

Conjugation in Bacteria

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Exchange of genetic material takes place through a conjugation tube, pileus, between two cells of bacteria. It can synapse with the homologous region of the recipient genome and undergo recombination to give new genome types.

The process was first postulated by Lederberg and Tatum (1946) in *Escherichia coli*.

Strains of *E. coli* show sexual differences and two mating types.

1. One acting as donor of genes having a **fertility factor**, called' 'F' factor in addition with normal genetic material.
 - This bacteria is called male(F^+) or donor bacteria.
 - 'F' factor is free in cytoplasm and autonomous.
 - 'F' factor is circular DNA.
2. Second type of bacteria is called female(F^-) and recipient .
 - It is devoid of 'F' factor.

Function of 'F' factor

- During conjugation only duplication of 'F'factor passes into the female cell.
- The 'F' factor is an infective element and is called Episome.

Episome can live in two states:-

- (a) **Free in cytoplasm** e.g. found in donor or F^+ Bacteria or male bacteria.
- (b) **Integrated with bacterial chromosome.** This type of male is called Hfr male-high fertility male which shows enormous increase in its frequency of recombination.

Process of conjugation :

Depending upon types of male, process can be broadly divided into two types

(I) F^+ MALE type –

- After formation of conjugation tube the two strands of 'F' factor begin to separate from each other.
- One strand passes to recipient F⁻ cell.
- Enzymes synthesize a complementary strand in both cells to form double strands of 'F' factor in each cell.
- F⁻ is converted into male F⁺. Fig. (I).

(II)Hfr male type---

- When Hfr male conjugate with a female F⁻ the genetic material is transferred.
- The bacterial chromosome of male breaks at the site of attachment of 'F' factor and becomes a linear DNA molecule having 'F' factor always at rear end.
- The genetic material may replace homologous portion of the female genome.
- This bring about genetic recombination.
- With various Hfr strains, the site of breakage varies.
- Chromosomal replication starts at the end which directed towards the conjugation tube.
- Only a portion of the chromosome enter the female cell, the 'F' factor being always at the rear end never goes to the recipient cell.
- The 'F' factor, because of its episomal nature, can spontaneously dissociate back to cytoplasm again. The Hfr males are then reverted to F⁺ male .Fig.(II).

Sexduction:-

During the dissociation of the 'F' factor from the chromosome; it may carry some of the bacterial genes. Such a mutant fertility factor is designated as F'(F prime).When such F' factors are transferred, the recipient bacterial cells become heterozygous for that part of the DNA which the F' had obtained from the male bacterium. This phenomenon is called Sexduction and employed to obtain partial diploid

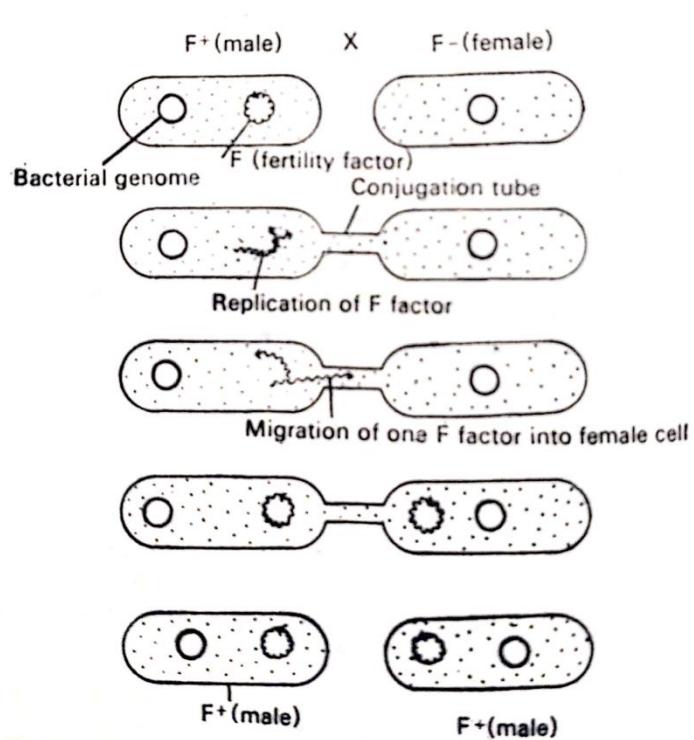


Fig.I. Conjugation between F^+ (male) and F^- (female) resulting in the conversion of female into male due to transfer of the fertility factor, F .

