BACTERIAL CELL

Ques: With the help of suitable diagrams describe the electron microscopic structure of Bacterial Cell?

Ans: In recent 20 years, through Electron microscope the Bacterial Cell has been studied in detail. It reveals that it is prokaryotic in Cellular Organisation; being Complicated and following main structures are visible:-

1. Capsule
2. Cell wall
3. Plasma membrane (Mesosomes)
4. Cyto Cytoplast - a) Ribosomes
   b) Flagella
   c) Pili
5. Nucleoid
6. Special structures - i) Endospore
   ii) Stalk

The detailed ultrastructure of Bacterial cell is given below:-

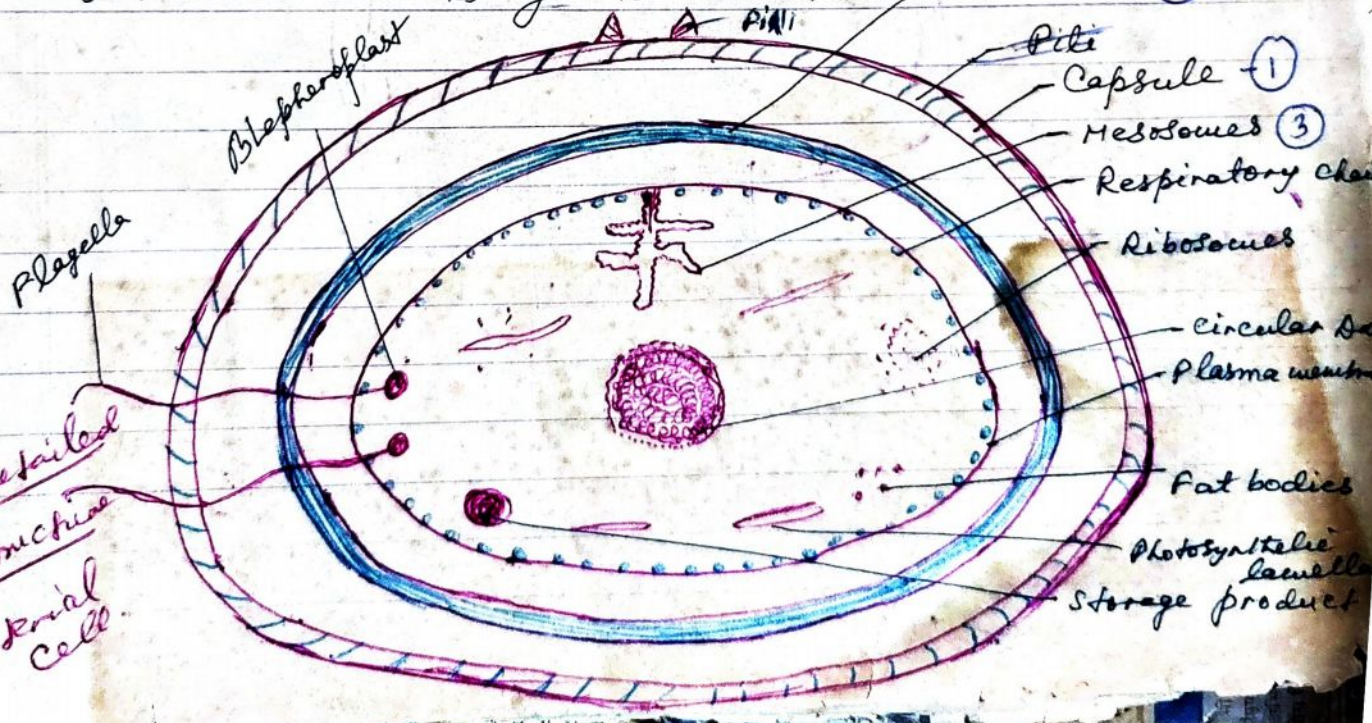
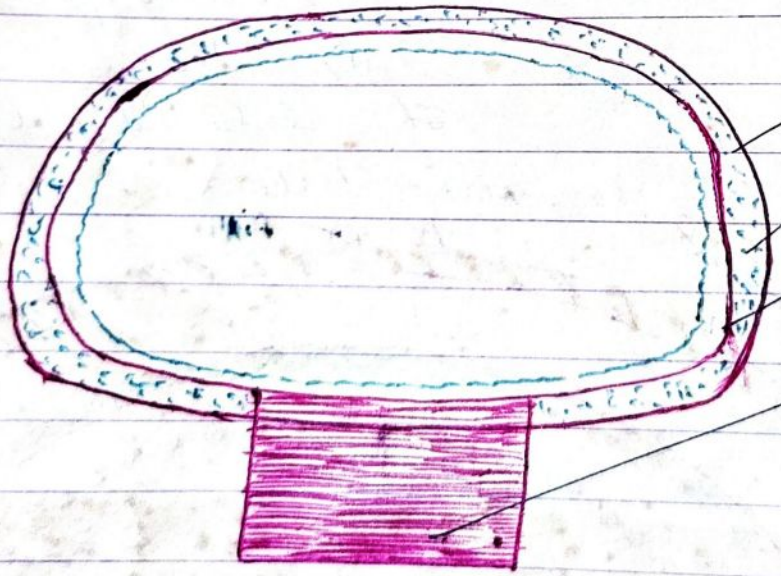


Fig - Detailed ultrastructure of Bacterial cell.

