CELL WALL

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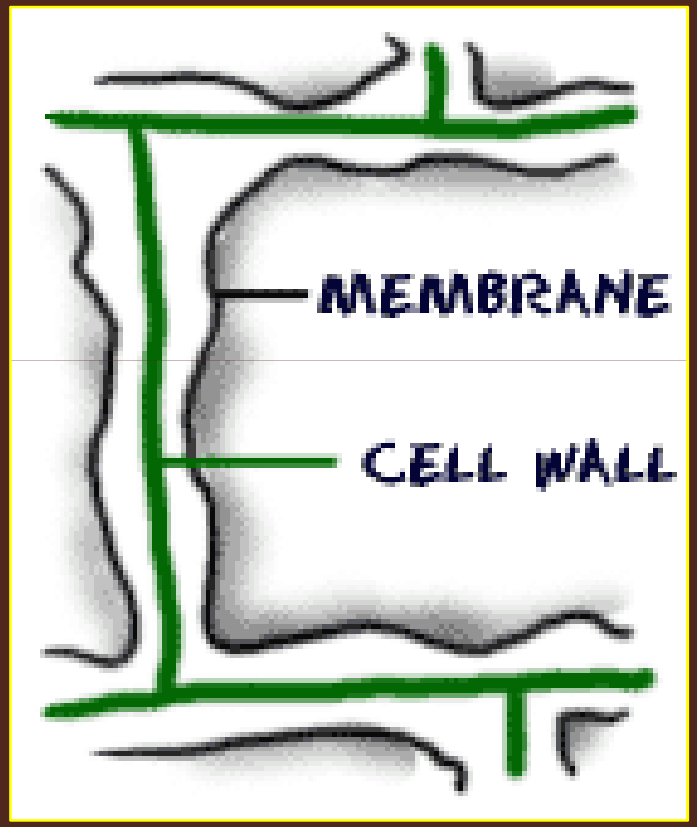
INTRODUCTION

- The cell wall is a tough and rigid layer that surrounds some types of cells.
- It is located outside the cell membrane and provides these cells with structural support and protection.
- Cell walls are found in plants and prokaryotic cells but not in Mycoplasmas.

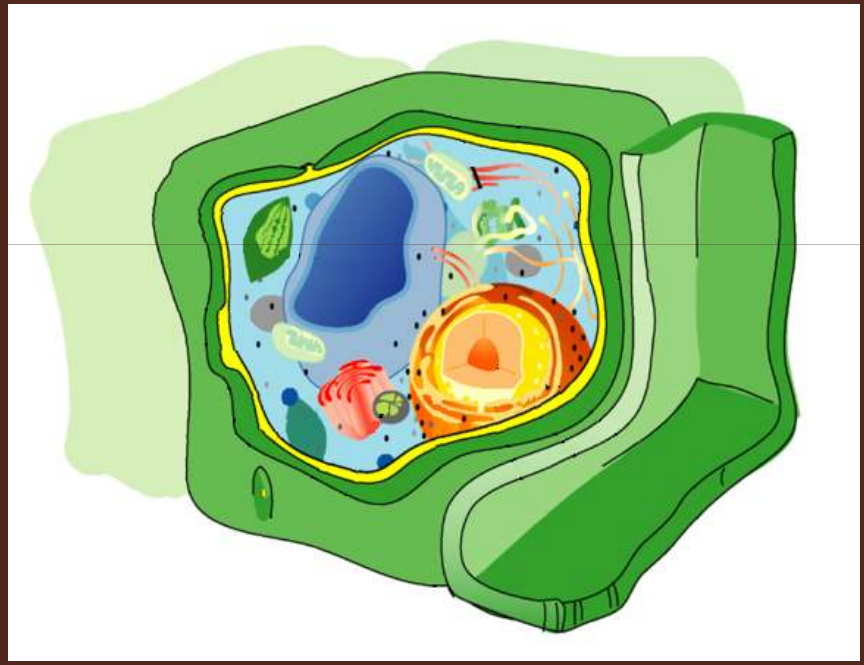


CELL WALL VARIES AMONG ORGANISMS

- In bacteria, peptidoglycan forms the cell wall.
- Archaean cell walls have various compositions, and may be formed of glycoprotein S-layers, pseudopeptidoglycan, or polysaccharides.
- Fungi possess cell walls made of the glucosamine polymer chitin, and algae typically possess walls made of glycoproteins and polysaccharides.

