillin binding proteins(PBP)	Above + Interstitial nephritis
Antipseudomonal penicillins	Carbenicillin Ticarillin Piperacillin	<i>Pseudomonas aeruginosa**</i>	Above

Cephalosporins

(inhibits bacterial cell wall synthesis via competitive inhibition of the transpeptidase enzyme)

1st generation	Cefazolin Cephalexin Cephalothin	<i>Staph. aureus**</i> <i>Staph. epidermidis**</i> Some Gram-negatives e.g.: <i>E. coli</i> <i>Klebsiella</i>	Allergic reaction
2nd generation	Cefoxitin Cefaclor Cefuroxime	Above + ↑ Gram-negative activity	Allergic Reaction ETOH Disulfiram reaction
3rd generation	Ceftriaxone Cefotaxime Ceftazidime	↑ Gram-negative activity ↓ Gram positive activity	Allergic Reaction ETOH Disulfiram reaction
4th generation	Cefepime	Anaerobe sparing (i.e. no activity against strict anaerobes)	

Other Cell Wall Inhibitors

Vancomycin	Vancomycin	MRSA** when Pen/Ceph allergies** <i>S. aureus</i> <i>S. epidermidis</i> <i>C. difficile</i>	Red man syndrome Nephrotoxicity Ototoxicity
Beta-lactamase Inhibitors	Clavulanic Acid Sulbactam Tazobactam	<i>S. aureus</i> <i>S. epidermidis</i> <i>E. coli</i> <i>Klebsiella</i>	Hypersensitivity reaction Haemolytic anaemia
Carbapenems	Imipenem Meropenem Doripenem Ertapenem	Broadest activity of any antibiotic (especially Gram negative, but polymicrobial also including anaerobes)	

Monobactam/Aztreonam	Aztreonam	Gram-negative rods Aerobes Hospital-acquired infections	
Polymyxins	Polymyxin B Polymyxin E	Topical Gram-negative infections	
Bacitracin	Bacitracin	Topical Gram-positive infections	

Protein Synthesis Inhibition

Anti-30S ribosomal subunit

Aminoglycosides	Gentamicin Neomycin Amikacin Tobramycin Streptomycin	Aerobic + facultative Gram-negatives e.g.: <i>Enterobacteriaceae</i> ? <i>Pseudomonas</i>	Nephrotoxicity Ototoxicity Monitor blood levels
Tetracyclines	Tetracycline Doxycycline Minocycline	<i>Rickettsia</i> <i>Mycoplasma</i> Spirochaetes	Hepatotoxicity Tooth discoloration Impaired growth Avoid in children < 12 years of age

Anti-50S ribosomal subunit

Macrolides	Erythromycin Azithromycin Clarithromycin Roxithromycin	<i>Mycoplasma pneumoniae</i> <i>Legionella</i> <i>Bordetella pertussis</i> <i>Chlamydia</i> <i>Streptococcus</i> <i>H. influenzae</i>	Coumadin interaction (cytochrome P450)
Chloramphenicol	Chloramphenicol	Many Gram pos and Gram negatives including anaerobes but increasing resistance worldwide. Conjunctivitis topical	Aplastic Anaemia Bone marrow toxicity, suppression
Lincosamide	Clindamycin	Anaerobes <i>Bacteroides fragilis</i> <i>S. aureus</i> Coagulase-negative Staph <i>Streptococcus</i>	Pseudomembranous colitis, <i>C. difficile</i> Hypersensitivity reaction
Oxazolidinone/Linezolid	Linezolid	Resistant Gram-positives e.g. MRSA, VRE	
Streptogramins	Quinupristin Dalfopristin	VRE Grp A Strep and <i>S. aureus</i> skin infections	

DNA Synthesis Inhibitors			
Fluoroquinolones (bactericidal: inhibit DNA gyrase enzyme, inhibiting DNA synthesis)			
1st generation	Nalidixic acid	<i>Streptococcus</i> <i>Mycoplasma</i> Aerobic/Facultative Gram +	Phototoxicity Achilles tendon rupture Impaired fracture healing
2nd generation	Norfloxacin Ciprofloxacin Enoxacin Ofloxacin Levofloxacin	As above + <i>Pseudomonas</i> Norfloxacin selects resistance more than Ciprofloxacin Use selects for <i>C. difficile</i> antibiotic associated diarrhoea	as above Use selects for <i>C. difficile</i> antibiotic associated diarrhoea
3rd generation	Gatifloxacin	As above + Gram-positives	as above
4th generation	Moxifloxacin Gemifloxacin	As above + Gram-positives + anaerobes	as above
Other DNA Inhibitors			
Metronidazole	Metronidazole ('Flagyl')	Anaerobes	Seizures ETOH disulfiram reaction
Nitrofurans	Nitrofurantoin	UTI cystitis – broad spectrum Gram pos/neg Not for pyelo or prostatitis Only acts in urine/bladder	Nausea, GI Pulmonary toxicity


