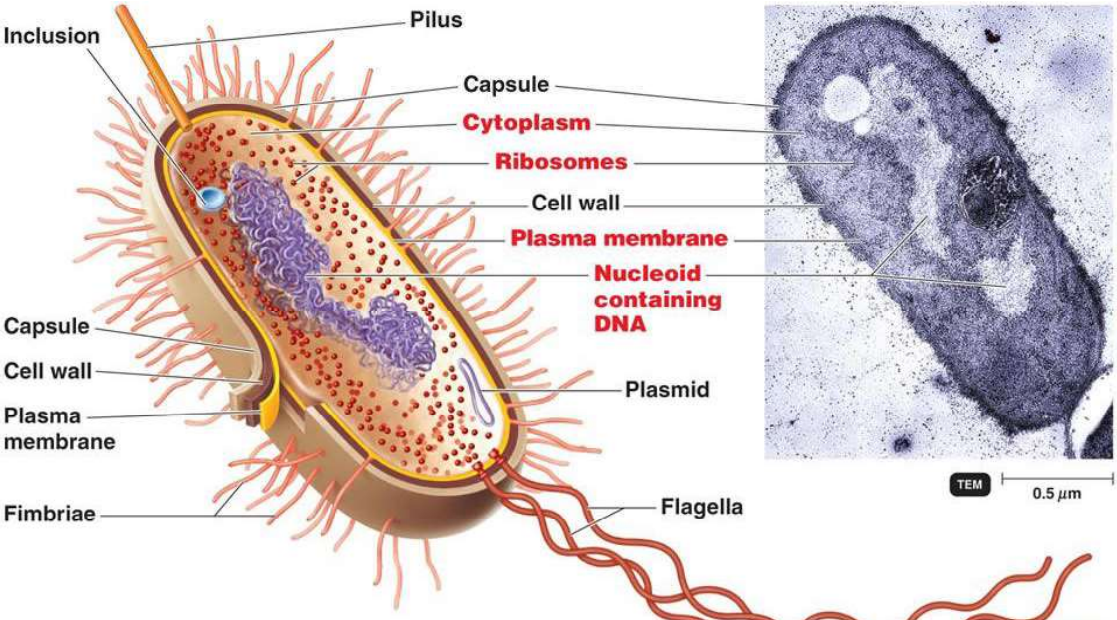
Bacterial cell structure

I-The Nucleoid :

- ∅ Concentrated DNA filament can be seen in stained cells by light microscope.
- ∅ Histone – like proteins can be associated with DNA.
- ∅ No nuclear envelope.
- ∅ The DNA can be considered as a single haploid chromosome , approx.. 1mm in length (supercoiled) .

Π-Cytoplasmic structures:

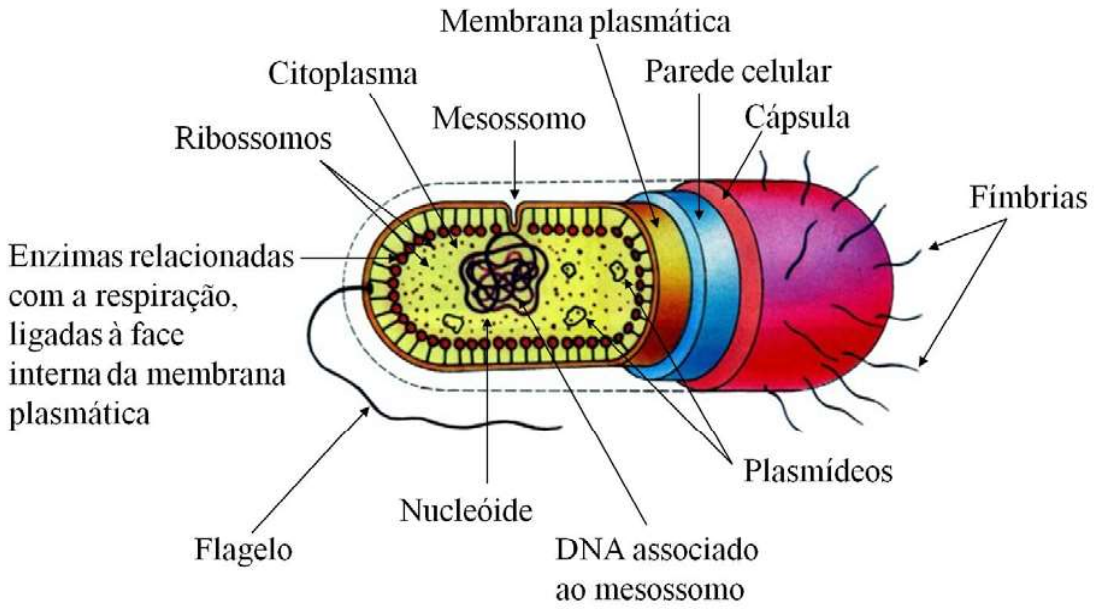
- ⇒ No plastids , no mitochondria or chloroplasts , no microtubular structures.
- ⇒ There are photosynthetic pigments localized in membrane–like arrangements in cyanobacteria known as thylakoids.
- ⇒ Many bacteria can accumulate granules of polyphosphate , that can be used in ATP synthesis , called (volutin granules or metachromatic granules) which can be seen in corynebacteria as red granules.
- ⇒ Some photosynthetic bacteria can oxidize S^{-2} from (H2S) producing S (sulfur) granules , deposited intracellularly.
- ⇒ Gas vesicles in aquatic microorganisms can be found .
- ⇒ Protein-bounded vesicles can be found in the cytoplasm (could be filled with proteins and/or enzymes).
- ⇒ Ribosomes are found in the cytoplasm with different kinds of proteins and enzymes .