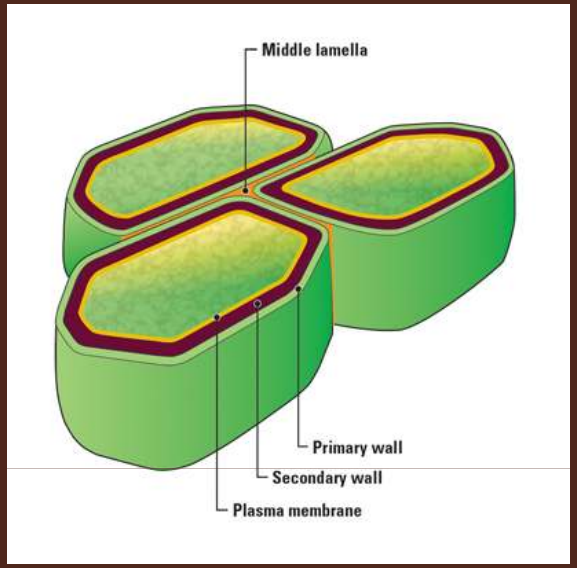
Plant cell walls

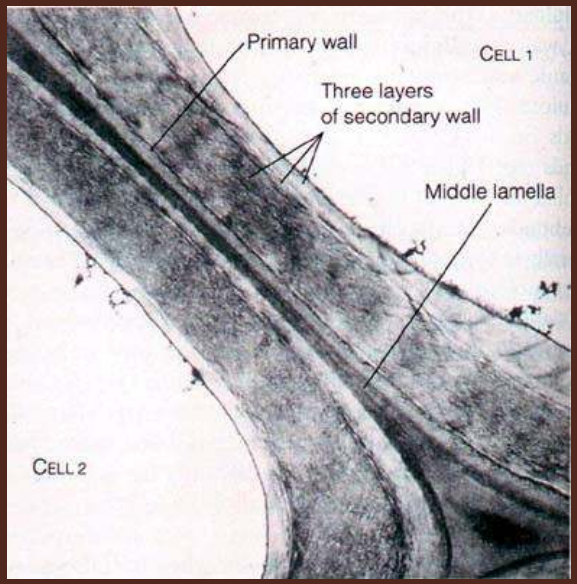
- Three to Four strata or layers may be found in plant cell walls
- 1/ *Middle Lamella*
- 2/ *Primary Cell Wall*
- 3/ *Secondary Cell Wall*
- 4/ *Tertiary Cell wall*



Plant cell wall : Middle Lamella

- The middle lamella join two cells together.
- Composed of Pectin (a Polysaccharide)

