

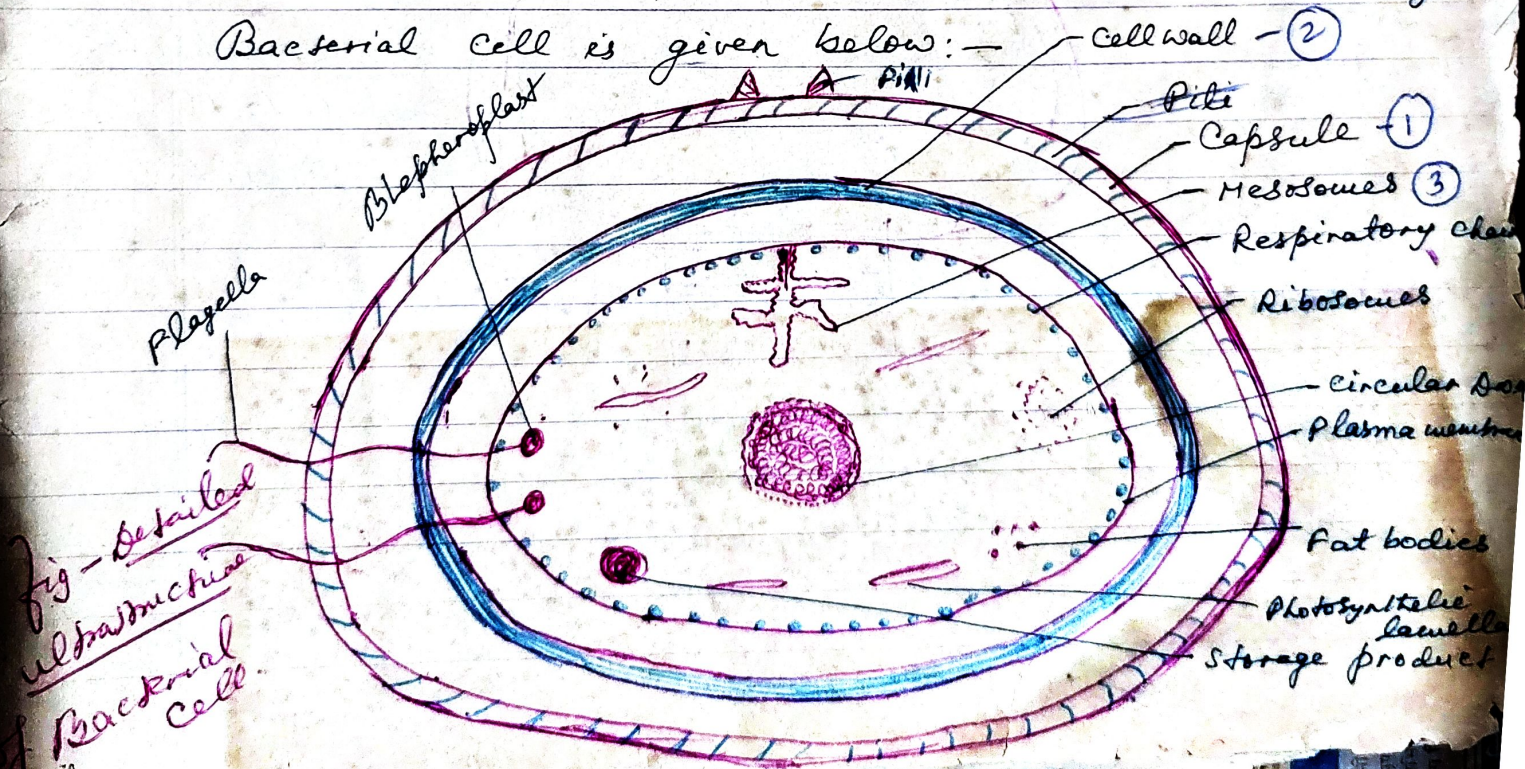
# BACTERIAL CELL

Ques. With the help of suitable diagram 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:

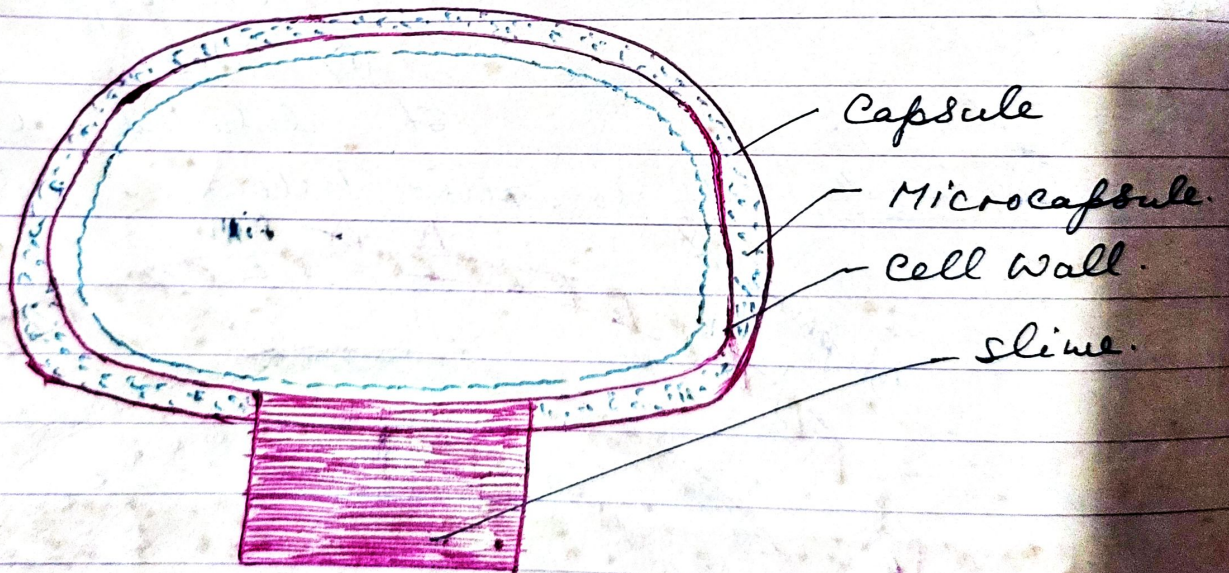
- ① Capsule
- ② Cell wall
- ③ Plasma membrane (Mesosomes)
- ④ Ckto cytoplasm - a) Ribosomes,  
b) Flagella  
c) Pili
- ⑤ Nucleoid
- ⑥ Special structures - i) Endospore  
ii) Stalk

