

Sexual Reproduction in Bacteria

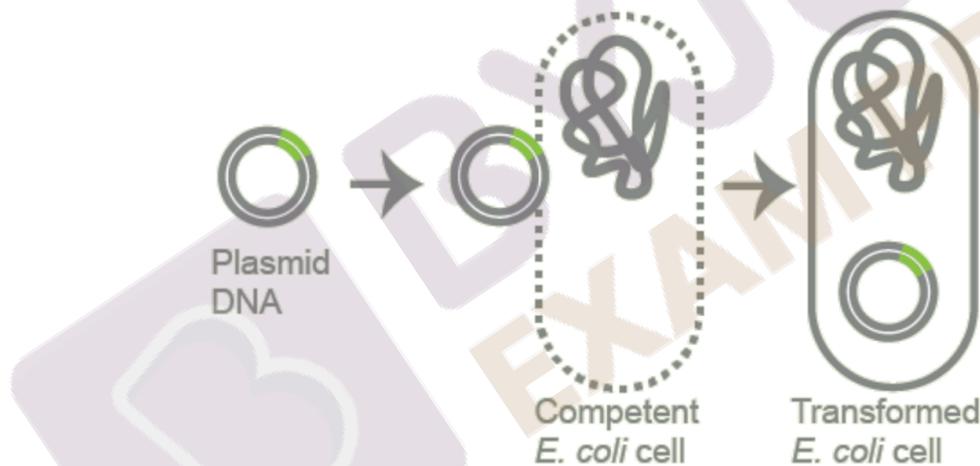


Sexual Reproduction in bacteria (Transformation, Transduction, and Conjugation)

The most common method of reproduction in bacteria (sole members of kingdom Monera) is via the asexual method. But this does not mean that bacteria do not exhibit sexual reproduction. Although not frequently, bacteria do reproduce sexually. The most common types of methods in bacterial sexual reproduction are Transformation, Transduction, and Conjugation.

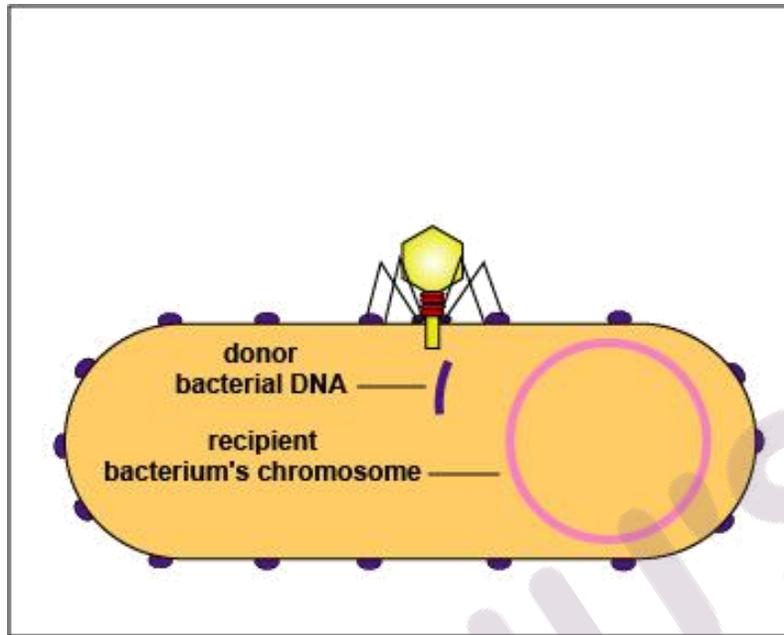
1. Transformation:

It is the absorption of a DNA segment from the surrounding medium by a living bacterium. The phenomenon was discovered by Griffith in 1928. Its mechanism was worked out by Avery (1944). Receptivity for transformation is present for a brief period when the cells have reached the end period of active growth. At this time, they develop specific receptor sites in the wall. Normally *E. coli* does not pick up foreign DNA, but it can do so in the presence of calcium chloride. By subjecting *E. coli* to calcium chloride, the cells become competent which means there are transient pores in the bacterial cell wall from where the foreign DNA can enter the bacterium.



