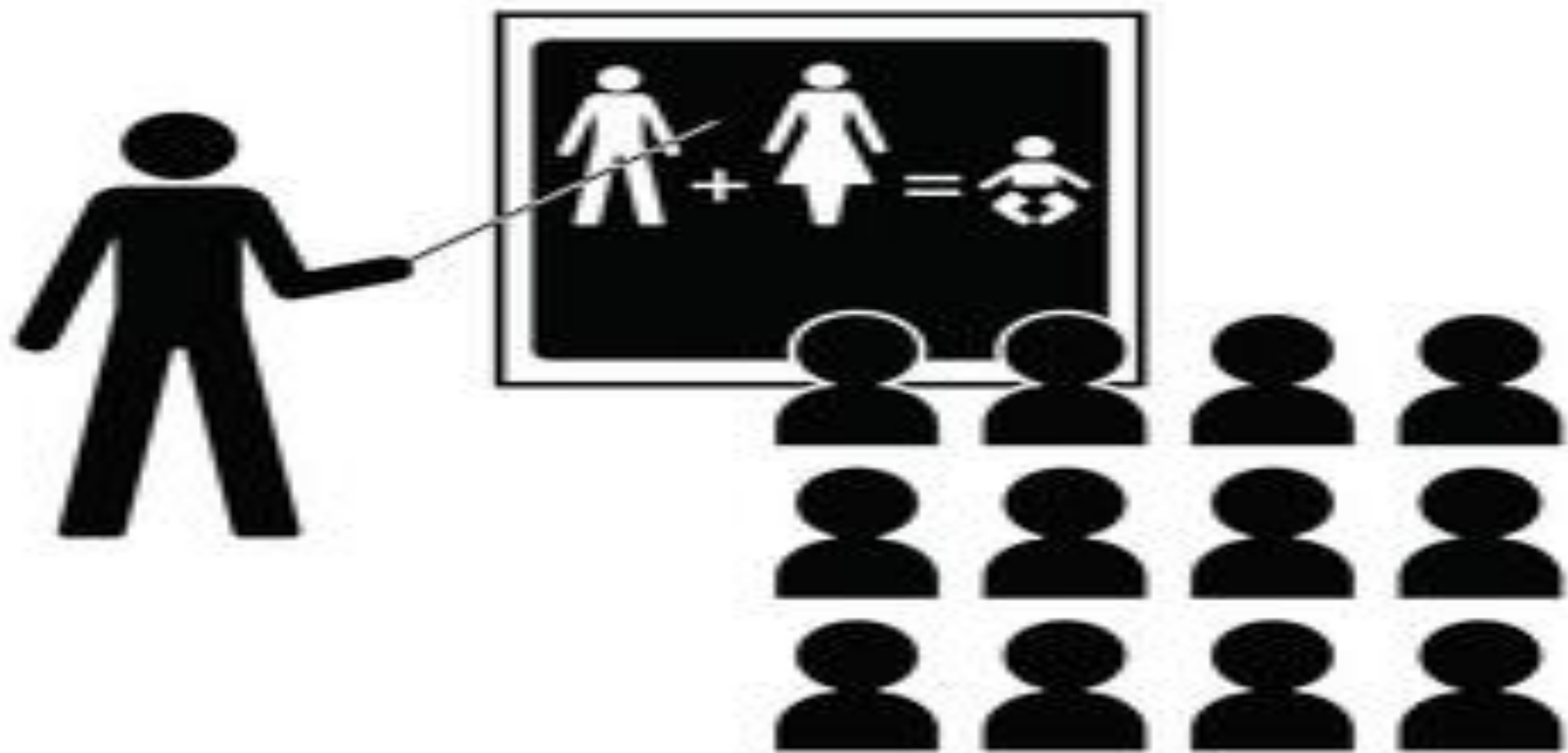


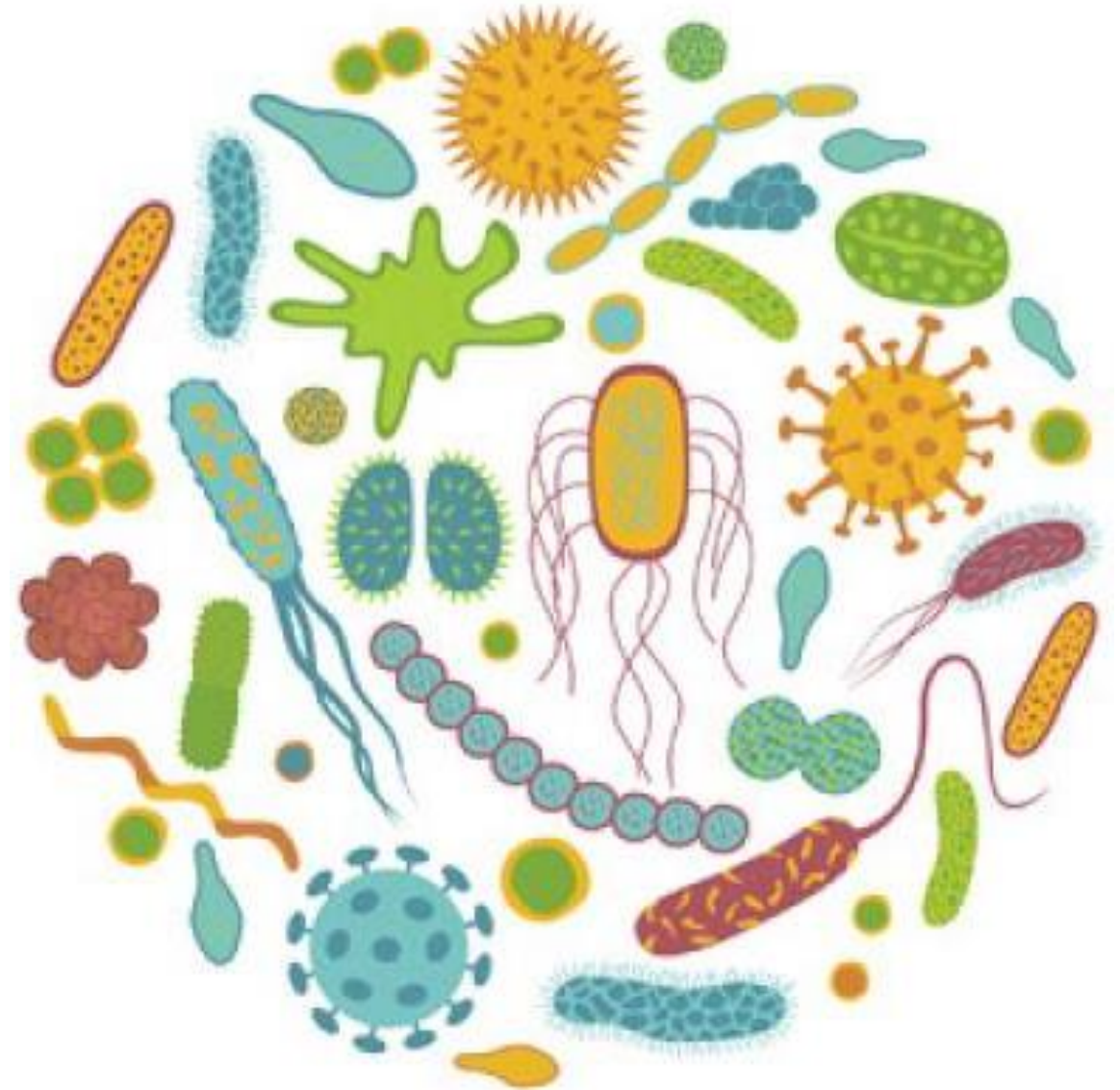
Battling Bugs With More Than Baytril

Nicki Rosenhagen, DVM
PAWS Wildlife Center



Antimicrobial Drugs

- Drugs that suppress the activity of organisms
 - Bacteria, fungi and viruses
 - Antibiotics = Antibacterial drugs



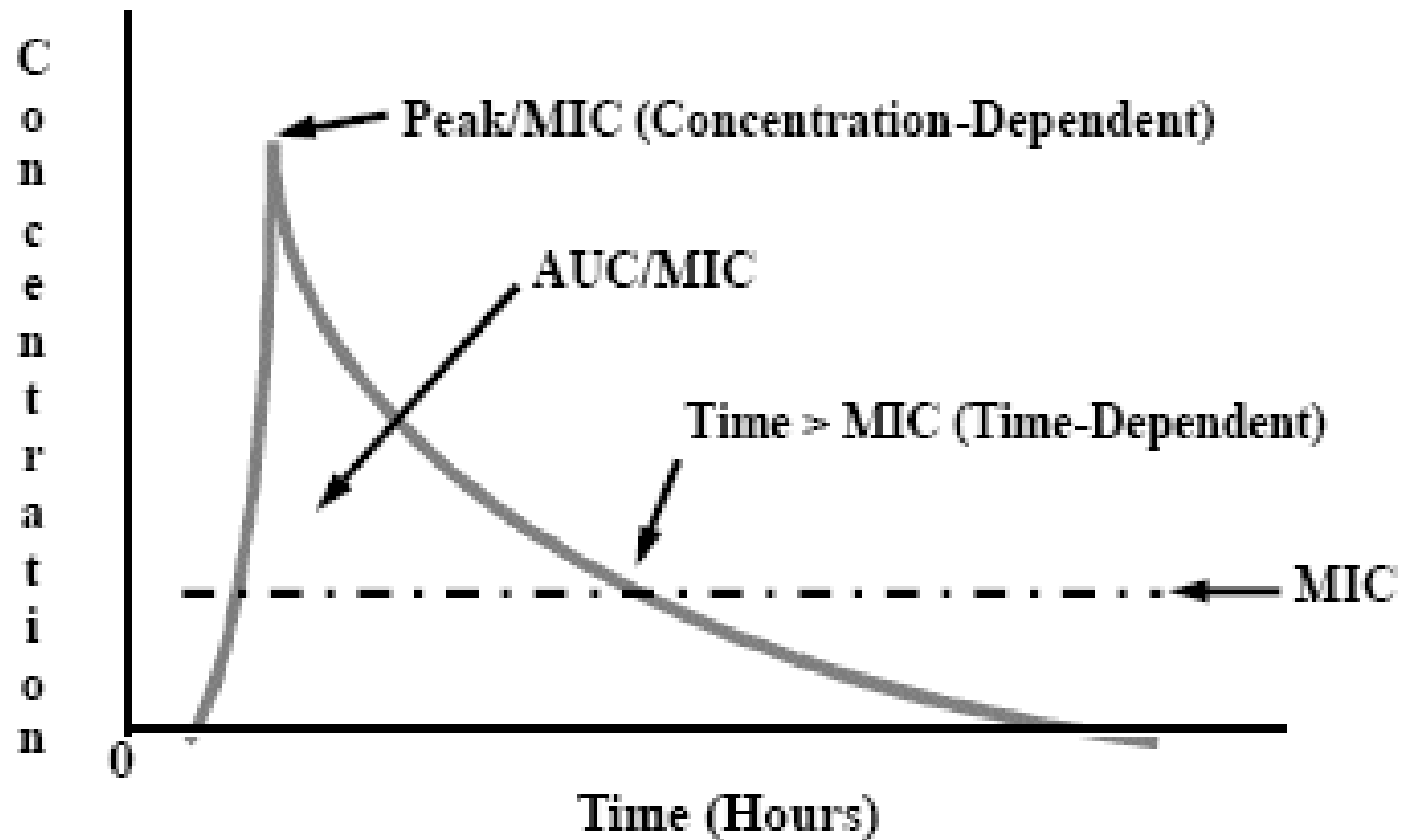
Antibiotic Drugs

- Variable:
 - Mechanisms of action
 - How the drug damages or kills the bacteria
 - Bactericidal vs bacteriostatic
 - Spectrums of activity
 - What bacteria the drug is effective against
 - Tissue distribution
 - Locations in the body the drug can access
 - Dosing regimen
 - How much, how often and how long the drug should be administered
 - Side effects
 - The drug's negative effects on the host

