(III) Sexual REPRODUCTION:

Sexual reproduction in bacteria does not involve production of gametes and their subsequent fusion. Instead, it takes place through the exchange of naked DNA. Hence, referred to as Sexual recombination, or Genetic recombination

It may occur by different processes —

1. Transformation
2. Transduction
3. Conjugation.

1. Transformation: (i) It is the transfer of DNA molecules from donar to recepient cell, and two never come in direct contact.

(ii) This proces was discovered by Griffith in 1928.

(iii) Griffith, while working on Pneumonia causing bacterium (Diplococcus pneumoniae) came across two strains – rough or R-Cells and Smooth or S-Cells.

(iv) He carried out several experiments with the two Strains in mouse.

(v) The R-Cells were avirulent (non-pathogenic) and had no capsule whereas S-cell were virulent (pathogenic) and capsulated.

(vi) When the mouse with living R-Cell and non-living S-Cell was injected, it died within a few days. Blood analysis of the dead mouse showed the presence of living S-Cells, besides R-Cells.

(vii) He, therefore, concluded that dead S-Cells had released a factor which resulted in the transformation R-Cells into virulent forms, thereby killing the host.

This transforming factor was later identified as DNA by Avery, Macleod and Mc Carty in 1944.

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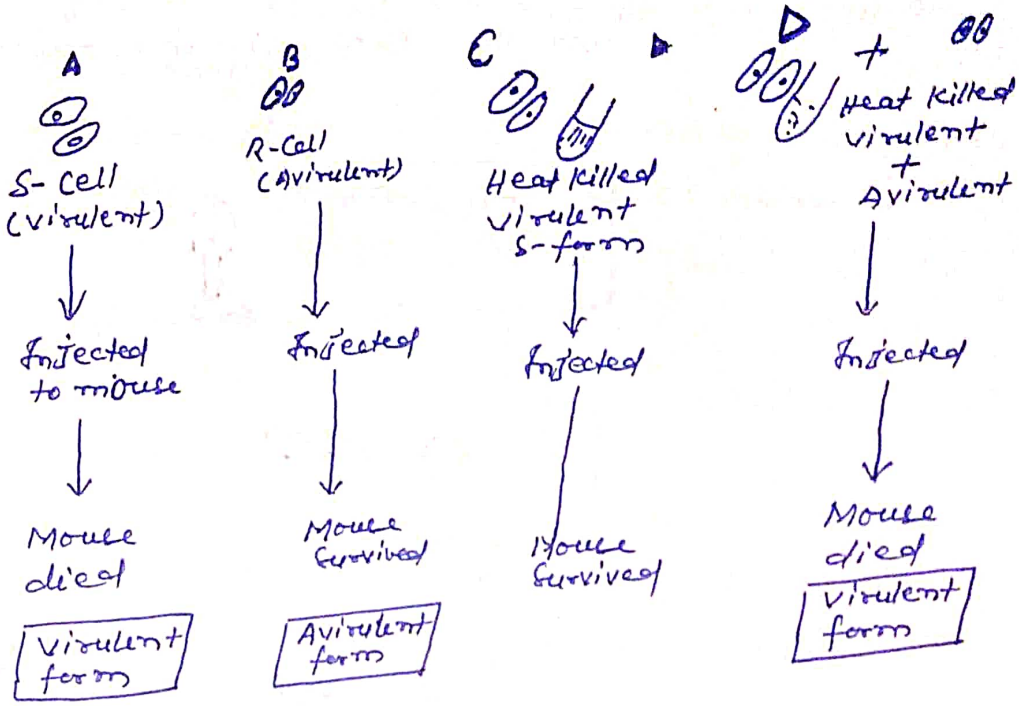
(iv) During this process a short piece of DNA, containing one or more genes, is released by the donor cell (in the medium). It enters the recipient cell and recombinants are formed.



Griffith's experiment

2. Transduction : (i) This is the transfer of genetic material from one bacterial cell (donor) to the ~~recipi~~ another (recipient) through a virus (bacteriophage).

