1. Natural Penicillins
MOA: Inhibit Transpeptidase PBP → Inhibit peptidoglycan crosslinking – Structure: D-Ala-D-Ala
Penicillin V - oral
Penicillin G
PK: Decreased absorp. w/ food, penetrates inflamed BBB
Spectrum: 4/7 - Narrow
- **G(+)** – Strep, Enterococcus(w/ AG), listeria, c. Diphtheria
- **G(-)** – Neisseria meningitidis
- **Anaerobes** – C. perfringes, actinomyces
- **Spirochetes** - Treponema pallidum, B. Burgdorferi

Resistance - SNAP-IN
Beta lactamase
- Staph, Enterobacteriaceae, N. Gonorrhea, B. Fragilis

Altered PBP
- PRSP, N. Gonorrhea, MRSA

Innate
- Atypical, Gram negative, intracellular orgs

SE: Hypersensitivity reaction, seizures, renal failure

2. Penicillinase-Resistant Penicillins (anti-staph)
MOA: Inhibit Transpeptidase PBP → Inhibit peptidoglycan crosslinking – resistant to β-lactamase
Nafcillin – IV, IM - Bile excreted
Oxacillin – IV, IM
Cloxacillin – Oral, IV, IM
Dicloxacillin – Oral
PK: Decreased absorp. w/ food, penetrates BBB in inflamed
Spectrum: 1/7 – Narrow
- **G(+)** – Methicillin sensitive Staph Aureus (MSSA)

Resistance - SNAP-IN
Altered drug target (PBP mutation)
- MRSA

Innate
- Atypical, Gram negative, intracellular orgs

SE: Hypersensitivity reaction, seizures, Nephrotoxicity, Hepatotoxicity

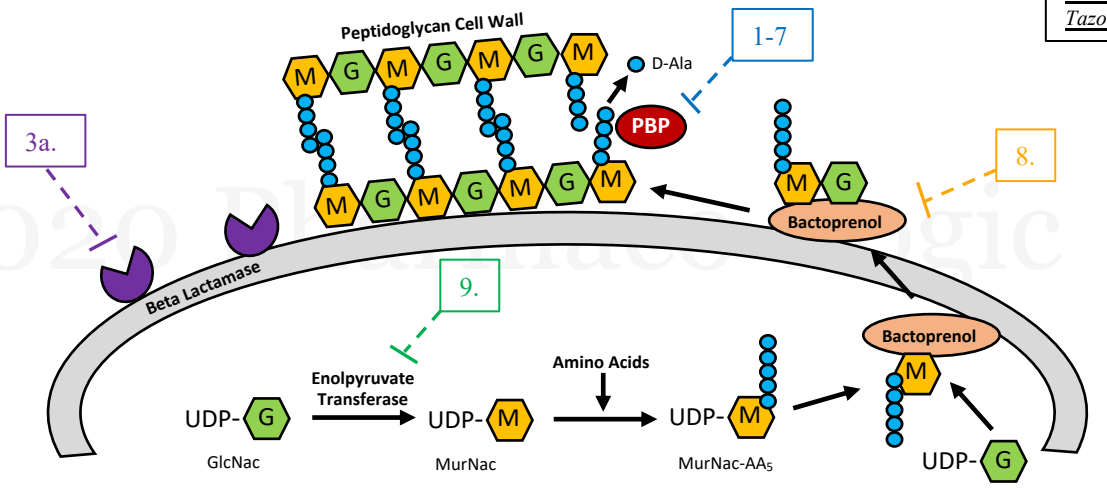
3. Aminopenicillins
MOA: Inhibit Transpeptidase PBP → Inhibit peptidoglycan crosslinking
Ampicillin – IV - renal and biliary
Amoxicillin – delayed with food, Long T1/2
PK: Penetrates inflamed BBB
Spectrum: 4/7 - Narrow
- **G(+)** –listeria (+AG), Strep
- **G(-)** – Proteus, H. Pylori (w/ PPI), H. influenza, E. coli, N. Meningitis, Moraxella, Acinetobacter
- **Anaerobes** – Most except C. Difficile
- **Spirochetes** - Treponema pallidum, B. Burgdorferi

