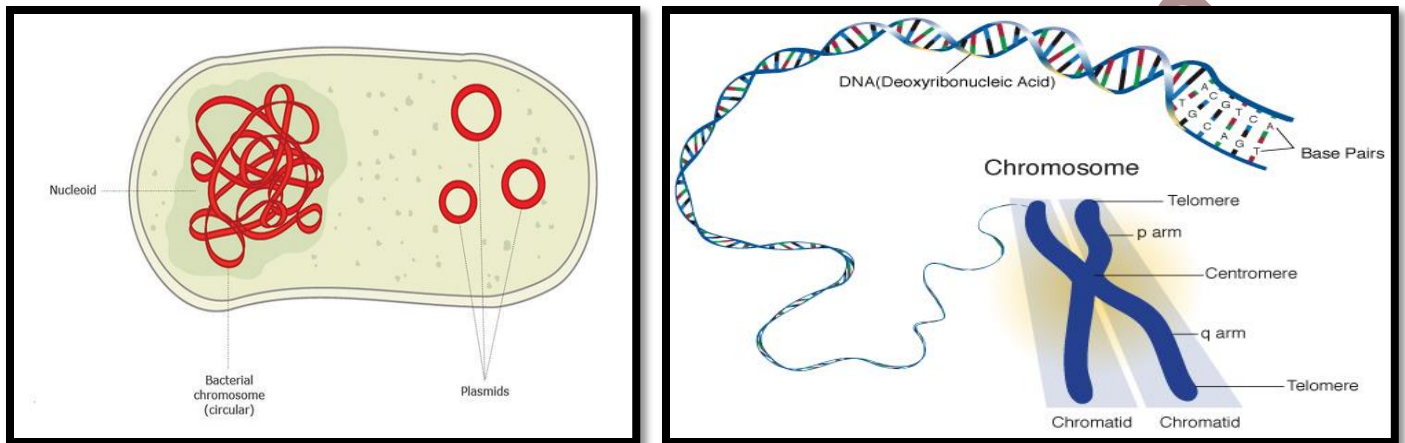


Lec.5 Bacterial genetics

Genetics is the study of inheritance. Bacterial inherited characteristics are encoded in DNA.

Bacteria have two types of DNA that contain their genes. These are :

- 1 . Chromosome
- 2 . Extra chromosome: Plasmid



- ✓ The bacterial chromosome is circular, double stranded DNA attached to bacterial cell membrane.

DNA replication in bacteria is semi-conservative i.e. each strand of DNA is conserved intact during replication and becomes one of the two strands of the new daughter molecules.

- ✓ Plasmids are self-replicating extra chromosomal DNA molecules. It multiplies independent of the host cell. Multiple copies of the same plasmid may be present in each bacterial cell. Different plasmids are also often present in the same bacterial cell.

- Plasmid types: There are many types of plasmid types. The following are examples.

1- R factors: Plasmids which contain genes that code for antibiotic resistance.

2- Col factors: Plasmids which contain genes that code for extracellular toxin (colicines) production that inhibit strains of the same and different species of bacteria.

3- F(fertility) factors: Plasmids that can recombine itself with the bacterial chromosome. It promotes transfer of the chromosome at a high frequency of recombination into the chromosome of a second (recipient) bacterial cell during mating.

Genetic variation in Bacteria

Mechanisms: Mutation and Gene transfer

1. Mutation: It is due to a chemical alteration in DNA. It could be spontaneous or induced by chemical and physical means.

Mutants are variants in which one or more bases in their DNA are altered; which are heritable and irreversible

Types of mutation

1. Substitution: Change of a single base.
2. Deletion: Loss of a base.
3. Insertion: Addition of a base.

2. Gene transfer

There are three types of gene transfer that alter the DNA gene content of bacteria:

- . Transformation
- . Transduction
- . Conjugation

1. **Transformation** occurs when fragments of exogenous bacterial DNA are taken up and absorbed into recipient bacterial cells.

Transformation of genes from one bacterium to another results in:

1. Change in pathogenicity of the bacterium.
2. Change in antibiotic sensitivity pattern of bacterium.

Competence: The recipient bacterium must be competent to absorb the exogenous fragments of bacterial DNA.

Frequency: The frequency of transformation is low.

2. **Transduction** occurs when fragments of chromosomal DNA is transferred or transduced into a second bacterium by phage.

During phage replication, the bacterial DNA may be accidentally enclosed instead of the normal phage DNA, and when this particle which enclosed the bacterial DNA infects a second bacterial cell, the DNA from the first bacterium is released and incorporated into The chromosome of the second bacterium.

3. **Conjugation** occurs when plasmid DNA is transferred from donor to recipient bacterium by direct contact via a sex pilus.

