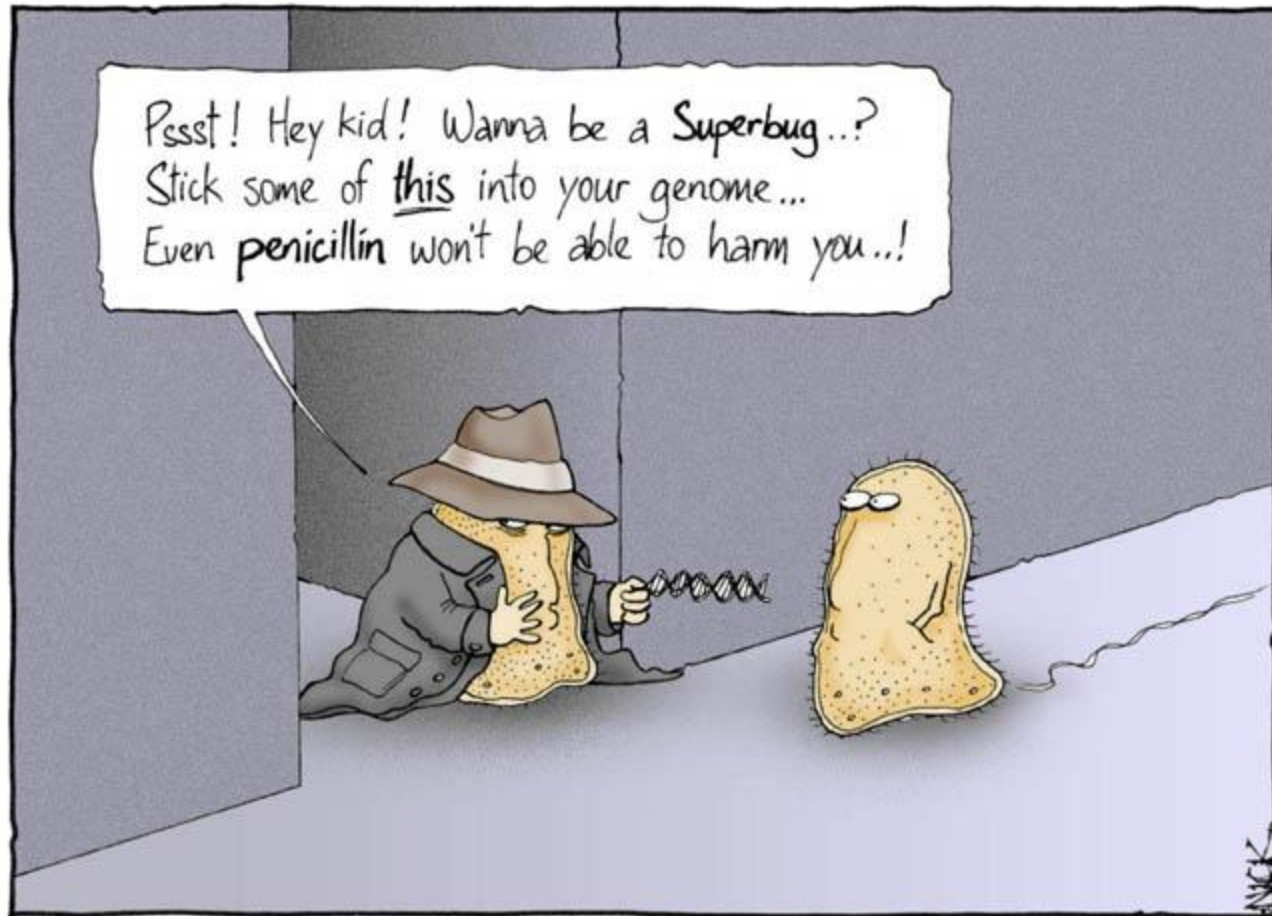


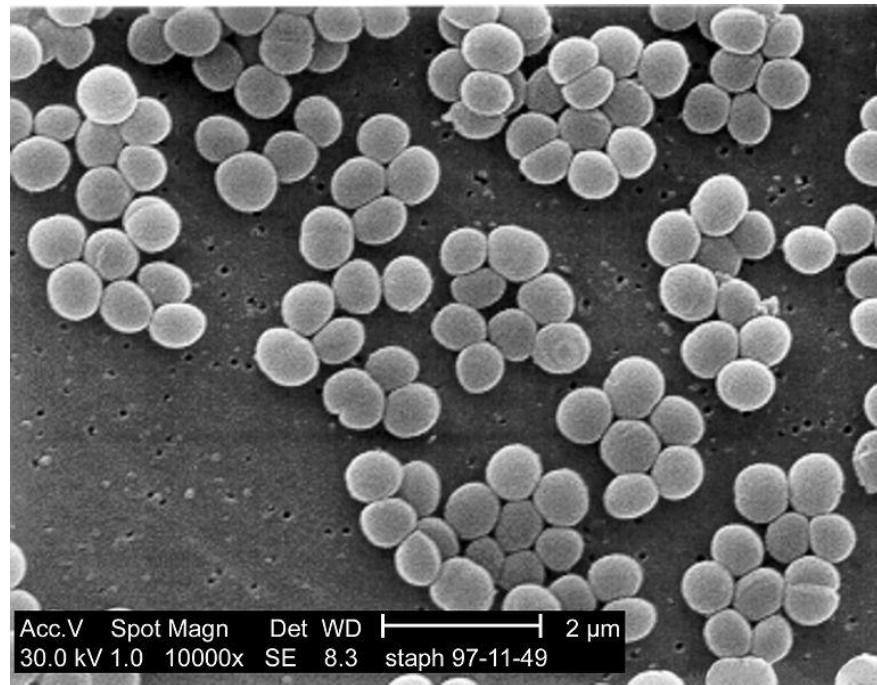
Lecture 6: Antibiotic Resistance



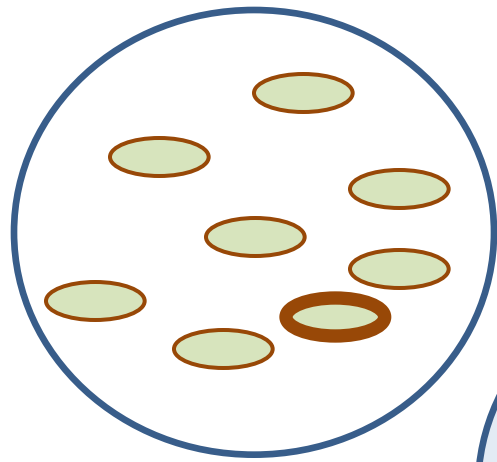
It was on a short-cut through the hospital kitchens that Albert was first approached by a member of the Antibiotic Resistance.

How does natural selection act on a bacterial population?

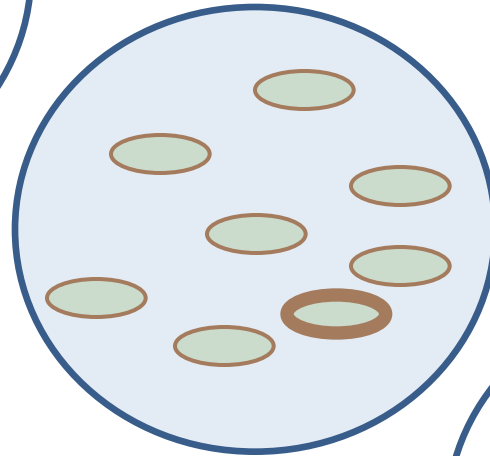
How do genes for resistance appear in the first place?



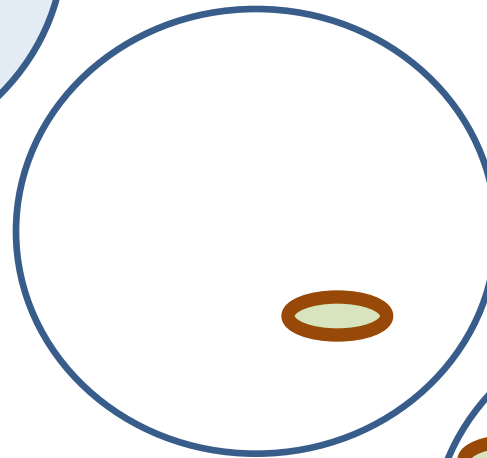
How natural selection acts on a bacterial population exposed to an antibiotic.