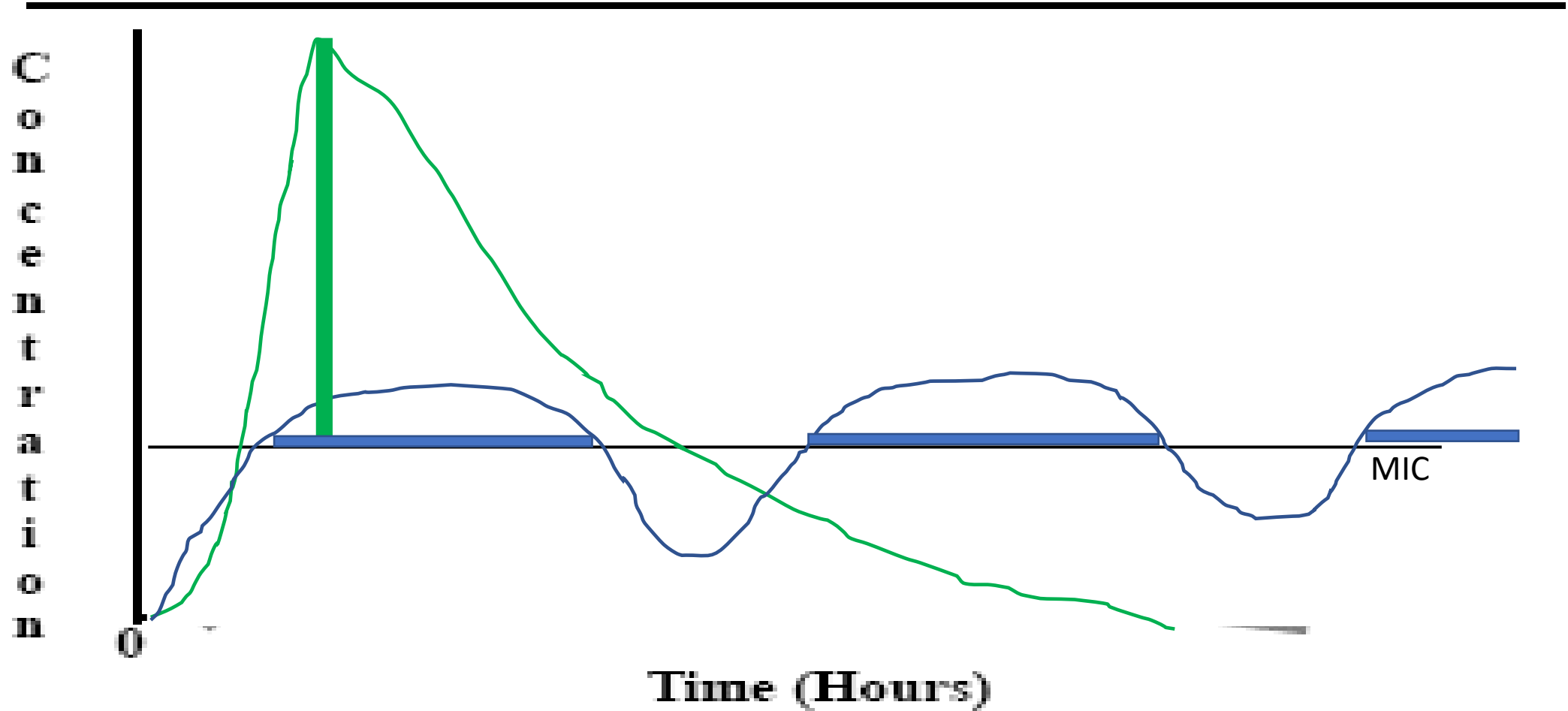
Gram Positive	Gram Negative
Aerobic	Anaerobic

Antibiotic Drugs

Minimum inhibitory concentration (MIC) is the lowest concentration of a drug that will prevent growth of a bacterium



Antibiotic Drugs



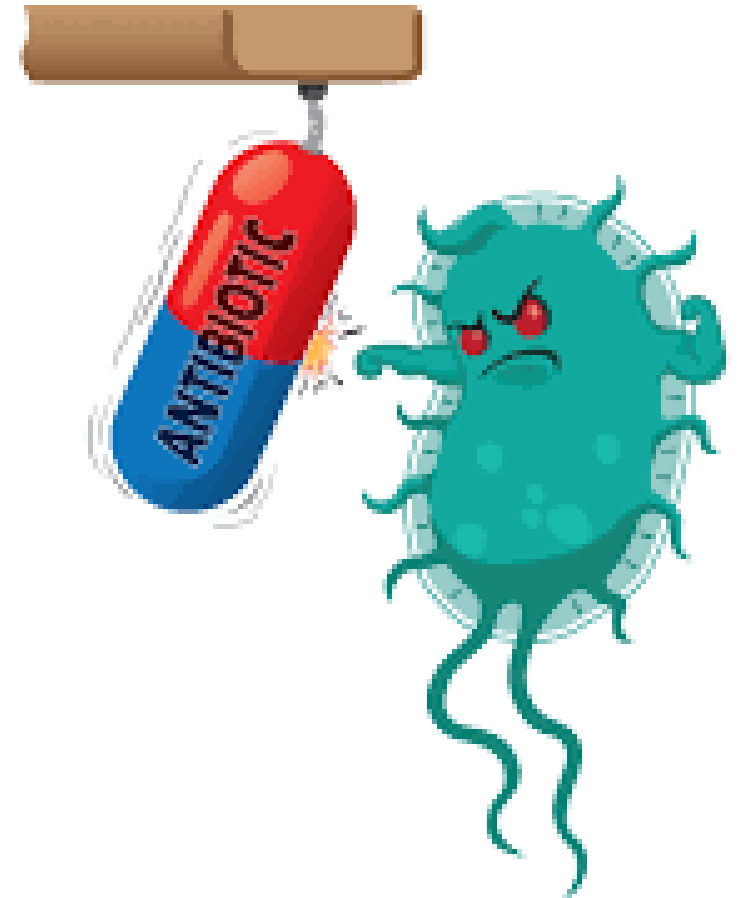


Antibiotic Drugs

- Importance of judicious use
 - Effectively and efficiently eradicate or prevent the infection
 - Limit side effects
 - Save time and money
 - Limit emergence of resistance
 - Many veterinary drugs are used in human medicine as well


