

REPRODUCTION IN BACTERIA

For M.Sc. SEM-I

MBOT CC-2

UNIT-II

AHMAD MASOOD
DEPARTMENT
OF BOTANY

H.D. JAIN COLLEGE
ARA.

Mob: 9430293428

WhatsApp: 9631235957

Bacteria reproduce

by (i) vegetative

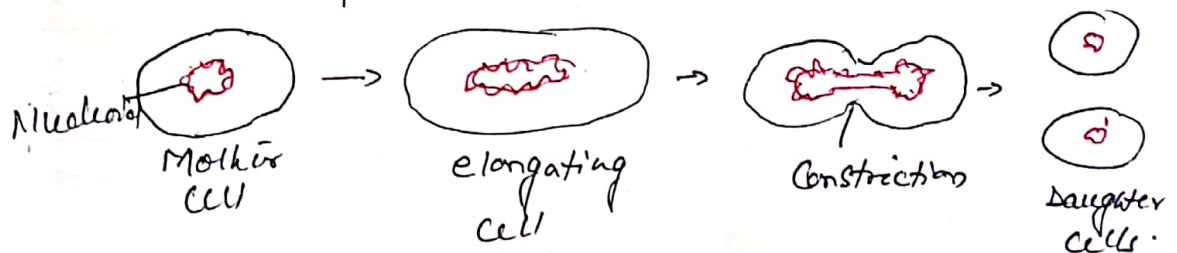
(ii) asexual, and

(iii) genetic recombination
or sexual means.

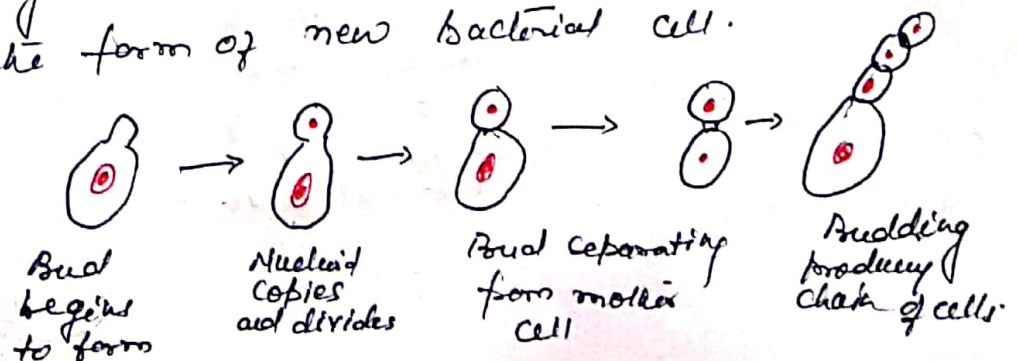
(1) VEGETATIVE REPRODUCTION:

Mainly by Binary fission and budding

(1) Binary fission: This is the commonest method of reproduction found in bacteria. This involves the elongation of cell and formation of a transverse septum as well as division of the chromosome. Both the events occur simultaneously and two genetically identical cells are produced.



(2) Budding: Commonly observed in the genus Hyphomicrobium. In this process, the cell produces outgrowth called buds. Cytoplasm and the chromatin material enter the bud which later separates from the parent cell by constriction. The separated bud takes the form of new bacterial cell.



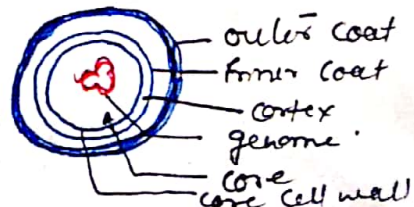
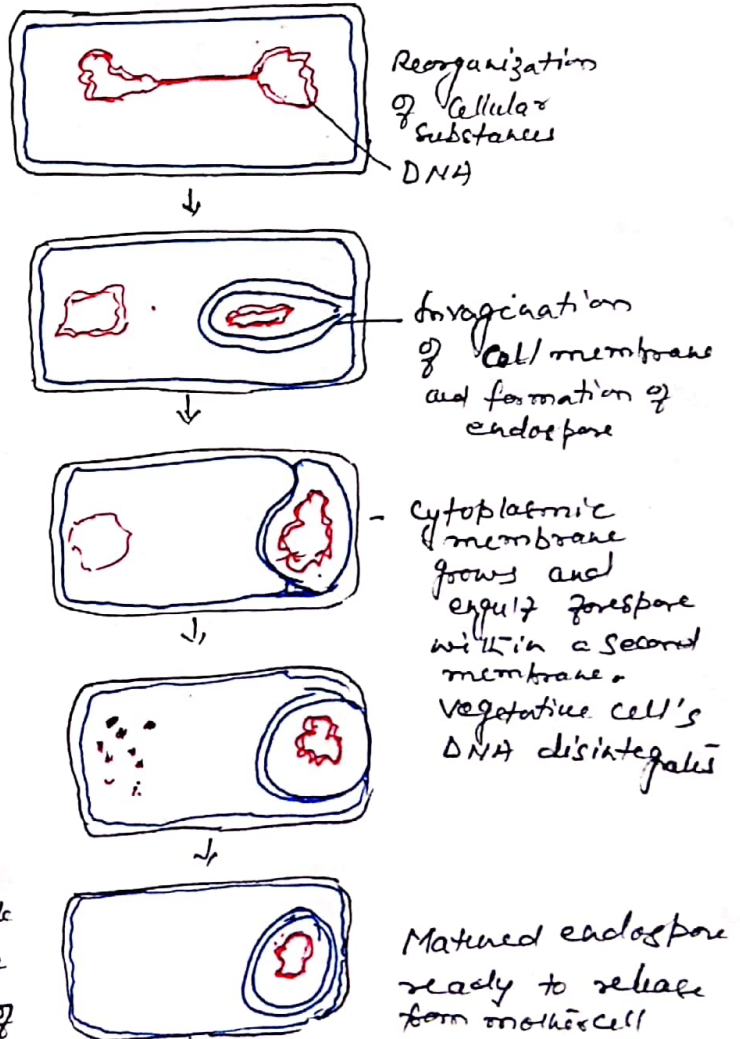
(II) ASEXUAL REPRODUCTION:

