© UNIVERSAL RESEARCH REPORTS | REFEREED | PEER REVIEWED
ISSN : 2348 - 5612 | Volume : 09 , Issue : 01 | January - March 2022

# Structure organisation & function of plant cell wall

Kamaldeep Singh
kamaldeep08singh@gmail.com

**Abstract**

The strong outer shell that serves to protect the plant cell is called the cell wall, and it is present in all plant species. Pectin, cellulose, and hemicellulose are the three primary types of polysaccharides that make up the cell wall. Carbohydrates make up the majority of the cell wall. In addition to these, there are phenolic and aliphatic polymers, which play an essential role as structural proteins. In addition to providing the plant body with the mechanical strength necessary for upright growth and the formation of structures, the cell wall also plays important roles in the processes of the cell itself, including cell expansion, tissue differentiation, intercellular communication, the movement of water, and defensive responses against pests or pathogens. It is also possible that cell walls have a role in signal detection during the pattern creation stage of plant growth.

**Keywords:** biosynthesis, cell wall, construction, function

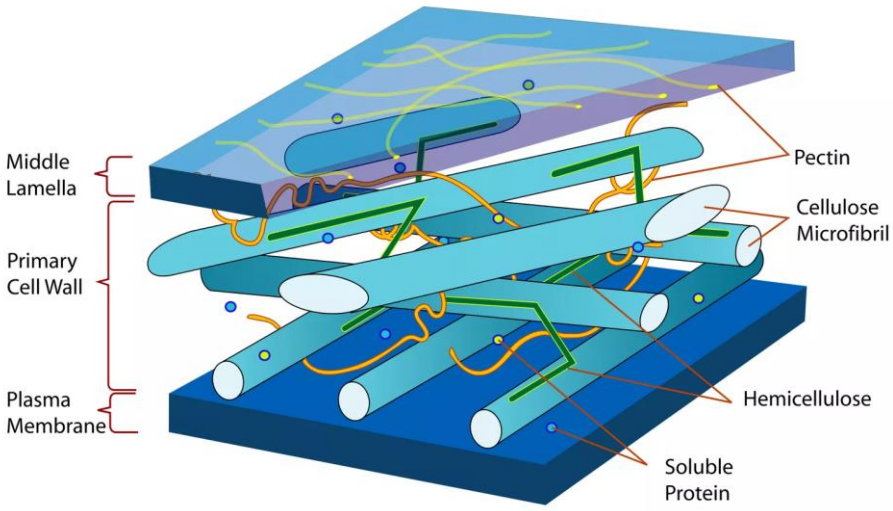
## Introduction

A robust exterior layer of the plant cell, the plant cell wall may be found on the opposite side of the plasma membrane from the nucleus. The cell wall is dense, complex, and dynamic. It serves as a semipermeable barrier to restrict the cell's physical movement and protect it from outside threats. Polysaccharides, highly glycosylated proteins, and lignin are the components that make up the wall. There is a large amount of variation in the exact composition of the wall since it is dependent on the plant species, the tissue, and the stage of development. The cell walls of live plants have a variety of functions, some of which are very subtle, in the growth, development, and defense of the plant. Even after the protoplast dies, the wall will continue to perform the specific biological function for which it was designed for a considerable amount of time. This is made abundantly obvious by the manner in which cork wraps around and shields the trunk of the tree throughout the duration of the tree's life.

Some kinds of cells have a protective covering that is composed of a stiff, semi-permeable membrane called a cell wall. In most plant cells, as well as those of fungus, bacteria, algae, and some archaea, this outer layer may be found next to the cell membrane, also known as the plasma membrane. However, animal cells do not possess a cell wall as plant cells do. Within a cell, the cell wall is responsible for numerous essential activities, including providing protection, structure, and support. “The make-up of an organism's cell walls may be very

distinct from one another. The plant cell wall is made up mostly of cellulose, which is a kind of carbohydrate polymer. These cellulose fibers are quite strong. Cellulose is the primary constituent of both cotton fiber and wood, and it plays an important role in the manufacturing process. Peptidoglycan is a kind of polymer that is made up of sugar and amino acids, and it is what makes up the cell walls of bacteria. Chitin, glucans, and proteins are the primary components that make up the cell walls of fungi.

