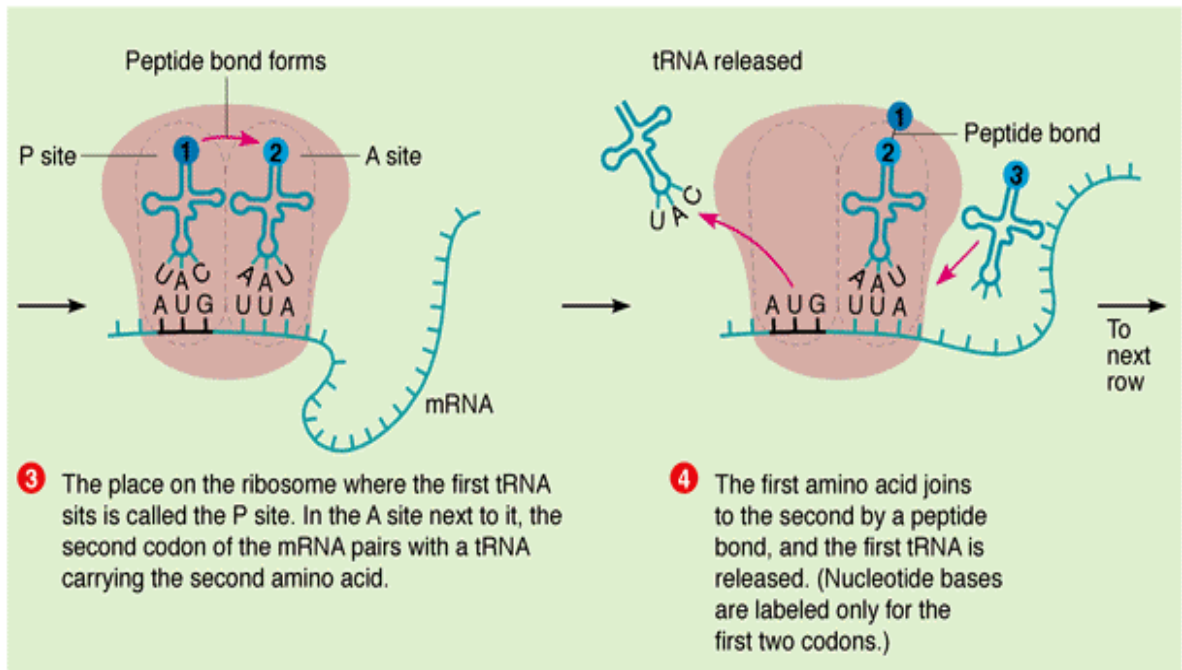
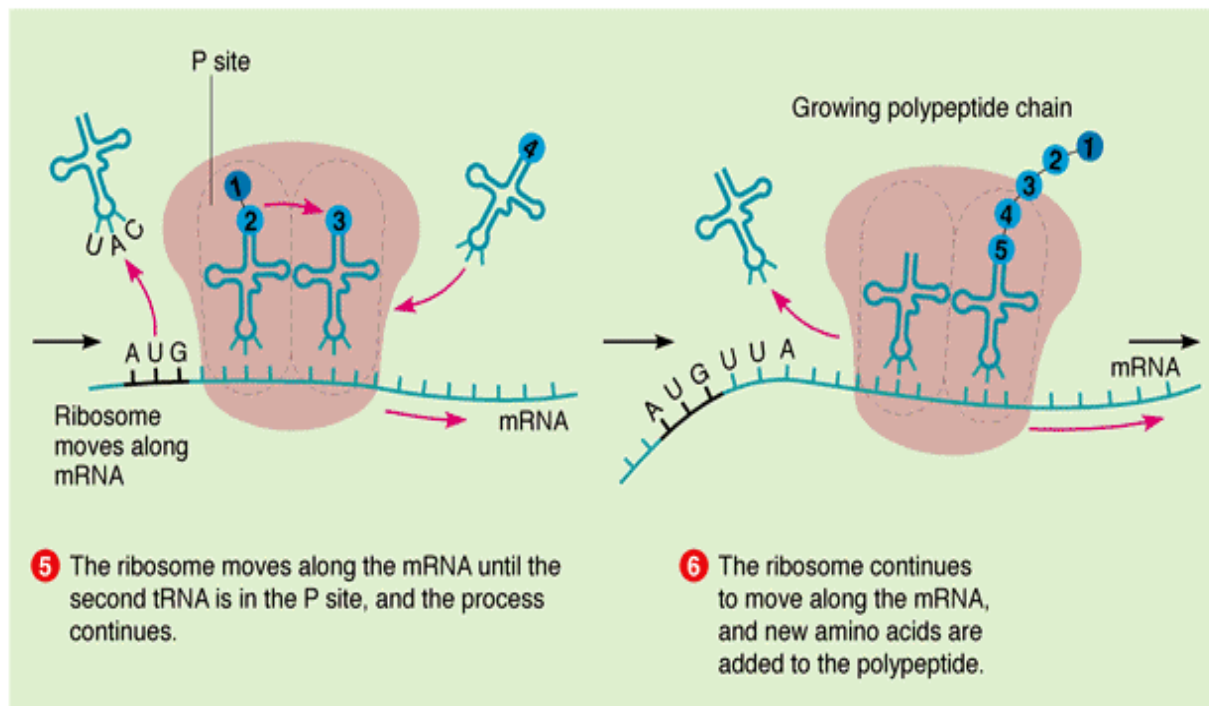


