ANTIBIOTIC RESISTANCE

Different types of bacteria possess a wide variety of genes. Some of these genes are encoded in small enough chunks of DNA (plasmids) that they can be passed via pili between organisms. There are even cases where a yeast cell (a eukaryote) exchanged plasmids with *E.coli* (a prokaryote)!!

Antibiotics tend to work by inhibiting cell wall formation; inhibiting protein synthesis; or blocking a reaction necessary for metabolism. Resistance may involve:

- Plasmids that allow an alternate way to build a cell wall
    - Example: vancomycin-resistant bacteria
- Plasmids that block membrane transport of antibiotics inside the cell; or plasmids that actively pump out the antibiotic before it can have effect.
    - Example: Bacteria resistant to tetracycline and/or aminoglycosides are particularly good at this
- Plasmids that produce enzymes that deactivate antibiotics
    - Example: *Staph aureus* strains may produce penicillinase or other enzymes that deactivate penicillin or methicillin and similar-acting antibiotics
- Plasmids that allow alternate metabolic pathways to occur and bypass a pathway that an antibiotic blocked.
    - Bacteria resistant to sulfanilamides often use this method of resistance.

A few famous Antibiotic-Resistant Microbes:

- *Methicillin-resistant Staph aureus* (MRSA): Actually, this strain of Staph aureus has a plasmid that codes for a gene that deactivates most every cell wall inhibiting antibiotic (not just methicillin). Sometimes it is caused "multi-drug resistant Staph aureus."
- *Vancomycin-Resistant Enterococcus* (VRE)
- *Multi-drug resistant tuberculosis* (MDR-TB)
- *Pseudomonas aeruginosa* is resistant to most antibiotics
- *Clostridium dificile*
- *Klebsiella pneumoniae*