Antibiotic Resistance

- Incorrect diagnosis
- Inappropriate:
 - Drug
 - Dose
 - Frequency
 - Route
 - Duration



Antibiotic Drugs

Tracking Acquired Antibiotic Resistance in Commensal Bacteria of Galápagos Land Iguanas: No Man, No Resistance

Maria Cristina Thaller , Luciana Migliore, Cruz Marquez, Washington Tapia, Virna Cedeño, Gian Maria Rossolini, Gabriele Gentile

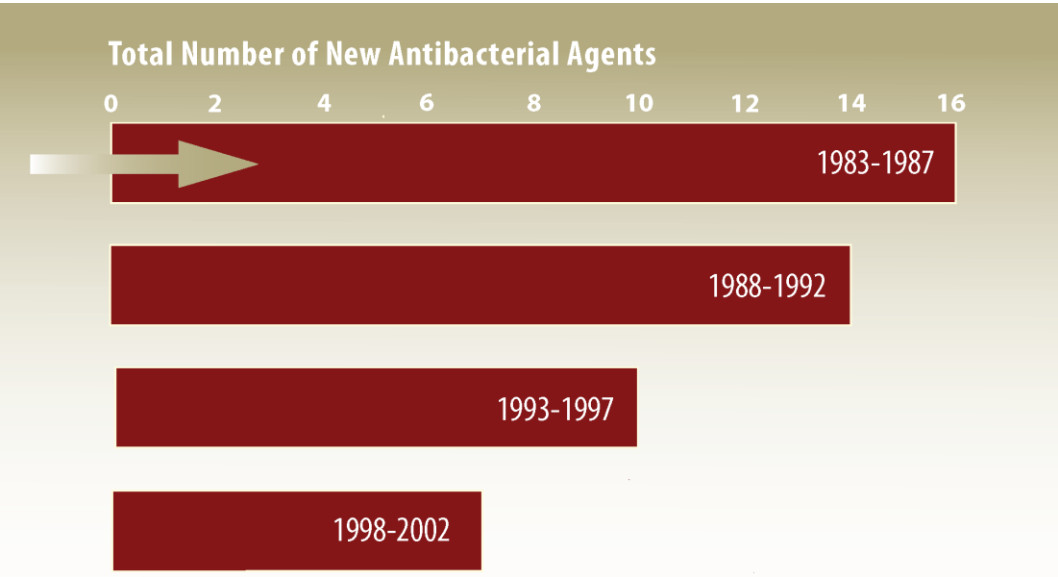
Background

Antibiotic resistance, evolving and spreading among bacterial pathogens, poses a serious threat to human health. Antibiotic use for clinical, veterinary and agricultural practices provides the major selective pressure for emergence and persistence of acquired resistance determinants. However, resistance has also been found in the absence of antibiotic exposure, such as in bacteria from wildlife, raising a question about the mechanisms of emergence and persistence of resistant strains under similar conditions, and the implications for resistance control strategies. Since previous studies yielded some contrasting results, possibly due to differences in the ecological landscapes of the studied wildlife, we further investigated this issue in wildlife from a remote setting of the Galapagos archipelago.

Conclusions/Significance

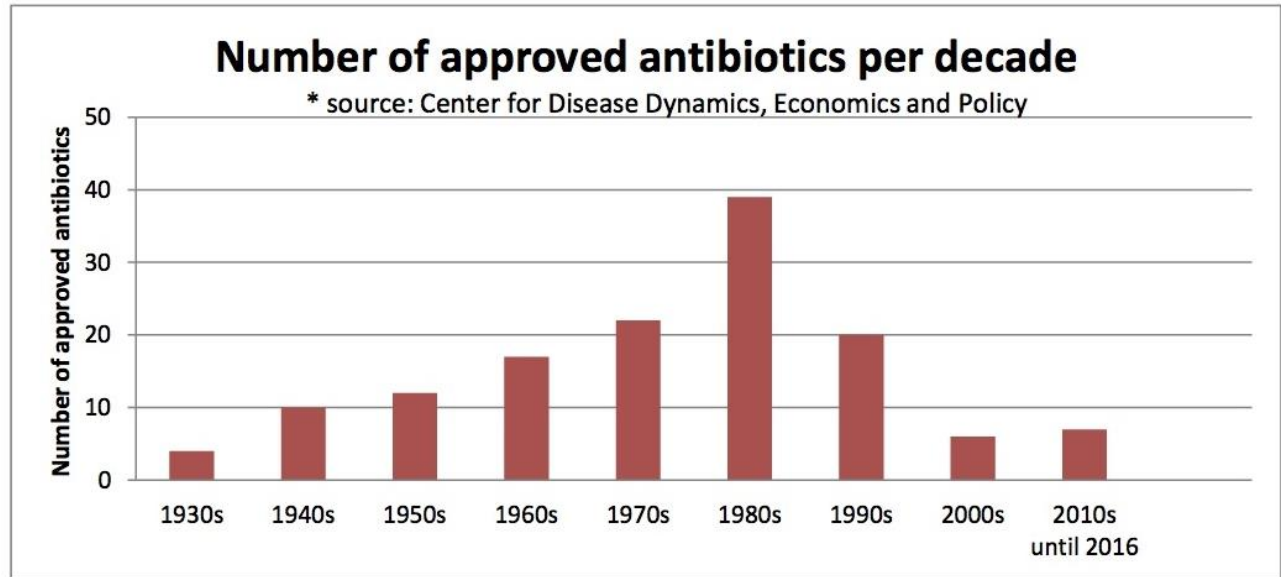
Where both the exposure to antibiotics and the anthropic pressure are minimal, acquired antibiotic resistance traits are not normally found in bacteria from wildlife, even if the ecological landscape is highly favourable to bacterial circulation among animals. Monitoring antibiotic resistance in wildlife from remote areas could also be a useful tool to evaluate the impact of anthropic pressure.

