

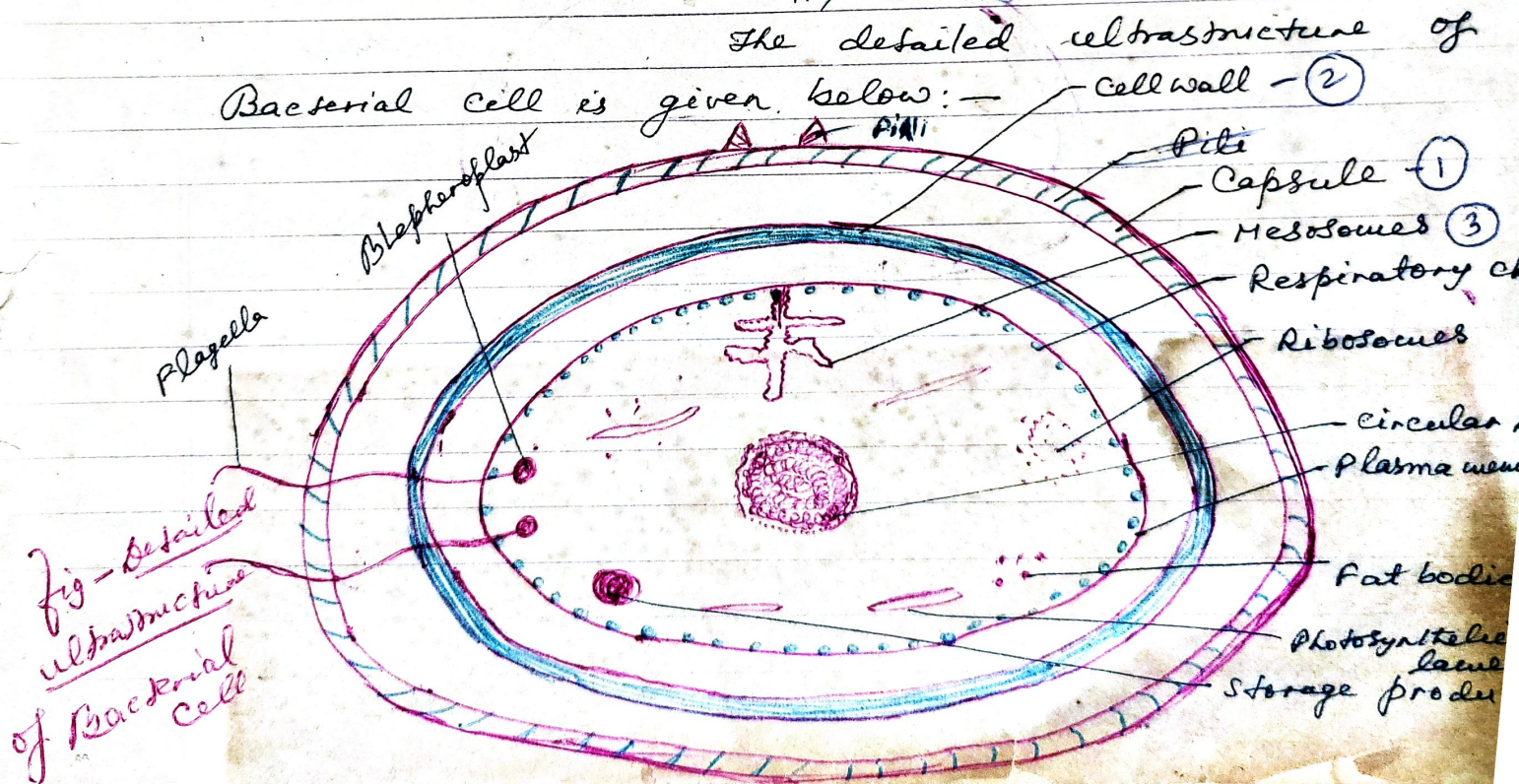
# BACTERIAL CELL

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:

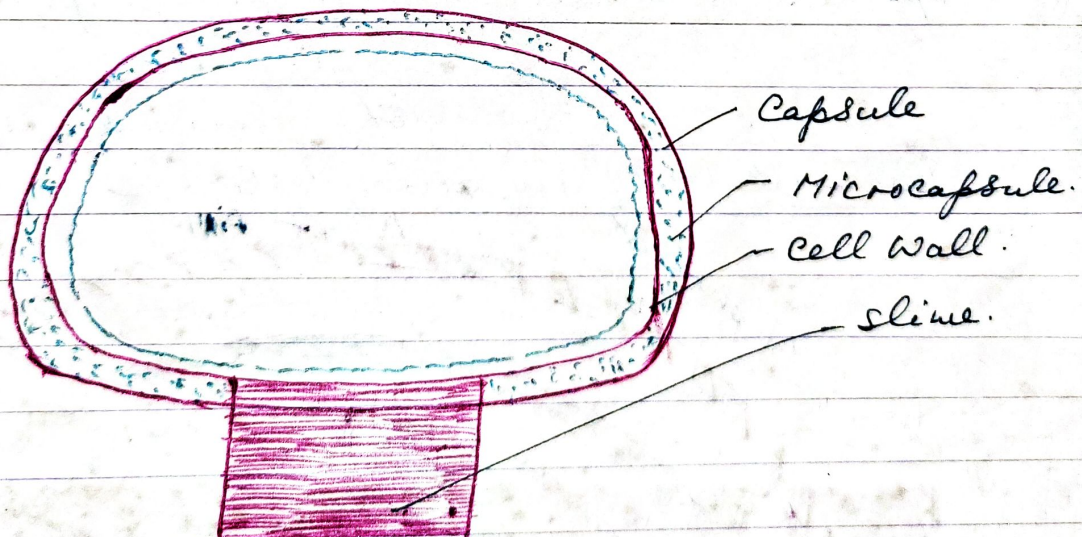
- ① Capsule
- ② Cell wall
- ③ Plasma membrane (Mesosomes)
- ④ Ckto Cytoplasm - a) Ribosomes, b) Flagella, c) Pili
- ⑤ Nucleoid
- ⑥ Special structures - i) Endospore, ii) Stalk