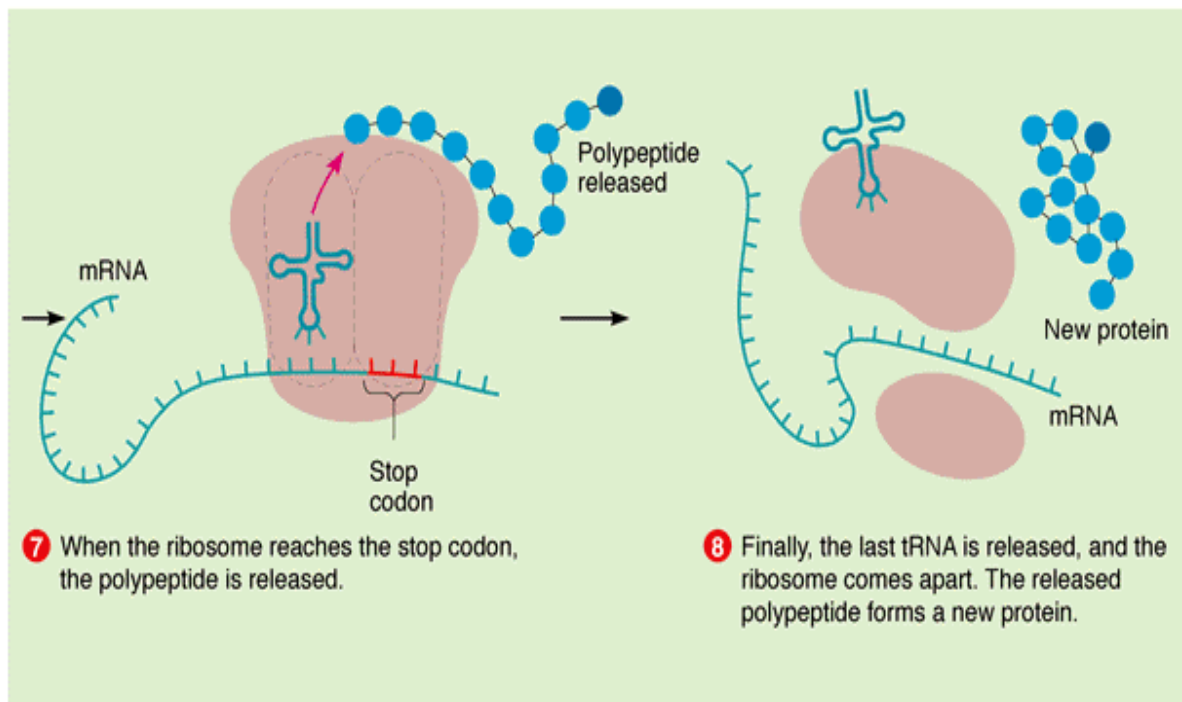
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### What are the genetic changes?

An **alteration** in a segment of DNA which can disturb gene's behavior and sometimes leads to disease. It may be:

- (1) Small genetic change, genetic drift (**mutation**)
- (2) Large genetic change, genetic shift (**recombination**)

**Mutation:** changes in base sequence of DNA. **Types of Mutations:**

- 1. Spontaneous mutation:-** occur in the absence of a mutagen, example:  
*Neisseria gonorrhoeae* penicillin resistance original mutation was spontaneous.
- 2. Induced mutation:** - chemical or physical agents enhance mutation rate.

