

B.Sc.Sem-I Paper Name:- Cell Biology and Biodiversity

Paper Code:- US01CBIO21

Unit-3 Reproduction in bacteria

- Reproduction in bacteria
- Asexual reproduction is characteristic of all bacteria, The exchange of genetic material is observed in some species of bacteria. This is essential (આવશ્યક) feature of sexual process and is denoted(અને તેના માટે) by the term genetic recombination(જનીનો નું ફરીથી જોડાણ).

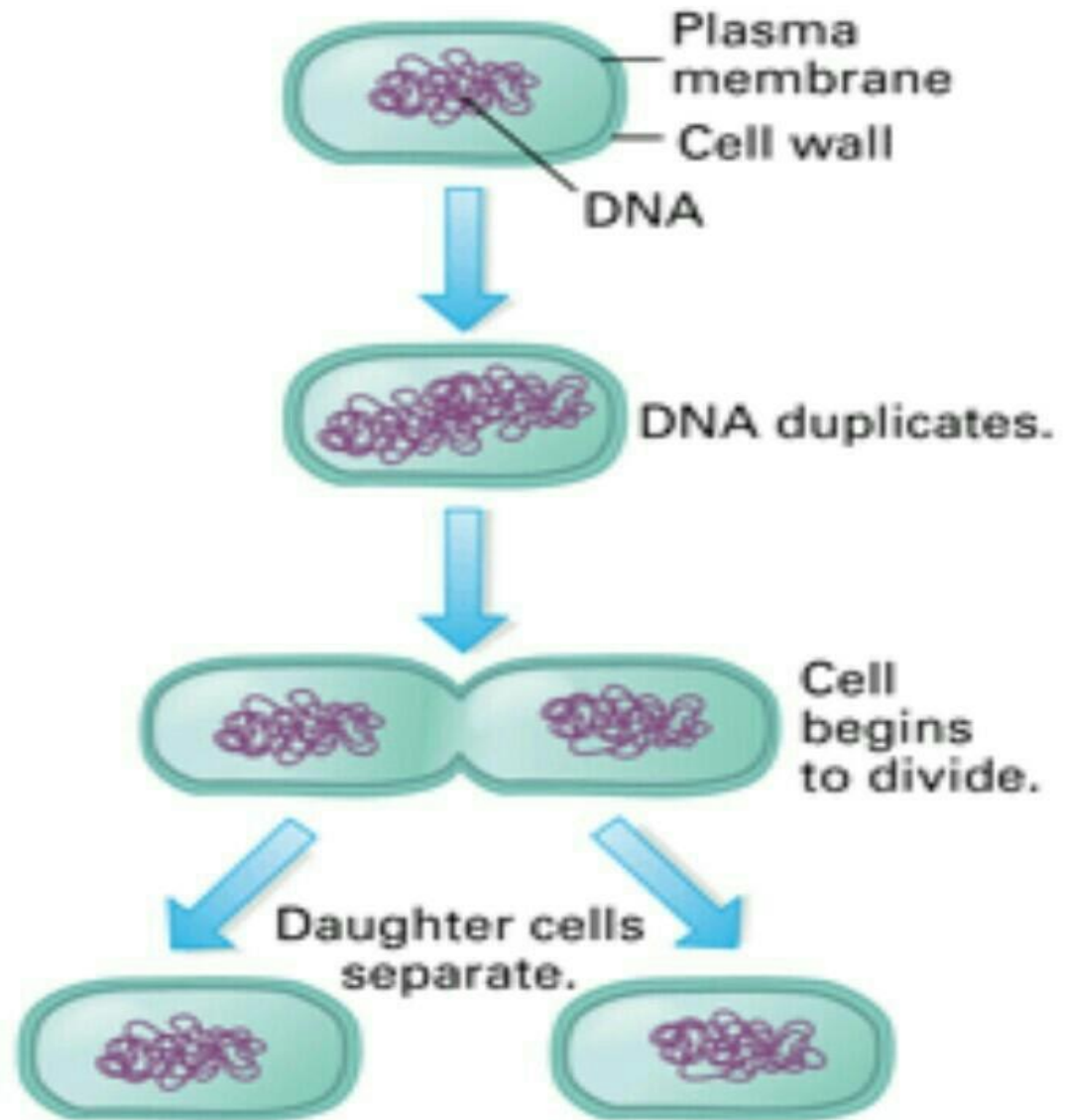
- ▶ It takes place by two method (1) Asexual and (2) Sexual reproduction.
- ▶ (1) Asexual reproduction :- It takes places by two method.
- ▶ (a) Vegetative and (b) Spore-formation
- ▶ The Most common method of vegetative reproduction in bacteria is binary fission.
- ▶ Binary fission(ଦ୍ଵିଭାଜନ):-
- ▶ Bacteria reproduce by a simple process of cell division called binary fission.
- ▶ The bacteria are doubled for every 20 minutes.