Antibiotic Drugs



ANTIBIOTIC DEVELOPMENT IS DWINDLING

Source: *The Epidemic of Antibiotic-Resistant Infections*, CID 2008:46 (15 January) Clin Infect Dis. (2011) May 52 (suppl 5): S397-S428. doi: 10.1093/cid/cir153



“Development of new antibacterial treatments is inadequate to address the mounting threat of antibiotic resistance, according to the annual pipeline report by the World Health Organization. The...antibacterial clinical and preclinical pipeline as stagnant and far from meeting global needs. Since 2017 only 12 antibiotics have been approved, 10 of which belong to existing classes with established mechanisms of antimicrobial resistance...”

STRAIN OF 2000

YOU ARE THE NEXT CLASS OF
DRUG-RESISTANT BACTERIA. AS
HUMAN CONTINUE TO ABUSE AND
OVERUSE ANTIBIOTICS, YOUR RANKS
WILL SWELL. SO, GO OUT THERE
AND MUTATE! AND REMEMBER:
THAT WHICH DOES NOT KILL US
MAKES US STRONGER!!!



Indications for the Use of Antibiotics

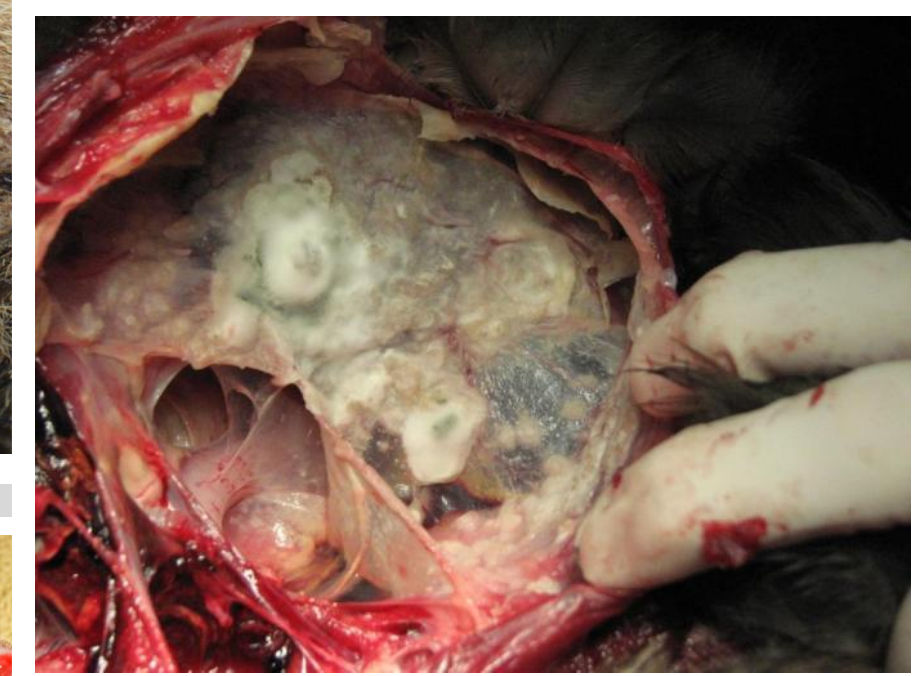
Ideally always have veterinary input

Work with a vet to develop standard operating procedures (SOP's) for common presentations

When a veterinarian is not available for consultation, care should be taken to determine if an antibiotic is indeed warranted. To do so, ask yourself the following questions:

Critical Questions

- Is there an active bacterial infection?
 - Redness, swelling, heat, discharge, odor
- If not, is there a high likelihood of infection without an antibiotic immediately?
 - Bite wounds
 - Open fractures



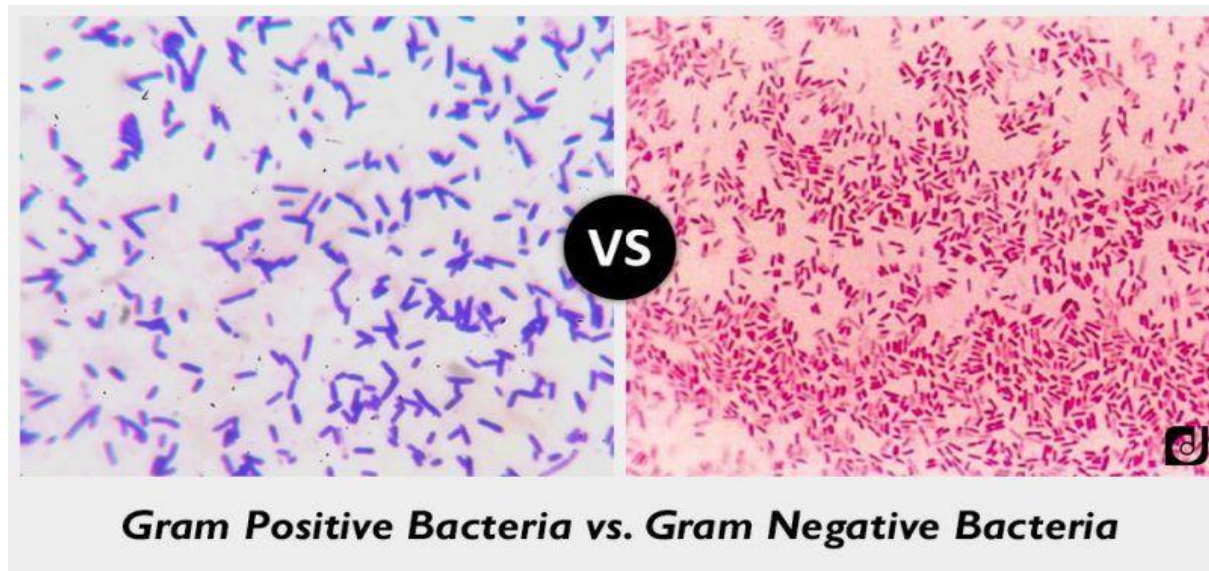
Critical Questions

- What part of the body is affected?
 - Skin, musculoskeletal, respiratory, gastrointestinal, central nervous system...



