REPRODUCTION

Bacteria reproduce by three methods

(1) Vegetative reproduction (2) Asexual reproduction (3) Genetic recombination

Vegetative reproduction

This type of reproduction takes place by two methods.

(i) By budding

(a) This type of veg. repro. Was discovered by **Bisset** and **Hale** in ***Bifidi*** bacterium.

(b) Bacterial cell produce a bud like out growth. Genophore of bacterium replicates and one copy is transferred to the bud. Now due to the constriction at the place of bud formation, it separates from the bacterial cell and acts as a new bacterial cell.

(ii) Binary fission -

(a) This is the most common method of bacterial reproduction. Binary fission takes place by amitosis. (Amitosis is characteristic of procaryotes. Mitosis and Meiosis never occurs in procaryotes).

(b) First of all DNA replication takes place in bacterial cell. Under favourable conditions bacterial cell divide into two cells due to formation of trans verse septum in the centre of the cell. Each daughter cell grows into a new bacterium

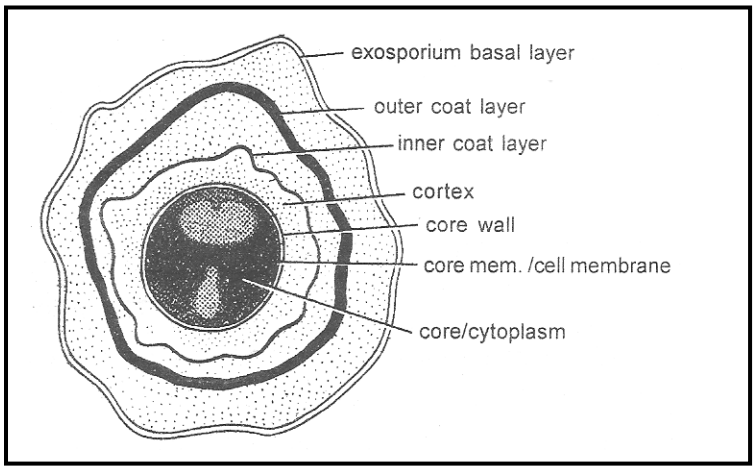
(c) Under favourable conditions, the cells of bacteria divides after every 20 minutes.

Asexual reproduction

(i) By Endospore - Endospore formation occurs under unfavourable conditions.

(a) It is a highly resistant structure. It is resistant to high temp. radiations, antibiotics and chemicals.

(b) It is also known as "reproduction with out multiplication".



Note : (1) Endospore is highly resistant structure due to presence of **Ca-dipicolinate** in its wall.

(2) Endospore is stain by **Nirosin reagent**

Structure of endosperm -

1. **Exosporium** → Lipid + Protein
2. **Spore coat** { Outer spore coat → Lipid + protein; Inner spore coat → Lipid + Protein + Sulphur
3. **Cortex** → Ca-dipicolinate (Dipicolinic acid) + Peptidoglycan
4. **Core wall** → Lipid + protein
5. **Core mem./Cell mem./Inner mem** → Lipid + protein
6. **Core/Cytoplasm** → DNA & other material

Under the favourable conditions protective layers rupture and the cytoplasm with cell membrane comes out side in the form of young bacterium.

e.g. Endospore formation is seen in mostly Bacillus type of bacteria.

(ii) By Cyst -

Under unfavourable conditions some bacteria reproduce by cyst formation. Bacterial cell secretes a thick wall around it self. Under favourable conditions protective layer breaks and bacterium becomes free.

Genetic recombination

True sexual reproduction is absent in bacteria because it does not involve fusion of male and female gametes to produce a diploid zygote. Genetic recombination involves transfer of some genes from a bacterium to another bacterium. There are three methods of genetic recombination.

(1) Transformation -

(a) In this process one kind ob bacterium is transformed into another kind.

(b) Transformation was first of all discovered by **Griffith** (1928) in ***Diplococcus pneumoniea*** (New name - ***Pneumococcus pneumoniae).***

(c) Detailed study was carried out by **Avery, Macleod** and **Mc Carty**

Griffith's experiment :

Griffith selected two strains of *Diplococcus pneumoniae* for his experiment.

1. **S - III strain -** This strain was virulent/pathogenic, capsulated, smooth

2. **R - II strain -** This strain was non virulent/non pathogenic, non capsulated, rough.

(a) First of all R-II was injected to a Mice $\rightarrow$ Mice survived and did not show symptoms of pneumonia.

(b) S-III injected to a mice $\rightarrow$ Mice developed symptoms of pneumonia and deiced.

