



ANTI-MICROBIAL RESISTANCE

RAKESH SHARDA

**Department of Veterinary Microbiology
NDVSU College of Veterinary Science & A.H.,
MHOW**

Introduction

- **Antimicrobial drug resistance (AMR) is the ability of a microbe to resist the effects of medication which was previously used to treat them.**
- Resistant organisms (they include bacteria, fungi, viruses and some parasites) are able to withstand attack by antimicrobial medicines, such as antibiotics, antifungals, antivirals, and antimalarial . Standard treatments become ineffective and infections persist increasing risk of spread to others.
- AMR is responsible for millions of death worldwide and is considered as a major health concern nowadays; around 700 000 human deaths worldwide are attributed annually to antibiotic resistant infections.

ORIGIN OF RESISTANCE

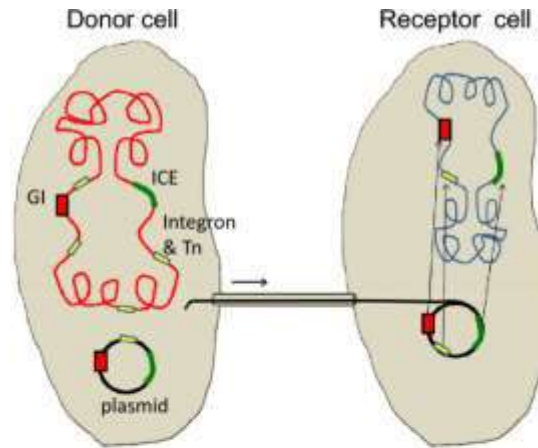
Bacterial resistance to antimicrobial agents may be intrinsic or acquired, intrinsic resistance as resistance of *Mycoplasma* species to B-lactams antibiotic, due to its lack of cell wall and pleomorphic characters.

And acquired resistance is arise from de novo mutation of DNA sequence or by horizontal gene transfer by different mechanisms (transformation, transduction and conjugation).

Acquired resistance(AR)

- Acquired resistance is said to occur when a particular microorganism obtains the ability to resist the activity of a particular antimicrobial agent to which it was previously susceptible.
 - **By mutation**
 - **By horizontal gene transfer**
- 1. **Mutation** – It is defined as a permanent change(s) in the sequence of DNA nucleotide of gene. This change can take place either by alteration, loss or gain of the nucleotide.
- 2. **Horizontal gene transfer(HGT)** – It is a recombination between two genetically different DNA molecules, then the resistance is acquired
 - **Conjugation**
 - **Transformation**
 - **Transduction**

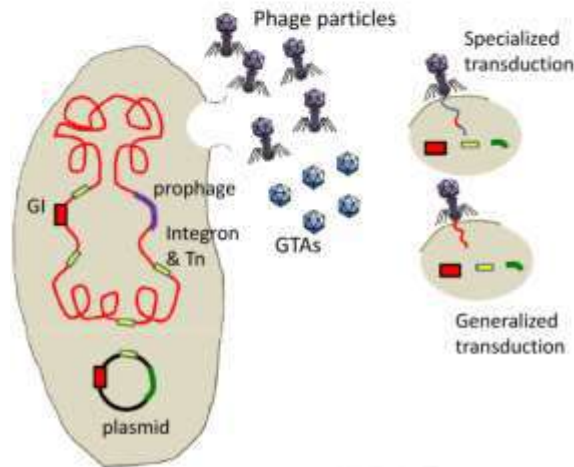
Transfer of ARGs through MGEs



Requires cell-cell contact

ARGs mobilization in:

- - Plasmids
- ▬ - Integrons/ Transposons
- - GI (through conjugation)
- └ - ICE (through conjugation)



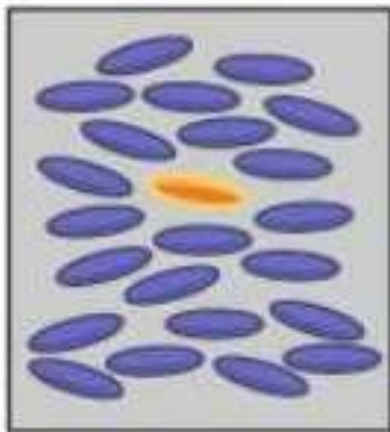
Not cell-cell contact

ARGs mobilization in:

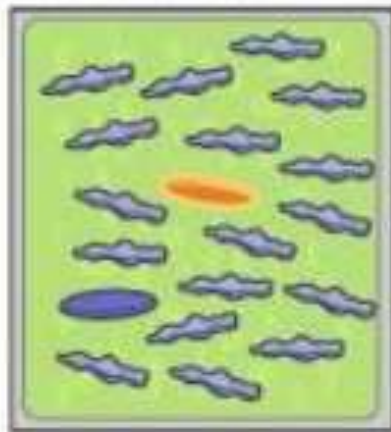
- - Phages
- - Composed elements
- - Plasmid-phage
- ▬ - Transposon-phage
- - GI-phage
- - GTAs

How do drug resistant bugs arise?

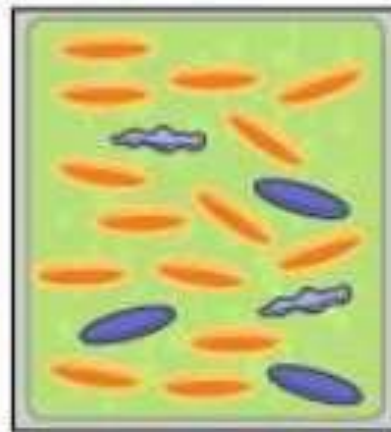
1
A bunch of bacteria,
including a resistant
variety...