Critical Questions

- What type of bacteria is likely to be present?
 - Cytology and Gram stain
 - Access to oxygen
 - Deep punctures likely to have *anaerobic* bacteria while respiratory infections likely to be composed of *aerobic* bacteria



Critical Questions

- Are there side effects or contraindications to antibiotic use?



Critical Questions

- Are there any laws prohibiting use of an antibiotic?



Food Animal Residue Avoidance Databank

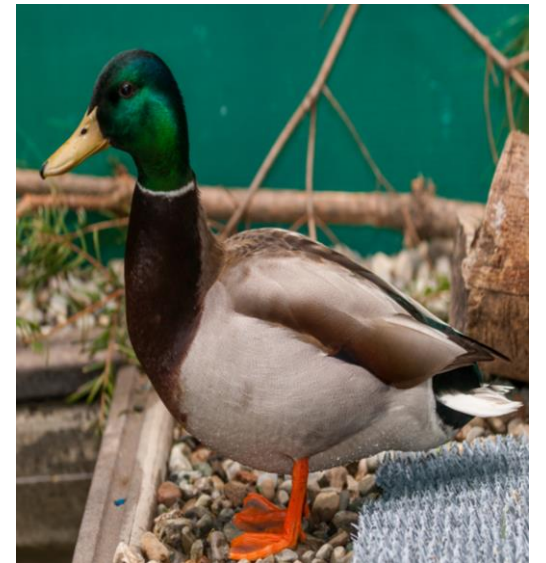
a component of the **Food Animal Residue Avoidance & Depletion Program**

GROUP I. Drugs with No Allowable Extra-Label Uses in Any Food-Producing Animal Species

- CHLORAMPHENICOL
- CLENBUTEROL
- DIETHYLSTILBESTEROL (DES)
- **FLUOROQUINOLONE-CLASS ANTIBIOTICS**
- GLYCOPEPTIDES – all agents, including VANCOMYCIN
- MEDICATED FEEDS
- **NITROIMIDAZOLES** – all agents, including DIMETRIDAZOLE, IPRONIDAZOLE, METRONIDAZOLE and others
- NITROFURANS – all agents, including FURAZOLIDINE, NITROFURAZONE and others

Critical Questions

- Are there any laws prohibiting use of an antibiotic?





Indications for Antibiotic Use in Wildlife Patients

- Immediate implementation of an appropriate antibiotic drug is warranted with the following presentations:
 - Predator attacks with significant wounds
 - Cat attacks even without obvious wounds
 - Open fractures
 - Wounds with purulent or caseous discharge
 - Other presentations with a known bacterial component
 - E.g. *Mycoplasma conjunctivitis* in finches



Indications for Antibiotic Use in Wildlife Patients

- Immediate implementation of an appropriate antibiotic drug is sometimes warranted with the following presentations:
 - Significant soft tissue injuries NOT from a predator
 - Severe aspiration
 - Open umbilicus in mammals
 - Primary viral/parasitic/fungal infections with highly likely secondary bacterial infections
 - Emaciation
 - Others...



Indications for Antibiotic Use in Wildlife Patients

- Presentations that DO NOT require immediate antibiotic use:
 - Diarrhea
 - Minor soft tissue injuries
 - Road rash, small lacerations not caused by a predator
 - Blunt force trauma without open fractures
 - HBV, window strike, road strike



Amoxicillin-Clavulanic Acid (Clavamox, Augmentin)

- Class: Beta Lactam
 - Includes penicillins and cephalosporins
- Mechanism of action:
 - Inhibit cell wall synthesis – need active growth
 - Time dependent
 - -cidal
- Effective against:
 - Aerobes and anaerobes; Gram +> Gram –
 - Newer generations have different regions of efficacy
- Tissue distribution:
 - Good soft tissue, fluid, bone; poor in protected (CNS)
- Common indications:
 - Predator attack/other soft tissue wounds
 - Respiratory infections
 - Open fractures
- Side effects:
 - GI upset
 - Consider pro/prebiotic use
- Contraindications:
 - Hind gut fermenters



Cefovecin (Convenia)

- Class: Beta Lactam (3rd generation cephalosporin)
 - Includes penicillins and cephalosporins
- Mechanism of action:
 - Inhibit cell wall synthesis - need active growth
 - Time dependent - long-acting formulation that can exert effect for 7-14 days depending on the microbe
 - -cidal
- Effective against:
 - Aerobes and anaerobes; Gram + and Gram - in carnivores; little to no activity in other mammals, birds or herptiles
- Tissue distribution:
 - Good soft tissue, fluid, bone; poor in protected (CNS)
- Common indications:
 - Should be reserved for animals that cannot be easily/safely medicated daily or based on C&S results
 - Predator attack/other soft tissue wounds
 - Open fractures
- Side effects:
 - Rare - GI upset
- Contraindications:
 - Very young animals (<8 weeks)
 - Food animals
 - Birds, herptiles, non-carnivores