The detailed ultrastructure of Bacterial cell is given below:-



①

Capsule  $\Rightarrow$  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  $0.2 \mu$ ) and Microcapsule (less than  $0.2 \mu$ ) if the covering  $\rightarrow$  is loose, it is termed as slime but if it is rigid and well defined, then it is termed as Capsule. Capsule is made up of polysaccharides and polypeptides of only one and some times two different amino acids.



Capsule

② Cell wall  $\Rightarrow$  Bacterial cells are surrounded by a wall made up of Mucopolysaccharide, 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 component (85%), however in gram negative, bacteria it is present in small quantity (3 to 12%) mucopolysaccharide. Mucopolysaccharide 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 Gram positive and Gram negative bacteria can be well marked by their differences given below:—

GRAM + (POSITIVE)	GRAM - NEGATIVE
<p>① <u>Thickness</u> <math>\rightarrow</math> Varies from 20-80 nm and lacks the outer lipopolysaccharide layer i.e. LPS.</p>	<p>Thickness is upto 2.5 nm (thinner). It is suppressed between the cell membrane and lipopolysaccharide layer. i.e. it is three layered.</p>
<p>② <u>Chemical Composition</u> <math>\Rightarrow</math> Mucopolysaccharide forms major portion of the cell wall 85% of the dry weight rest being simple polysaccharides which are in form of <u>Teichoic acid</u>. (It don't contain lipid).</p>	<p>② Muramic acid forms only 3 to 12% of the total dry wt. Major portion is contributed by lipoprotein, lipid and polysaccharide. Thus it has lipid contents but absence of <u>Teichoic acid</u>.</p>

GRAM POSITIVE

GRAM NEGATIVE

③ Rigidity → It is much rigid due to presence of greater amount of Muco-peptide.

③ Less rigid due to plasma nature of polysaccharide complex.

④ Amino acid <sup>contents</sup> 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.

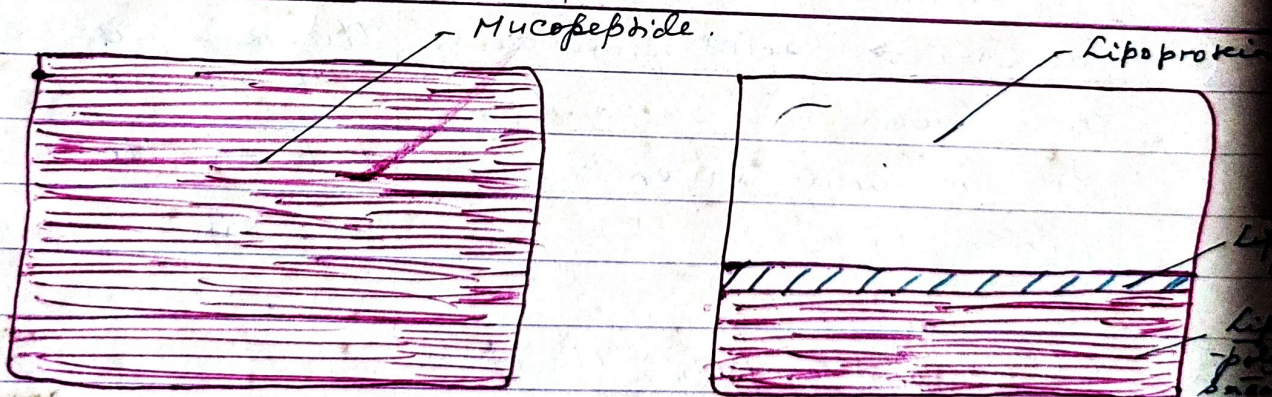
⑧ Example of Gram positive bacteria is —

Staphylococcus aureus

Eg —

— E. coli

Fig



GRAM POSITIVE

GRAM NEGATIVE

3

Plasma membrane → It is present just beneath the cell wall. It is 75 Å 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 plasma membrane are mainly (Glycerophospholipids). In addition, several types of Co-enzymes, Vitamin 'K' and <sup>Carotenoid</sup> ~~Carotenoid~~. The variety of proteins in the plasma-membrane of prokaryote is much wider than Eukaryotes. Electron transport systems are located in the plasma membrane. 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 invaginated and folded to form a structure called Mesosomes. It consists of cell membranes with many <sup>Vesicle</sup> ~~vesicles~~, 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.