

Antimicrobial	Class	Mechanism of Action	Gram +	Gram -	Anaerobes	Pseudomonas	Clinical uses	Resistance Mechs.	Important pharmacological facts	Other notes	Major side effects/drug interactions
<b>Penicillins- In general</b>	<b>Beta lactam-penicillins</b>	<b>Block action of PBP</b>									Side effects: - Allergic reactions (from rash to anaphylaxis) - Acute interstitial nephritis (esp. methicillin class) - Seizure (esp. in high, non-renal adjusted doses)  Drug interactions: - Minimal, but probenecid can block renal excretion and prolong half life
Penicillin	Beta lactam-Penicillins	Block action of PBP	+	-	-	-	- Syphilis - Dental coverage - Necrotizing fasciitis - Definitive therapy for streptococcal infections	Beta lactamases, penicillinases		- Streptococci (S. pyogenes, S. viridans, S. pneumoniae) - Enterococci (E. faecalis) - Treponema pallidum - Clostridium species except C. diff - Other mouth anaerobes	
Benzathine penicillin (depot preparation; must be given IM)	Beta lactam-Penicillins	Block action of PBP; slow release over a long time	+	-	-	-	- Syphilis - Dental coverage - Necrotizing fasciitis - Definitive therapy for streptococcal infections	Beta lactamases, penicillinases		Only extremely susceptible bugs can be treated this way (ex: syphilis)	
Nafcillin	Beta lactam-penicillinase-resistant penicillins	Block action of PBP	+	-	-	-	Drug of choice for MSSA, some streptococcal activity	PBP alterations (MRSA)	Most commonly used, along with oxacillin	"Antistaphylococcal penicillins"	
Methicillin	Beta lactam-penicillinase-resistant penicillins	Block action of PBP	+	-	-	-	Drug of choice for MSSA, some streptococcal activity	PBP alterations (MRSA)	Not used clinically, but used in lab reports (this is the M in MRSA)	"Antistaphylococcal penicillins"	
Oxacillin	Beta lactam-penicillinase-resistant penicillins	Block action of PBP	+	-	-	-	Drug of choice for MSSA, some streptococcal activity	PBP alterations (MRSA)	Most commonly used, along with nafcillin	"Antistaphylococcal penicillins"	
Dicloxacillin	Beta lactam-penicillinase-resistant penicillins	Block action of PBP	+	-	-	-	Drug of choice for MSSA, some streptococcal activity	PBP alterations (MRSA)		"Antistaphylococcal penicillins"	
Ampicillin (IV)	Beta lactam-aminopenicillins	Block action of PBP	+	-	-	-	- Enterococcal infections (only E. faecalis, not E. faecium) - Serious infections like endocarditis - Meningitis - Streptococcal infections - Respiratory tract infections	Beta lactamases		HELPS bugs - H. influenzae - E. faecalis - L. monocytogenes - P. mirabilis - Salmonella and shigella	
Amoxicillin (PO)	Beta lactam-aminopenicillins	Block action of PBP	+	-	-	-	- Enterococcal infections (only E. faecalis, not E. faecium) - Serious infections like endocarditis - Meningitis - Streptococcal infections - Respiratory tract infections	Beta lactamases		HELPS bugs - H. influenzae - E. faecalis - L. monocytogenes - P. mirabilis - Salmonella and shigella	
Piperacillin (IV)	Beta lactam	Block action of PBP	+	-	-	+	Expands the coverage of ampicillin to include P. aeruginosa			- If enterococcus is susceptible to ampicillin it is susceptible to piperacillin - Only available as a piperacillin/tazobactam combined IV	
Amoxicillin/Clavulanic Acid = Augmentin (PO)	Beta lactam + beta lactamase inhibitor	Block action of PBP + block action of beta lactamase	+	-	-	-	Empiric/broad coverage for community-based pathogens				
Ampicillin/sulbactam = Unasyn (IV)	Beta lactam + beta lactamase inhibitor	Block action of PBP + block action of beta lactamase	+	+	+	-	Empiric/broad coverage for community-based pathogens; also the drug of choice against A. baumannii			The sulbactam, aside from being a beta lactamase inhibitor, also has some antimicrobial activity itself	