RNA Synthesis Inhibitors			
Rifampin	Rifampin	<i>Staphylococcus</i> <i>Mycobacterium</i> (TB) Always use in combination with another AB to prevent resistance	Body fluid discoloration (red) Hepatotoxicity Reduces oral contraception effectiveness
Mycolic Acids Synthesis Inhibitors			
Isoniazid	Isoniazid	TB Latent TB	
Folic acid Synthesis Inhibitors			
Trimethoprim/Sulfonamides (bacteriostatic: inhibition with PABA)	Trimethoprim/Sulfamethoxazole (SMX)	UTI organisms <i>Proteus</i> <i>Enterobacter</i> MRSA	Thrombocytopenia Avoid in third trimester of pregnancy
Pyrimethamine	Pyrimethamine	Malaria <i>Toxoplasma gondii</i>	


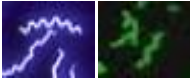

Gram Stain classification of bacteria

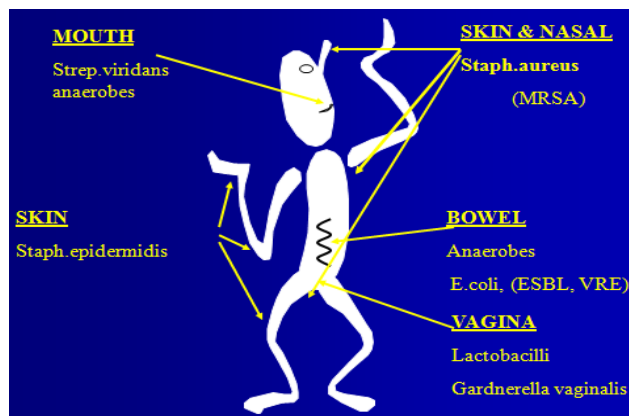
Gram Positive Cocci	
Staphylococcus (all species)	<i>Staph. aureus</i> (MSSA and MRSA) <i>Staph. epidermidis</i> <i>Staph. saprophyticus</i>
Streptococcus (all species)	<i>Strep. pneumoniae</i> <i>Strep. pyogenes</i> (Group A) <i>Strep. agalacticae</i> (Group B) <i>Strep. viridans</i> <i>Strep. bovis</i> (Group D)
Enterococci	<i>E. faecalis</i> (Group D strep)
Gram Positive Bacilli	
Bacillus and Clostridium species (Spore forming, antibiotics effective against the bacilli/vegetative forms but NOT the spores, which can germinate later)	<i>Bacillus anthracis</i> <i>Bacillus cereus</i> <i>Clostridium tetani</i> <i>Clostridium botulinum</i> <i>Clostridium perfringens</i> <i>Clostridium difficile</i>
Non-Spore Forming	<i>Corynebacterium diphtheriae</i> <i>Listeria monocytogenes</i> <i>Lactobacillus</i>

Gram Negative (diplo) Cocci	
Neisseria	<i>Neisseria meningitidis</i> <i>Neisseria gonorrhoeae</i>

Gram Negative Bacilli	
Enterics (GI/bowel)	<i>Escherichia coli</i> <i>Klebsiella pneumoniae</i> <i>Serratia</i> <i>Proteus</i> <i>Enterobacter</i> <i>Pseudomonas aeruginosa</i> <i>Bacteroides fragilis</i> <i>Salmonella</i> <i>Shigella dysenteriae</i> Comma shaped: <i>Campylobacter jejuni</i> <i>Vibrio cholerae</i> <i>Vibrio parahaemolyticus/vulnificus</i> <i>Helicobacter pylori</i> (gastric)
Respiratory bacilli	<i>Haemophilus influenzae</i> <i>Klebsiella</i> <i>Bordetella pertussis</i> <i>Legionella</i>

Zoonotic bacilli (animal source)	<i>Salmonella</i> <i>Pasteurella multocida</i> <i>Yersinia enterocolitica</i> <i>Yersinia pestis</i> <i>Brucella</i> <i>Francisella tularensis</i> <i>Bartonella</i> (e.g. 'cat scratch disease') Comma shaped: <i>Campylobacter jejuni</i> <i>Vibrio cholerae</i> <i>Vibrio parahaemolyticus/vulnificus</i>
Other (vagina)	<i>Gardnerella vaginalis</i> (gram variable +/-) 

Other Bacteria (difficult to stain)	
Mycobacteria (do not gram stain well, but are visualised by 'acid fast' ZN stain) 	<i>Mycobacterium tuberculosis</i> <i>Mycobacterium bovis</i> <i>Mycobacterium leprae</i>
Spirochaetes (corkscrew spiral shape)	<i>Treponema pallidum</i> <i>Borrelia</i> <i>Leptospira</i> 
Chlamydiaceae	<i>Chlamydia</i>
Mycoplasmataceae	<i>Mycoplasma pneumoniae</i> <i>Ureaplasma urealyticum</i>
Rickettsiaceae	<i>Rickettsia</i>
Fungus-like Bacteria	<i>Actinomyces</i> <i>Nocardia</i> 



Most endogenous bacterial infections are caused by an increase in numbers of some or all species of adjacent/nearby normal flora at a compromised site