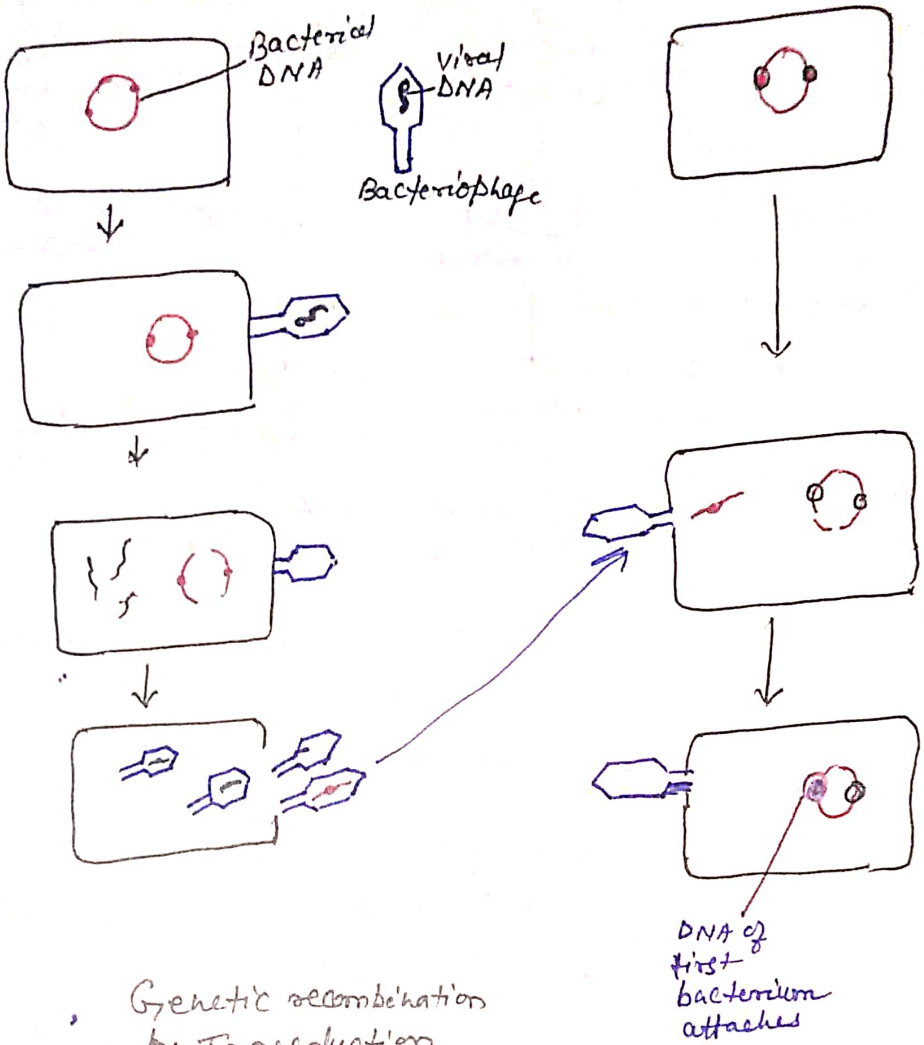
(ii) The process was discovered in the bacterium Salmonella by Zinder and Lederberg (1952).

(iii) When the phage attaches itself to the bacterial cell, its DNA is transferred.

(iv) Once inside the bacterial cell, the phage DNA starts synthesizing new phage components. Meanwhile the bacterial DNA also gets fragmented and these segments are incorporated in some of the new phage particles.

(v) The bacteriophage particles with gene of bacterial cell, when attacks another bacterium,

transfer the genes carried from the earlier bacterium to this bacterium and recombination occurs. In this way phage particles carried out transduction or transfer of genetic material from one bacterium to another.



Genetic recombination by Transduction

3. Conjugation: (i) It involves direct contact between donar and recipient bacteria.
(ii) The process was discovered by Lederberg and Tatum (1946) in Escherichia coli, a common human colon bacterium, and worked out in details by Wollman, Jacob and Hayes in 1956.

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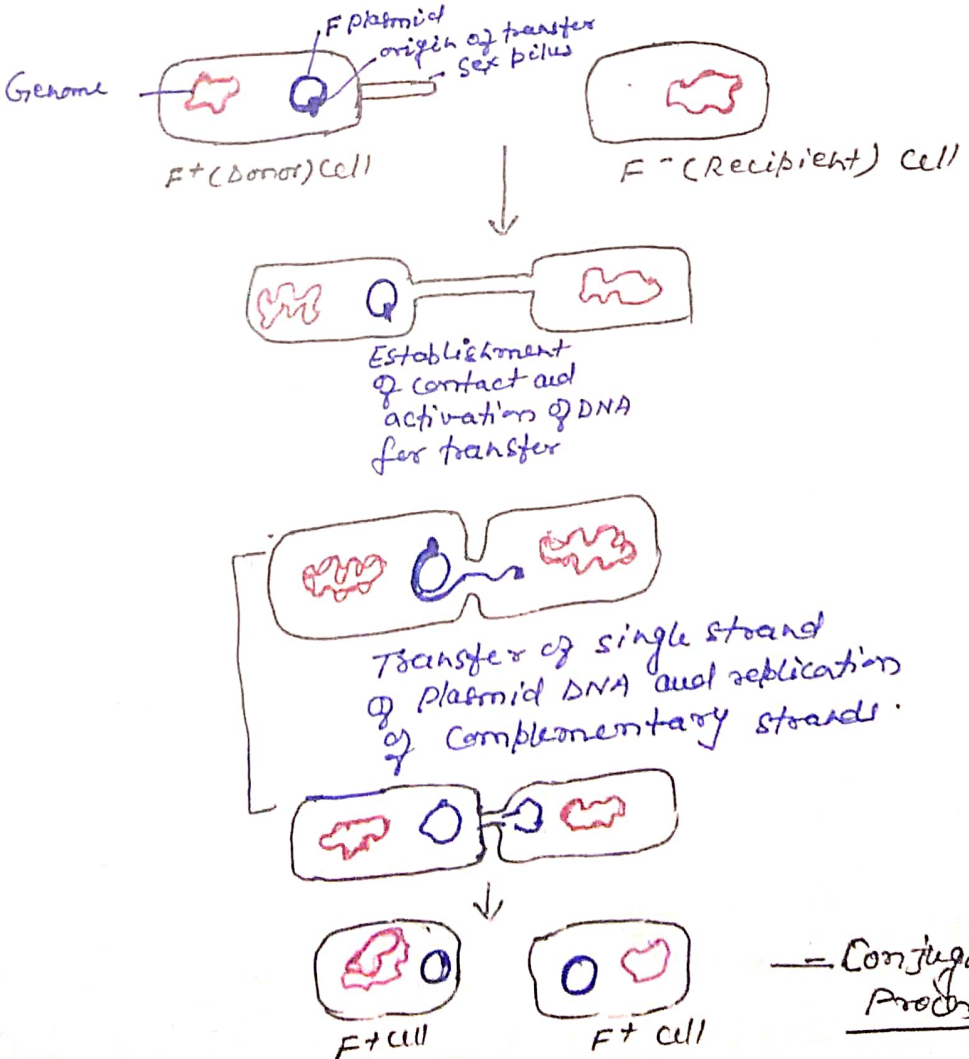
(iii) E. Coli shows sexual differentiation. The donor cell contain a fertility, sex or F-factor, also called Male cell (F^+ cell). The recipient cell lacks F-factor and designated as F^- cell or Female cell.