Note that not all bacteria have all the structures shown. Structures labeled in red are found in all bacteria. Both the drawing and the micrograph show a bacterium sectioned lengthwise to reveal the internal composition.

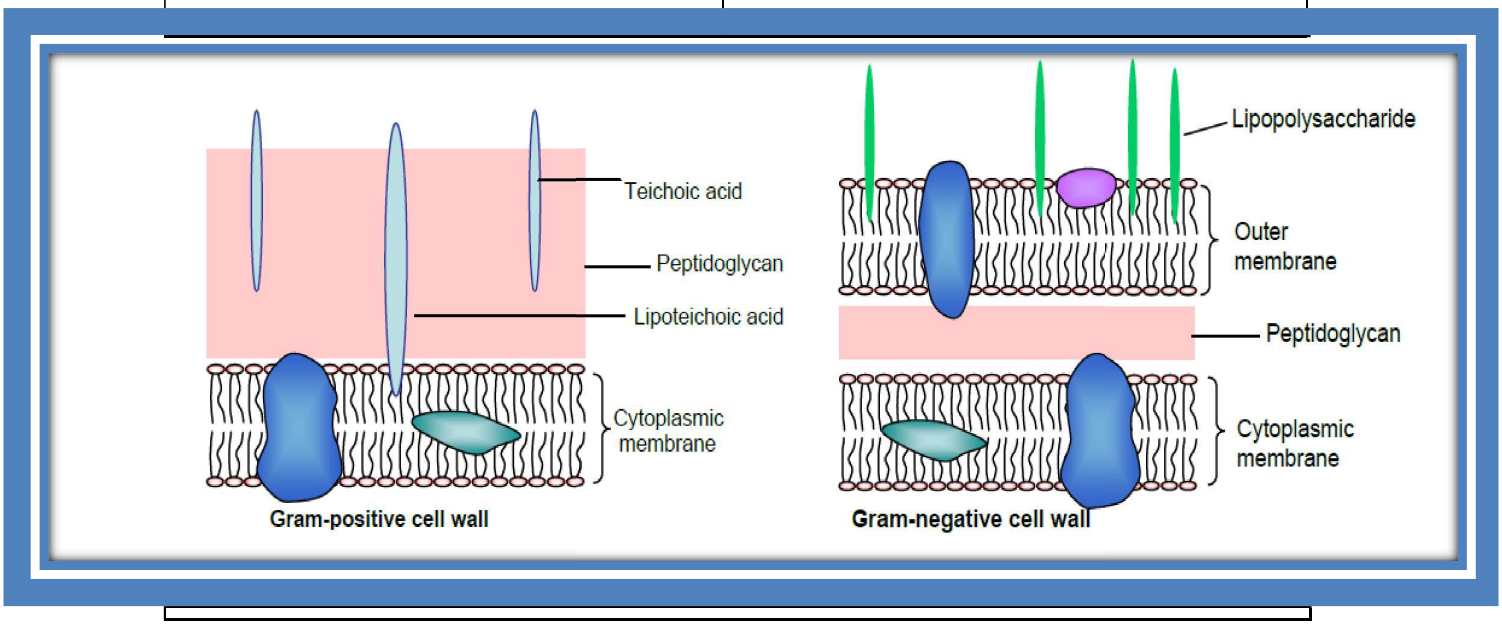
Key Concept

Prokaryotic cells lack membrane-enclosed organelles. All bacteria contain cytoplasm, ribosomes, a plasma membrane, and a nucleoid. Almost all bacteria have cell walls.