By endospore, conidia, zoospore and cyst formation.

(1) Endospore: This is the most common method of asexual reproduction.

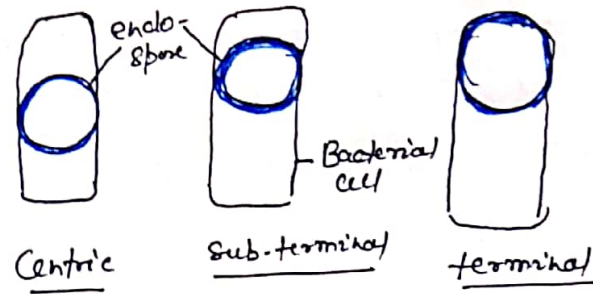
- Endospores are organs of preservation rather than reproduction. They can withstand extreme conditions.
- Formed in bacteria like Clostridium, Bacillus etc under unfavourable condition.
- A single endospore is formed in one cell
- The endospore formation begins with the invagination of cell wall followed by invagination of the cell membrane

- A septum is laid down around the concentrated genome.
- The released endospore has a cortex and spore coat.
- The cortex of the endospore is a complex of calcium, dipicolinic acid and peptidoglycan.
- This complex forms about 5-10% of the dry weight of the endospore and is responsible for the resistance to the extremes of physical and chemical forces.



AHMAD MAJID
BOTANY
H.D. Jain College
etc.

- The endospores are smaller than the parent cell.
- According to the place of formation, the endospores may be central, terminal and subterminal.



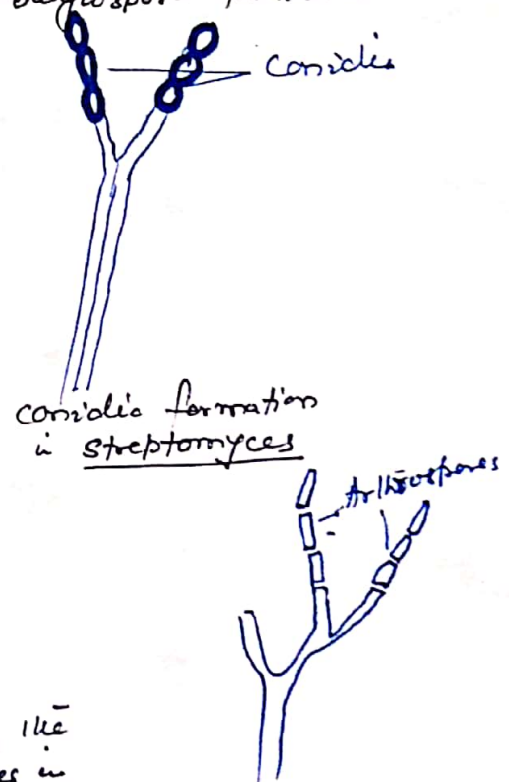
- With the advent of favourable condition, the spore coat breaks open and a new bacterium is produced.

2. Conidia, Sporangiospores: In some bacteria

like Streptomyces, the asexual reproduction occurs by conidia or Sporangiospore formation.

They are formed by multiple cleavage and fragmentation in the mycelial forms.

When the spores are not in any sac like structure, they are called Conidia or Conidiospores or arthrospores. When they are formed in a sac, they are called Sporangiospores.