► The time required for a cell to divide by binary fission is called doubling or generation time.

► If bacteria go on dividing at this rate, theoretically 10^{21} cells are formed in 24 hours.

But in reality , the multiplication is stopped after few cell divisions due to non - availability of nutrients and accumulation (સંગ્રહ થવો અથવા ભેંજ થવું) of toxic substance

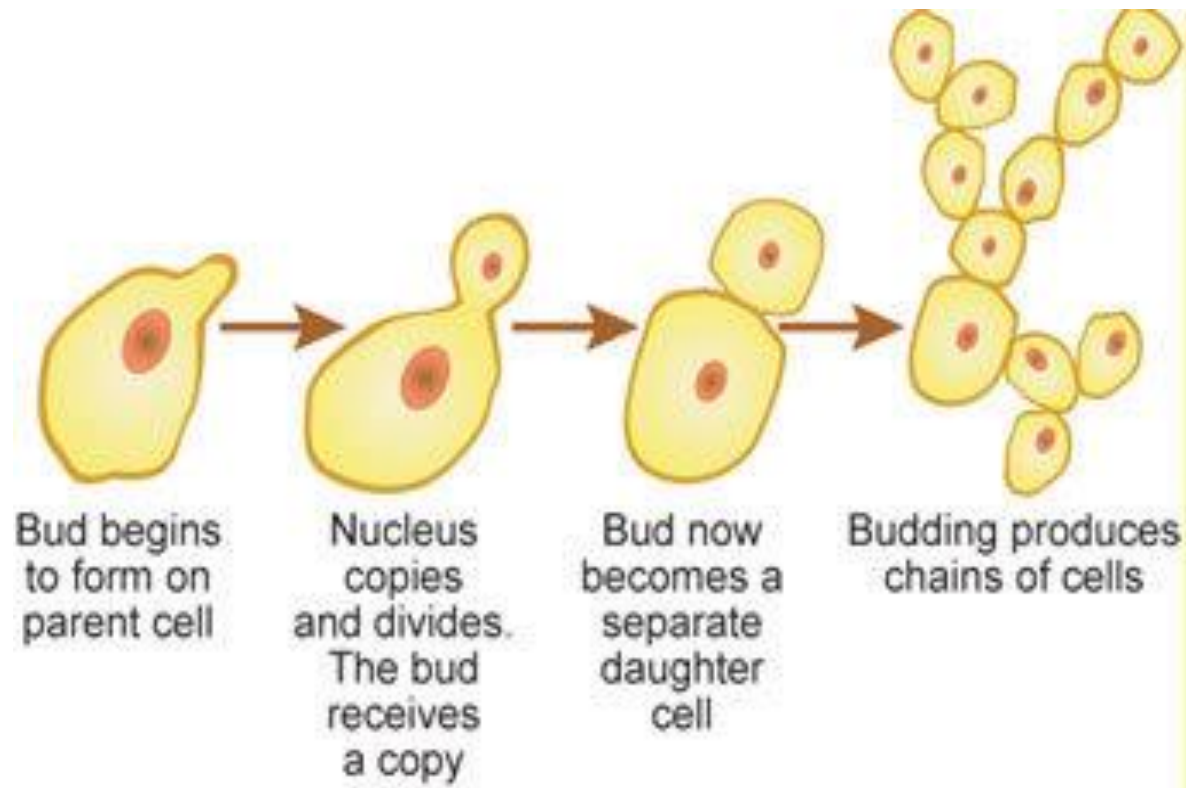
Binary Fission



- ▶ Binary fission involves 3 steps.
- ▶ 1 DNA duplication. 2 DNA partition 3 Cross wall formation.
- ▶ In first step the duplication occurs by separation of two strands of DNA.
- ▶ Each separated DNA strand acts as template(નમુના તરીકે) and synthesizes a complimentary copy (તેના જેવીજ નકલ ઉત્પન્ન કરવી) .
- ▶ In second step, the double DNA distributed.
- ▶ In the third step the cytoplasmic membrane grows towards the centre to form a transverse septum.

