Systems of DNA transfer in bacteria

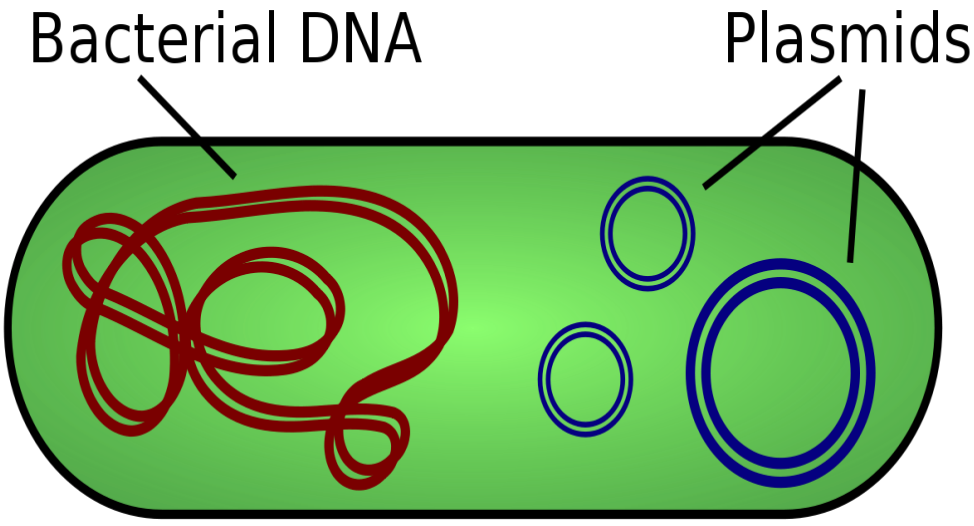
Introduction:

The bacterial world and their viruses are not distant from molecular genetics, in such way a large part of this science is involved in the studying these prokaryotic organisms intensively and revealed many basics on which molecular biology is built.

Before we take the three major methods by which DNA can be transferred between bacterial cells m we must know an important concept which is related to microbial genetics which is the plasmids.

plasmid

A plasmid is a small, circular, double-stranded DNA molecule that is distinct from a cell's chromosomal DNA. Plasmids naturally exist in bacterial cells, and they also occur in some eukaryotes. Often, the genes carried in plasmids provide bacteria with genetic advantages, such as antibiotic resistance. Plasmids have a wide range of lengths, from roughly one thousand DNA base pairs to hundreds of thousands of base pairs.