(iv) F-factor, which is a piece of DNA, exists in the cytoplasm either as an autonomous body (i.e, episome) or may be integrated into the chromosome of the bacterial cell. The later condition is known as Hfr (High frequency of recombinant)

(v) During conjugation a copy of F-factor from Donor cell is transferred to the recipient cell. As a result the F^- cell (female) ~~cell~~ is changed into F^+ cell (male cell). The process occurs through a cytoplasmic bridge which is formed after chance collision and surface contact.



— Conjugation Process

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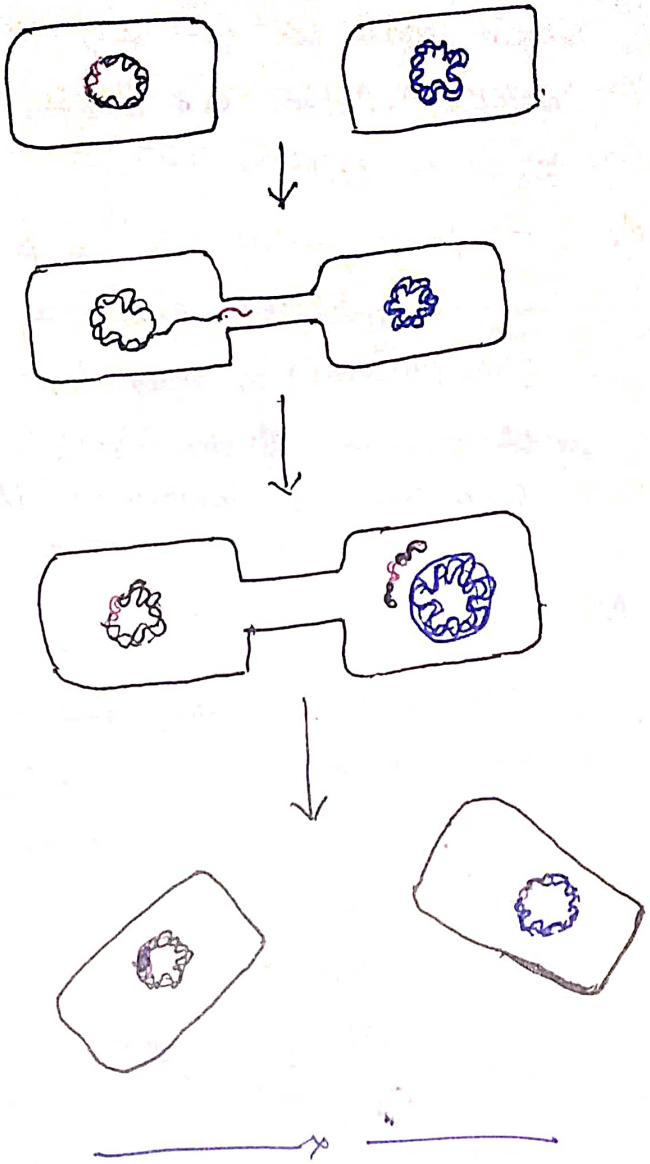
Bacterial Conjugation with Hfr donor cell



1. Hfr cells contains contains genes that allow them to transfer some or all of their chromosom to another cell

2. Conjugation tube connects Hfr cell to normal cell. Copy of Hfr chromosome begins to move to recipient cell

3. Homologous sections of chromosome synapse.

4. Cells separate. Section of Hfr chromosome integrates into recipient chromosome by crossing over.