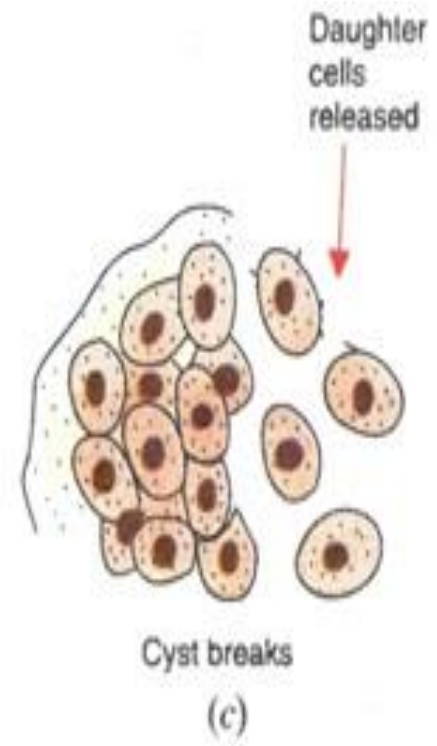
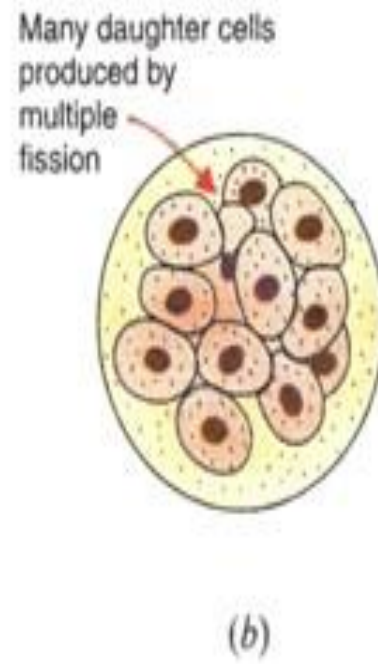
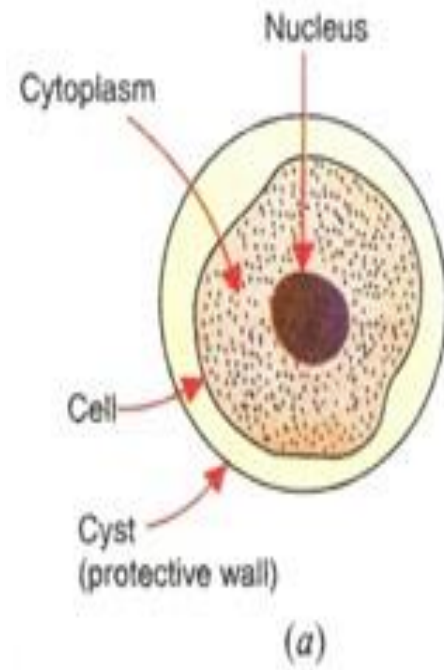
- ▶ The cell wall material is deposited on both side forming cross wall.
- ▶ The daughter cells are seprated.

- ▶ **Budding(કલિકા):-** Some bacteria multiply by budding. A small protuberance (ઉપસીઆવેલ ભાગ) is developed on cell surface.
- ▶ Which gradually (ધીરે ધીરે) increase in size. It is called bud. The genetic material divides into two portions. One of these migrates into bud. The bud subsequently (ત્યાર પછી) grows to the normal size. It may get separated later.



► Cysts(કોષ)

- :-In certain bacteria. The entire protoplast (આદીજીવરસ) of the cell shrinks from the cell wall and becomes rounded. A thick wall is secreted around it to form a resistant(પ્રતિકારક) structure, which is called cyst. The cysts are formed in certain species of Azotobacter. Under favourable conditions ,the cyst germinates (અંકુરણ થવું, તૂટવું) to produce new bacterium cell.



Spore formation

- ▶ Some bacteria produce non - motile spores , which are of the following type.
- ▶ **Conidia(કોનીડીઆ):-** The bacteria streptomycetes are gram +ve , filamentous branched bacteria. It cuts of tiny oval or round spores - conidia in chain
- ▶ Each conidium can germinate to give rise to a new bacterium.