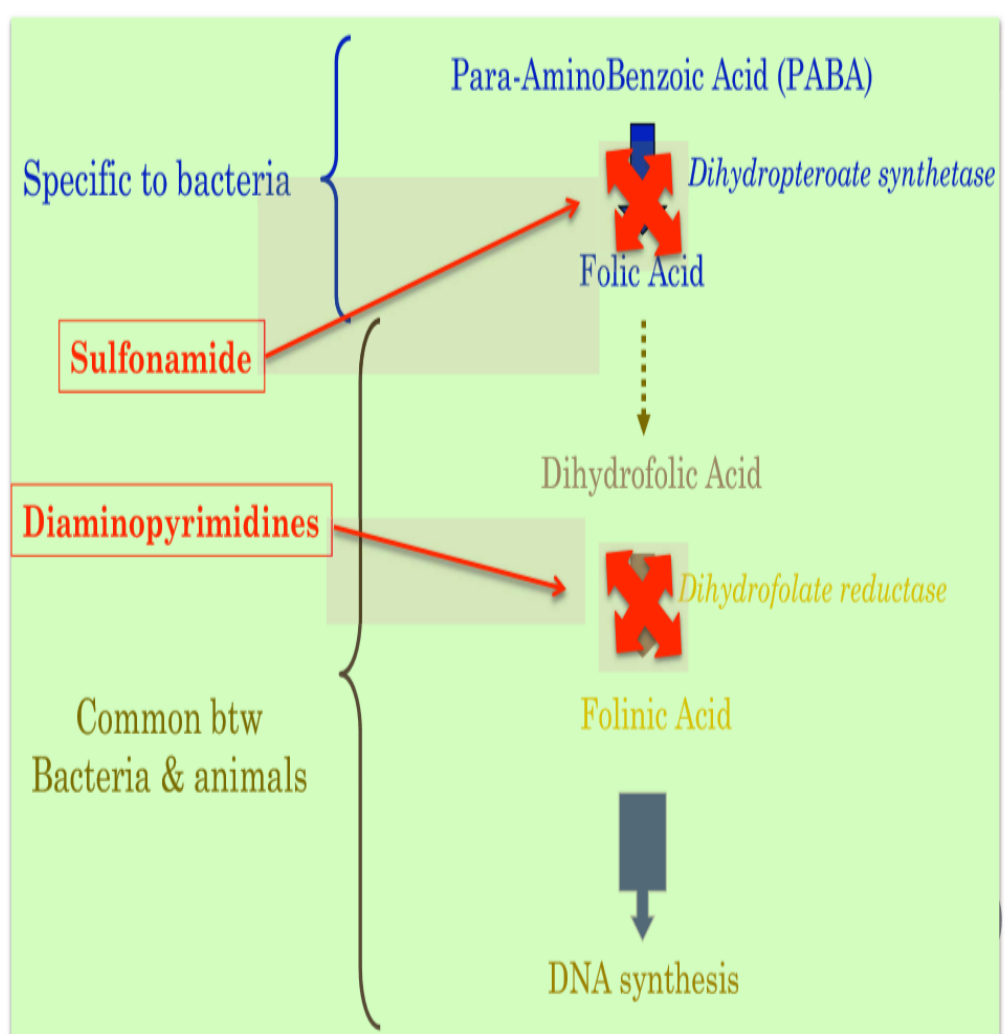


Enrofloxacin (Baytril)

- Class: Fluoroquinolone
- Mechanism of action:
 - Disrupts DNA replication
 - Concentration dependent
 - -cidal
- Effective against:
 - Gram - aerobes
- Tissue distribution:
 - Soft tissue, fluid, bone
 - Moderate deep and protected
- Common indications:
 - Susceptible Gm- bacteria (C&S) based on veterinary prescription
 - Use other appropriate antibiotics first, if possible
 - “Baytril Because” ☹️ - avoided as an empiric choice by veterinarians
- Side effects:
 - Joint damage in young canids
 - Retinal degeneration in cats
- Contraindications:
 - Food animals
 - Young, growing animals



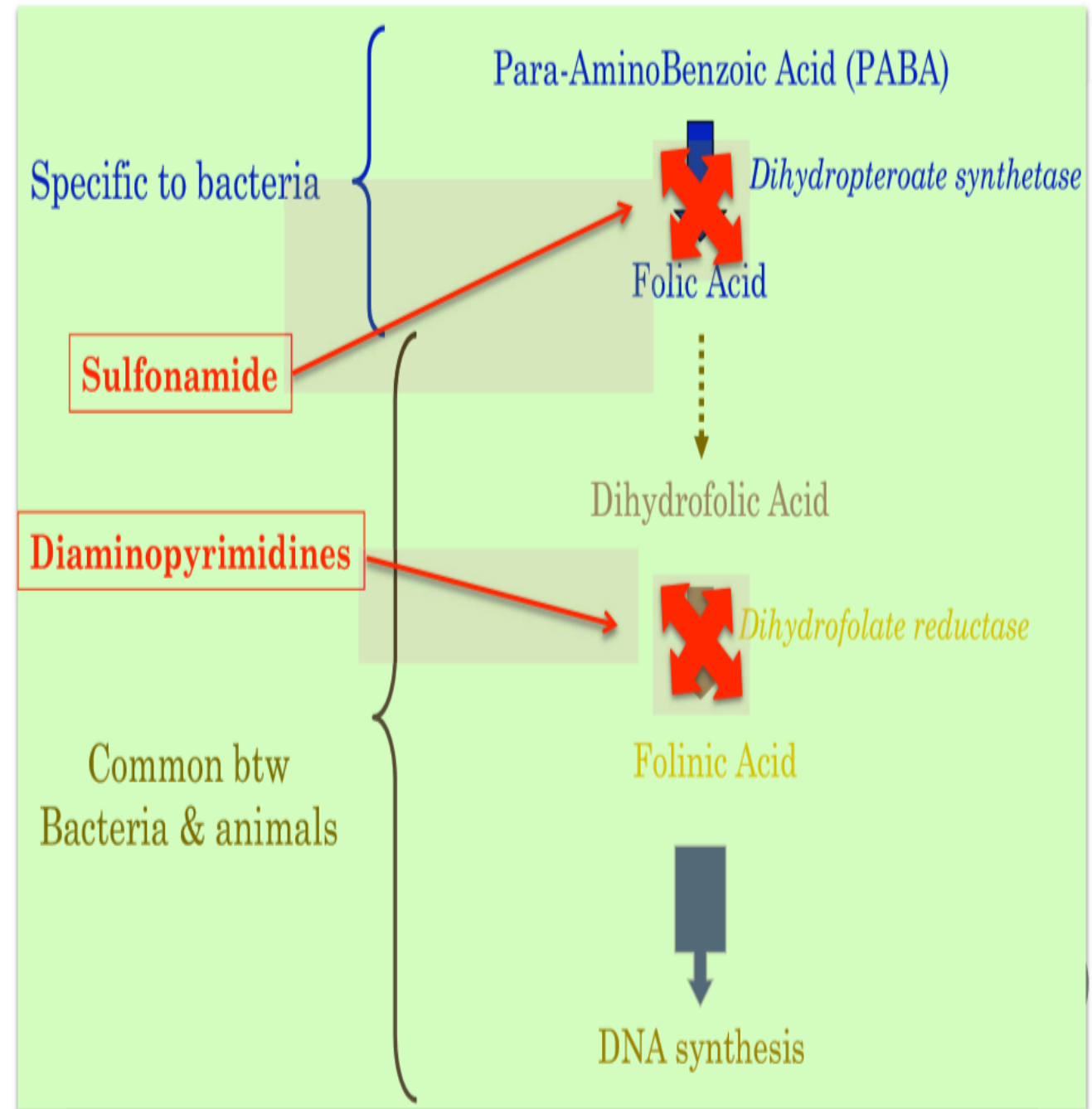
Potentiated Sulfonamides (SMZ-TMP, Sulfatrim, TMS)