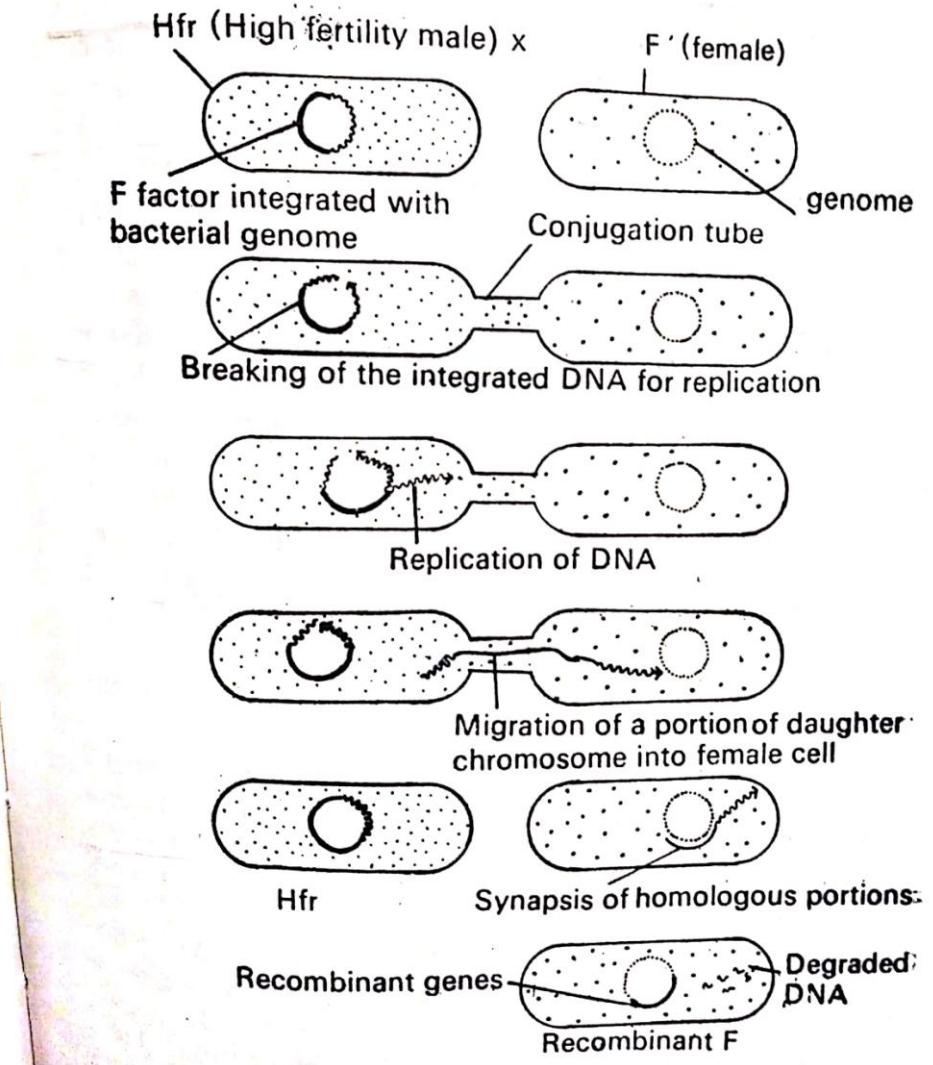


Fig.II. Cojugation between high fertility male(Hfr) and female (F') cells, resulting in production of recombinant female.