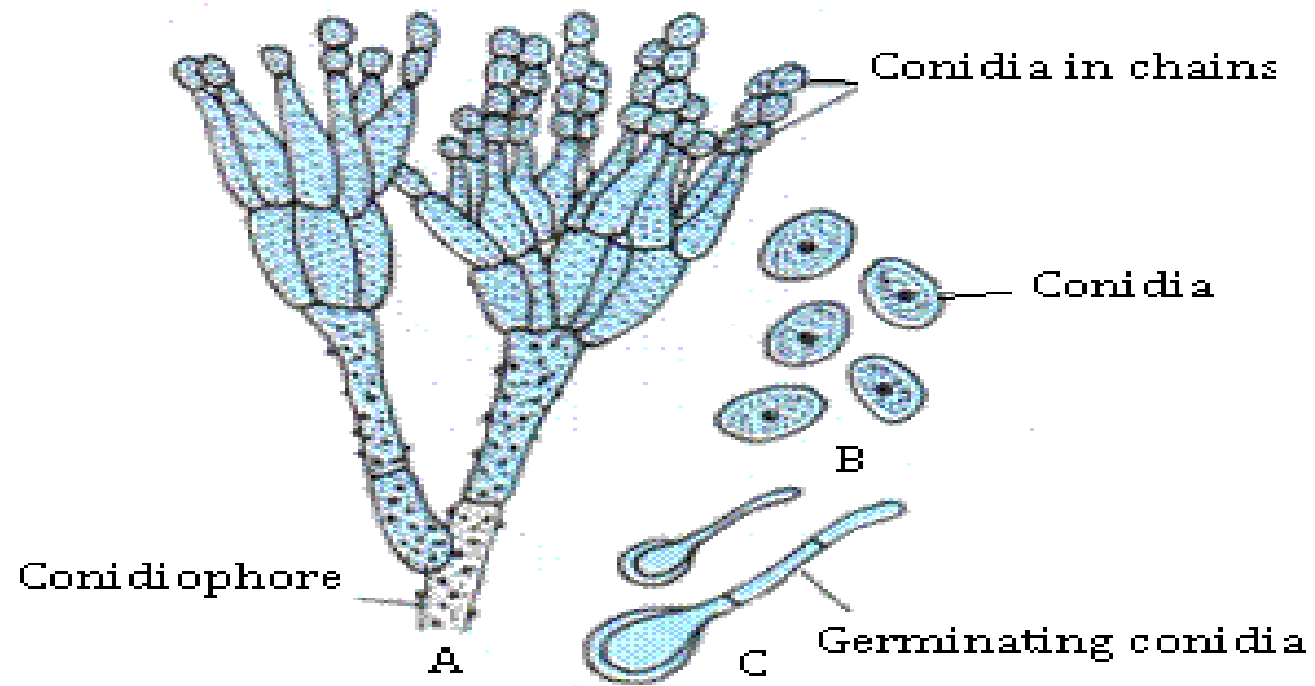


Fig. 13. *Penicillium*: Asexual reproduction
A. Conidiophore; B. Conidia; C. Germinating conidia

- **Oidiospores:-** In bacteria , Actinomycetes , the filament undergoes(પસાર થવું) septation(નિર્ણય ભાગ થવું) throughout its length to form numerous small reproductive units know as Oidiospores. Each oidiospore , on germination produce a filamentous bacterium.



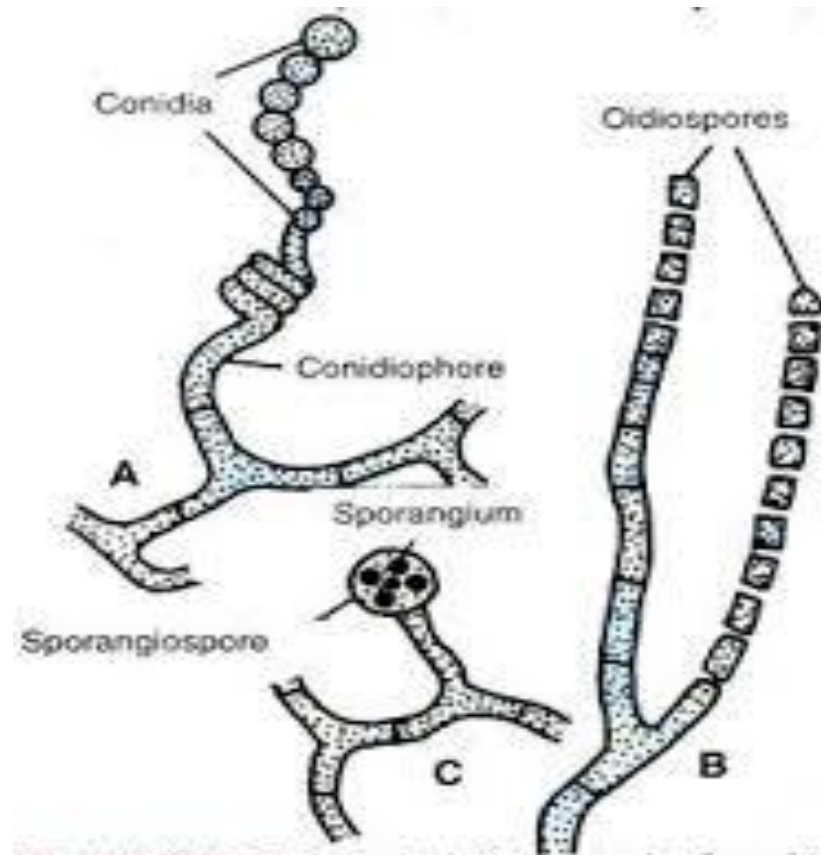
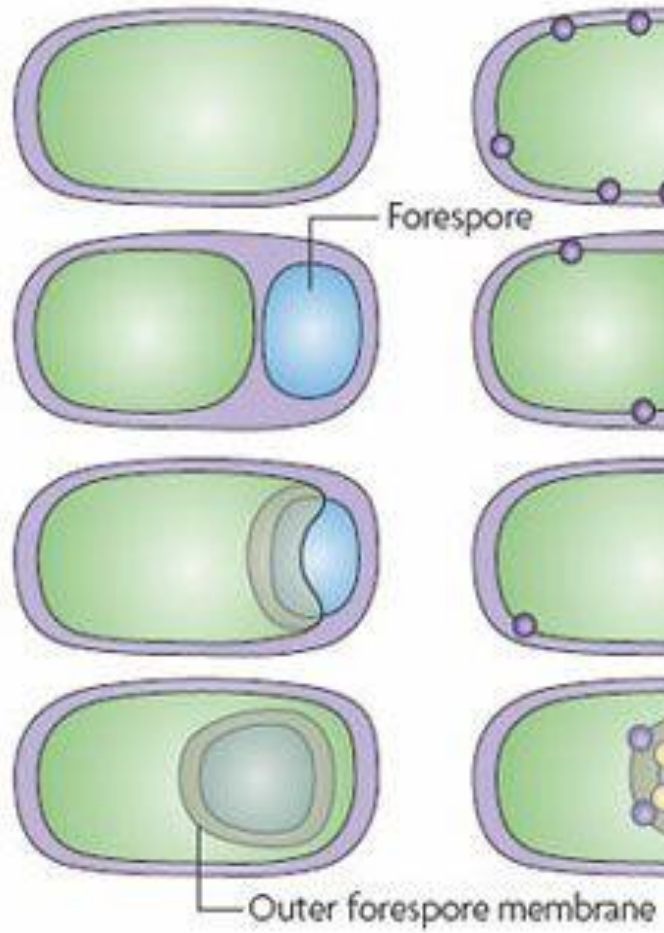