Ticarcillin/clavulanic acid = Timentin (IV)	Beta lactam + beta lactamase inhibitor	Block action of PBP + block action of beta lactamase	+	+	+	-	Timentin just has a niche-Activity vs. S. maltophilia				
Piperacillin/tazobactam = Zosyn (IV)	Beta lactam + beta lactamase inhibitor	Block action of PBP + block action of beta lactamase	+	+	+	+	Empiric/broad spectrum for nosocomial infections INCLUDING pseudomonas				
Cephalosporins- In general	Beta lactam-cephalosporins	Same as penicillins (block PBP)								Good gram + coverage, but entire class lacks activity against enterococcus	- Ceftriaxone can cause biliary sludging (avoid ceftriaxone in neonates) - ~5% cross-reactivity with penicillins - Cross reactivity is way lower when different R groups are used
Cephalexin (Keflex)	Beta lactam- 1st generation cephalosporins	Block PBP	+	Weak	-	-	- Good vs. staphylococcus (MSSA) - Good vs. most strep (variable with S. pneumoniae) - Good skin coverage, if MRSA not a concern			As far as gram - activity, it has questionable utility against "PEK": - Proteus - E. coli - K. pneumoniae But would probably not be used for gram -	

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Cefazolin	Beta lactam- 1st generation cephalosporins	Block PBP	+	Weak	-	-	- Good vs. staphylococcus (MSSA) - Good vs. most strep (variable with S. pneumoniae) - Good skin coverage, if MRSA not a concern			As far as gram - activity, it has questionable utility against "PEK": - Proteus - E. coli - K. pneumoniae But would probably not be used for gram -	
Cefadroxil	Beta lactam- 1st generation cephalosporins	Block PBP	+	Weak	-	-	- Good vs. staphylococcus (MSSA) - Good vs. most strep (variable with S. pneumoniae) - Good skin coverage, if MRSA not a concern			As far as gram - activity, it has questionable utility against "PEK": - Proteus - E. coli - K. pneumoniae But would probably not be used for gram -	
Cefaclor	Beta lactam- 2nd generation cephalosporin-Respiratory	Block PBP	+	Little better	-	-	- Same as first generation, but improved S. pneumoniae coverage - Used to treat respiratory tract infections, due to coverage of: S. pneumoniae (gram +) H. influenzae (gram -) M. cattarhalis (gram -)				
Cefuroxime	Beta lactam- 2nd generation cephalosporin-Respiratory	Block PBP	+	Little better	-	-	- Same as first generation, but improved S. pneumoniae coverage - Used to treat respiratory tract infections, due to coverage of: S. pneumoniae (gram +) H. influenzae (gram -) M. cattarhalis (gram -)				
Cefotetan	Beta lactam- 2nd generation cephalosporin- GI	Block PBP	+	Little better	+	-	Used for community acquired intraabdominal infections and surgical prophylaxis; ONLY one with good anaerobic activity				
Cefoxitin	Beta lactam- 2nd generation cephalosporin- GI	Block PBP	+	Little better	+	-	Used for community acquired intraabdominal infections and surgical prophylaxis; ONLY one with good anaerobic activity				
Cefotaxime (IV)	Beta lactam- 3rd generation cephalosporin	Block PBP	+	+	-	-	Gram +: - Excellent S. pneumoniae --> drug of choice for inpatient CAP and community-acquired bacterial meningitis  Gram -: - Excellent vs. nosocomial gram - bacilli; enhanced activity against "PEK"	For all 3rd generations: use caution with SPICE organisms: - Serratia - Providencia - Indole (+) proteus - Citrobacter - Enterobacter because you can select for the beta-lactamase that can confer resistance in those organisms		- Variable MSSA coverage- not as good as 1st generation cephalosporins - CAUTION with: enterobacter, possibly citrobacter, serratia	