Original population

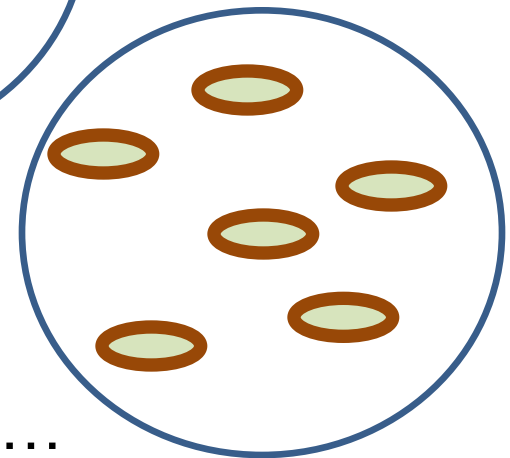


Add penicillin



After penicillin

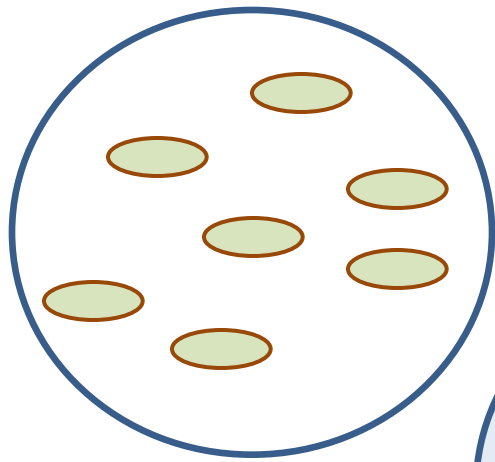
Example 1



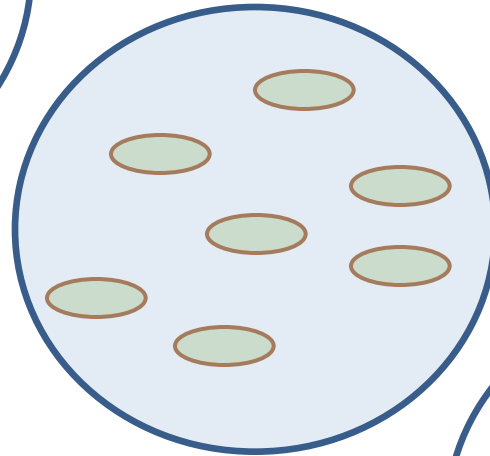
Later...

How natural selection acts on a bacterial population exposed to an antibiotic.