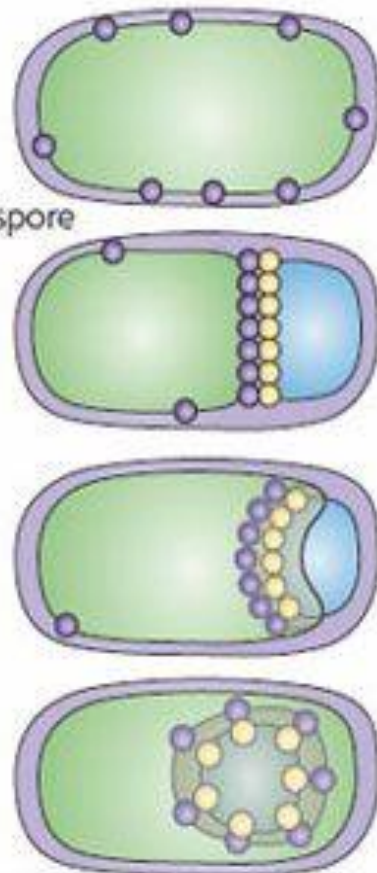
Fig. 18.10 (A-C). *Bacteria*, Actinomycetales (branching bacteria) producing three types of spores.

- ▶ **Endospores:-** Certain bacteria produce thick walled extremely resistant (જાડી દીવાલ અને ખુબજ પ્રતિરોધકતા ધરાવતી) spore within cell .They are called endospores.
- ▶ They are resistant (પ્રતિરોધકતા) to unfavourable conditions like heating,drying,freezing,,chemical and radiation.
- ▶ Only one spore is formed per cell.
- ▶ When conditions are favourable the endospore transform into vegetative cell.
- ▶ The endospore may be central , terminal or lateral in position.
- ▶ They are resting spores found in Bacillus and Clostridium species.