USE: URTI, UTI, Meningitis, Endocarditis, GI-infections
Resistance - Beta lactamase – always combined with **β**-lactamase inhibitor
SE: Hypersensitivity reaction, seizures, renal failure, superinfection

4. Antipseudomonal Penicillins
MOA: Inhibit Transpeptidase PBP → Inhibit peptidoglycan crosslinking
Ticarcillin – parenteral
Piperacillin - parenteral
PK: Penetrates inflamed BBB
Spectrum: 3/7 - Extended
- **G(+)** –listeria, Enterococcus, Strep, Staph
- **G(-)** – Most, Pseudomonas
- **Anaerobes** – Most except C. Difficile

USE: URTI, UTI, Meningitis, Endocarditis, GI-infections
Resistance - Beta lactamase – always combined with **β**-lactamase inhibitor (Tazobactam)
SE: Hypersensitivity reaction, seizures, renal failure, Bleeding, Neutropenia

3a. Beta-Lactamase inhibitor
MOA: Binds and irreversibly inhibits β-lactamase – administered with aminopenicillin
Clavulanic acid
Sulbactam – effective against Acinetobacter
Tazobactam



5. Cephalosporins
MOA: Inhibit Transpeptidase PBP → Inhibit peptidoglycan crosslinking
1st Generation – Does not cross the BBB, surgical Prophylaxis, UTI
Cefazolin
Cefadroxil
Spectrum – PEcKSS, **Resistance:** LEMPAS, **β**-Lactamase
2nd Generation –
Cefoxitin- Anaerobes – "O" - oxygen
Cefotetan – Anaerobes – MTT side chain – Bleeding, Disulfiram effect
Cefuroxime – Spirochete – "U" undulate
Spectrum – More G(-), PEcKSS + H. influ, Moraxella, **Resistance:** LEMP
3rd Generation – crosses inflamed BBB
Ceftriaxone – Biliary excretion, Used for N. Gonorrhea
Ceftazidime – Pseudomonas
Ceftizoxime – Anaerobes, Spirochetes
Cefotaxime - Spirochetes
Spectrum – More G(-), PEcKSS + H. influ, N. Gon, **Resistance:** LEM
4th Generation - Crosses the BBB – Reserved by ID
Cefepime – G(+) < G(-) PEcKSS + H. influ, Pseudomonas, **Resistance:** LEMA
5th Generation – binds to the mutated PBP(2A) of MRSA, Inflamed BBB
Ceftaroline – PEcKSS + enterococcus, MRSA, **Resistance**: LAP
SE: well tolerated, Hypersensitivity (cross-sensitivity), Superinfection (4th Gen)

6. Carbapenems
MOA: Inhibit Transpeptidase PBP → Inhibit peptidoglycan crosslinking
Imipenem – Seizures, Preg C – Administered with cilastatin
Meropenem – Combined with Vaborbactam
Ertapenem – Not effective against APE
Spectrum: Broad spectrum
- **G(+)**– Most– Staph, Entero, Strep, Listeria
- **G(-) –** Most – Enterobacter, Pseudomonas, acinetobacter
- **Anaerobes** – Most, Not C. Diff

Resistance – Spirochetes, MRSA, Atypicals, C. Diff (**SMAC**)
SE: Hypersensitivity reaction, Superinfections

7. Monobactams
MOA: Inhibit Transpeptidase PBP → Inhibit peptidoglycan crosslinking
Aztreonam
Spectrum: Narrow
- **G(-) –** Most –

Resistance – Beta Lactamase, Porin
SE: Hypersensitivity reaction, Superinfections

8. Bacitracin
MOA: Inhibits Step 2 of cell wall synthesis → Inhibits bactoprenol mediated transport
Spectrum:
- **G(+) –** Most –
- **G(-) –** Most
- **Anaerobes –** Including C. Diff

SE: Nephrotoxicity – topical use only

9. Fosfomycin
MOA: Inhibits Step 1 of cell wall synthesis → Inhibits Enolpyruvate transferase (UDP-MurNAC)
PK: penetrates Kidneys, Bladder, Prostate
Spectrum: Narrow
- **G(+)** and **G(-)**
- Enterobacteriacaea, S. Saprophyticus, Psuedomonas

SE: Diarrhea