2. Transduction:

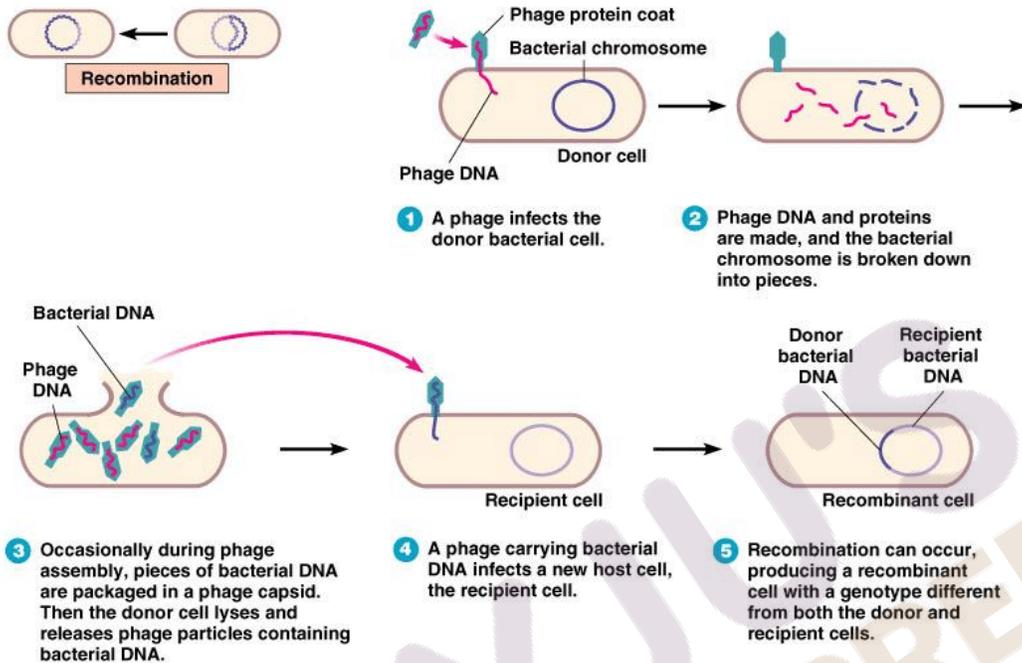
It is the transfer of foreign genes by means of viruses. Transduction was first discovered by Zinder and his teacher Lederberg (1952) in *Salmonella typhimurium*. The process also occurs in *E. coli* and a few other hosts. A virus may pick up a gene of the host in place of its own gene during its multiplication in the host cell. Such a virus is never virulent. It passes over the gene of the previous host to the new host. Transducing viruses may carry the same genes (restricted transduction) or different genes (generalized transduction) at different times.



DIFFERENCES BETWEEN GENERAL AND SPECIALISED TRANSDUCTION

GENERAL TRANSDUCTION	SPECIALISED TRANSDUCTION
In generalized transduction, the bacteriophages (virus) can pick up any portion of the host's genome	In specialized transduction, the bacteriophages (virus) pick up only specific portions of the host's DNA.
In this type of transduction, at first, bacteriophage infects donor cells and begins the lytic cycle.	At first temperate bacteriophage enter into donor bacteria and then its genome gets integrated with the host cell's DNA at a certain location and remains dormant and passes generation to generation into daughter cell during cell division.
When viruses enter into the bacterial cells, viruses hijack host cells and synthesize virus components such as the genome, enzymes, capsid, head-tail, and tail fibers. Then viral enzyme hydrolyses host cell DNA into small fragments.	The bacteriophage which follows the lysogenic cycle is known as temperate phage.

