GENETIC TRANSFER AND RECOMBINATION (Chapter 8):

Genetic recombination is exchange of genes between 2 DNA molecules→new combination of genes or chromosomes: contributes to genetic diversity

Vertical gene transfer: between parent and offspring
Horizontal gene transfer: between other organisms in the same generation

Three types:

1. Transformation
2. Conjugation
3. Transduction

All types:

Involve unidirectional transfer of information (donor to recipient—recipient called recombinant cell)
Require the integration of newly acquired DNA "homologous recombination"
Increases genetic diversity

Transformation: genes transferred by naked DNA in solution

Can occur naturally in only a few cells and works best when donor and recipient are closely related:

"Competent" bacteria: Acinetobacter
Bacillus
Haemophilus
Neisseria
Some Staphs and Streps

(E. coli is not naturally competent but can be altered for research)

Griffith's (1928 in England): experiments with Strep pneumoniae
Avery, MacLeod, McCarty (1944 in USA): DNA was carrier of genetic information

Conjugation: transfer mediated by PLASMID (circular piece of DNA that replicates independently from the cell chromosome)

1. Requires cell to cell contact
2. Conjugation cells must be of opposite mating types (Donor cell carries plasmid)
   In Gram negative bacteria use a sex pili (projection of donor cell surface that contacts recipient and brings into contact)
   F factor (fertility factor): F+ cells have F plasmid/F- lack F plasmid
   F plasmid can integrate into the chromosome and becomes a Hfr (high frequency of recombination cell)
   Gram positive bacteria produce a sticky surface molecule to cause cell contact
3. Conjugation can be used to map genes on chromosomes by order in which genes are transferred

Transduction: Bacteria DNA is transferred from donor to recipient inside a virus (bacteriophage or phage) that infects bacteria

Generalized Transduction: occurs with lytic or lysogenic phage

1. Phage attaches to bacteria and injects phage DNA into cell
2. Phage DNA is template for new DNA and synthesis of phage protein coat/ breaks bacterial chromosome
3. Some pieces of bacterial DNA packaged into phage protein coat and released from cell
4. When virus infects new bacteria population, bacterial genes are transferred
5. All genes are equally likely to be packaged into phage coat and transferred

Examples of generalized transduction: phage PI of E.coli
P22 of Salmonella

Specialized Transduction: Occurs with lysogenic phage

Only certain genes are transferred

Example: toxin products of bacteria