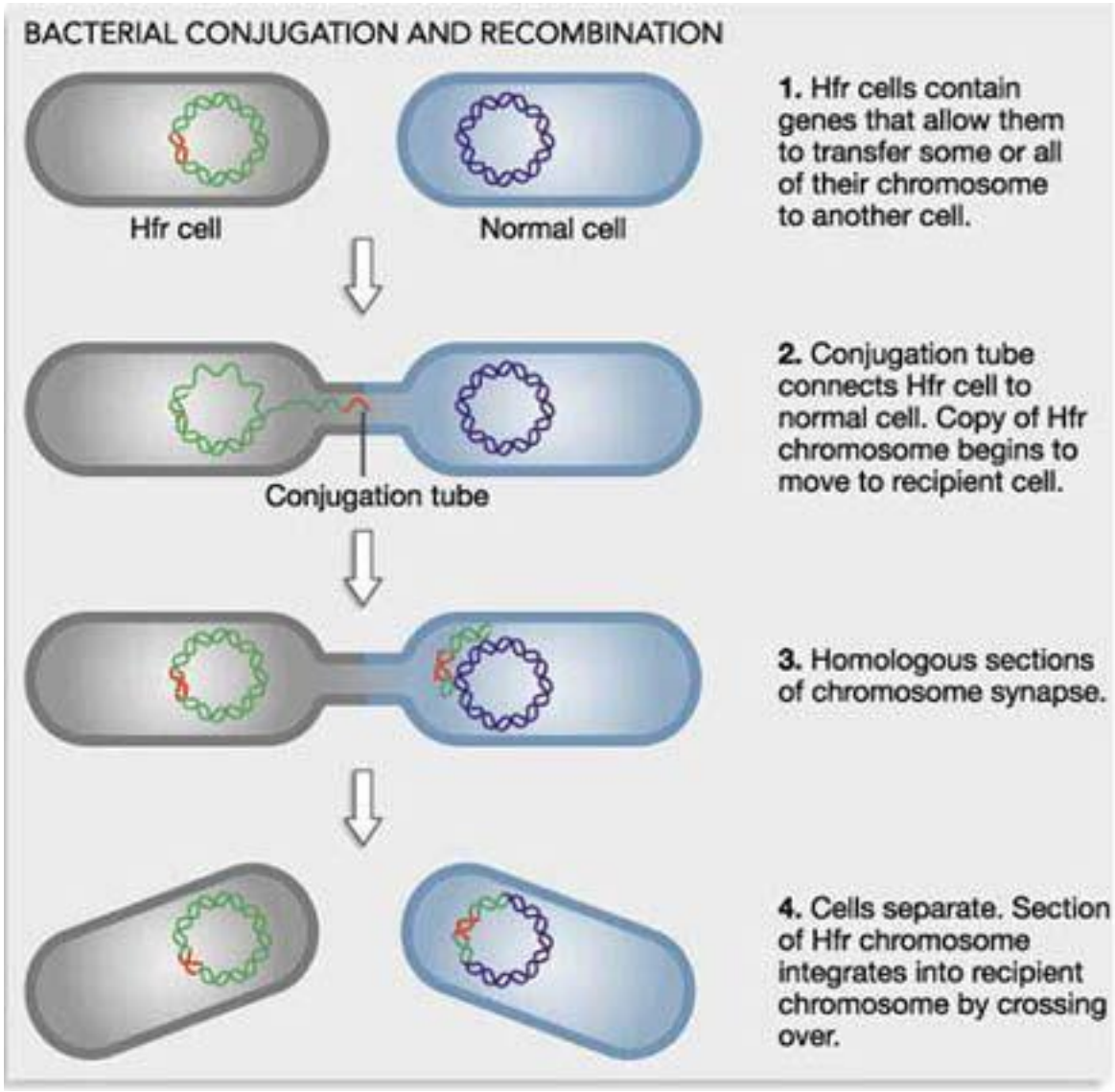


When a bacterium divides, all of the plasmids contained within the cell are copied such that each daughter cell receives a copy of each plasmid. Bacteria can also transfer plasmids to one another through a process called conjugation.

Conjugation :