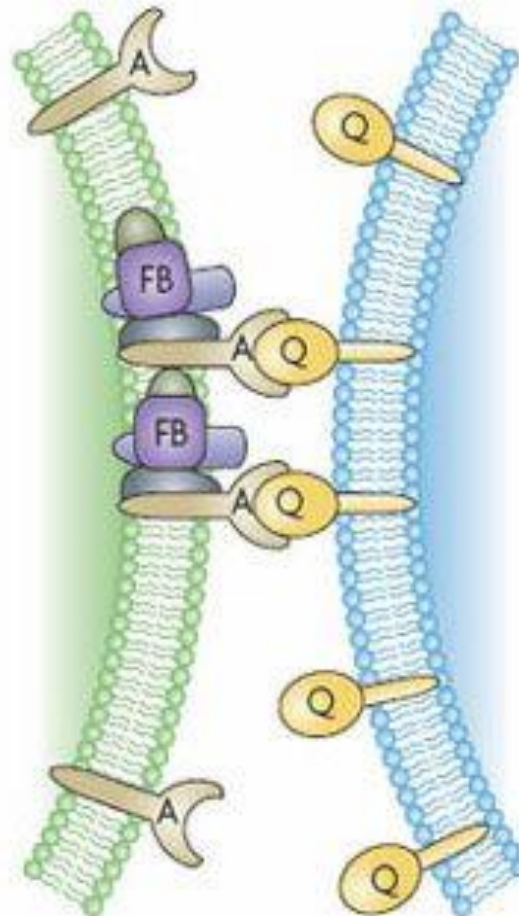
a *B. subtilis* sporulation



b Diffusion and capture



c Zipper model



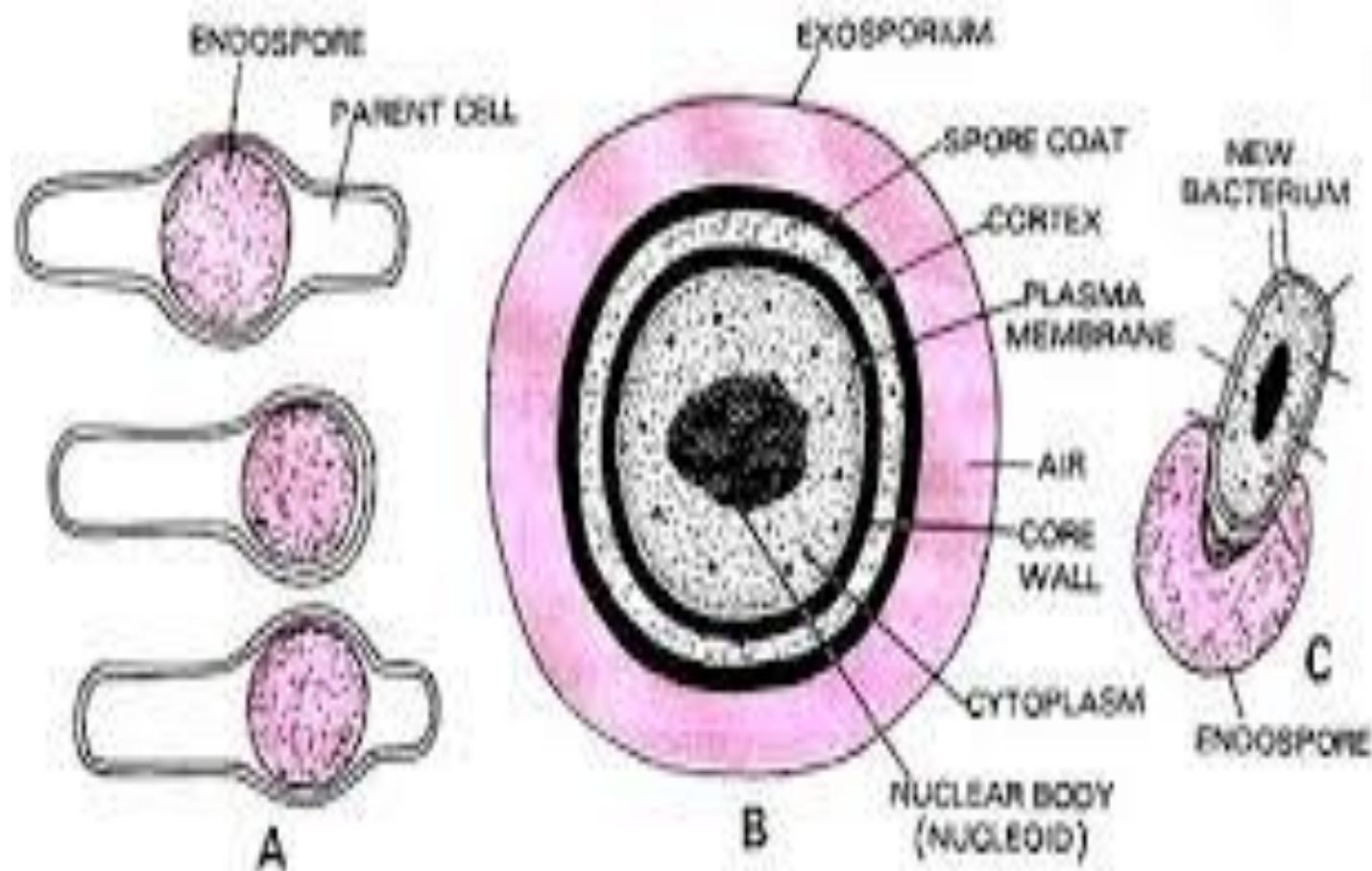