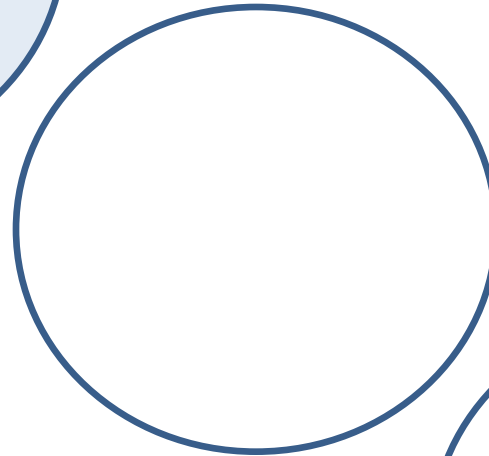
Example 2



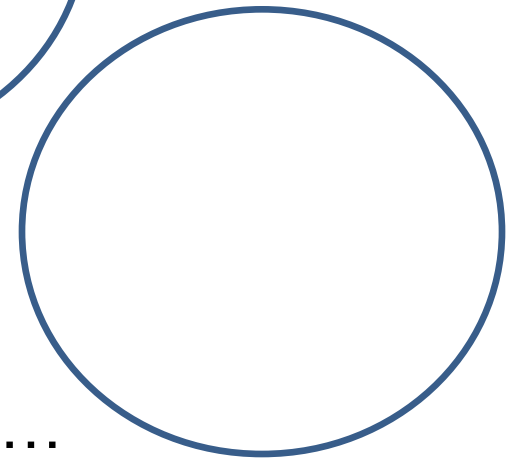
Original population