3. Cyst: In Azotobacter, the encystment occurs by changes in the cell wall and the whole cell is transformed into cyst (unlike endospore formation). Bacterial cyst differs from endospores in the way they are formed.

(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.

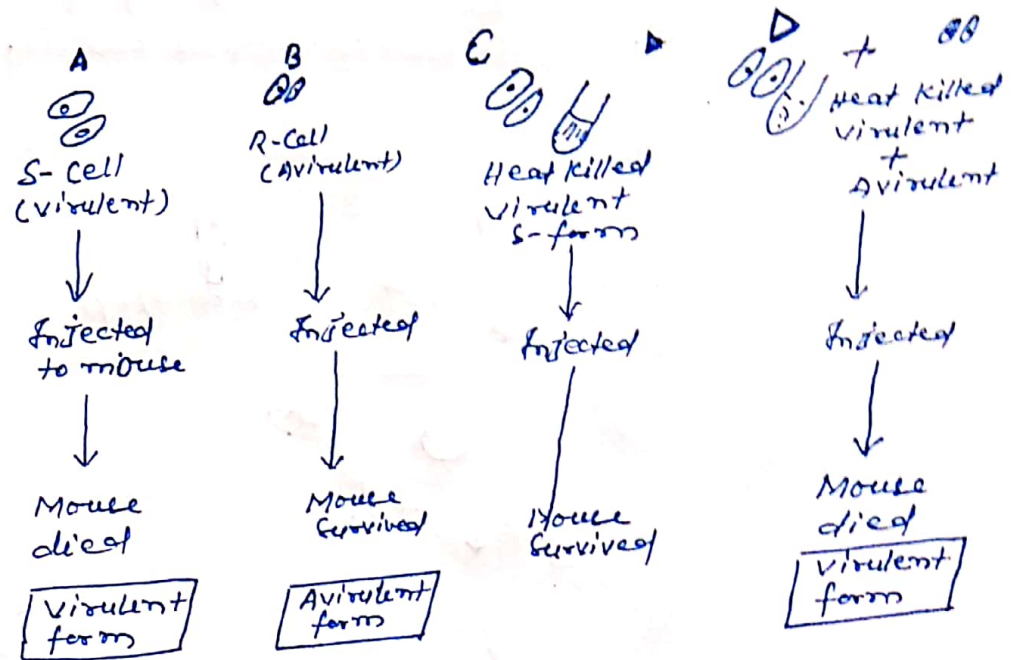
It may occur by different processes —

1. Transformation
2. Transduction
3. Conjugation.

1. Transformation: (i) It is the transfer of DNA molecules from donor to recipient cell, and two never come in direct contact.
- (ii) This process 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-cells 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 McCarty in 1944.

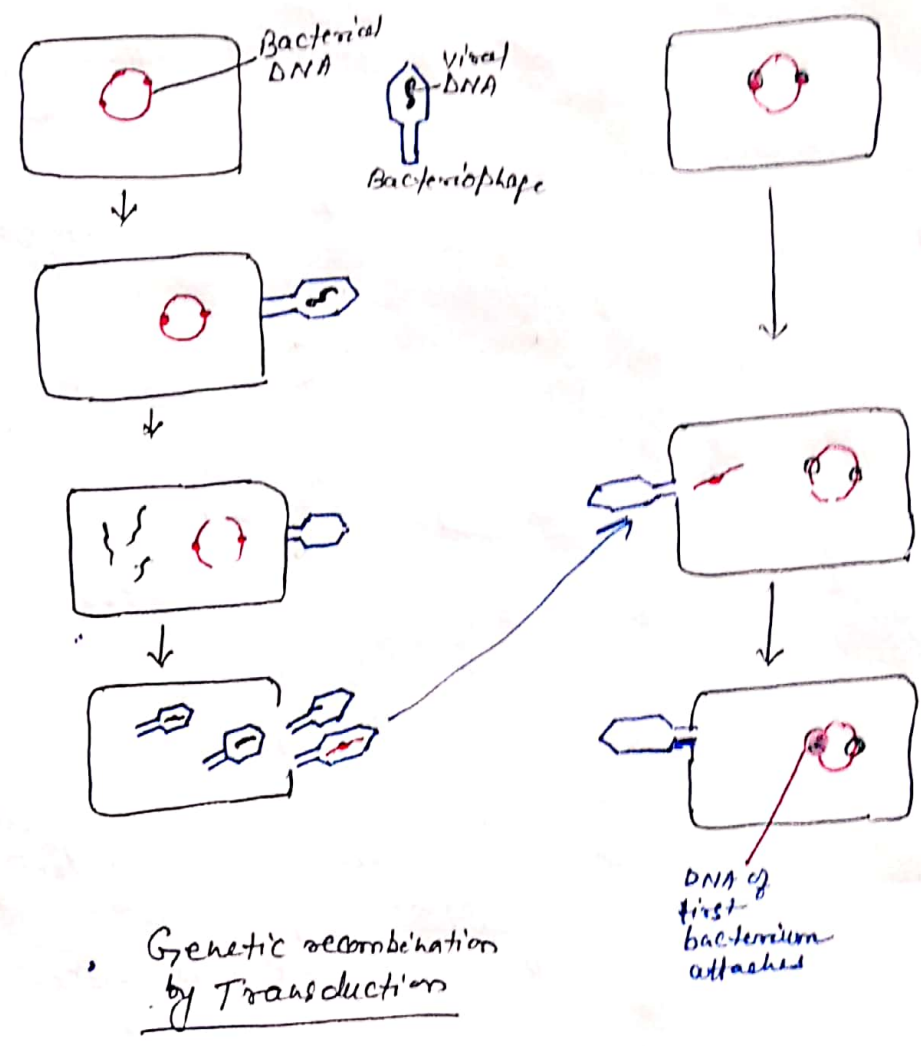
(ix) During this process a short piece of DNA, containing one or more genes, is released by the donor cell (in the medium). It enters the recipient cell and recombinants are formed.



