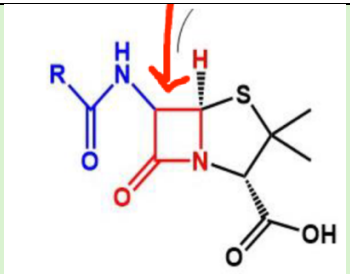
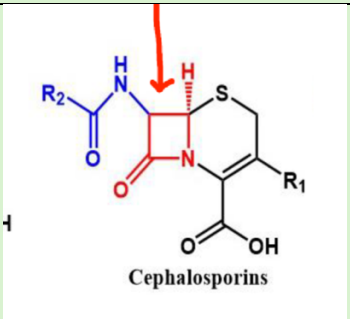
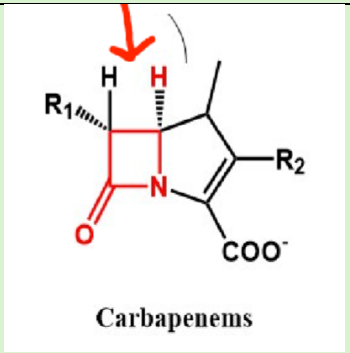
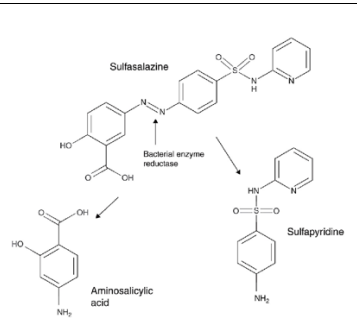
Drug	Drug Examples	Mechanism of Action	Pharmacokinetics/ Pharmacodynamics	Structure/Clinical Use
Penicillin	Beta-lactam	Inhibition of cell wall synthesis	Broad and Narrow Spectrum Bactericidal Time Dependent PK:PD Resistance develops rapidly Weak Acids Many are inactivated @ gastric pH Distributes to extracellular fluid Active tubular secretion of parent compound Short $t_{1/2}$ **Adverse Effects**: Vomiting and diarrhea, disruption of intestinal microflora, CNS excitation @ high doses, immune mediated reactions/allergies **Resistance**: Production of beta-lactamases, decreased penetration through outer cell membrane, efflux through pumps, altered binding site (use b-lactamase inhibitors such as clavulanic acid, sulbactam)	 **Penicillins**
Cephalosporins	Beta-lactam	Inhibition of cell wall synthesis	Broad spectrum Bactericidal Time Dependent PK:PD Good oral absorption in small animals Distributes to extracellular fluid Minimal metabolism Renal Excretion *good for UTIs Short $t_{1/2}$ **Adverse Effects**: Vomiting and diarrhea, disruption of intestinal microflora, CNS	 **Cephalosporins**

			excitation @ high doses, immune mediated reactions/allergies **Resistance**: Production of beta-lactamases, decreased penetration through outer cell membrane, efflux through pumps, altered binding site	
Carbapenems Imipenem Meropenem	Beta-lactam	Inhibition of cell wall synthesis	"High Priority Critically Important" Broadest antibacterial action of the beta-lactams Imipenem: shorter shelf-life, deliver diluted in fluids, risk of renal injury and seizures, combined with cilastatin to avoid renal toxicity Meropenem: Greater antibacterial activity than imipenem, more soluble, can also give SQ, lower incidence of adverse effects	 Carbapenems
Vancomycin Bacitracin Polymyxin	Antibiotics	Inhibition of cell wall synthesis	**Vancomycin**: High priority critically important, bactericidal, time dependent, given by IV infusion, primarily gram + antibiotics, Nephrotoxic, do not use in food animals! **Bacitracin**: Blocks phosphorylase reaction, gram + organisms, used topically, often combined with polymyxin B, neomycin **Polymyxin**: Surface cationic detergent, gram – spectrum, not absorbed following oral administration, primarily used topically	

Sulfonamides Diaminopyrimidines		Alter metabolic pathways	Broad Spectrum Gram + and – Time Dependent PK:PD Bacteriostatic Potentiated Sulfonamides: Bactericidal Less effective in presence of cellular debris Do not use in lactating dairy cattle! **Synergism of Potentiates Sulfonamides** Good oral and parenteral absorption Widely distributed Elimination: Renal excretion and metabolism **Adverse Effects**: Crystalluria, Keratoconjunctivitis Sicca, Hypersensitivity Reactions, Hepatic Necrosis, Hypoprothrombinemia, Thyroid Metabolism Disorders	
Aminoglycosides	Gentamicin Amikacin Neomycin	Inhibition of protein synthesis/disruption of cell surface	Basic compounds Anaerobic Gram – and limited Gram + Highly polar Bactericidal Concentration dependent Post-antibiotic effect Once daily administration Diffusion through outer membrane through aqueous channels, further transport into cells requires proton pump and oxygen. Anaerobic bacteria are resistant Activity is affected by low pH and cellular debris	Intra-articular for septic arthritis Antibiotic-impregnated polymethylmethacrylate Regional perfusion IV or intraosseous