Add penicillin

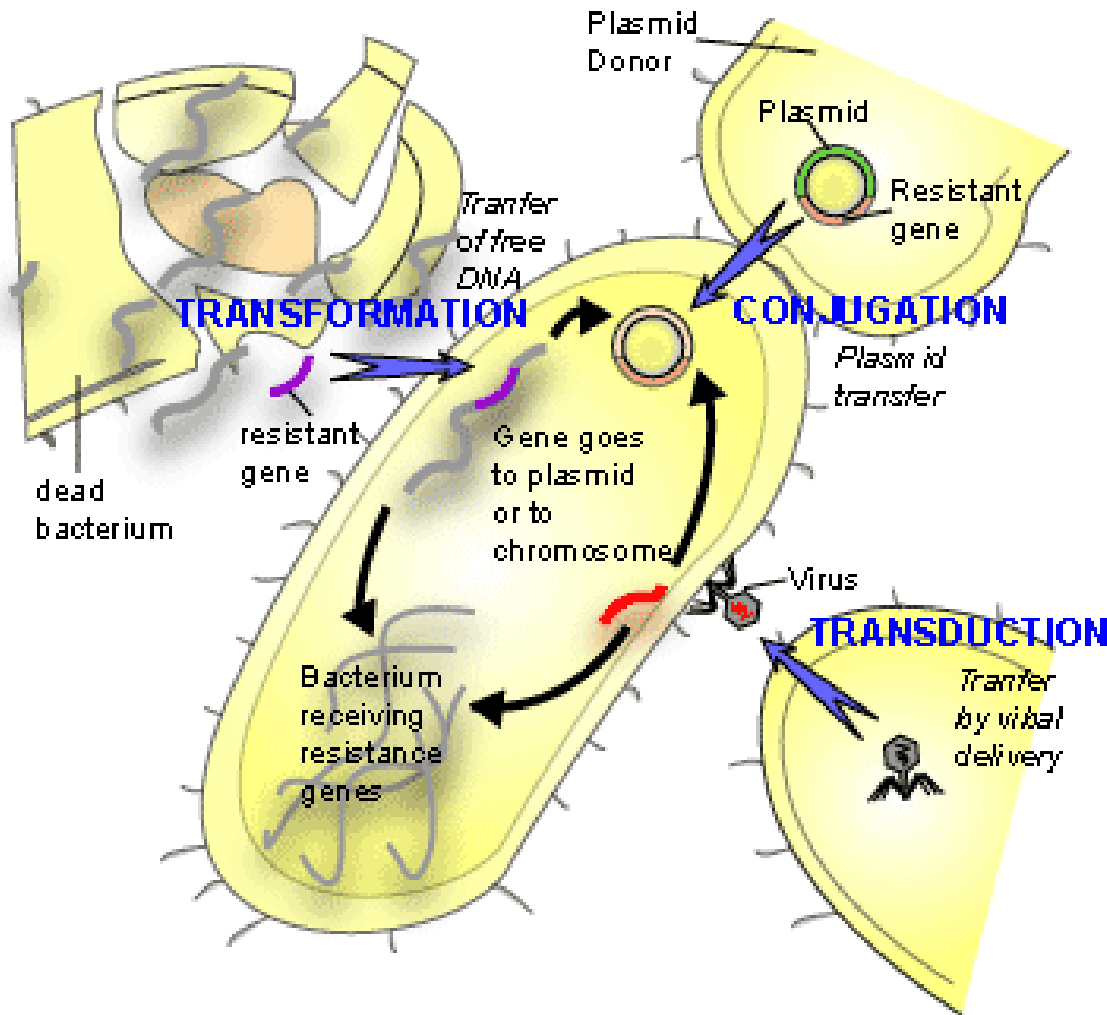


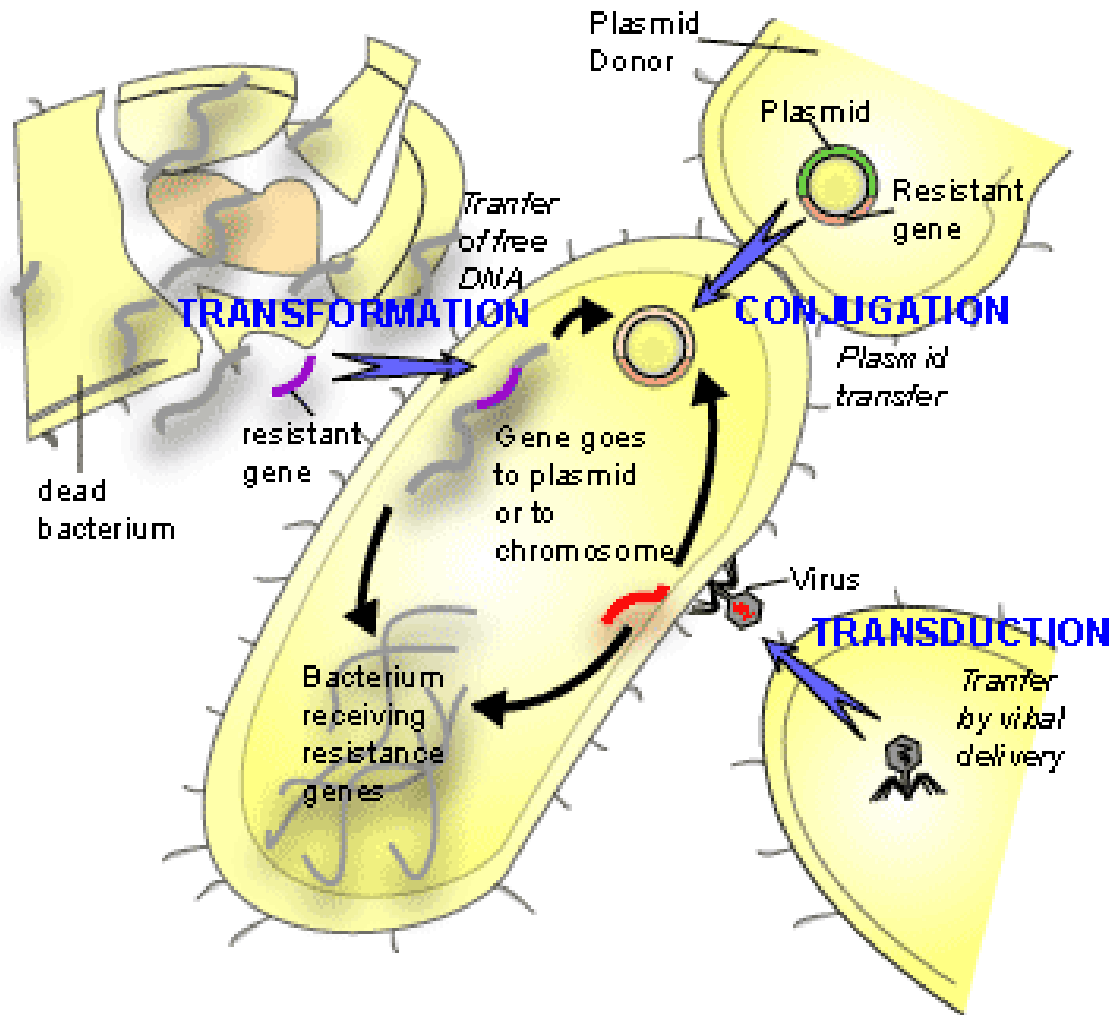
After penicillin



Later...