**Plant Cell Wall Structure**

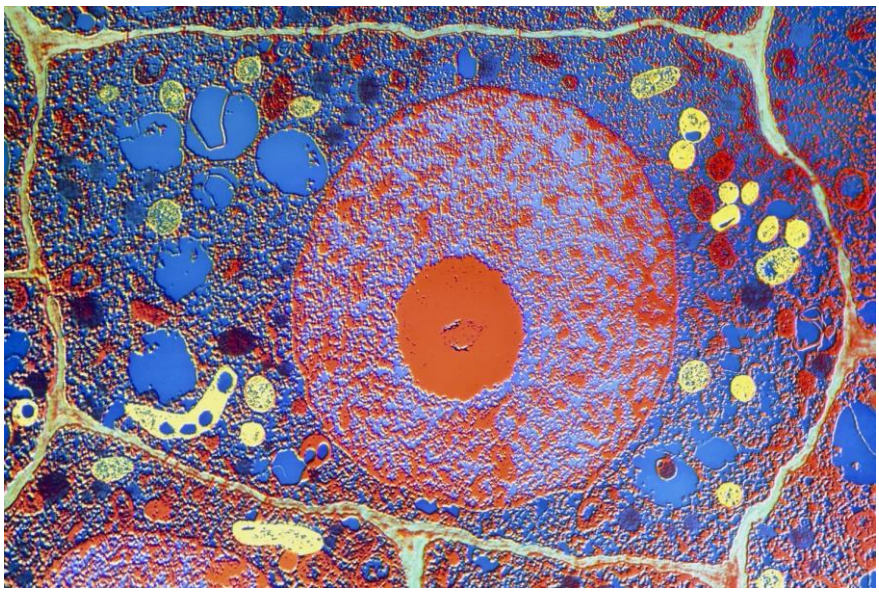



By LadyofHats (Own work) [Public domain], via Wikimedia Commons

The cell wall of a plant is multi-layered and may be broken down into as many as three pieces. Beginning with the most superficial layer of the cell wall, the middle lamella, primary cell wall, and secondary cell wall are the names given to the next layers of the cell wall. There is a central lamella and a primary cell wall in all plant cells; however, secondary cell walls are not present in all plant cells.

- **Middle lamella:** The outermost layer of the cell wall is composed of pectins, which are polysaccharides. Pectins contribute to the process of cell adhesion by facilitating the binding of the cell walls of neighboring cells to one another.
- **Primary cell wall:** During the process of plant cell growth, this layer develops in between the middle lamella and the plasma membrane. It is mostly made up of cellulose microfibrils that are embedded inside of a gel-like matrix that is made up of hemicellulose fibers and pectin polysaccharides. The basic cell wall offers both the necessary strength and flexibility for cell development, hence making it possible.

- **Secondary cell wall:** In some plant cells, this layer is produced in the space that exists between the main cell wall and the plasma membrane. After the primary cell wall has completed its cycle of division and growth, it may begin to thicken, which will result in the formation of the secondary cell wall. The cell's strength and integrity are both contributed to by this hard layer. Lignin is a component of certain secondary cell walls. Lignin is found in some secondary cell walls with cellulose and hemicellulose. In plant vascular tissue cells, lignin helps to reinforce the cell wall and contributes to the cells' ability to carry water.
- **Plant Cell Wall Function**



This micrograph image shows a plant cell and its internal organelles. The cell wall appears as the thin layer between the cells and the nucleus is the prominent, round organelle with the smaller red nucleolus.

The formation of a framework for the cell that stops it from becoming too large is a significant part of the function of the cell wall. The structure and form of the cell are kept intact thanks to the contributions of cellulose fibers, structural proteins, and other polysaccharides. The cell wall also performs the following additional functions::

- **Support:** The mechanical support and strength of the cell come from the cell wall. In addition to this, it regulates the path that cell development takes.

- **Withstand turgor pressure:** The force that is exerted on the cell wall as a result of the contents of the cell pushing the plasma membrane against the cell wall is referred to as turgor pressure. This pressure keeps a plant's stem and leaves firm and upright, but it also has the potential to cause a cell to burst.
- **Regulate growth:** Signals are sent by the cell wall in order for the cell to start the cell cycle and begin the process of dividing and growing.
- **Regulate diffusion:** • Because the cell wall is porous, it allows some things, such as proteins, to enter into the cell while preventing the passage of other substances.
- **Communication:** Plasmodesmata are the means through which cells interact with one another (pores or channels between plant cell walls that allow molecules and communication signals to pass between individual plant cells).
- **Protection:** The cell wall functions as a defensive barrier, preventing plant viruses and other diseases from entering the plant. Additionally, it aids in the prevention of water loss.
- **Storage:** Carbohydrates are stored in the cell wall for use in the development of the plant, particularly in the seeds.

**Plant Cell Structures and Organelles**

This micrograph image of a section through a plant cell reveals its internal structure. Inside the cell wall are chloroplasts (dark green), the site of photosynthesis, and the nucleus (orange), which contains the cell's genetic information.

The interior components and organelles of the plant are supported and protected by the cell wall. These so-called tiny organs carry out essential activities that are necessary for the

continued existence of the cell. The following are examples of organelles and structures that are present in a normal plant cell:

**Cell (Plasma) Membrane:** This membrane surrounds the cytoplasm of a cell, enclosing its contents.

**Cell Wall:** The outer covering of the cell that protects the plant cell and gives it shape is the cell wall.

**Centrioles:** These cell structures organize the assembly of microtubules during cell division.

**Chloroplasts:** The sites of photosynthesis in a plant cell are chloroplasts.

**Cytoplasm:** This gel-like substance within the cell membrane supports and suspends organelles.

**Cytoskeleton:** The cytoskeleton is a network of fibers throughout the cytoplasm.

**Endoplasmic Reticulum:** This organelle is an extensive network of membranes composed of both regions with ribosomes (rough ER) and regions without ribosomes (smooth ER).