			Can be inactivated if combined with some drugs in syringes/vials Not absorbed from GIT Near complete after IM or SC Limited diffusion into some tissues due to charge/hydrophilicity Altered distribution in young animals Elimination: No metabolism, GFR short plasma $t_{1/2}$ NEPHAROTOXICITY	
Tetracyclines	Tetracylcine Chlortetracycline Oxytetracycline Doxycycline Minocycline	Inhibition of protein synthesis	Broad spectrum Gram + and – Bacteriostatic Entrance into bacterial cells: Passive diffusion through outer cell membrane. Energy dependent active transport Concentration dependent Oral absorption is best for doxy and mino. IV or IM for oxytetracycline Vd>TBW in most species, intracellular accumulation Elimination: Half-life allows for once daily dosing in most species Glomerular filtration and fecal elimination (doxy)	Adverse Effects Gastrointestinal effects Esophageal lesions (cats) Tooth discoloration / inhibition of growth of long bones Renal tubular necrosis Risk with IV administration (horses and cattle)
Chloramphenicol	Chloramphenicol Florfenicol	Inhibition of protein synthesis	Broad spectrum Time dependent	Adverse Effects

			Bacteriostatic DO NOT USE in food animals Well absorbed in most species Widely distributed: Eye, CNS, Heart, Lung, Prostate, Saliva, Liver, Spleen, Milk Extensive metabolism (glucuronidation) Short elimination $t_{1/2}$ in most species except cats Frequent administration	Decreased appetite, weight loss, depression Peripheral neuropathy Bone marrow suppression (dose dependent, dose independent in humans) CYP450 inhibitor
Lincosamides	Erythromycin Tylosin Clarithromycin Azithromycin Tilmicosin Tulathromycin Gamithromycin Tildipirosin	Inhibition of protein synthesis	Weak base, highly lipid soluble Gram + very limited Gram – Respiratory pathogens Bacteriostatic Concentration dependent Moderate oral absorption Food decreases absorption of erythromycin Primarily fecal elimination Short $t_{1/2}$: erythromycin, tylosin Long $t_{1/2}$: gamithromycin, tildipirosin, tilmicosin, tulathromycin	Used in bovine respiratory disease Swine dysentery (tylosin) Pleuropneumonia (tylosin) Diarrhea in dogs (tylosin) Adverse effects: GI cats/dogs Hyperthermia in foals Tilmicosin injections to horses, goats, swine, non-human primates can be fatal CYP450 inhibition-erythromycin
Macrolides	Lincomycin Clindamycin	Inhibition of protein synthesis	Basic compounds Highly lipid soluble Mainly gram + Concentration dependent Complete oral absorption Large Vd	Contraindicated for use in horses, guinea pigs, hamsters, rabbits, chinchillas, and ruminants Clostridial overgrowth and entercolitis

			Clindamycin has high intracellular concentrations Elimination: Biliary and renal	Horses: Severe and fatal colitis Vomiting (cats) Loose stool (dogs)
Fluoroquinolones	Enrofloxacin Orbifloxacin Marbofloxacin Pradofloxacin Danofloxacin	Inhibition of DNA replication and transcription DNA gyrase, topoisomerase IV	Gram – and variable Gram + Intracellular Bacteriacidal Concentration dependent Post antibiotic effect Absorbed well from all routes Large Vd Brain and prostate Elimination: Renal excretion and metabolism Resistance: Alteration of target enzymes, 2-4 fold increases in MIC values, decreased drug permeation into bacterial cells	Adverse effects Articular cartilage damage Bone Marrow Suppression Retinal degeneration Tendon rupture (humans)
Rifampin		Inactivation of DNA-dependent RNA polymerase = inhibition of RNA synthesis Higher concentrations needed for inhibition of mammalian enzymes	Highly lipophilic Gram + Very limited Gram – Intracellular organisms Bactericidal Concentration dependent Good oral bioavailability Distribution: Lungs, liver, bile, urine, neutrophils, macrophages	Interactions: Induction of metabolic enzymes, induction of P-gp Adverse effects: Orange red urine, saliva, tears Hepatitis reported in dogs Thrombocytopenia, hemolytic anemia, anorexia

			Metabolism: Active metabolite, biliary excretion, some renal excretion Resistance Develops quickly when used alone Decreased affinity for RNA polymerase	