Bacteria can acquire new genetic information via three mechanisms (plus mutation)





Transformation

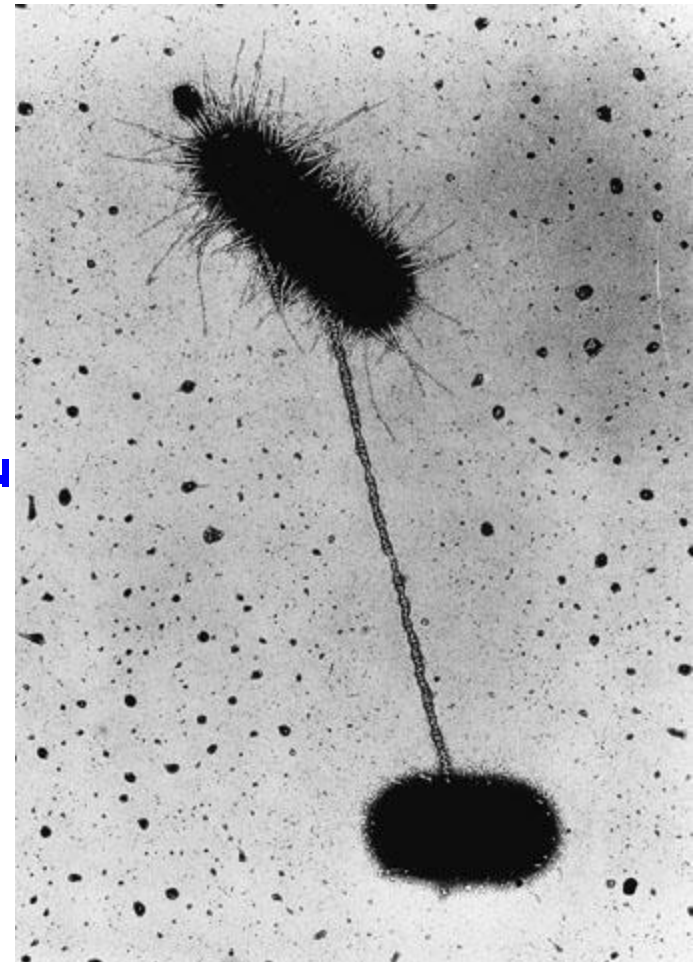
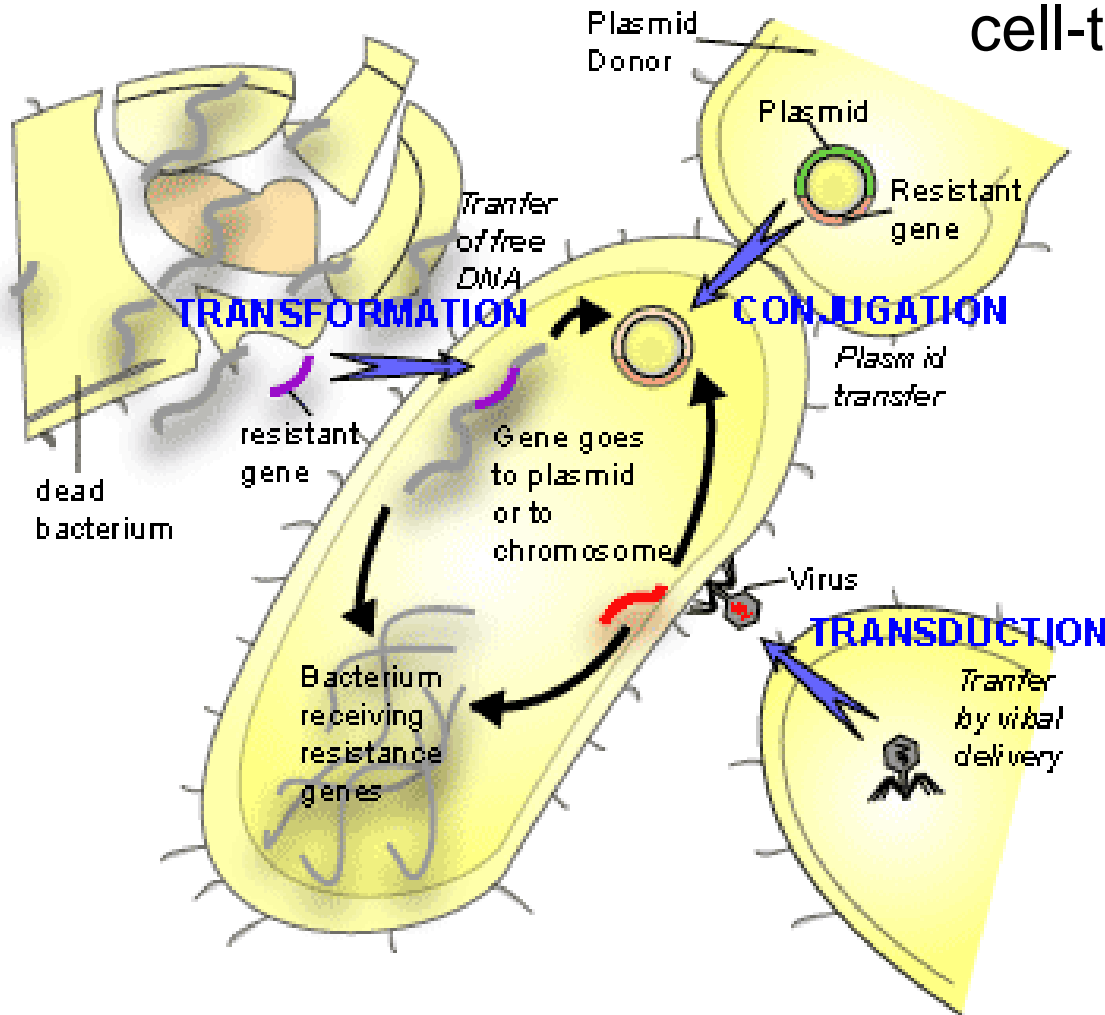
The genetic alteration of a cell resulting from the uptake and expression of foreign genetic material (DNA).