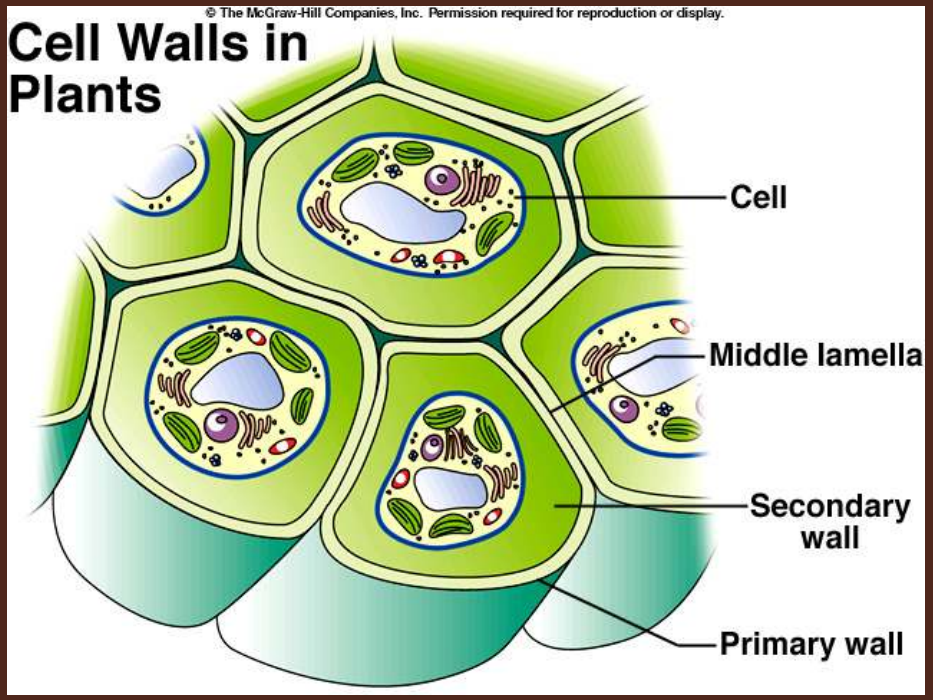




Plant cell wall : Primary cell wall

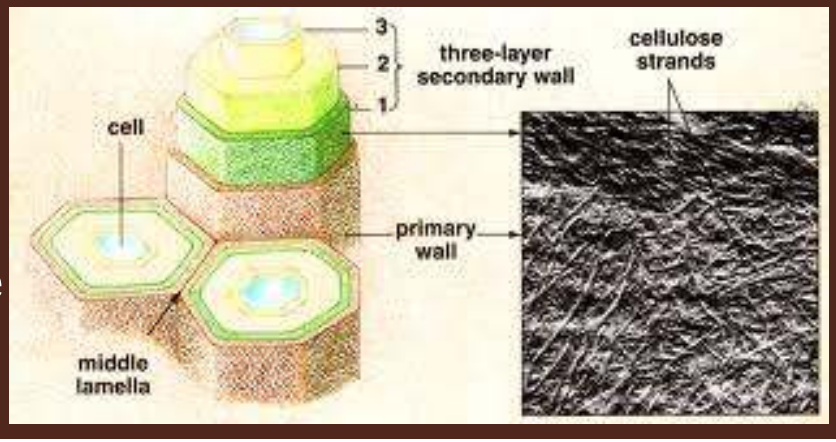
- Inner to middle lamella
- Composed of three networks –

- Cellulose microfibril network
- Pectin Polysaccharides
- Structural protein - glycoprotein



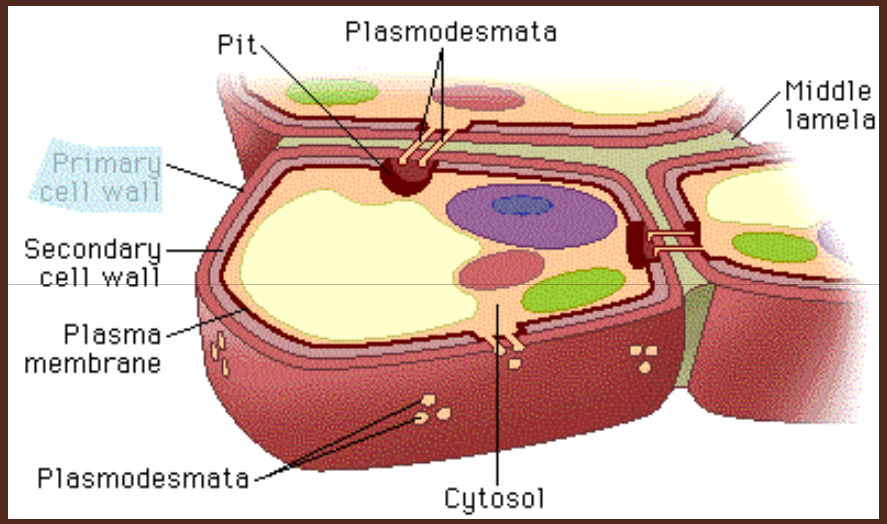
Plant cell wall : Secondary cell wall

- Contain – High Cellulose fibril, Low Hemicelluloses
- May also contain –
- Lignin – Derived from Lignum (Latin word = wood), it is phenol containing polymer
- Suberin – fatty substances found in endodermal cells known as rubbry material (Waxy Substances)
- Cutin – it forms cuticle in epidermis helps as protective film of leaves



Plant cell wall : Tertiary cell wall

- Rarely present in cell wall
- Lacks cellulose fibril
- Very thin layer
- Contain - xylan



