



# NEET Biology

## Short Notes

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## Function

- **PROVIDES SUPPORT** (Mechanical strength)
- **TO WITHSTAND TURGOR PRESSURE**
- **COMMUNICATION** (via plasmodesmata)
- **PROTECTION**- (against plant viruses and other pathogens)
- **REGULATE GROWTH**- (sends signals to enter the cell cycle for division and growth)
- **REGULATE DIFFUSION**- (porous and allows selective substances, including proteins, to pass in and out)
- **STORAGE**- (stores carbohydrates, especially in seeds)

## DISCOVERY

- Discovered by Robert Hooke in 1665A.D.
- Used thin slices of cork and cork tissues
- Discovered plant cells which were actually celled walls.

## EUKARYOTIC CELL WALL

Present only in Plant Cells.

### The chemical composition of cell wall

Hemicellulose: 5-15%; Water: 30-60%; Pectin substances: 2-8%; Lipid: 0.5-3%; Proteins: 1-2%; Microfibrils: 20-40%; Deposition: 00-25%

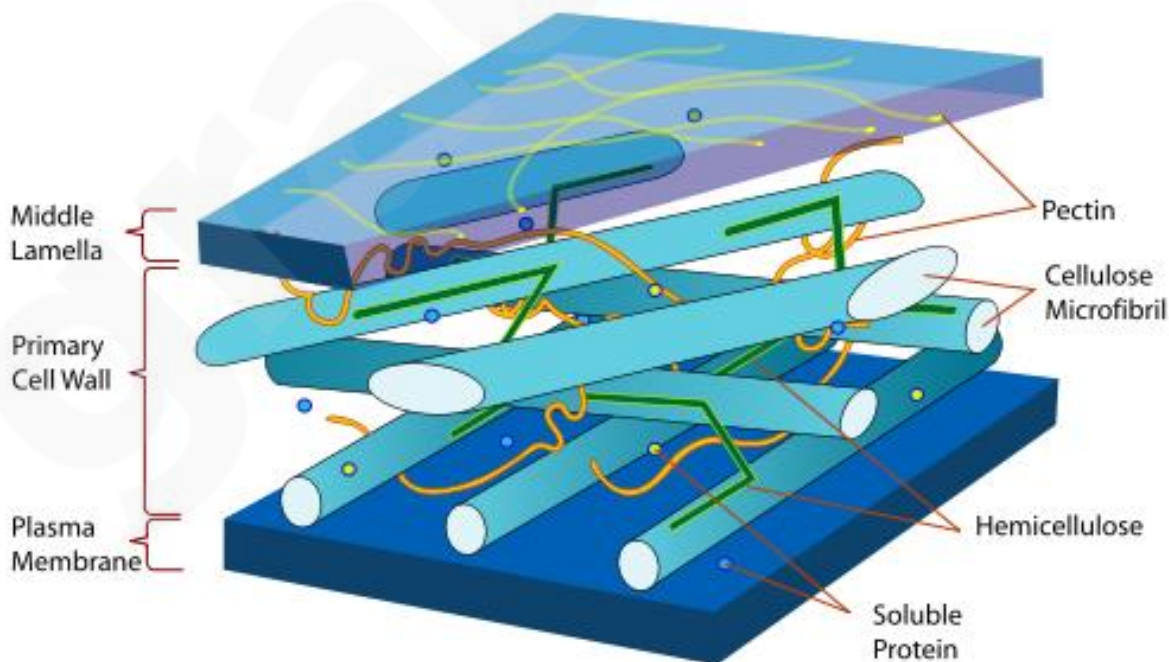
### Parts of a cell wall

The cell wall is made up of 3 main parts that make up its chemical composition.

- **Matrix:** consists of water, hemicellulose, pectin, glycoproteins, lipids and proteins
- **Microfibrils:** the structural elements are formed by cellulose in plants, in fungi they are made by chitin.
- **Deposition:** It is about 0-25% consists of iron and calcium, silica, lignin and suberin etc.