Competence (for bacteria)

The ability of a cell to take up extracellular ("naked") DNA from its environment.

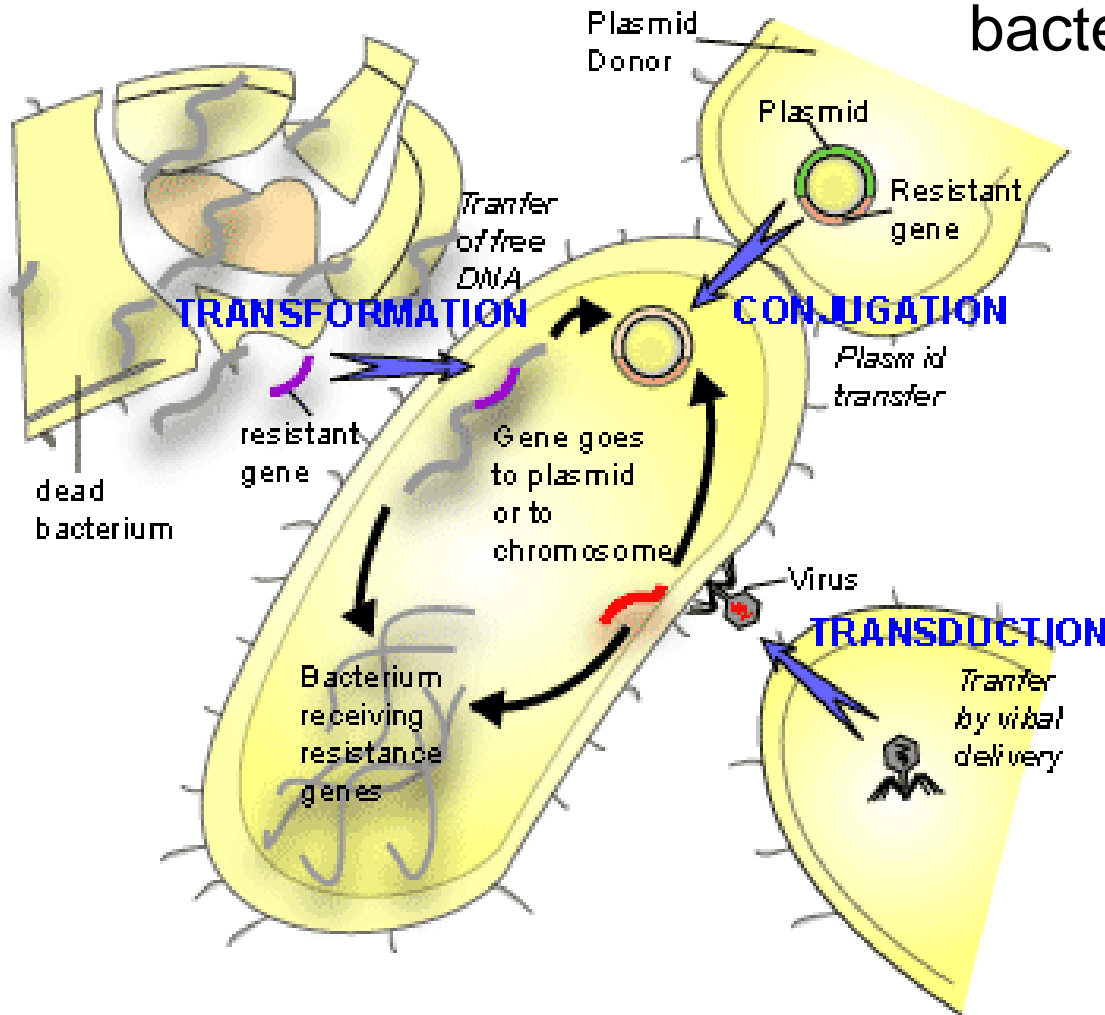
Conjugation

The transfer of genetic material between bacteria through direct cell-to-cell contact