The detailed ultrastructure of Bacterial cell is given below: -





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 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 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 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 component (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 <u>Thickness</u> $\rightarrow$ Varies from 20-80 <sup>Nm</sup> and lacks the outer lipopolysaccharide layer i.e. <u>homo-</u> <u>genous</u> .	Thickness is upto 2.5 Nm (thinner). It is suppressed between the cell membrane and lipopolysaccharide layer. i.e. it is three layered.
② <u>Chemical Compn</u> $\Rightarrow$ Mucopeptide forms major portion of the wall 85% of the dry weight rest being simple polysaccharide which are in form of <u>Teichoic acid</u> . (It don't contain lipid).	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 absent of <u>Teichoic acid</u> .

Galaxy S21 FE 5G



... (all the time) ...

plasma membrane → It is present just inside cell wall. It is 75% wet membrane with a lipid bilayer on either side of lipid and protein. It is usually composed of lipid and protein but small amount of carbohydrates, DNA, RNA have also been recorded.

are mainly Glycophospholipids. In addition, several types of waxes, Vitamin K and B<sub>12</sub> are also present. The membrane of prokaryotes is more rigid and less permeable than that of eukaryotes. The membrane of higher plants is similar to that of bacteria. The electron transport chain of higher plants are located in the plasma membrane. The electron transport chain of bacteria are linearly arranged or often it may be branched.

mesosomes → Specially in gram positive bacteria, the cell membrane becomes integrated and folded to form a structure called mesosomes. It consists of cell membrane with many folds and lamellae. The lipid composition is similar to that of cell membrane but protein is different. Many junctions have been suggested. They are related with septum formation. The surface area of the cell is increased by the presence of mesosomes.



# Embryology

① Structure & types of ovules (at the time of fertilisation)

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—

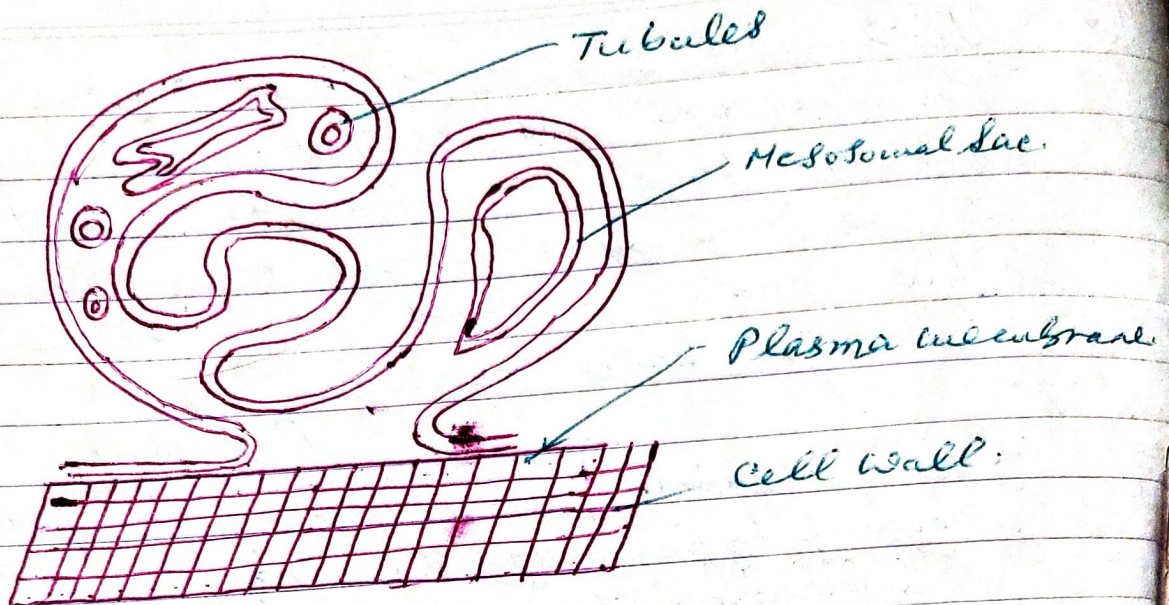
- 1) They increase the surface area of the cell.
- 2) It plays role during DNA Replication.
- 3) It is also involved in septum formation.

Galaxy S21 FE 5G





Fig

Diagram of  
Mesosome.

- ④ **Cytoplasm** → It mainly consists of ground plasma and ribosomes:-
- ⓐ **Ground plasma** → It is a liquid consisting of salts, sugar, amino acid, vitamin, soluble proteins and deposits of lipid granule. It doesn't contain Endoplasmic reticulum, Golgi body, Lysosomes, Mitochondria etc. Only ribosomes are prominently observed.
- Ribosomes** - A bacterial cell contains about 10,000 ribosomes which constitute 30% of the total weight of the cell. Its chemical composition shows that it is made up of 30 to 50% protein and 50-70% RNA. They are found freely in the cytoplasm but they may form clusters then it is termed as polysomes. Each ribosome measures about 20  $\mu$ m in diameter and contains two units. The upper smaller unit is represented by 30S and the lower bigger unit is of 50S. The sedimentation coefficient of such ribosome is 70S.