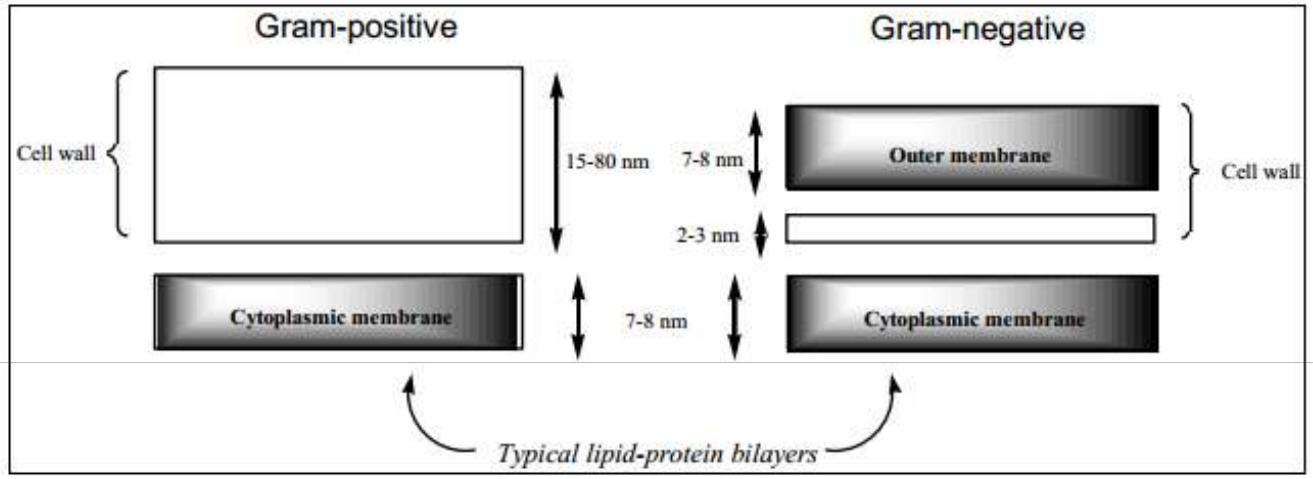
Plant cell wall : Plasmodesmata

- Cytoplasmic bridge between two adjacent cells
- It form minute pores in cell wall

Plant cell wall : Functions

- Provides shape to cells
- Provides rigidity to cells
- Protect protoplasm against mechanical injury
- Prevent from loss of water through transpiration
- Give strength to plant, to stand opposite to gravitational force