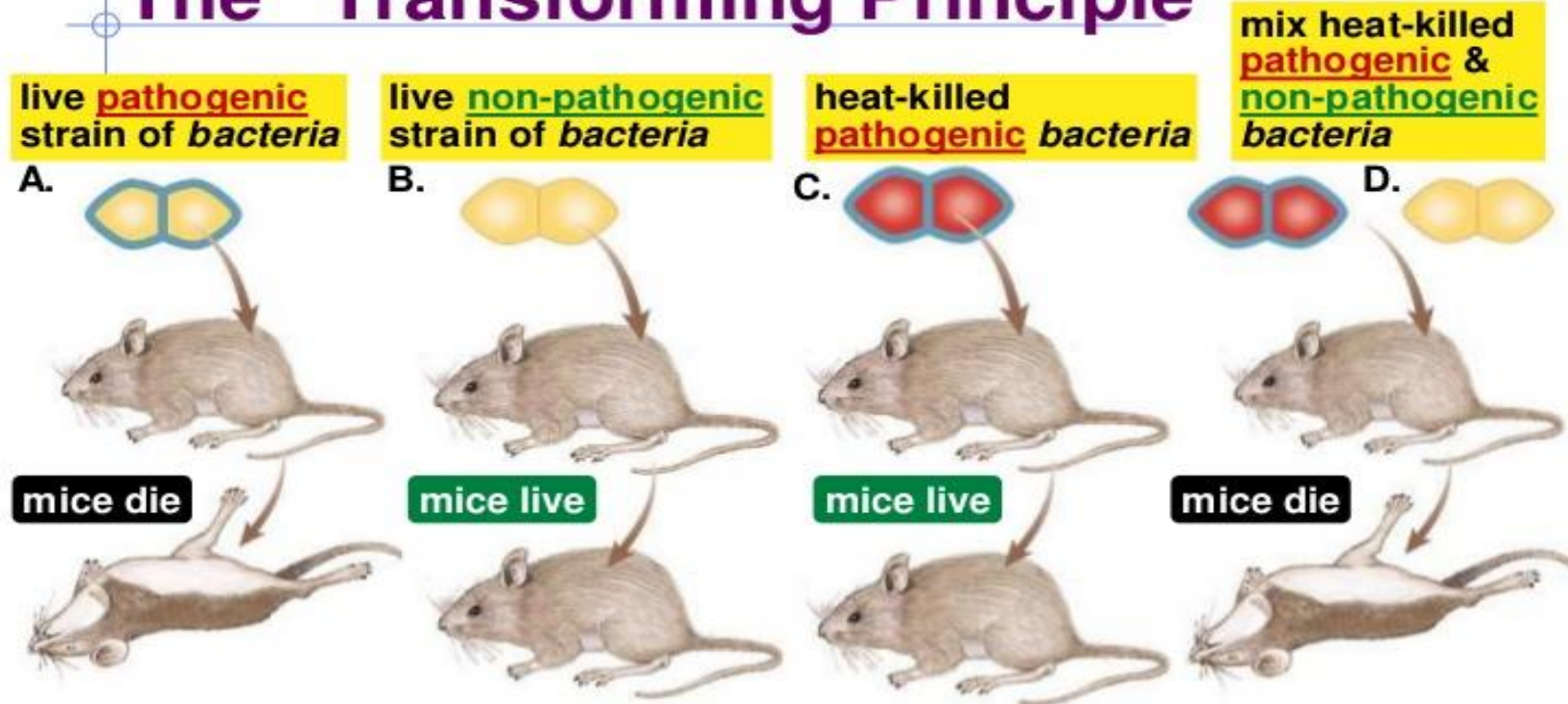
Fig. 2.12. Endospores. A, types of endospores according to their position in parent cells. B, structure of an endospore. C, germination of endospore.

