Functions of the cell wall :

1-Gives osmotic protection to the cell.

2-Plays an essential role in cell division.

3-The site of many antigenic determinants of cell surface.

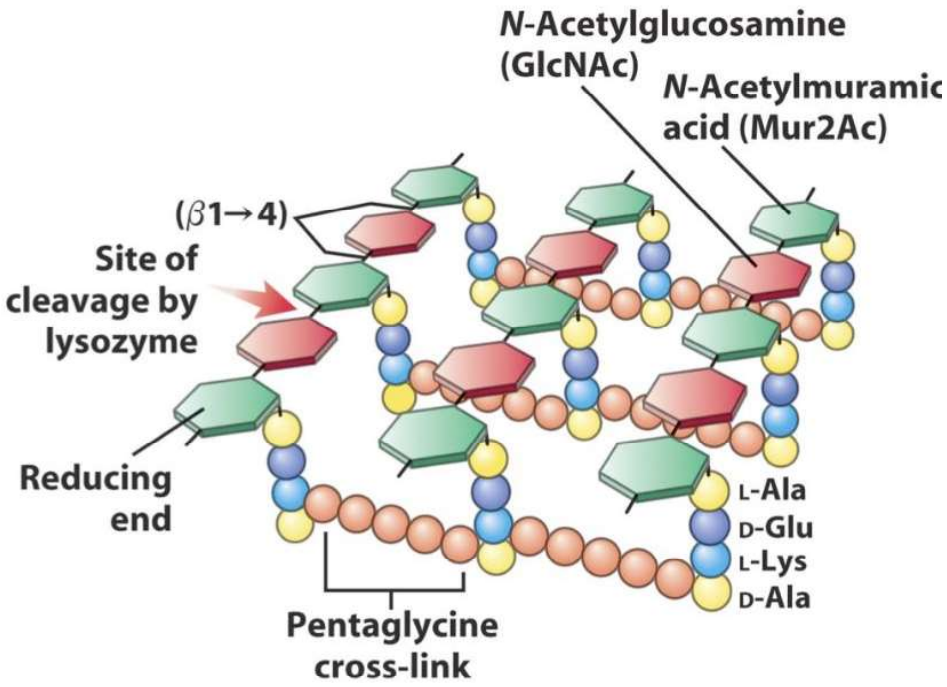
The peptidoglycan layer:

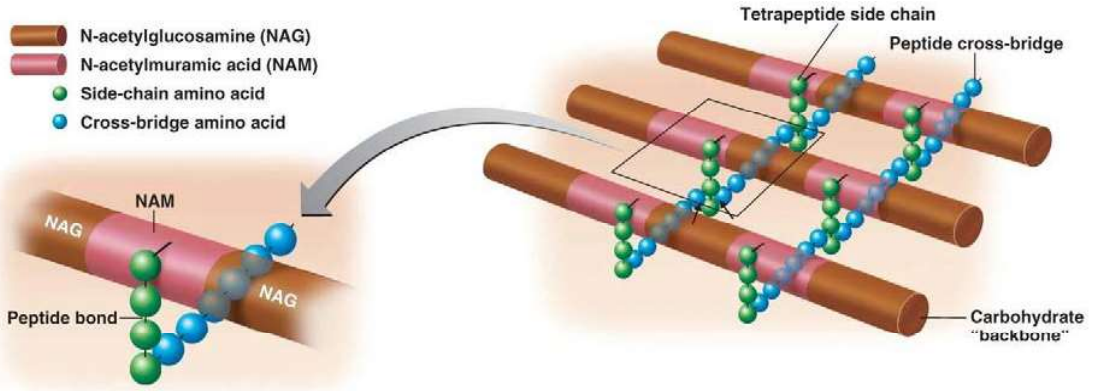
Is a complex polymer consisting of 3 parts:

1-Backbone : composed of N-acetylglucosamine and N-acetylmuramic acid.

2-Tetra peptide cross-linked.

3-Identical pentapeptide cross-bridge.





(a) Structure of peptidoglycan in gram-positive bacteria

-There are some components in G+ve cell walls attached to peptidoglycan and to cell membrane called :

A.Teichoic acid and teichuronic acid :

(in cell membrane lipoteichoic acid) , which are responsible for antigenic characteristics of G+ve cell wall .

B.polysaccharides : which representing the outer layer in G+ve cell.

3.Special components in –ve envelope :

A.Lipoprotein : function to stabilize outermembrane.

B.Outer membrane :

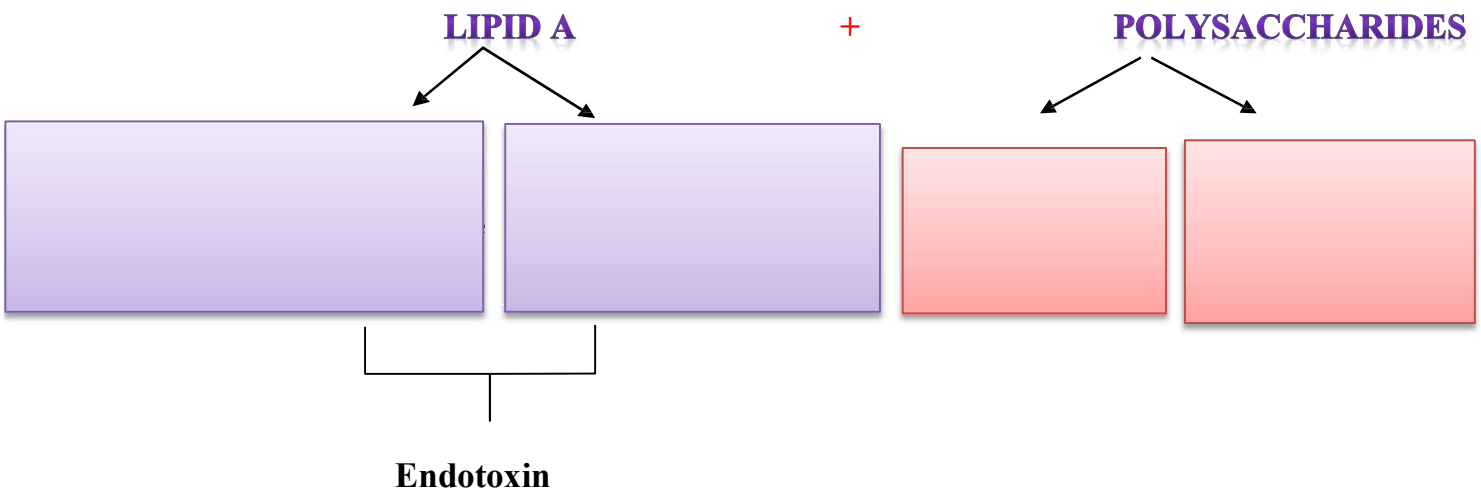
composed of bilayered phospholipid structure:

⇒ Inner layer : resemble the cytoplasmic membrane

⇒ Outer layer: The phospholipids are replaced by LPS

This kind of structure gives G-ve bacteria less permeability and higher selectivity to large molecules like antibiotics, and consequently more microbial resistance.

C.lipopolysaccharides (LPS) composed of :



4- The periplasmic space : Located between the inner and outer membranes (contain high amounts of proteins and active enzymes).

Molecules and enzymes attacking cell membrane and cell wall :

A-Cell membrane :

1.Detergents : Disruption of the membrane like EDTA

2.Antibiotics :

-Disruption of the membrane , e.g. polymyxin

-Inhibit DNA synthesis and teichoic acid synthesis , e.g. : nalidixic acid , novobiocin

-Discharge membrane potential (ionophores) e.g. valinomycin

B-Cell wall :

1.Lysis by lysozyme enzyme that attack peptidoglycan layer ; treatment produce protoplasts of G+ve cells.

2.EDTA : disrupt outer membrane of G-ve cells ; treatment with EDTA + lysozyme produce spheroplasts of G-ve cells.

3.Autolysins in bacterial cells , causing autolysis .

4.Penicillins cause blocking of cell wall biosynthesis ; treatment of G+ve cells produce L-form cells.

5.Capsule (Glycocalyx):

An extracellular polysaccharides forming a layer surrounding the cell entirely , its role is in adherence and pathogenecity , example :

Streptococcus mutans , Diplococcus pneumoniae and Klebsiella pneumoniae.

Flagella :

Thread –like appendages , protein in structure , they are organs of locomotion

Arrangement of flagella :

1.Monotrichous : Single polar flagellum e.g Vibrio

2.Lophotrichous :Multiple polar flagella e.g Spirillum

3.Peritrichous : Flagella distributed over the entire cell e.g Proteus vulgaris

4.Amphitrichous : Having a single or multiple polar flagella at each end of the cell e.g: Alcaligenes faecalis.

Flagellar protein is called Flagellin (H-antigen), which is highly antigenic.

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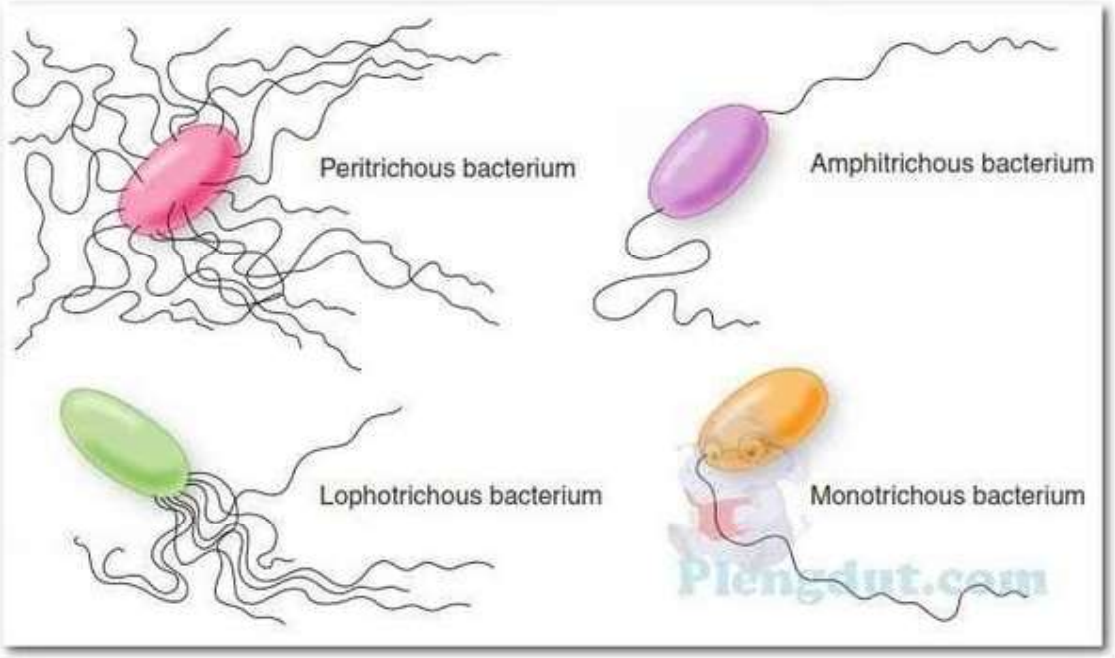

Motility of the bacterial cell is a response to a chemical substance (chemotaxis) , air (aerotaxis) , light (phototaxis) which **depends on cellular receptors** (Repellants and Attractants).