Ceftriaxone (IV)	Beta lactam- 3rd generation cephalosporin	Block PBP	+	+	-	-	Gram +: - Excellent S. pneumoniae --> drug of choice for inpatient CAP and community-acquired bacterial meningitis  Gram -: - Excellent vs. nosocomial gram - bacilli; enhanced activity against "PEK"	For all 3rd generations: use caution with SPICE organisms: - Serratia - Providencia - Indole (+) proteus - Citrobacter - Enterobacter because you can select for the beta-lactamase that can confer resistance in those organisms		- Variable MSSA coverage- not as good as 1st generation cephalosporins - CAUTION with: enterobacter, possibly citrobacter, serratia  - Ceftriaxone is DOC for CAP, meningitis (S. pneumo.) - Intra-abdominal infections (+ metronizadole) - UTI's	Can cause biliary sludging; do not use in neonates
Cefixime (PO)	Beta lactam- 3rd generation cephalosporin	Block PBP	+	+	-	-	Gram +: - Excellent S. pneumoniae --> drug of choice for inpatient CAP and community-acquired bacterial meningitis  Gram -: - Excellent vs. nosocomial gram - bacilli; enhanced activity against "PEK"	For all 3rd generations: use caution with SPICE organisms: - Serratia - Providencia - Indole (+) proteus - Citrobacter - Enterobacter because you can select for the beta-lactamase that can confer resistance in those organisms		- Variable MSSA coverage- not as good as 1st generation cephalosporins - CAUTION with: enterobacter, possibly citrobacter, serratia	

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Cefpodoxime (PO)	Beta lactam- 3rd generation cephalosporin	Block PBP	+	+	-	-	<ul style="list-style-type: none"> <li>Gram +: <ul style="list-style-type: none"> <li>- Excellent S. pneumoniae -- &gt; drug of choice for inpatient CAP and community-acquired bacterial meningitis</li> </ul> </li> <li>Gram -: <ul style="list-style-type: none"> <li>- Excellent vs. nosocomial gram - bacilli; enhanced activity against "PEK"</li> </ul> </li> </ul>	<ul style="list-style-type: none"> <li>For all 3rd generations: use caution with SPICE organisms: <ul style="list-style-type: none"> <li>- Serratia</li> <li>- Providencia</li> <li>- Indole (+) proteus</li> <li>- Citrobacter</li> <li>- Enterobacter</li> </ul> </li> <li>because you can select for the beta-lactamase that can confer resistance in those organisms</li> </ul>		<ul style="list-style-type: none"> <li>- Variable MSSA coverage- not as good as 1st generation cephalosporins</li> <li>- CAUTION with: enterobacter, possibly citrobacter, serratia</li> </ul>	
Ceftazidime	Beta lactam- 3rd generation cephalosporin (different spectrum)	Block PBP	Eh	+		+	<ul style="list-style-type: none"> <li>- Less gram + staph/strep coverage</li> <li>- First cephalosporin with P. aeruginosa coverage</li> </ul>	<ul style="list-style-type: none"> <li>For all 3rd generations: use caution with SPICE organisms: <ul style="list-style-type: none"> <li>- Serratia</li> <li>- Providencia</li> <li>- Indole (+) proteus</li> <li>- Citrobacter</li> <li>- Enterobacter</li> </ul> </li> <li>because you can select for the beta-lactamase that can confer resistance in those organisms</li> </ul>		<ul style="list-style-type: none"> <li>Along with ceftriaxone, this can penetrate into the meninges in high doses and therefore is treatment of choice for CNS infections</li> <li>(use ceftriaxone for community-acquired bact. mening.; use ceftazidime for nosocomial because it adds pseudomonas coverage)</li> </ul>	