Griffith's experiment

2. Transduction :
- (i) This is the transfer of genetic material from one bacterial cell (donor) to the ~~recepti~~ 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.



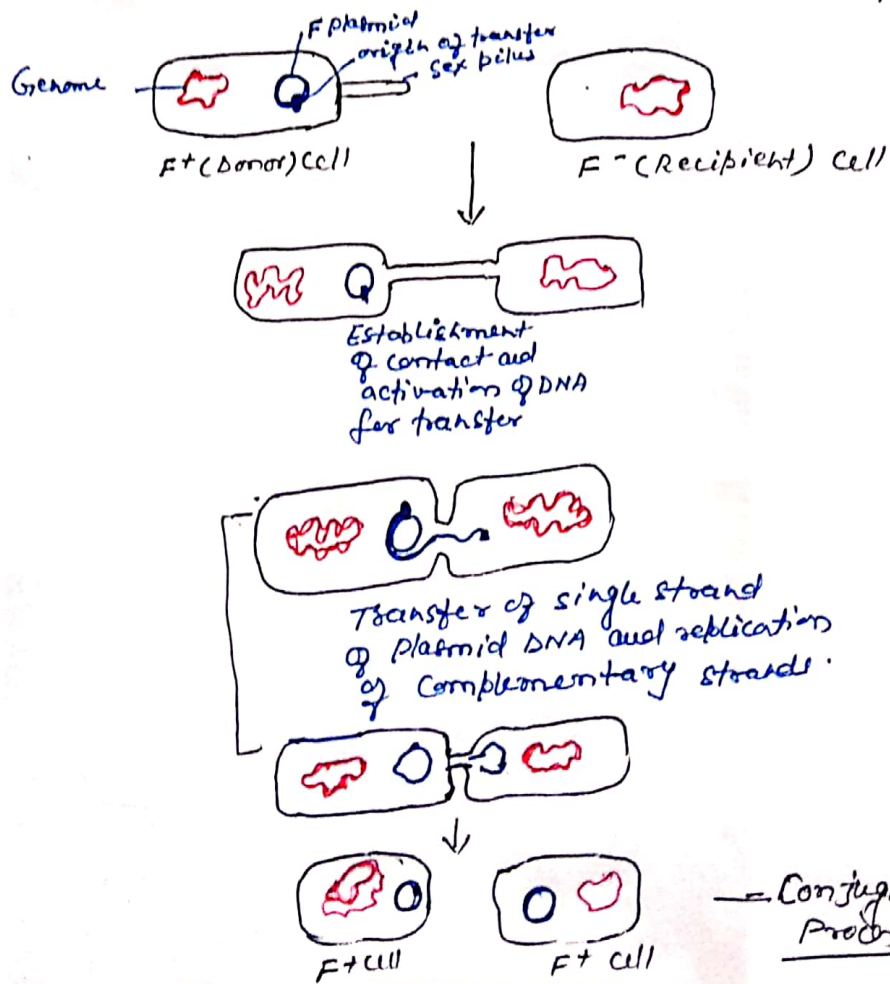
3. Conjugation: (i) It involves direct contact between donor and recipient bacteria.
 (ii) The process was discovered by Lederberg and Tatum (1946) in Escherichia coli, a common human colon bacterium, and worked out in details by Wollman, Jacob and ~~by~~ Hayes in 1956.

AHMAD MAHMOOD

(iii) E. coli shows sexual differentiation. The donor cell contains 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 latter condition is known as Hfr (High frequency of recombination)

(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.



AHMAD M. MOHAMED
BOTANY
H. A. Saikh College
Ain

Conjugation Process