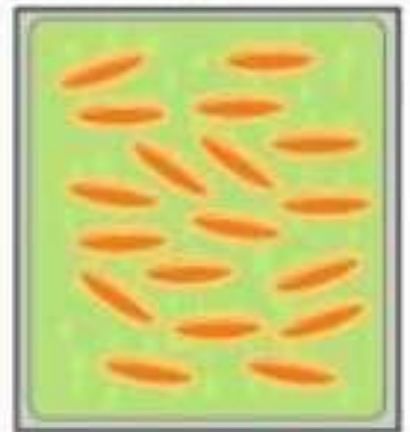
2
...get bathed in
antibiotics. Most
of the normal
bacteria die.





3
The resistant
bacteria multiply
and become more
common.



4
Eventually, the
entire infection
evolves into a
resistant strain.

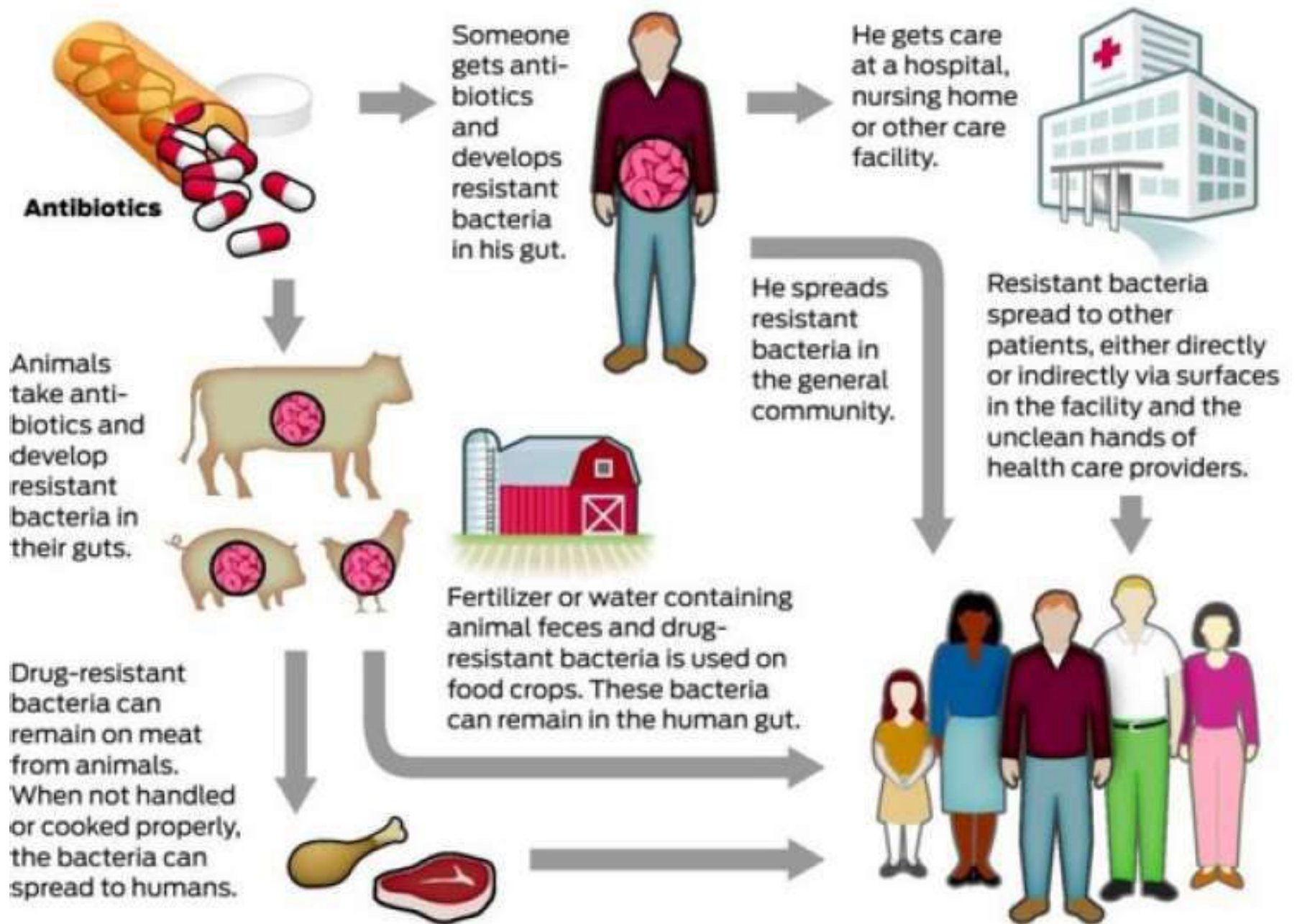


 normal bacterium

 dead bacterium

 resistant bacterium

How antibiotic resistance spreads



Different antibiotic resistance mechanisms in bacteria

- **Antibiotic modification** involves the addition of acetyl, phosphate, or adenyl groups to aminoglycosides by N-acetyl transferases (AAC), O-phosphotransferases (APH), and O-adenyltransferases (ANT).
- **Antibiotic degradation** is observed with β -lactamases, which hydrolyze the antibiotic.
- **Antibiotic efflux pumps** remove the antibiotic from the cell using energy from ATP hydrolysis in ABC pumps.
- **Target modification** includes various target alterations, such as 23S rRNA or 16S rRNA methylation
- **Antibiotic sequestration** involves proteins that can associate with the antibiotic and block them from reaching their targets.
- **Target bypass** involves generation of additional antibiotic targets or subunits that are not susceptible to binding of the antibiotic.