(c) S-III Strain heat killed and then injected in mice $\rightarrow$ Mice did not develop the pneumonia.

(d) Heat killed S-III were incubated with the living R-II for some time. This mixture was then injected in a mice $\rightarrow$ Mice developed pneumonia and died.

Conclusion -

On the basis of this experiment Griffith concluded that some material of S-III strain transformed the R-III into S-III.

But Griffith could not identify the material responsible for transformation. It was later identified by **Avery, Macleod** and **Mc Carty** as **DNA.**

(2) Conjugation -

Conjugation was first discovered in 1946 by **Lederberg** and **Tatum** in ***E.coli.*** They were awarded Nobel prize for their work.

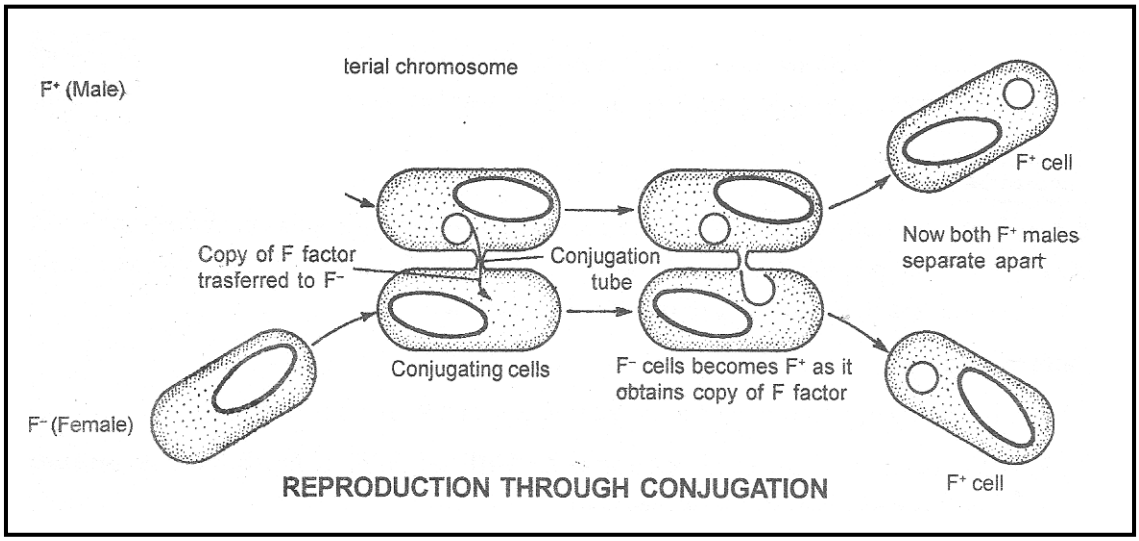
Detail study was carried out by Wollman and Jacob In *E.coli.*

Conjugation between F^+ and F^-

(a) First of all donor cell (F^+) is attached to recipient cell (F^-) with the help of sex pili. Sex pili functions as conjugation tube.

(b) The 'F' factor (F plasmid) now replicates and the replica moves to F^- though conjugation tube.

(c) Both the cells are the separated. Due to transfer of 'F' factor F^- bacteria now becomes F^+ bacteria.



Conjugation between Hfr (male and F^- (female) :

(Hfr - High frequency or super male)

(Name **Hfr** was given by **Cavalli**)

(a) Some times the 'F' factor (F plasmid) incorporates in genophore then this cell is called Hfr male or high fertility male.
(b) First of all Hrf attached to the F^- cell.
(c) The genophore now replicated and 'F' factor also replicates along with the genophore.
(d) Now the replica of the genophore and 'F' factor moves in to the F^- cell in the linear form. The 'F' factor lies at the last end.
Only a part of genophore can be transferred to F^- because even a slightest disturbance in nature leads to the separation of conjugating bacteria.
(e) DNA segment of Hfr cell now attached with the homologous segment of F^- genophore.
(f) Transferred DN of Hfr cell is called exogenote and homologous part (Endogenote) of F^- genophore is called endogenote.
(g) F^- cell is now called **merozygote** (partial diploid) or **partial zygote** (Flase zyote). F^- cell now develops some characters of F^+ cell.

(iii)Sexduction –

(a) It was discovered by **Jacob** and **Adelberg.**
(b) When 'F' factor detaches it self from the senophore. It also carry some part of genophore.
(c) Hfr male now converted into F^+ male.
(d) When this cell conjugates with F^- its, 'F' factor transferred into the F^-.
(e) Due to the genophore segment of donor cell the F^- or recipient cell becomes partially diploid and also converted in male.