**B) Anatomy**

**1. Cell wall**

A **cell wall** is a rigid, semi-permeable protective layer in some [cell](https://www.thoughtco.com/what-are-cells-373361) types. This outer covering is positioned next to the [cell membrane](https://www.thoughtco.com/cell-membrane-373364) (plasma membrane) in most [plant cells](https://www.thoughtco.com/what-is-a-plant-cell-373384), [fungi](https://www.thoughtco.com/interesting-facts-about-fungi-373407), [bacteria](https://www.thoughtco.com/prokaryotes-meaning-373369), [algae](https://www.thoughtco.com/major-types-of-algae-373409), and some [archaea](https://www.thoughtco.com/archaea-373417). [Animal cells](https://www.thoughtco.com/all-about-animal-cells-373379) however, do not have a cell wall. The cell wall has many important functions in a cell including protection, structure, and support.

Cell wall composition varies depending on the organism. In plants, the cell wall is composed mainly of strong fibers of the [carbohydrate](https://www.thoughtco.com/carbohydrates-373558) polymer **cellulose**. Cellulose is the major component of cotton fiber and wood, and it is used in paper production. Bacterial cell walls are composed of a sugar and amino acid polymer called **peptidoglycan**. The main components of fungal cell walls are **chitin**, glucans, and proteins.

**Plant Cell Wall Structure**

The plant cell wall is multi-layered and consists of up to three sections. From the outermost layer of the cell wall, these layers are identified as the middle lamella, primary cell wall, and secondary cell wall. While all plant cells have a middle lamella and primary cell wall, not all have a secondary cell wall.

* **Middle lamella:** This outer cell wall layer contains polysaccharides called pectins. Pectins aid in cell adhesion by helping the cell walls of adjacent cells to bind to one another.​
* **Primary cell wall:** This layer is formed between the middle lamella and [plasma membrane](https://www.thoughtco.com/cell-membrane-373364) in growing plant cells. It is primarily composed of cellulose microfibrils contained within a gel-like matrix of hemicellulose fibers and pectin polysaccharides. The primary cell wall provides the strength and flexibility needed to allow for cell growth.​
* **Secondary cell wall:** This layer is formed between the primary cell wall and plasma membrane in some plant cells. Once the primary cell wall has stopped dividing and growing, it may thicken to form a secondary cell wall. This rigid layer strengthens and supports the cell. In addition to cellulose and hemicellulose, some secondary cell walls contain lignin. Lignin strengthens the cell wall and aids in water conductivity in [plant vascular tissue](https://www.thoughtco.com/plant-tissue-systems-373615) cells.

**Plant Cell Wall Function**

A major role of the cell wall is to form a framework for the cell to prevent over expansion. Cellulose fibers, structural proteins, and other polysaccharides help to maintain the shape and form of the cell. Additional **functions of the cell wall** include:

* **Support:** The cell wall provides mechanical strength and support. It also controls the direction of cell growth.​
* **Withstand turgor pressure:** Turgor pressure is the force exerted against the cell wall as the contents of the cell push the plasma membrane against the cell wall. This pressure helps a plant to remain rigid and erect, but can also cause a cell to rupture.​
* **Regulate growth:** The cell wall sends signals for the cell to enter the [cell cycle](https://www.thoughtco.com/understanding-the-cell-cycle-373391) in order to divide and grow.
* **Regulate diffusion:** The cell wall is porous allowing some substances, including [proteins](https://www.thoughtco.com/protein-function-373550), to pass into the cell while keeping other substances out.​
* **Communication:** Cells communicate with one another via plasmodesmata (pores or channels between plant cell walls that allow molecules and communication signals to pass between individual plant cells).​
* **Protection:**The cell wall provides a barrier to protect against [plant viruses](https://www.thoughtco.com/plant-viruses-373892) and other pathogens. It also helps to prevent water loss.​
* **Storage:** The cell wall stores carbohydrates for use in plant growth, especially in seeds.

**Plant Cell Structures and Organelles**

The plant cell wall supports and protects internal structures and [organelles](https://www.thoughtco.com/organelles-meaning-373368). These so called 'tiny organs' perform needed functions for the support of cell life. Organelles and structures that can be found in a typical plant cell include:

* [Cell (Plasma) Membrane](https://www.thoughtco.com/cell-membrane-373364): 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](https://www.thoughtco.com/centrioles-373538): These cell structures organize the assembly of microtubules during [cell division](https://www.thoughtco.com/stages-of-mitosis-373534).​
* [Chloroplasts](https://www.thoughtco.com/chloroplast-373614): The sites of [photosynthesis](https://www.thoughtco.com/photosynthesis-373604) in a plant cell are chloroplasts.​
* [Cytoplasm](https://www.thoughtco.com/cytoplasm-defined-373301): This gel-like substance within the cell membrane supports and suspends organelles.​
* [Cytoskeleton](https://www.thoughtco.com/cytoskeleton-anatomy-373358): The cytoskeleton is a network of fibers throughout the cytoplasm.​
* [Endoplasmic Reticulum](https://www.thoughtco.com/endoplasmic-reticulum-373365): This organelle is an extensive network of membranes composed of both regions with ribosomes (rough ER) and regions without ribosomes (smooth ER).​
* [Golgi Complex](https://www.thoughtco.com/golgi-apparatus-meaning-373366): This organelle is responsible for manufacturing, storing and shipping certain cellular products.​
* [Lysosomes](https://www.thoughtco.com/lysosomes-cell-organelles-373357): These sacs of enzymes digest cellular macromolecules.​
* [Microtubules](https://www.thoughtco.com/microtubules-373545): These hollow rods function primarily to help support and shape the cell.​
* [Mitochondria](https://www.thoughtco.com/mitochondria-defined-373367): These organelles generate energy for the cell through respiration.​
* [Nucleus](https://www.thoughtco.com/the-cell-nucleus-373362): 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](https://www.thoughtco.com/journey-into-the-cell-peroxisomes-373360): These tiny structures are bound by a single membrane and contain enzymes that produce hydrogen peroxide as a by-product.​
* [**Plasmodesmata**](https://www.thoughtco.com/plasmodesmata-the-bridge-to-somewhere-419216)**:** These pores, or channels, between plant cell walls allow molecules and communication signals to pass between individual plant cells.​
* [Ribosomes](https://www.thoughtco.com/ribosomes-meaning-373363): Composed of [RNA](https://www.thoughtco.com/rna-373565) and proteins, ribosomes are responsible for protein assembly.​
* [Vacuole](https://www.thoughtco.com/vacuole-organelle-373617): 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.