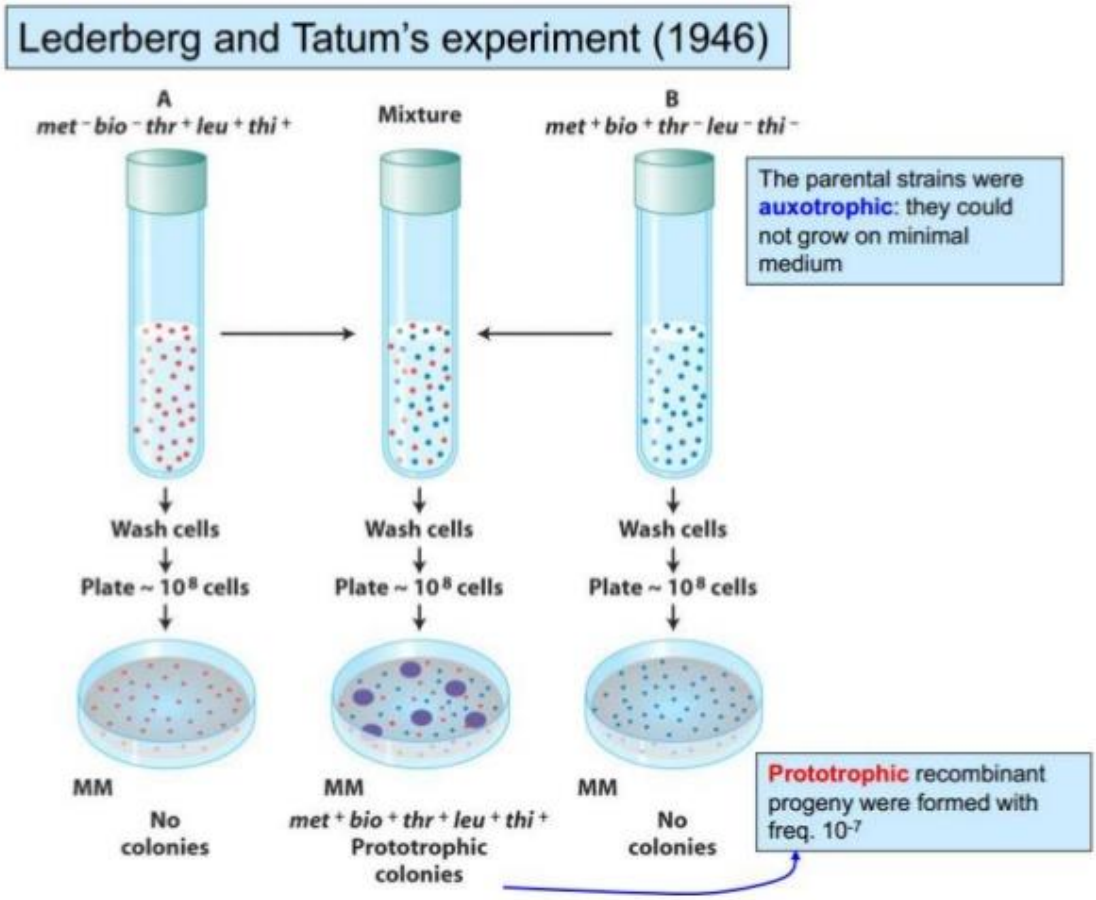
is the process by which one bacterium transfers genetic material to another through direct contact. During conjugation, one bacterium serves as the donor of the genetic material, and the other serves as the recipient. The donor bacterium carries a DNA sequence called the fertility factor, or F-factor. The F-factor allows the donor to produce a thin, tubelike structure called a pilus, which the donor uses to contact the recipient. The pilus then draws the two bacteria together, at which time the donor bacterium transfers genetic material to the recipient bacterium. Typically, the genetic material is in the form of a plasmid, or a small, circular piece of DNA. The genetic material transferred during conjugation often provides the recipient bacterium with some sort of genetic advantage. For instance, in many cases, conjugation serves to transfer plasmids

that carry antibiotic resistance genes



The excited experiment that performed by Joshua Lederberg and Edward Tatum at 1946 was answered the question that is asked from time to time whether bacteria possess any processes similar to sexual reproduction or not.

They discovered a sex-like process in bacteria. Their experiment was summarized by using two strains of E.coli with different sets of auxotrophic mutations.



Lederberg and Joshua suggested that some form of recombination of genes had taken place between the genomes of the two strains to produce the prototrophs.

Lederberg and Tatum did not directly prove that physical contact of the cells was necessary for gene transfer.

This evidence was provided several years later by Bernard Davis (1919-1994), who constructed a U-tube consisting of two pieces of curved glass tubing fused at the base to form a U shape with a glass filter between the halves. The filter allowed passage of media but not bacteria. The U-tube was filled with a growth medium and each side inoculated with a different auxotrophic strain of E. coli. During incubation, the medium was pumped back and forth through the filter to ensure medium exchange between the halves. When the bacteria were later plated on minimal medium, Davis discovered that if the two auxotrophic strains were separated from each other by the filter, gene transfer did not take place. Therefore direct contact was required for the recombination that Lederberg and Tatum had observed.