Cefepime	Beta lactam- 4th generation cephalosporin	Block PBP	+	+		+	<ul style="list-style-type: none"> <li>- Gram +: Activity against strep and staph, but still not as good as 1st gen. cephalosporins</li> <li>- Gram -: Great against nosocomial orgs., SPICE orgs., and P. aeruginosa</li> </ul>				
Ceftaroline	Beta lactam- Advanced generation cephalosporin	Block PBP (binds PBP2A, PBP2X)	+	Between 2nd and 3rd generation coverage			<ul style="list-style-type: none"> <li>- MRSA</li> <li>- Great S. pneumoniae coverage</li> <li>- Activity against ampicillin-sensitive E. faecalis</li> </ul>			Being looked at for CAP, skin infections, and MRSA when vancomycin is not an option	
Carbapenems- in general	Beta lactam- carbapenems		+	+	+		<ul style="list-style-type: none"> <li>- Broadest agents we currently have</li> <li>- Gram + coverage including MSSA but not MRSA</li> <li>- Gram - activity including resistant orgs.</li> <li>- Excellent anaerobic coverage, except C. difficile</li> </ul>			Carbapenems are the drug of choice for all ESBL (Extended Spectrum B-lactamase)-secreting organisms	Seizures (most likely not true due to old data)
Ertapenem	Beta lactam- Group 1 carbapenem					-	<ul style="list-style-type: none"> <li>Holes: <ul style="list-style-type: none"> <li>- APE (acinetobacter, pseudomonas, enterococcus)</li> <li>- Allows you to avoid selecting for resistant versions of these</li> </ul> </li> <li>Drug of choice for ESBL producing organisms</li> </ul>			<ul style="list-style-type: none"> <li>Do not cover: <ul style="list-style-type: none"> <li>- MRSA</li> <li>- Enterococci resistant to ampicillin</li> <li>- S. maltophilia</li> <li>- Carbapenem-resistant enterobacteriaceae</li> <li>- C. diff.</li> </ul> </li> <li>- Fungi/viruses (obviously)</li> </ul>	
Imipenem	Beta lactam- Group 2 carbapenem			+		+	<ul style="list-style-type: none"> <li>- Used for multi-drug resistant orgs.</li> <li>- Great gram - coverage: ESBL</li> <li>P aeruginosa (including those resistant to cefepime, pip/tazo</li> <li>A. baumannii</li> </ul>			<ul style="list-style-type: none"> <li>Do not cover: <ul style="list-style-type: none"> <li>- MRSA</li> <li>- Enterococci resistant to ampicillin</li> <li>- S. maltophilia</li> <li>- Carbapenem-resistant enterobacteriaceae</li> <li>- C. diff.</li> </ul> </li> <li>- Fungi/viruses (obviously)</li> </ul>	
Meropenem	Beta lactam- Group 2 carbapenem			+		+	<ul style="list-style-type: none"> <li>- Used for multi-drug resistant orgs.</li> <li>- Great gram - coverage: ESBL</li> <li>P aeruginosa (including those resistant to cefepime, pip/tazo</li> <li>A. baumannii</li> </ul>			<ul style="list-style-type: none"> <li>Do not cover: <ul style="list-style-type: none"> <li>- MRSA</li> <li>- Enterococci resistant to ampicillin</li> <li>- S. maltophilia</li> <li>- Carbapenem-resistant enterobacteriaceae</li> <li>- C. diff.</li> </ul> </li> <li>- Fungi/viruses (obviously)</li> </ul>	
Doripenem	Beta lactam- Group 2 carbapenem			+		+	<ul style="list-style-type: none"> <li>- Used for multi-drug resistant orgs.</li> <li>- Great gram - coverage: ESBL</li> <li>P aeruginosa (including those resistant to cefepime, pip/tazo</li> <li>A. baumannii</li> </ul>			<ul style="list-style-type: none"> <li>Do not cover: <ul style="list-style-type: none"> <li>- MRSA</li> <li>- Enterococci resistant to ampicillin</li> <li>- S. maltophilia</li> <li>- Carbapenem-resistant enterobacteriaceae</li> <li>- C. diff.</li> </ul> </li> <li>- Fungi/viruses (obviously)</li> </ul>	