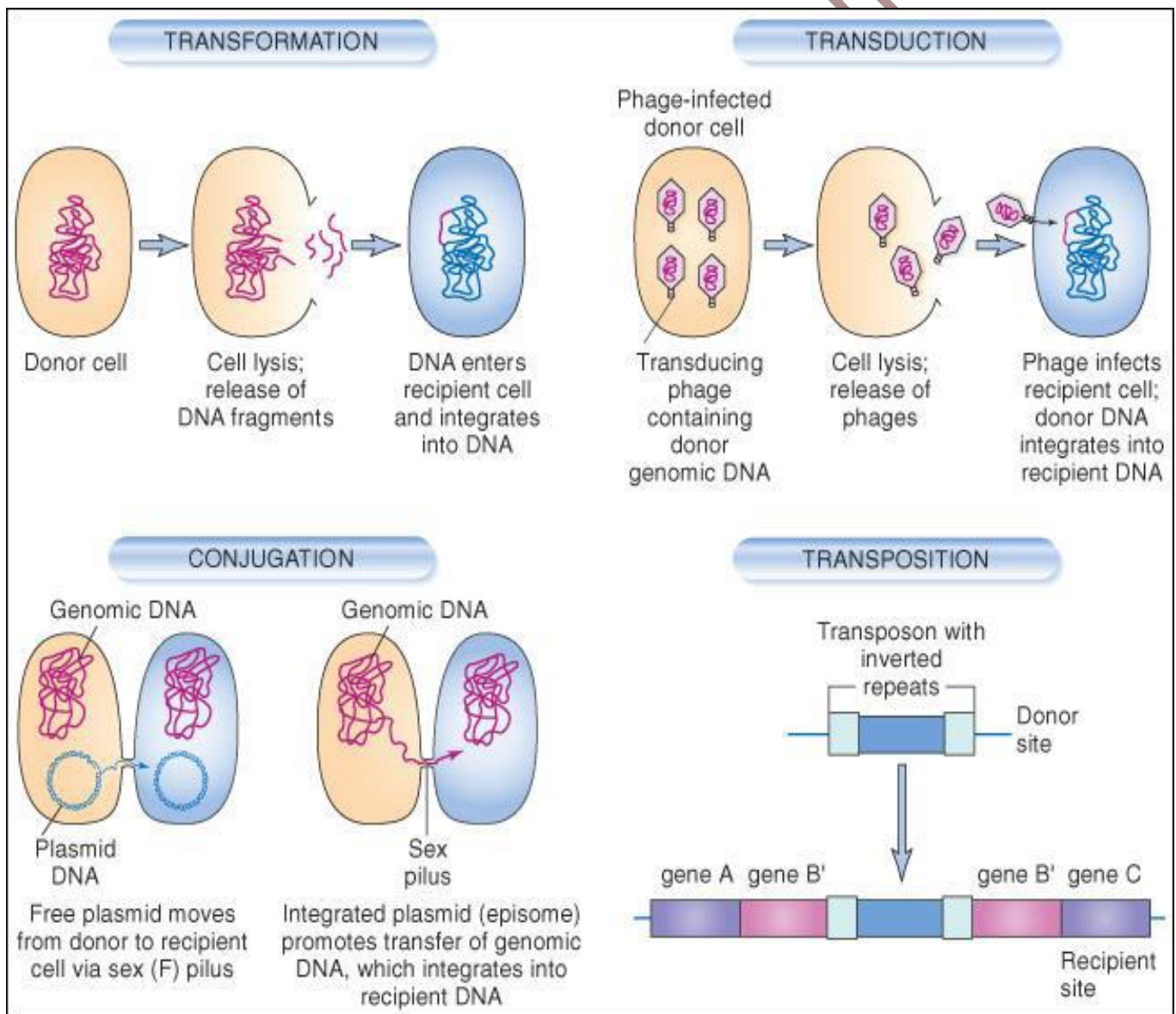
➤ **Transposition**

Mechanism which enhances genetic flexibility among plasmids and bacterial chromosomes.

Transposons(Jumping genes) are segments of DNA that can transpose or move extremely readily, from plasmid to plasmid or from plasmid to chromosome(and viceversa).In this way, plasmid genes become part of the chromosomal component of genes.

When transposons transfer to a new site, it is usually a copy of the transposon that moves, the original transposon remaining in situ.

Transposons code for toxin production, resistance to antibiotics as well as other fuctions.



Characters	Plasmid DNA	Chromosomal DNA
Definition	Extra-chromosomal DNA of bacteria	Genomic DNA of living organisms
Size	Smaller in size	Larger in size
Survival	Not important for survival of bacteria	Extremely important for the survival
Function	Provides extra characteristics to bacteria for survival under harsh environment conditions	Provides all information for the regular well-being of bacteria
Number	Bacteria have variable number of plasmid DNA	Only one chromosome in bacteria
Strands	Always double stranded	Can be single stranded or double stranded
Replication	Show self replication independently to genomic DNA replication	Replicate during cell division
Shape	Always circular	Can be linear or circular