### Mutagens

Tobacco products, nitrous acid, mold toxins, X-rays, Gamma rays, UV radiation, some artificial sweeteners

### Repair Mechanisms:-

1. Mismatch repair “proofreads” (DNA polymerase).
2. Excision repair (nucleases).

### Recombination (Genetic Transfer in Bacteria):-

- Genetic transfer-results in genetic variation
- Genetic variation-needed for evolution
- **Vertical** genetic transfer

Genetic information passed from an organism to its offspring.

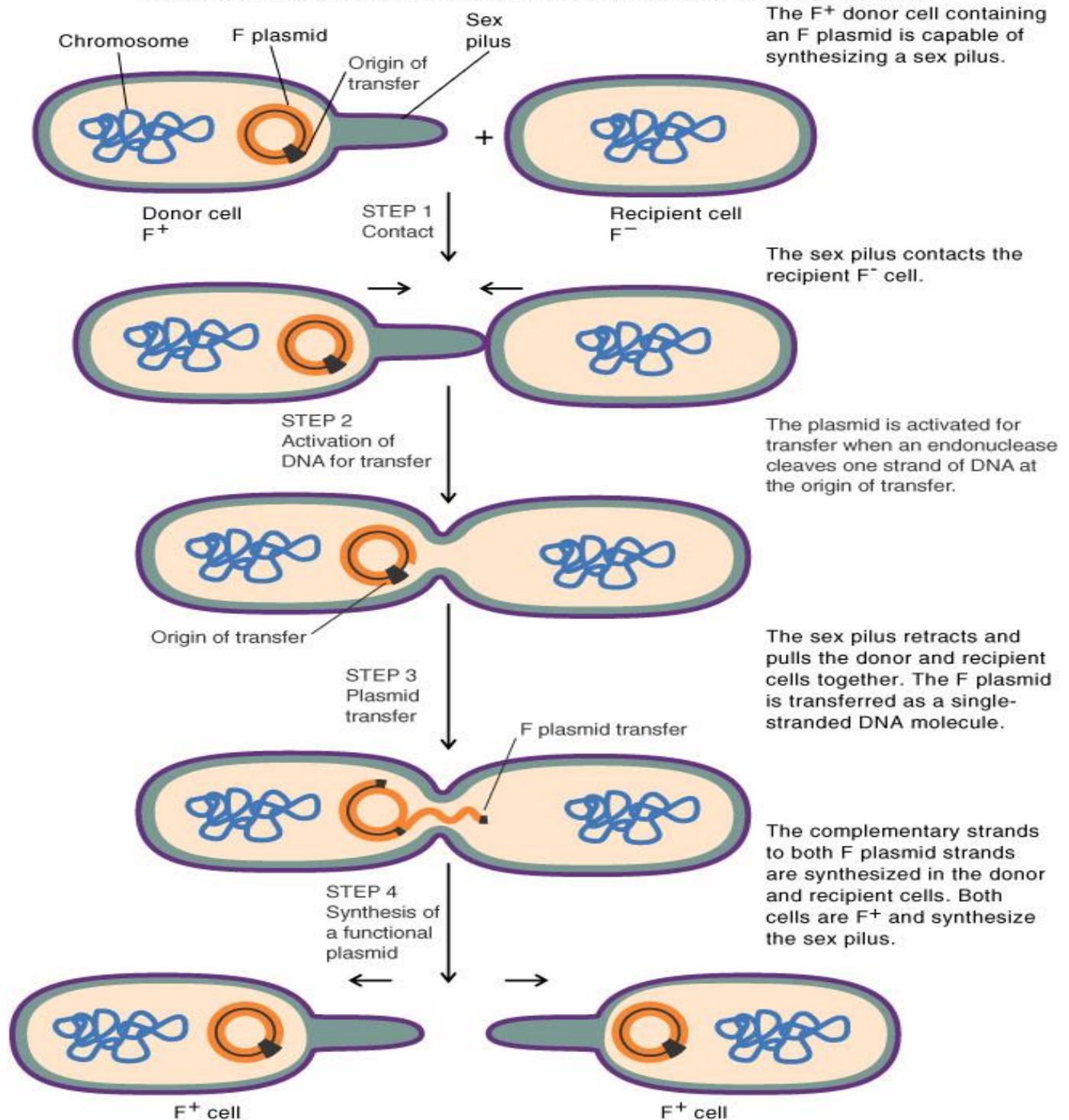
- **Horizontal** genetic transfer

Bacteria transfer genetic information from one organism to another in the same generation, by three ways:

- 1. Transduction:** donor DNA is carried in a phage coat and is transferred into the recipient by the mechanism used for phage infection DNA transferred from one bacterium to another by a virus.
- 2. Transformation:** the direct uptake of donor DNA by the recipient cell, may be natural or forced genes transferred from one bacterium to another as “naked” DNA.
- 3. Conjugation:** only one strand of DNA is transferred plasmids transferred one bacterium to another via a pilus.