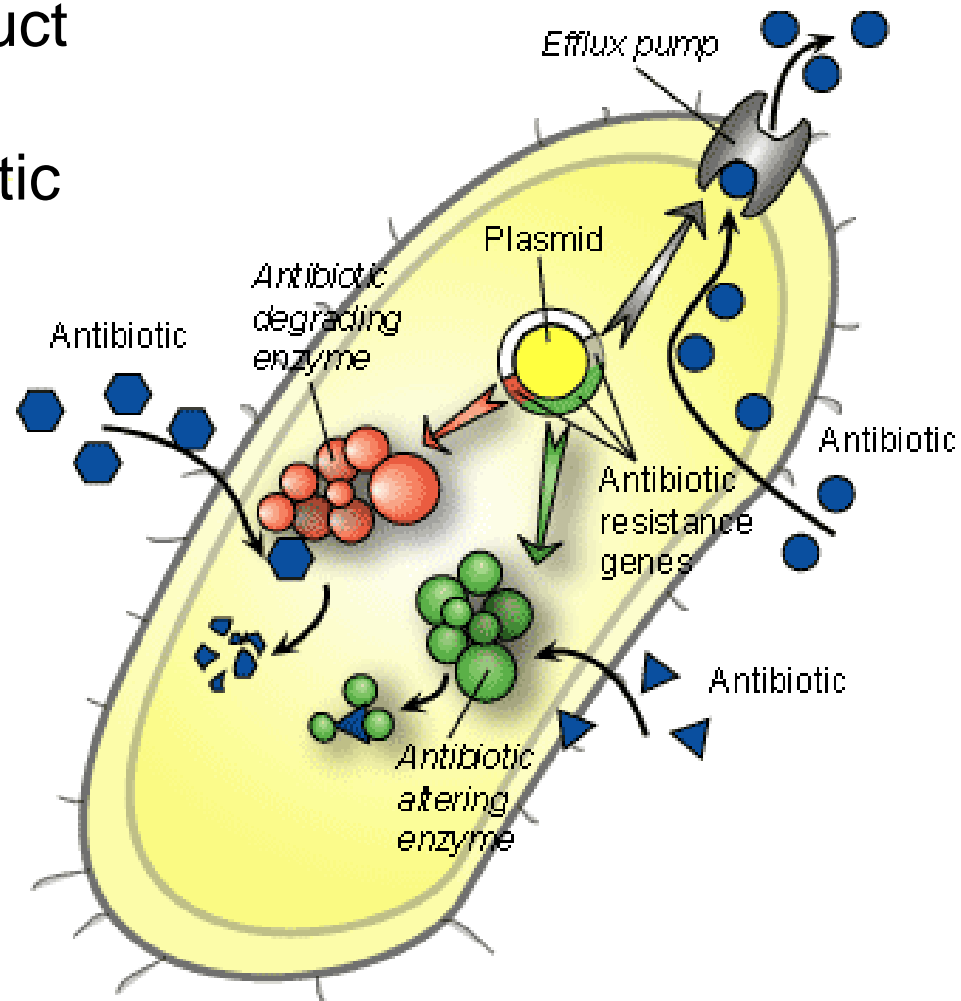
Transduction

The process by which bacterial DNA is moved from one bacterium to another by a virus.



Some resistance mechanisms:

- Degrade antibiotic
- Make more product
- Alter antibiotic
- Pump out antibiotic



Streptomyces bacteria, source of:

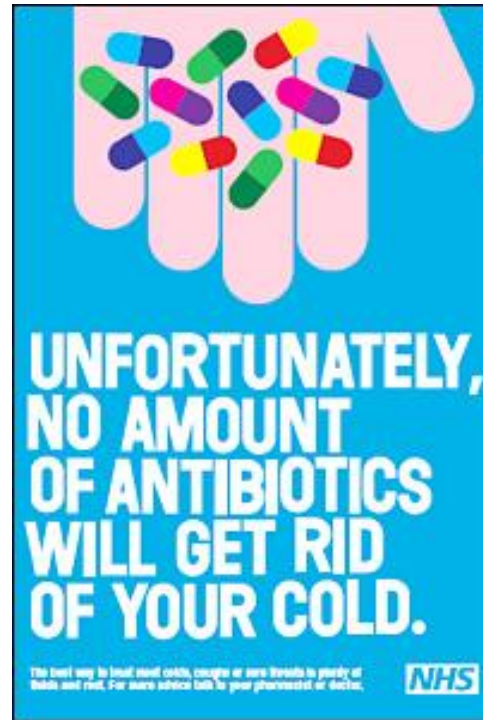
- Streptomycin,
- Tetracycline,
- Neomycin,
- Chloramphenicol,
- Erythromycin

and many other antibiotics.