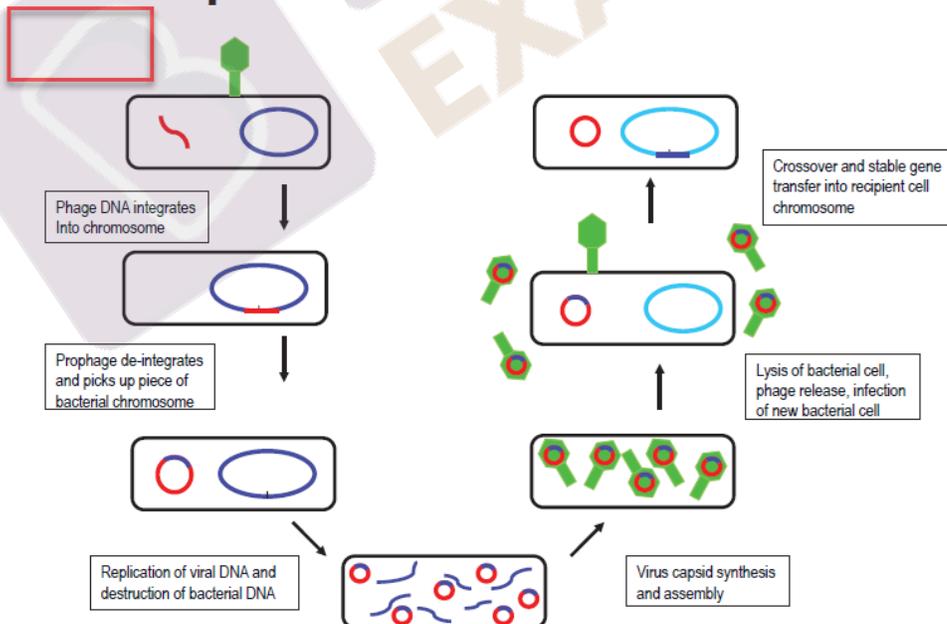
GENERALISED TRANSDUCTION:



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SPECIALISED TRANSDUCTION:

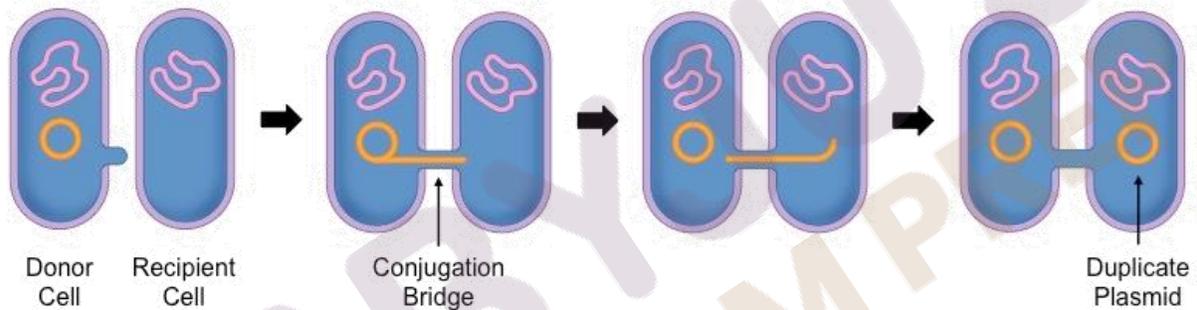
Specialized transduction



Courtesy of M. Mulks (MSU)

3. Conjugation:

It was first discovered in *Escherichia coli* by Lederberg and Tatum (1946). They found that two different types of auxotroph (nutritional mutants) grown together on a minimal medium produced an occasional prototroph (wild type). Cell contact was required for this change. Anderson (1957) observed conjugation between two such bacteria under the electron microscope. Conjugation was later reported in a number of other bacteria. Bacteria showing conjugation are dimorphic, i.e., they have two types of cells, male (F+) or donor and female (F-) or recipient. The male or donor cell possesses 1-4 sex pili on the surface and fertility factor (transfer factor, sex factor) in its plasmid. The fertility factor contains genes for producing sex pili and other characters needed for gene transfer. Sex pili are 1- 4 narrow protoplasmic outgrowths. Both sex pili and fertility factors are absent in female or recipient cells. If these two types of cells happen to come nearer, a pilus of male cells establishes a protoplasmic bridge or conjugation tube with the female cell. It takes 6-8 minutes.



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