

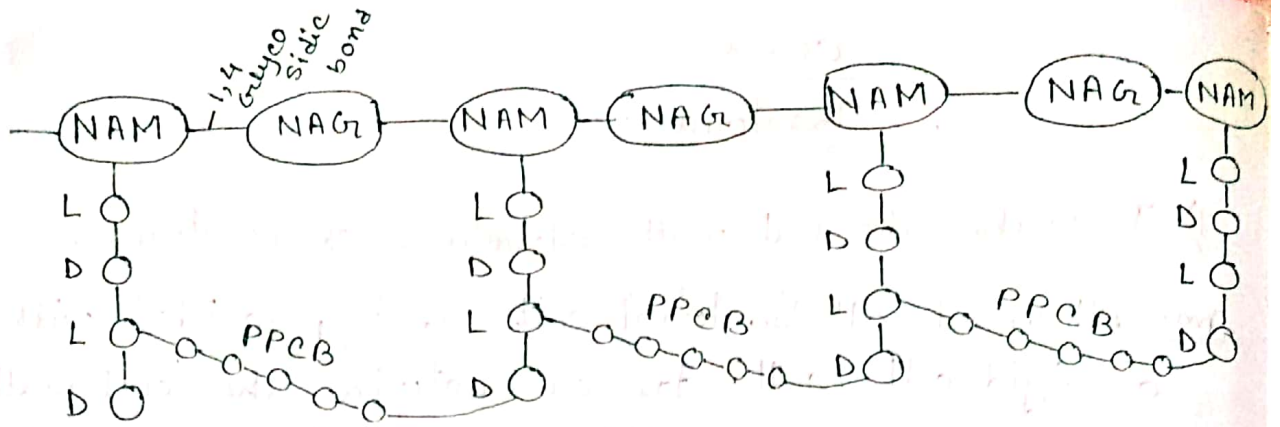
Bacteria

1) Describe the cell wall structure of Bacteria.

Ans. All most all bacterial cells are provided with a rigid cell wall. In eu-bacteria the cell wall is made up of peptidoglycan. It is present almost in all bacterial cell except Halobacterium and Halococcus. Peptidoglycan determines the shape of a cell. It is an insoluble porous crosslinked polymer that provides rigidity.

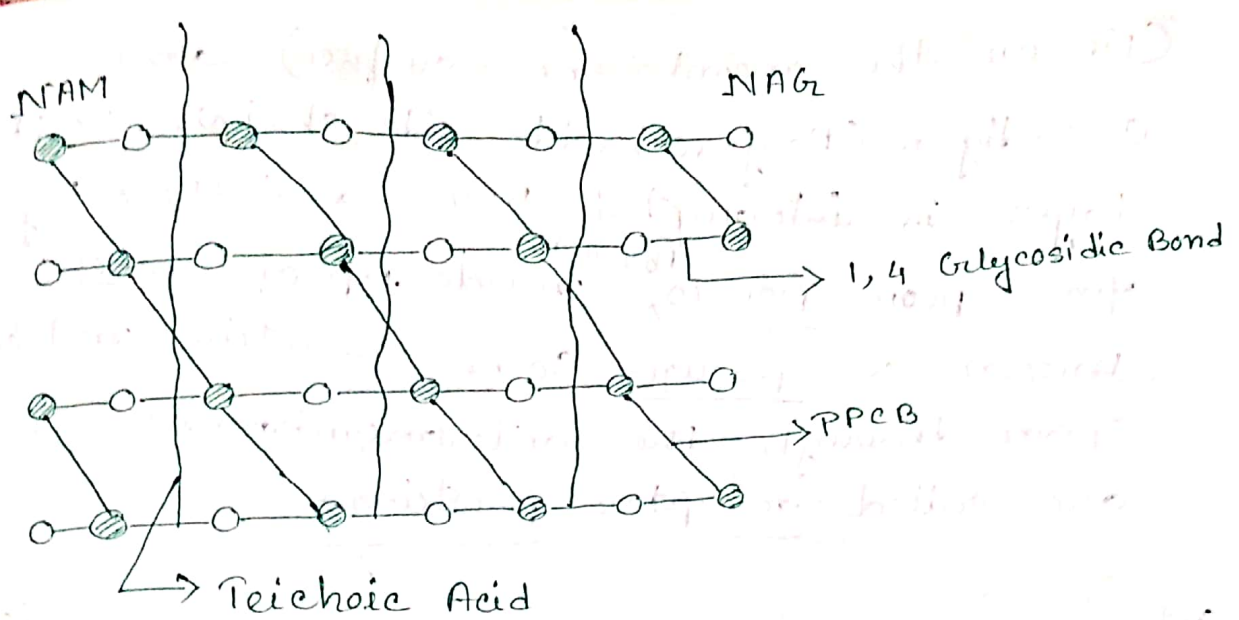
The backbone of peptidoglycan is made up of long chain of two alternative molecules — an amino sugar called N-acetyl glucosamine (NAG) and lactic acid called N-acetyl muramic acid (NAM). NAG and NAM are joined by 1,4 glycosidic bond.

A tetra cyclic side chain containing four amino acids — L-alanine, D-glutamate, L-lysine and D-alanine are attached to each NAM. The 3rd amino acid varies with different bacteria and may be di amino and palmitic acid or threonine. The D and L forms of amino acid alternate with each other. The parallel tetrapeptide side chains are linked by a pentaglycine peptide cross bridge (PPeB) that contains five amino acids. The PPeB links L-lysine to one tetrapeptide with D-alanine of other peptide.



i) Cell wall structure of Gram +ve bacteria —

In most Gram +ve bacteria the cell wall contains several layers of peptidoglycan which are interconnected by side chain and cross bridge. The layers of peptidoglycan are thicker than that of gram -ve bacteria. The peptidoglycan accounts for 70-80% of total dry weight. In most of the Gram +ve bacteria peptidoglycan is associated with acidic polymer of ribitol phosphate or glycerol phosphate called Teichoic Acid. Teichoic Acids are hydrophilic, flexible and linear molecules. Teichoic acid molecules are negatively charged. They probably regulate movement of cations and play an important role in holding Mg^{2+} in the walls of Gram +ve bacteria. Teichuronic acid, another polymer is present in the cell wall of some Gram +ve bacteria like Bacillus licheniformis. In some acid fast bacteria e.g. - Mycobacterium tuberculosis one type of lipid called mycolic acid is present on the cell wall which is responsible for the acid fastness.



ii) Cell wall structure of Gram -ve bacteria

The cell wall of Gram -ve bacteria is more complex than those of Gram +ve bacteria. The most interesting feature is the presence of an outer membrane outside the peptidoglycan. In the cell wall of Gram -ve bacteria the peptidoglycan content is very low (10-20%). They totally lack teichoic acid and the peptidoglycan is situated in the periplasmic space being connected to the outer membrane. The periplasmic space lies in between the outer (inner membrane) membrane and plasma membrane. The cell envelop (outer membrane) of Gram -ve bacteria is a bilayered structure consisting mainly of lipoprotein, lipopolysaccharide and phospholipid.

The lipopolysaccharide (LPS) forms the outer layer of the outer membrane. The LPS has three components → Lipid-A (embedded in the outer membrane), Core polysaccharide

(Lie on the membrane surface) and O-antigen (Polysaccharide side chain). The LPS layer is interrupted here and there by fine ~~poor~~ ^(Pores) pores, made up of protein known as porin. Some protein molecules span through the outer membrane, these are called receptor proteins.