Antibiotic misuse

- Inappropriate prescriptions

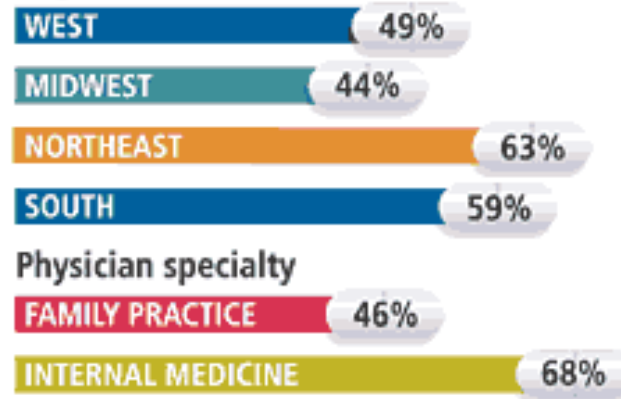


Antibiotic misuse

- Inappropriate prescriptions
- Use of broad spectrum antibiotics

Percentage of patients prescribed a broad-spectrum antibiotic* (among those prescribed an antibiotic)

Region



'Who wants to invest millions of dollars to develop a new drug whose widespread use is guaranteed to render it ineffective?'

Martin Blaser, President Infectious Disease Society of America

Antibiotic misuse

- Inappropriate prescription
- Use of broad spectrum antibiotics
- Agricultural use



Wonder Drug Speeds Growth of Animals

*Aureomycin Has Spectacular Effect
In Increasing Poundage of Livestock*

PHILADELPHIA, April 10 (AP) — A golden colored wonder drug developed to fight disease has been found to be a spectacular growth accelerator for at least some animals.

Antibiotic misuse

- Inappropriate prescription
- Use of broad spectrum antibiotics
- Agricultural use
- **Incorrect use**



A full course of antibiotics are needed to clear a TB infection

Antibiotic misuse

- Inappropriate prescription
- Use of broad spectrum antibiotics
- Agricultural use
- Incorrect use
- **Water contamination**



'We are back in the nineteenth century.'

Mario Raviglione, in charge of TB for WHO in 2007



“We need to consider this (sanatoriums) again, or we need to admit that we are going to tolerate the transmission of an incurable disease to innocent people.”

Ross Upshur, Doctor and ethicist

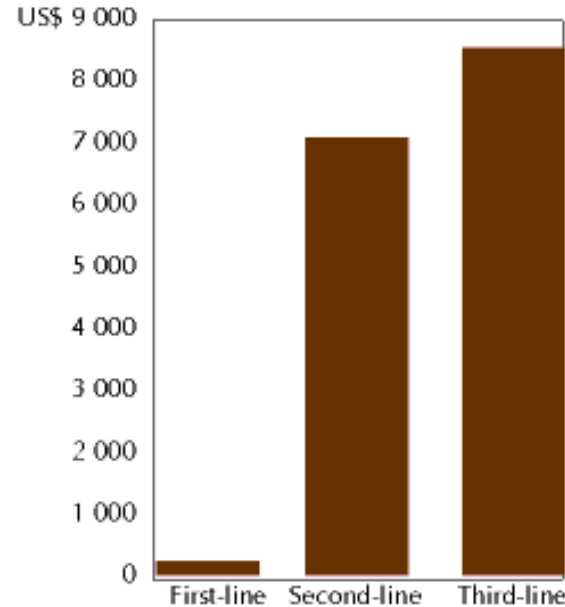


Up to 50 million people may be infected with MDR-TB.

MDR-TB

Multi-drug resistant Tuberculosis – any strain of TB that is resistant to both of the two main first line antibiotic drugs.

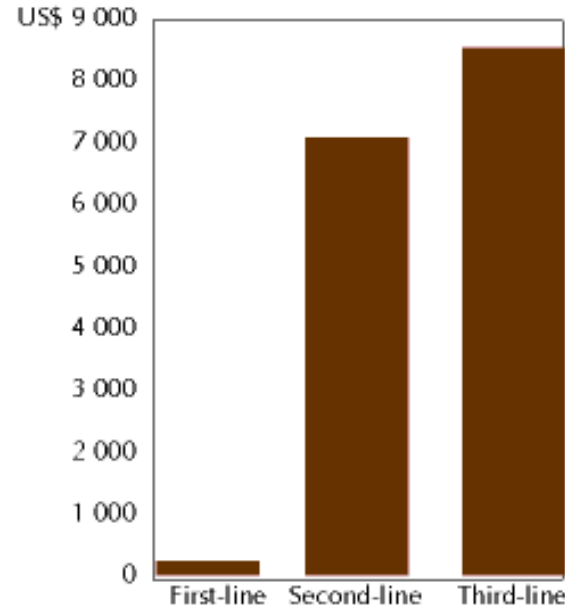
COST OF TREATING MULTI DRUG-RESISTANT TB



MDR-TB

Multi-drug resistant Tuberculosis – any strain of TB that is resistant to both of the two main first line antibiotic drugs.

COST OF TREATING MULTI DRUG-RESISTANT TB



MDR-TB

Multi-drug resistant Tuberculosis – any strain of TB that is resistant to both of the two main first line antibiotic drugs.

XDR-TB

Extreme drug resistant TB – any strain of TB that is resistant to both of the two main first line antibiotic drugs AND two more of the second line drugs.