### Structure of the plant cell wall

The cell wall of plants is multi-layered and is made of 3 sections (Though, not all cells have a secondary cell wall)



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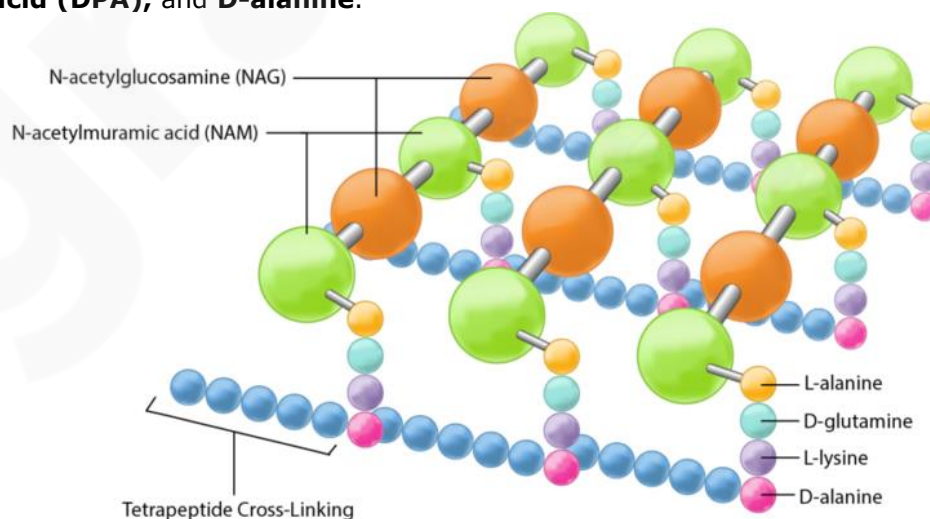
- **Middle lamellae:**
  - Outermost layer
  - contains polysaccharides (pectins), helps in the cell to cell adhesion by helping the cell walls to bind to one another.
- **Primary cell wall:**
  - Young Cell has a single layer. Formed between middle lamella and the plasma membrane in growing cells.
  - Thin, elastic and capable of extension in Plant Cell.
  - Contains cellulose microfibrils within a gel-like matrix of hemicellulose fibres and pectic polysaccharides. The growth of primary wall occurs due to to-in Corporation of -materials within the existing wall (**intussusception**).
- **Secondary cell wall:**
  - Formed between the primary cell wall and plasma membrane in some plant cells but not all.
  - The primary cell wall may thicken to form a secondary cell wall once it has stopped dividing and growing.
  - This rigid layer strengthens and supports the cell. The growth in the secondary wall is called **accretion**.
  - Some secondary cell walls contain lignin (strengthens the cell wall and aids in water conductivity) in addition to cellulose and hemicellulose.
- **Tertiary cell wall:**
  - Sometimes laid on the Secondary cell wall.
  - Composed of cellulose and xylan (tracheids of gymnosperm)

#### **Additional Structures**

- **Plasmodesmata**
  - Cytoplasmic or protoplasmic bridges between adjacent plant cells.
  - Pores or channels between plant cell walls that allow molecules and communication signals to pass between individual plant cells.
- **Pits**
  - irregular thickenings in secondary cell wall
  - Different Types: **Simple** (Pit Chamber uniform), **Bordered** Pit (Pit chamber Flask-Shaped), Blind Pit (without any corresponding pit on the adjacent wall). Half Bordered Pit ( one-half is half bordered and other half is a simple pit)

#### **Prokaryotic Cell Wall**

Cell Wall in prokaryotes is made of Peptidoglycan/ Murein or Mucopeptide. It is a polymer made by the interlocking of chains formed by two sets of Monomer, NAM (n-acetyl muramic acid) and NAG (n-acetyl glucosamine), held together by  $\beta$ -1,4 linkage. The chains are cross-linked to one another by a **tetrapeptide** that extends from the NAM sugar unit. The four amino acids that compose the tetrapeptide are **L-alanine**, **D-glutamine**, **L-lysine** or **diaminopimelic acid (DPA)**, and **D-alanine**.