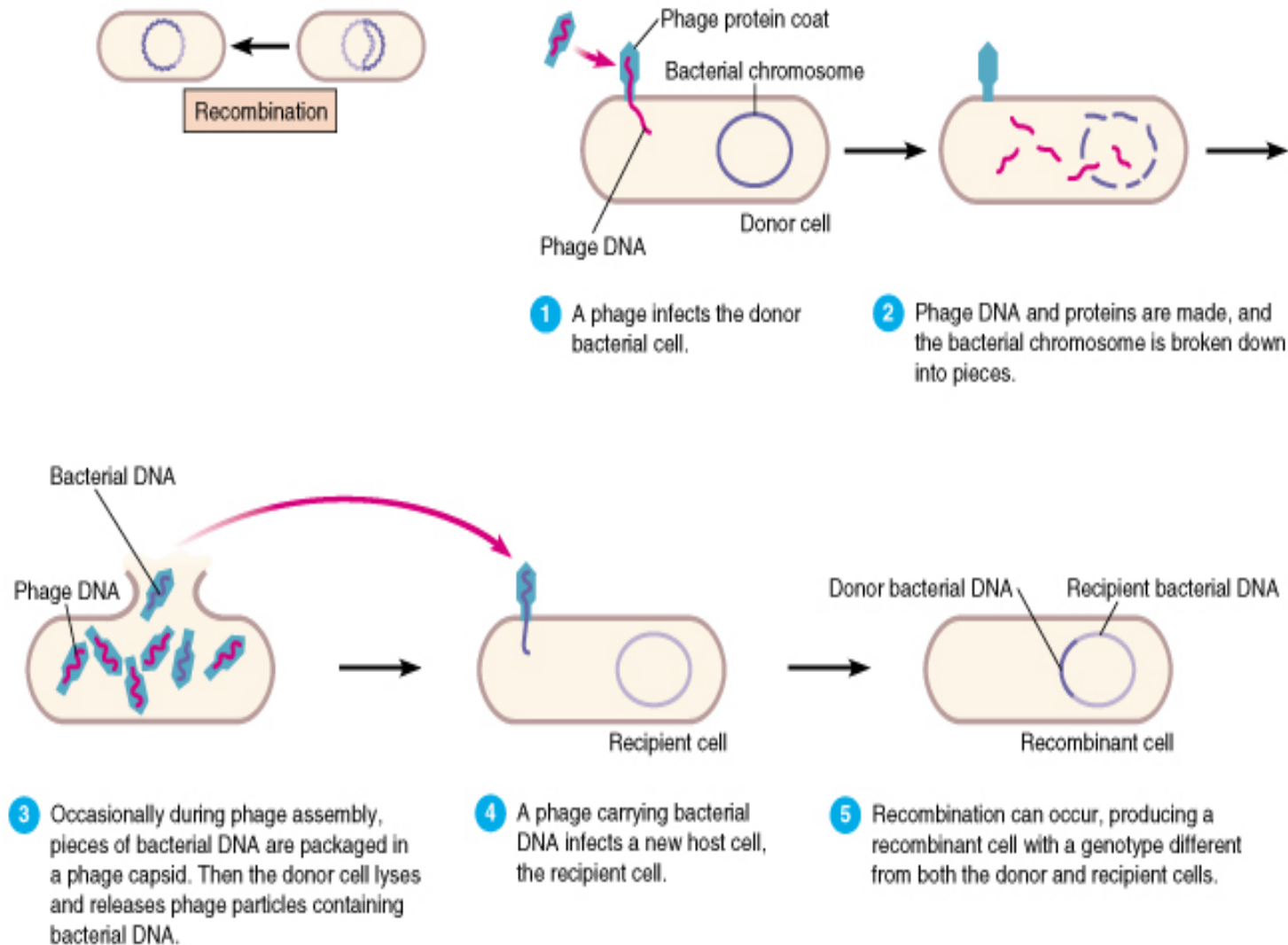
## Conjugation: - e.g. *E. coli*