- Mechanism of action:
 - Inhibit folic acid synthesis
 - Time dependent
 - -cidal
- Effective against:
 - Gram + and Gram - aerobes; some protozoans
- Tissue distribution:
 - Good soft tissue, fluid, bone, deep and protected
- Common indications:
 - Soft tissue injuries
 - Safe for hind gut fermenters
 - Respiratory infections
 - Open fractures

Potentiated Sulfonamides (SMZ-TMP, Sulfatrim, TMS)

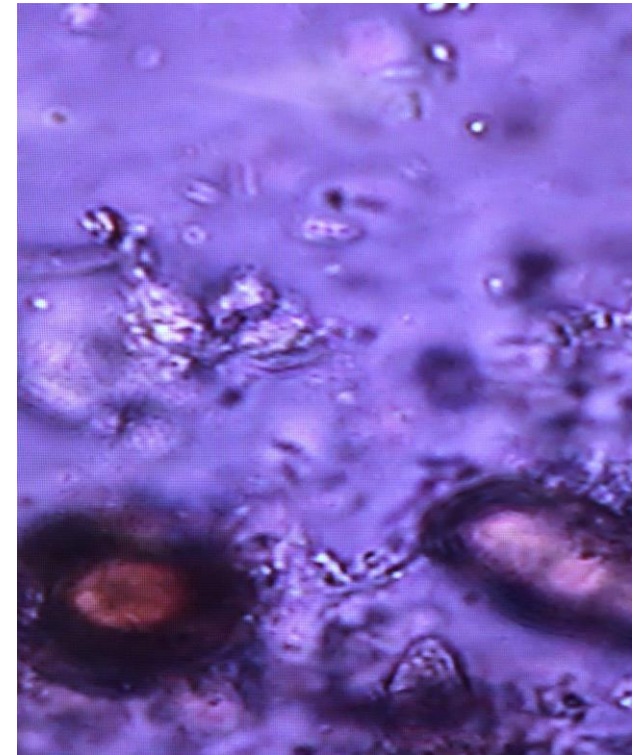
- Side effects:
 - Rare in wildlife
- Contraindications:
 - Purulent or necrotic tissue
 - Pregnant animals



Metronidazole (Flagyl)

- Class: Nitroimidazole
- Mechanism of action:
 - Damage DNA
 - Time or concentration dependent depending on microbe
 - -cidal
- Effective against:
 - Anaerobes; Gram ->Gram +; many protozoans
- Tissue distribution:
 - Good soft tissue, fluid, bone, deep and protected
- Common indications:
 - Bacterial gastrointestinal infections
 - Protozoan gastrointestinal infections (trichomonas, giardia)
- Side effects:
 - Neurotoxicity
 - Unpalatable

- Contraindications:
 - Food animals
 - Pregnant animals



Recent C&S Results from PAWS' Patients

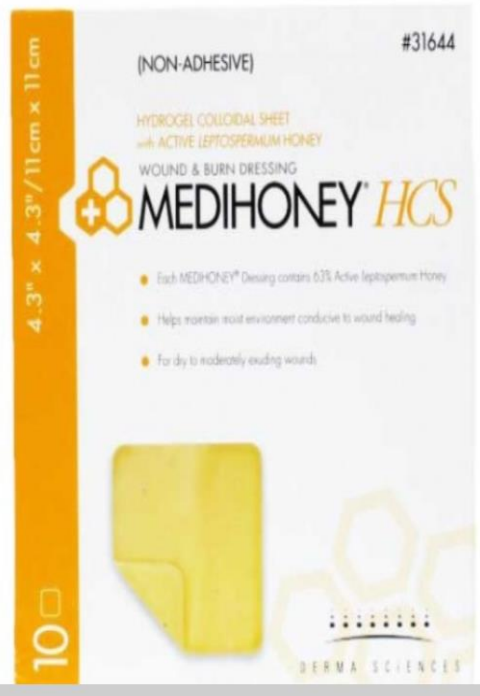
Case	Clavamox	SMZ-TMP	Baytril
GWGU Hock Wound	S	S	I
GBHE Open Fracture	R	S	S
MALL Surgical Site	R	R	R
PEFA Digit Amputation Site	S	S	I
GBHE Open Fracture	S	S	R
BAEA Surgical Site	R	R	R
GWGU Skull Abscess	S	S	S
AMCR Hock Wound	S	N/A	S



Regional Limb Perfusion

- Common therapy implemented in human and equine medicine for distal extremity infection
 - Higher concentrations locally at the site of infection
 - Fewer drug-related side effects?
 - Success reported with single administration

Non-Pharmaceutical Options for Control of Bacterial Infections



- Flush open wounds
- Wound cleaning products
 - 0.05% chlorhexidine, 0.1% povidone-iodine
- Medicinal honey, sugar
- Wound management products
 - Vetericyn, SSD, aloe vera, triple antibiotic ointment
- Use PPE to prevent contamination
- Keep instruments/supplies clean
- Isolate suspect individuals

Take Home Messages

- Work with a veterinarian whenever possible
 - Directly or via development of SOP's
- In other cases, make sure there is an active *bacterial* infection or a high likelihood of one if an antibiotic is not implemented
- Use non-pharmaceutical options when possible to treat and prevent infections
- When a systemic antibiotic drug is needed, make a selection based on the infection location and the most likely bugs
- Consider side effects and contraindications



Questions?

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