BACTERIAL CELL WALL



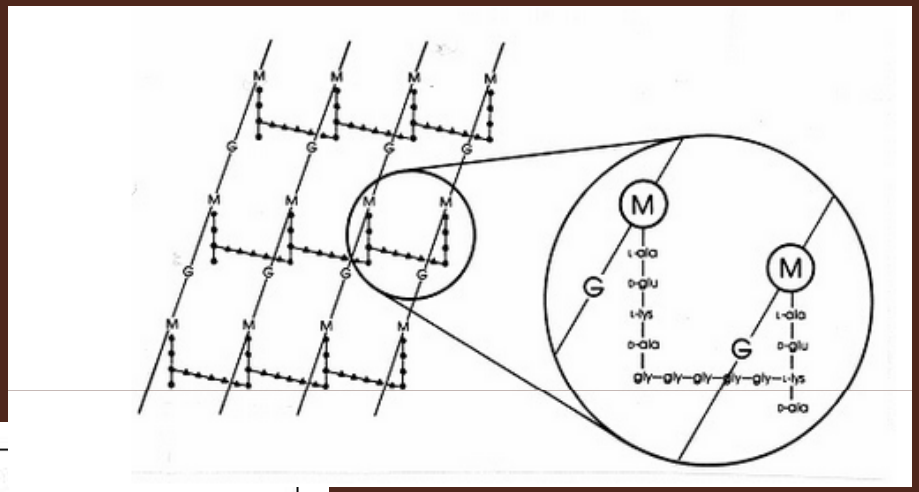
Gram-positive

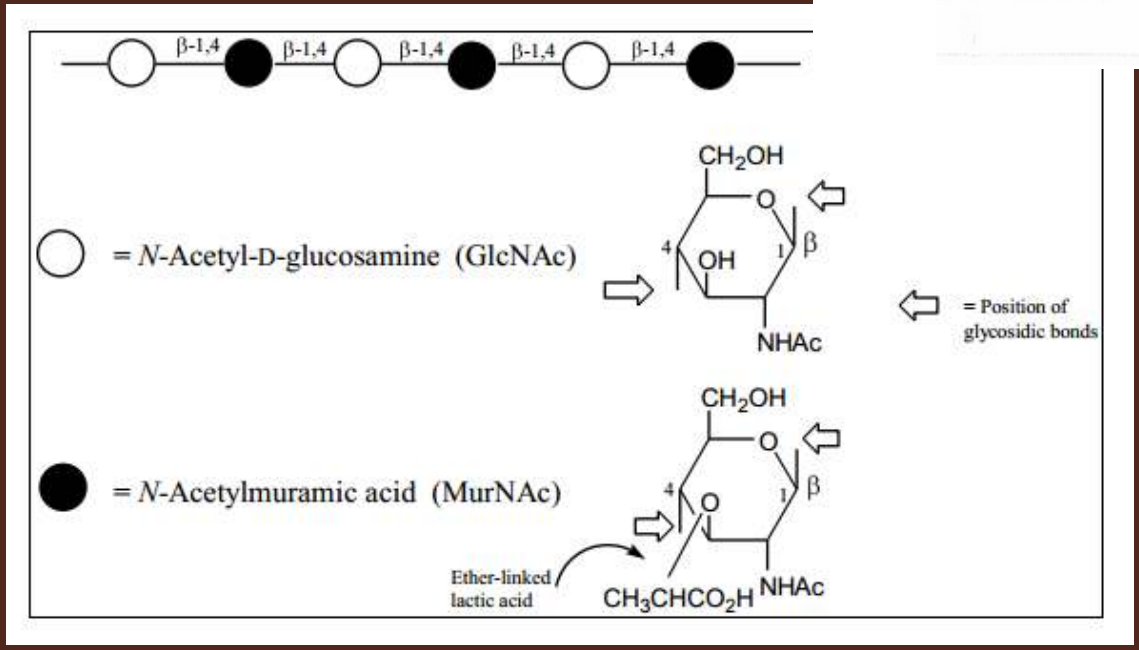
- Relatively thick and featureless (electron microscope)
- Major component (~50%) is **peptidoglycan**
- No lipid and often no protein
- Accessory polymers (*teichoic acid* and/or *teichuronic acid*) covalently linked to peptidoglycan

Gram-negative

- The cell envelope consists of a *pair* of membranes (*cytoplasmic* and *outer*) with a thin, intermediate layer of **peptidoglycan**
- The outer membrane contains **lipopolysaccharide (LPS)** as well as *lipids* and *proteins*. LPS is located exclusively in the outer leaflet: lipid embedded in the membrane, polysaccharide protruding. This makes the bacteria appear rather fuzzy under an electron microscope.

BACTERIAL CELL WALL





ALGAL CELL WALL

- Like plants, algae have cell walls Algal cell walls contain either polysaccharides (suc h as cellulose (a glucan)) or a variety of glycoproteins or both.
- The inclusion of additional polysaccharides in algal cells walls is used as a feature for algal taxonomy.

ALGAL CELL WALL

- Mannans: They form microfibrils in the cell walls of a number of marine green algae including those from the genera, Codium, Dasycladus, and Acetabularia as well as in the walls of some red algae, like Porphyra and Bangia.
- Xylans:
- Alginic acid: It is a common polysaccharide in the cell walls of brown algae.
- Sulfonated polysaccharides: They occur in the cell walls of most algae; those common in red algae include agarose, carrageenan, porphyran, furcelleran and funoran.

FUNGAL CELL WALL

- Most true fungi have a cell wall consisting largely of chitin and other polysaccharides. True fungi do not have cellulose in their cell walls.
- In fungi, the cell wall is the outer-most layer, external to the plasma membrane. The fungal cell wall is a matrix of three main components.
- chitin: polymers consisting mainly of unbranched chains of ß-(1,4)-linked-N-Acetylglucosamine in the Ascomycota and Basidiomycota, or poly-ß-(1,4)-linked-N-Acetylglucosamine (chitosan) in the Zygomycota. Both chitin and chitosan are synthesized and extruded at theplasma membrane.
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FUNGAL CELL WALL

- Glucans: glucose polymers that function to cross-link chitin or chitosan polymers.
- proteins: Most of the structural proteins found in the cell wall are glycosylated and contain mannose, thus these proteins are called mannoproteins or mannans.

Table 1: Common wall constituents found in each division of fungi (adapted from Gooday in Gow & Gadd, 1995).

Division	Fibrous	Gel-like Polymer
Basidiomycota	Chitin β -(1-3), β-(1-6) Glucan	Xylomannoproteins α (1-3) Glucan
Ascomycota	chitin β -(1-3), β-(1-6) Glucan	Galactomannoproteins α (1-3) Glucan
Zygomycota	Chitin Chitosan	Polyglucuronic acid Glucuronomannoproteins Polyphosphate
Chytridiomycota	Chitin Glucan	Glucan

Thank you