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Vancomycin	Glycopeptide	Binds D-Ala D-Ala to prevent further peptidoglycan cross-linking	+	-	-	-	- Empirically covers for MRSA - Inferior to beta-lactams for MSSA, strep, entero. (broader spectrum but weaker killing)		- Comes IV or PO, but PO is not absorbed and only used against C. diff - Renally eliminated (need dose adjustments)	- Slowly bactericidal	- Nephrotoxicity (esp with increasing doses) - "Red-man's syndrome" (not an actual allergy...just from dosing too quickly)
Telavancin	2nd gen. glycopeptide (LIPoglycopeptide)	Same as vanco + direct binding to bacterial membrane to disrupt barrier function	+							- Increased bactericidal activity against gram positives	- Nephrotoxicity (worse than vanco) - Interference with coagulation tests
Coming soon: Dalbavancin and Oritavancin	Long-acting lipoglycopeptide								- Half-life of over 300 hours, only requires 1x weekly dose		
Daptomycin (IV)		Leads to holes in bacterial membrane and huge K+ efflux	+	-	-	-	- MRSA and VRE bloodstream infections - Endocarditis - Soft tissue infections			- Gram +s only (staph, strep, entero) - Highly bactericidal	- CPK elevations (possible rhabdo) - Irreversible binding to pulmonary surfactant (avoid in pneumonia) (note: surfactant is similar to gram + membranes) - CPK elevations can occur in concordance with taking statins
Linezolid	Oxazolidinone	Binds 50S subunit	+	-	-	-	- VRE infections - Sometimes with MRSA		- 100% absorption (IV and PO dose the same) - Not renally eliminated	- Gram + only	Side effects: - Thrombocytopenia (usually with long courses) Drug interactions: - Weak MAOI...careful with SSRIs (also careful eating tyramine)
Tedizolid	New oxazolidinone	Binds 50S subunit	+	-	-	-	- 6 day course for skin infections		- Once daily dose		- Less thrombocytopenia - Less SSRI issues
Macrolides- In general	Macrolides	Bind 50S subunit					- Cover the "respiratory pathogens" (Strep., H int., M catar.) - Chlamydia trachomatis	- Target-site modification - Dec. conc. in cell (efflux pump)			Side effects: - Nausea/vomiting/diarrhea (worst with erythromycin, less with azithromycin) Drug interactions: - Inhibit CYP3A4- azithro not as bad
Erythromycin (IV/PO)	Macrolides	Bind 50S subunit									
Clarithromycin (PO)	Macrolides	Bind 50S subunit					- Adds H. pylori				
Azithromycin (IV/PO)	Macrolides	Bind 50S subunit					- First line for CAP in outpatient setting (RESPIRATORY) - C. trachomatis		- IV dose = PO dose - Long half life (72 hrs) = short course		
Telithromycin	Ketolides (derivative of macrolides)						- Similar spectrum to azithromycin, with enhanced S. pneumo coverage - Thought to be niche drug for CAP, but has severe hepatotoxicity - Rare clinical use				
Tetracyclines- In general	Tetracyclines	Binds 30S subunit (along with aminoglycosides)	+	+		-		- Efflux pumps - Target-site alterations			
Tetracycline (PO)	Tetracyclines	Binds 30S subunit (along with aminoglycosides)	+	+		-					
Doxycycline (IV/PO)	Tetracyclines	Binds 30S subunit (along with aminoglycosides)	+	+		-	- Resp. pathogens - A baumannii (minocycline most potent) - Animal bites + Lyme disease! - Skin and soft tissue infections, esp. when CA-MRSA is a concern		- Highly lipophilic (lots of tissue penetration) - Not renally eliminated		- N/V/D - PHOTSENSITIZATION - Chelation with divalent/trivalent cations
Micocycline (IV/PO)	Tetracyclines	Binds 30S subunit (along with aminoglycosides)	+	+		-	- Resp. pathogens - A baumannii (minocycline most potent) - Animal bites + Lyme disease! - Skin and soft tissue infections, esp. when CA-MRSA is a concern				
Demeclocycline (PO)	Tetracyclines	Binds 30S subunit (along with aminoglycosides)	+	+		-					