Sexual Reproduction

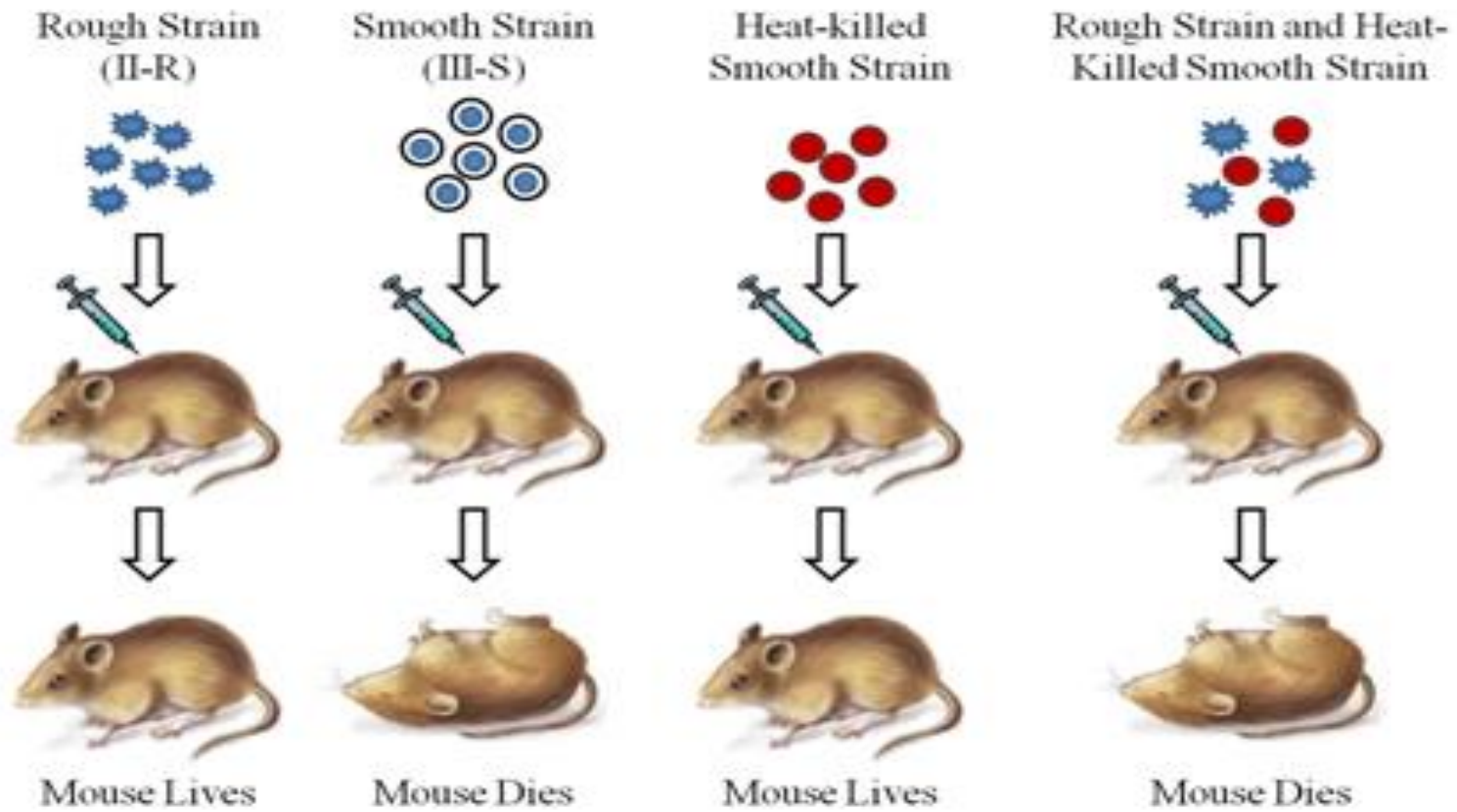
- In bacteria sexual reproduction involves genetic recombination. In bacteria sex organs and meiosis do not occur. A portion of DNA is transferred from donor cell to recipient cell. This gene transfer or genetic recombination is a precise process(યોજકસ પ્રક્રિયા). There is no increase or decrease in nucleotide of recipient cell but only an exact(નિશ્ચિત, યોજકસ) substitution of some donor nucleotides in place of some recipient nucleotides.

- **Transformation:-** The phenomenon of transformation was first observed by Griffith, a British bacteriologist (1928). He was working with bacteria *Diplococcus pneumonia* (*pneumococcus pneumonia*). There are two strains of bacteria. One virulent and other avirulent strain, both differ in morphological and colony characters. The virulent strain was capsulated and formed smooth colonies on growth medium (S type). The avirulent strain was non-capsulated and formed rough colonies on growth medium (R type).

The “Transforming Principle”



Transformation = change in phenotype
something in heat-killed bacteria could still transmit
disease-causing properties



- ▶ He carried out the experiment as follows:-
- ▶ 1) He injected S type virulent bacteria strain into mice, as a result, the mice was dead.
- ▶ 2) He injected R type avirulent bacteria strain, the mice was not dead.
- ▶ 3) The heat killed S type bacteria also could not kill mice.
- ▶ 4) He injected mixture of heat killed S type and live R type, the mice was killed. The dead mice showed(સાબિત કરવું ,બતાવવું) the presence of virulent S type bacteria.

- It means that the avirulent non - capsulated bacteria were transformed into virulent capsulated bacteria. Griffith concluded that something has been transferred from heat killed S type capsulated bacteria to live R type non - capsulated bacteria. So that R type bacteria are transferred into S type.
- Avery, McLeod and McCarty (1943) proved(સાબીત) that transformation from avirulent R type to virulent S type was brought about by DNA.(જે ફેરફાર થયેલ છે, તે DNA ફેરફાર ને હિસાબે થયેલ છે.)

- The S type bacteria were heat killed, but their DNA remained intact (DNA યથાવત, અંકબંધ રહ્યું).

DNA is heat stable (સ્થિર, અચળ).

The DNA of S type was taken up by live R type bacteria and subsequently (ત્યારબાદ), they become S type capsulated. This type of gene transfer is called transformation (ક્રિયાપલટ, રૂપાંતર).

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