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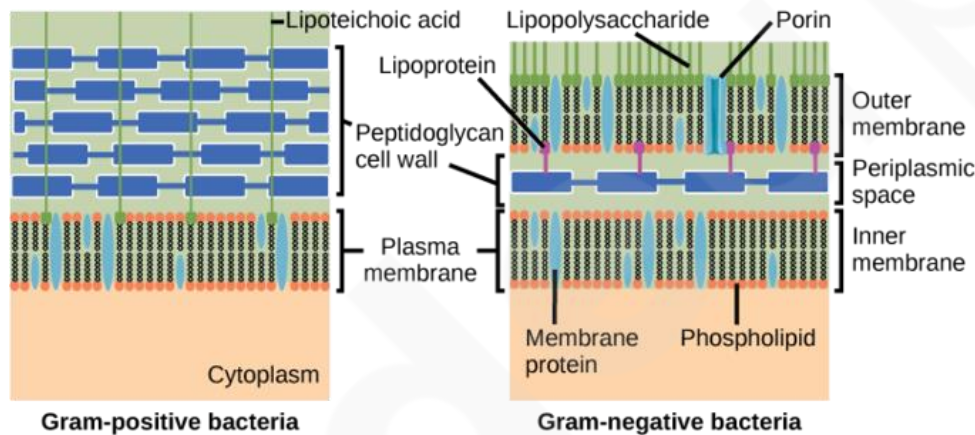
Bacteria are divided into two major groups: gram-positive and gram-negative, based on their reaction to Gram staining (Christian Gram (1853–1938)).

### Gram-Positive Bacterial Cell Wall

- **THICK PEPTIDOGLYCAN** - 90% of the cell wall is composed of peptidoglycan.
- Rest composed of acidic substances called **teichoic acids** (have a negative charge, covalently linked to lipids in the plasma membrane to form lipoteichoic acids)- anchor the cell wall to the cell membrane by attracting cations like magnesium and sodium.

### Gram-Negative Bacterial Cell Wall

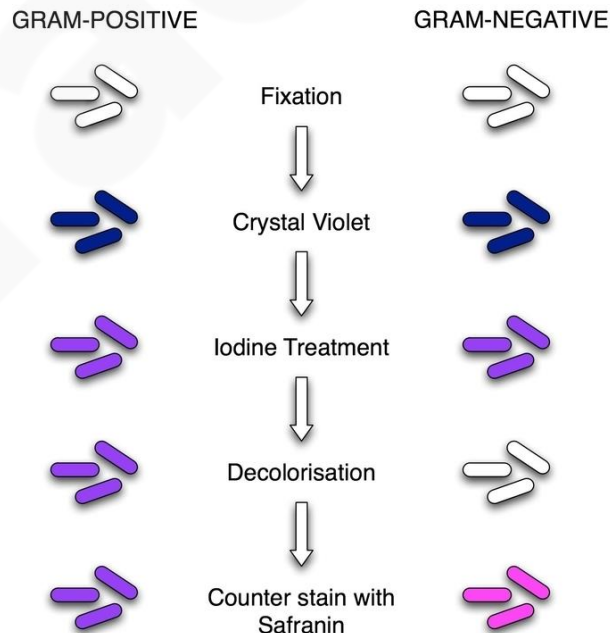
- **THIN PEPTIDOGLYCAN** - few layers of peptidoglycan (only 10% of the total cell wall)
- Surrounded by an outer envelope containing lipopolysaccharides (LPS) and lipoproteins.
- LPS contains Polysaccharides. O- side chain or antigen and Lipid A (toxic therefore LPS act as endotoxin)
- Outer Membrane is permeable, because of the presence of Porins.
- Space between the outer membrane and Plasma membrane is periplasmic space.



### **Gram Staining**

Empirical Method to differentiate Bacterial species in two major groups: Gram Positive and Gram-negative.

#### **Basic Steps Involved:**



### IMPORTANT STEP

- **Application of mordant:** Addition of Gram Iodine allows the stain to be retained better by forming an **insoluble Crystal Violet-iodine complex**.
- **Differential Step (Addition of Decoloriser - organic solvent such as acetone or ethanol):** Extracts the blue dye complex from the lipid-rich, thin-walled gram-negative bacteria to a greater degree than from the lipid-poor, thick-walled, gram-positive bacteria. Thus, gram -ve bacteria appear colourless and gram +ve bacteria remain blue.

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