**Golgi Complex:** This organelle is responsible for manufacturing, storing and shipping certain cellular products.

**Lysosomes:** These sacs of enzymes digest cellular macromolecules.

**Microtubules:** These hollow rods function primarily to help support and shape the cell.

**Mitochondria:** These organelles generate energy for the cell through respiration.

**Nucleus:** This large, membrane bound structure with in the cell contains the cell's hereditary information.

**Nucleolus:** This circular structure within the nucleus helps in the synthesis of ribosomes.

**Nucleopores:** These tiny holes within the nuclear membrane allow nucleic acids and proteins to move into and out of the nucleus.

**Peroxisomes:** These tiny structures are bound by a single membrane and contain enzymes that produce hydrogen peroxide as a by-product.

**Plasmodesmata:** These pores, or channels, between plant cell walls allow molecules and communication signals to pass between individual plant cells.

**Ribosomes:** Composed of RNA and proteins, ribosomes are responsible for protein assembly.

**Vacuole**: This typically large structure in a plant cell helps to support the cell and participates in a variety of cellular functions including storage, detoxification, protection, and growth.

**Review of literature**

(Del and Del 2012) studied cell — structure and functions discovered that, and you already know that items in our environment may be classified as either alive or non-living. In addition, you can keep in mind that every living creature is responsible for performing a set of fundamental activities. Are you able to enumerate these capabilities? The numerous duties that you have outlined are carried out by distinct groups or sets of organs.

(Zhang et al. 2021) studied The plant cell wall: Biosynthesis, construction, and functions discovered this and One of the most intricate structural networks in nature is the plant cell wall, which is made up of a number of different biopolymers. There are probably hundreds of genes involved in the construction of such a natural masterpiece. However, the plant cell wall is the cellular structure in plants that is the least known by scientists.

(Srivastava, McKee, and Bulone 2017) studied Plant Cell Walls" discovered this and The strong outer shell that serves to protect the plant cell is called the cell wall, and it is present in all plant species. Celulose, hemicellulose, and pectin are the three primary types of polysaccharides that make up the cell wall. Carbohydrates make up the majority of the cell wall's composition. In addition to these, there are phenolic and aliphatic polymers, which play an essential role in the structure of the cell.

(Anonymous 2020) studied "Plant Cells - Definition, Diagram, Structure & Function" found that and The cell is the basic unit of life in all organisms. Like humans and animals, plants are also composed of several cells. The plant cell is surrounded by a cell wall which is involved in providing shape to the plant cell. Apart from the cell wall, there are other organelles that are associated with different cellular activities.

(Physiology and Hill 2008) studied "The Plant Cell" discovered this and Even though these early researchers were unable to identify many of the features contained inside a cell, modern technology enables us to magnify incredibly minute aspects of the cellular structure and see them in greater detail than ever before. The use of the electron microscope has significantly contributed to the expansion of our understanding of the structure and function of individual cells.

**Conclusion**

The evolutionary connections of cell walls from the numerous plant species and their algal progenitors is one last topic that is significant to both the structure of plant cell walls and the biosynthesis of wall components. This subject was brought up since both issues are related to each other. Recent research on the cell walls of algae and primitive plants has begun to yield interesting insights into the evolution of cell walls and the components that make them up. While the majority of research on structure and biosynthesis has focused on angiosperms, particularly model systems such as Arabidopsis and crop plants, recent research on the cell walls of algae and primitive plants has begun to yield these insights. These kinds of investigations could result in significant new insights into the functional links that exist between the many different wall components. The plant community has a great deal of difficulty in understanding the structure, function, and biosynthesis of cell walls, which is one of the primary conclusions that can be drawn from this concise description. To comprehend the arrangement of the components that make up the wall of a single cell, new biophysical and imaging approaches are going to be required. Because molecular biology, molecular genetics, and genomics have already provided many powerful new tools, it is reasonable to anticipate that rapid progress will be made in this area of research, which concerns the difficulties associated with comprehending the processes of cell wall biosynthesis and their regulation.

**References**

1. Anonymous. 2020. “Plant Cells - Definition , Diagram , Structure & Function.”
2. Del, E. J. E., and E. J. E. Del. 2012. “Canal F / S F / S F / S F / S F / S F / S F / S Canal.” 5:2012.
3. Physiology, Plant, and The Mcgraw Hill. 2008. “Life : Botanical Principles.”
4. Srivastava, Vaibhav, Lauren S. McKee, and Vincent Bulone. 2017. “Plant Cell Walls.” *ELS* (July 2018):1–17. doi: 10.1002/9780470015902.a0001682.pub3.
5. Zhang, Baocai, Yihong Gao, Lanjun Zhang, and Yihua Zhou. 2021. “The Plant Cell Wall: Biosynthesis, Construction, and Functions.” *Journal of Integrative Plant Biology* 63(1):251–72. doi: 10.1111/jipb.13055.