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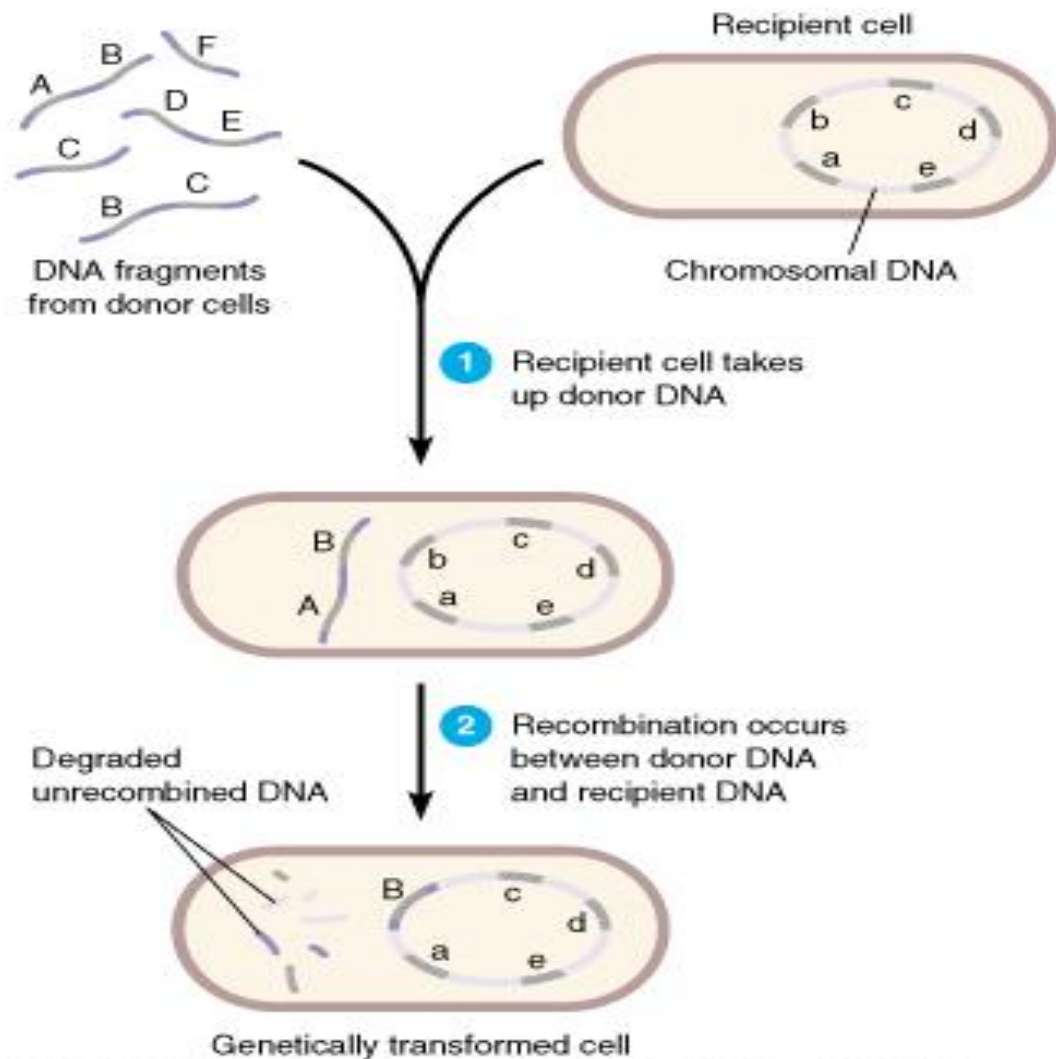