(1) **Capsule** ⇒ Some Bacteria like *Bacillus anthracis* and *Diplococcus pneumoniae* possess a thick or thin gelatinous covering outside the cell wall called Capsule. Its function is to protect bacterial cell from injury, to prevent complete drying of the cell and to protect from viral infection. Depending upon the thickness of the Capsule, it is named as Macrocapsule (More than 0.2 μ) and Microcapsule (less than 0.2 μ) if the covering is loosed, it is termed as Slime but if it is rigid and well defined, then it is termed as Capsule. Capsule is made up of poly saccharides and polypeptides of only one and sometimes two different amino acids.



Capsule.

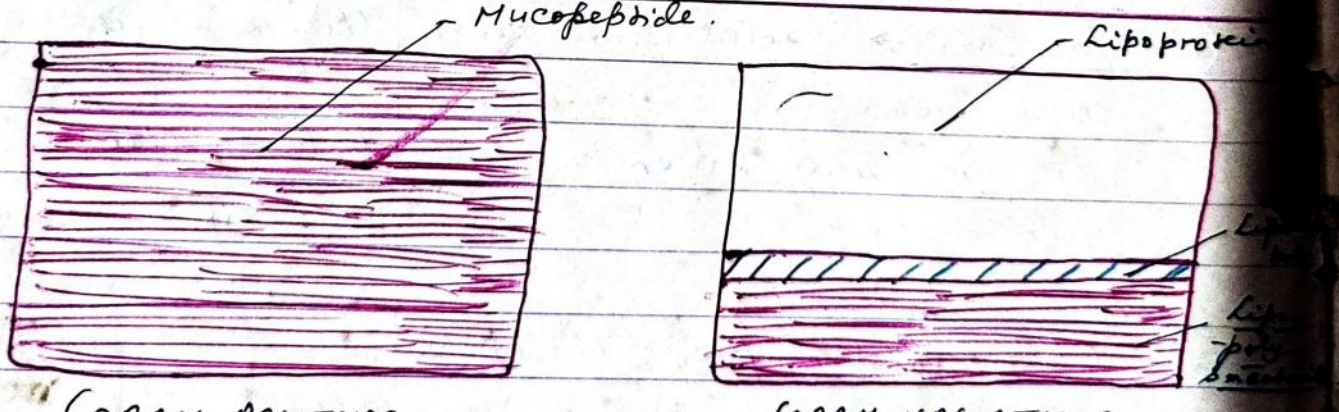
② **Cell Wall** ⇒ Bacterial cells are surrounded by a wall madeup of Mucopeptide, which is peculiar to bacteria. The amount of cell wall varies in two main divisions of true bacteria Commonly known as Gram '+' and Gram '−' bacteria.

In gram positive bacteria, it is major cell wall Components (85%), however in gram negative, bacteria it is present in small quantity (3 to 12%) mucopeptide. Mucopeptide is Composed of large number of alternating molecules of N- acetyl Glucosamine and N- acetyl muramic acid both being derivatives of glucose. The detailed chemical composition and structure of Gm positive and Gm negative bacteria Can be well marked by their differences given below:—

GRAM + (POSITIVE)	GRAM − NEGATIVE
① Thickness → Varies from 20-80 Nm and lacks the outer lipo-polysaccharide layer i.e homo-genous.	Thickness is upto 2.5 Nm (thinner). It is suppressed between the Cell membrane and lipo — polysaccharide layer. ie it is three layered
② Chemical Compon ⇒ Mucopeptide forms major portion of the wall 85% of the dry weight rest being simple polysaccha-ride which are in form of Teichoic acid. (It don't contain lipid).	② Muramic acid forms onl 3 to 12% of the total dry wt. Major portion is contributed by Lipoprotein, lipid an polysaccharide. Thus it ha lipid contents but absenc of Teichoic acid

GRAM POSITIVE	GRAM NEGATIVE.
③ Rigidity → It is much rigid due to presence of greater amount of Muco-peptide.	③ Less rigid due to plastic nature of polysaccharide Complex.
④ Amino acid Contents Complex are less.	④ Amino acid Contents are very high.
⑤ Cell wall is not so Complex.	⑤ Cell wall is more Complex
⑥ Presence of mesosomes are generally recorded in Gram positive bacteria	⑥ Generally absent
⑦ Pili absent generally	⑦ Pili present.
⑧ Example of Gram positive Bacteria is — Staphylococcus aureus	⑧ Eg - E. coli

Fig



(3) **Plasma membrane** → It is present just beneath the cell wall. It is 75Å unit membrane with a protein layer on either side of lipid bilayer. It is mainly composed of lipid and protein but small amount of Carbohydrates, DNA, RNA have also been recorded.

Lipids of plasmamembrane are mainly (Glycerophospholipids). In addition, several types of co-enzymes, Vitamin 'K' and Carotenoid. The variety of proteins in the plasma-membrane of prokaryote is much wider than Eukaryotes. Electron transport Systems are located in the plasmamembrane. Thus it is similar to Mitochondria of higher plants. The electron transport chains of Bacteria are linearly arranged or often it may be branched.

Mesosomes → Specially in gram positive bacteria, the cell membrane becomes invagenated and folded to form a structure called Mesosomes. It consists of cell membranes with many vesicle vehicles, tubules and lamellar foldings. The lipid composition is similar to that of cell membrane but protein content differ.

FUNCTION ⇒ Many functions have been suggested but generally they are related with—

1) They increase the surface area of the cell.
2) It plays role during DNA Replication.
3) It is also involved in septum formation.