

Bacterial Cell Wall

Bacterial cell wall is about 100-250 Å thick. It is made of **peptidoglycan**, also known as **murein** or **mucopeptide**.

The peptidoglycan cell wall structure of bacteria varies from species to species. However, all have the same general chemical composition (Fig. 2). It is a polymer of two amino sugars known as — **N-acetylglucosamine (AGA)** and **N-acetylmuramic acid (AMA)**. These molecules are cross-linked by chains of four amino acids (tetrapeptides). Of these four amino acids, D-alanine, D-glutamic acid and L-alanine are common in all types of bacteria. In most Gram positive bacteria, the fourth amino acid is lysine and in most Gram-negative bacteria, it is diaminopimelic acid.

Cell wall also has small quantities of carbohydrates and lipids. Cell walls of Gram-positive bacteria have an additional molecule, **teichoic acid**.

In *Mycobacterium* and *Nocardia* the wall is similar to Gram positive bacteria but a part of their wall is made of a very long chain of fatty acid called **mycoic acid**. In *Acetobacter xylinum*, *A. acetigenum* and *Zymosarcina venticuli*, the cell wall is made of cellulose only.

The cell wall has two main functions.

- (1) It maintains the characteristic shape of the cell.
- (2) It prevents the cell from bursting.

Staining of Bacteria

Hans Gram (1884), a Danish microbiologist, introduced **Gram stain**. This stain differentiates two types of bacteria, called **Gram positive (Gram-ve)** and **Gram negative (Gram+ve)** bacteria on the basis of their cell wall composition (Table 2).

A bacterial smear is prepared on a clean slide. It is stained with weak alkaline solution of crystal violet and then

Solutions in order applied	Reaction and appearance of bacteria	
	Gram positive	Gram negative
1. Crystal violet (CV)	Cells stain violet.	Cells stain violet.
2. Iodine solution (I)	CV-I complex formed within cells; cells remain violet.	CV-I complex formed within cells; cells remain violet.
3. Alcohol	Cell walls dehydrated, shrinkage of pores occurs, permeability decreases, CV-I complex cannot pass out of cells; cells remain violet.	Lipid extracted from cells walls, porosity increases, CV-I is removed from cell; cells become colourless.
4. Safranin	Cells not affected, remain violet.	Cells take up this stain, become red.