## Transduction by a Bacteriophage: - e.g. Corynebacterium diphtheria



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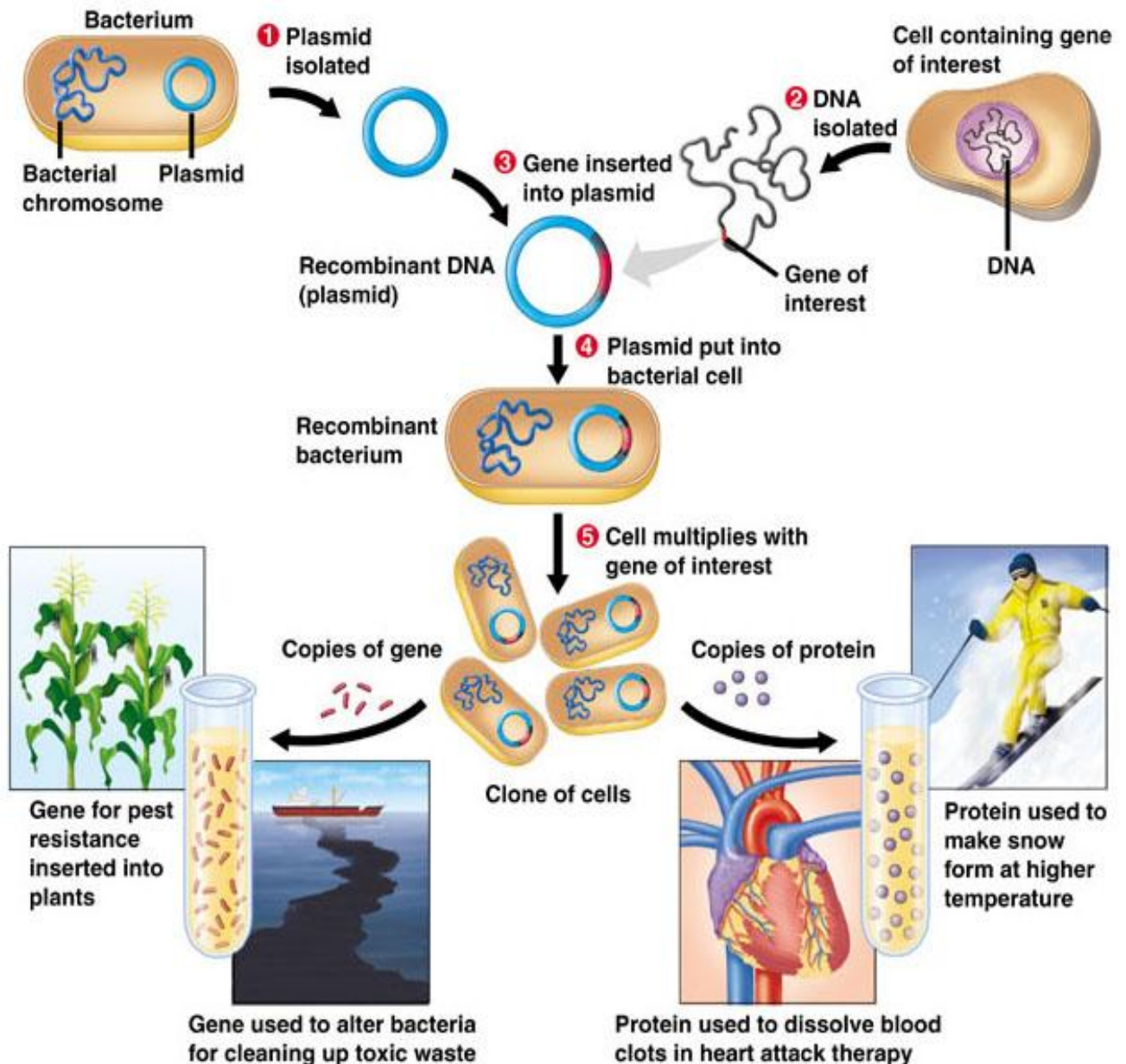
Transformation: - e.g. Streptococcus pneumoniae



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**Recombinant DNA technology** is a technology which allows DNA to be produced via artificial means.

- Recombinant DNA technology works by taking DNA from two different sources and combining that DNA into a single molecule. That alone, however, will not do much.
- Recombinant DNA technology only becomes useful when that artificially-created DNA is reproduced. This is known as DNA **cloning**.





**Six basic steps** are common to most recombinant DNA experiments:

1. Isolation and purification of DNA.
2. Cleavage of DNA at particular sequences by nucleases and restriction endonucleases.
3. Ligation of DNA fragments.
4. Introduction of recombinant DNA into compatible host cells.
5. Replication and expression of recombinant DNA in host cells.
6. Identification of host cells that contain recombinant DNA of interest.

**Applications of Recombinant DNA Technology:**

1. Analysis of Gene Structure and Expression
2. Pharmaceutical Products
  - Drugs
  - Vaccines
3. Genetically modified organisms (GMO)
  - Transgenic plants
  - Transgenic animal
4. Application in medicine
  - Human Gene Therapy
  - Diagnosis of genetic disorders
  - Forensic Evidence
  - Human gene therapy seeks to repair the damage caused by a genetic deficiency through introduction of a functional version of the defective gene. To achieve this end, a cloned variant of the gene must be incorporated into the organism in such a manner that it is expressed only at the proper time and only in appropriate cell types. At this time, these conditions impose serious technical and clinical difficulties.