III-The cell envelope

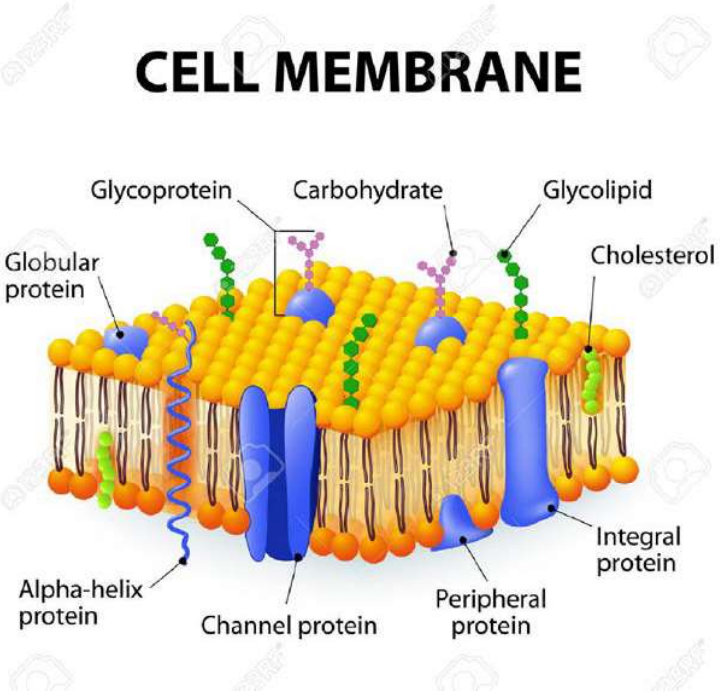
Gram positive bacteria (G+ve)	Gram negative bacteria (G-ve)
1-Cytoplasmic membrane 2-Thick peptidoglycan layer 3-Outer layer (capsule or S-layer) composed of Glycoproteins	More complex multilayered structure: 1-Cytoplasmic membrane (inner membrane). 2-Thin peptidoglycan layer (within the periplasmic space). 3-Outer membrane 4-Outermost capsule or S-layer composed of LPS (lipopolysaccharides)



1-The cytoplasmic membrane :

a) Composed of bilayered phospholipid and proteins with the absence of sterols (cholesterol) .

b) Presence of mesosomes (invaginations inside cytoplasm) lateral and septal mesosomes : function in the formation of cross -walls during cell division.



The functions of cytoplasmic membrane:

1-Permability and transport of nutrients.

2-Electron transport and oxidative phosphorylation.

3-Excretion of hydrolytic exoenzymes and pathogenecity proteins (toxins).

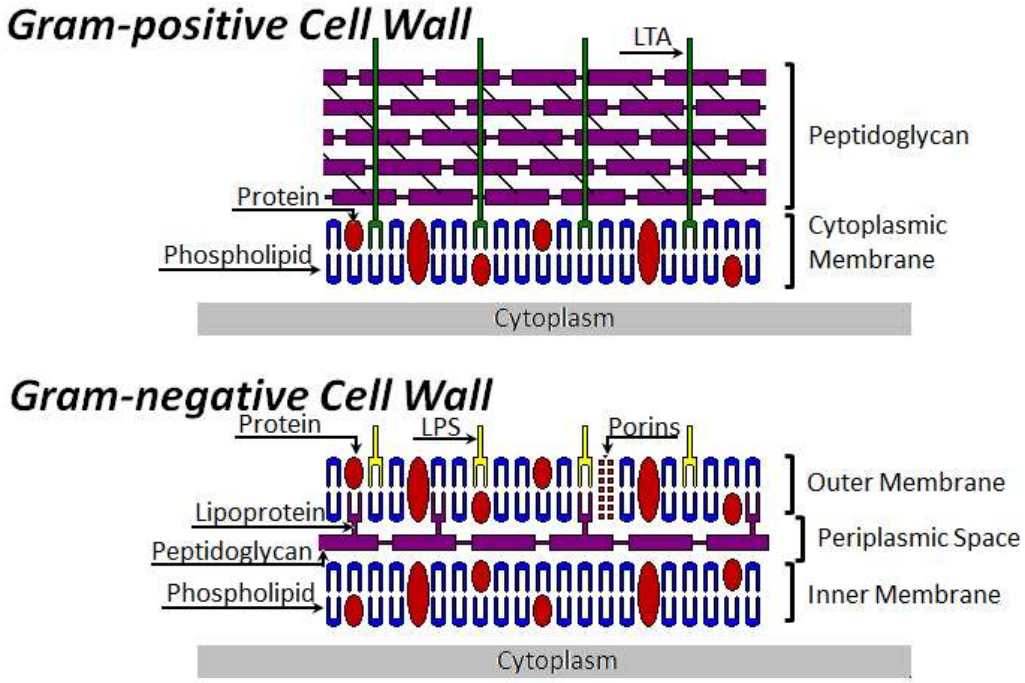
4-Biosynthetic functions : some proteins and enzymes of DNA replication , and enzymes of phospholipid synthesis.

5-Chemotactic systems : specific receptors for chemicals and other nutrients .

2-The cell wall :

-In Gram positive (+ve) : Peptidoglycan and teichoic acid.

-In Gram negative (G –ve): The peptidoglycan and outer membrane.



Peptidoglycan = murein = mucopeptide

Gram´s staining (differential stain) by Hans Christian Gram:

1-Crystal violet 1-2min (primary stain).

2-Iodine (mordant) 1 min.

3-Acetone or alcohol (decolorizer) 10-30 sec.

4-Washing with water.

5-Safranin or carbol fuchsin (counter stain) 1 min (secondary stain).

6- Washing with water

Gram +ve = blue (bluish purple) **Gram –ve = red**