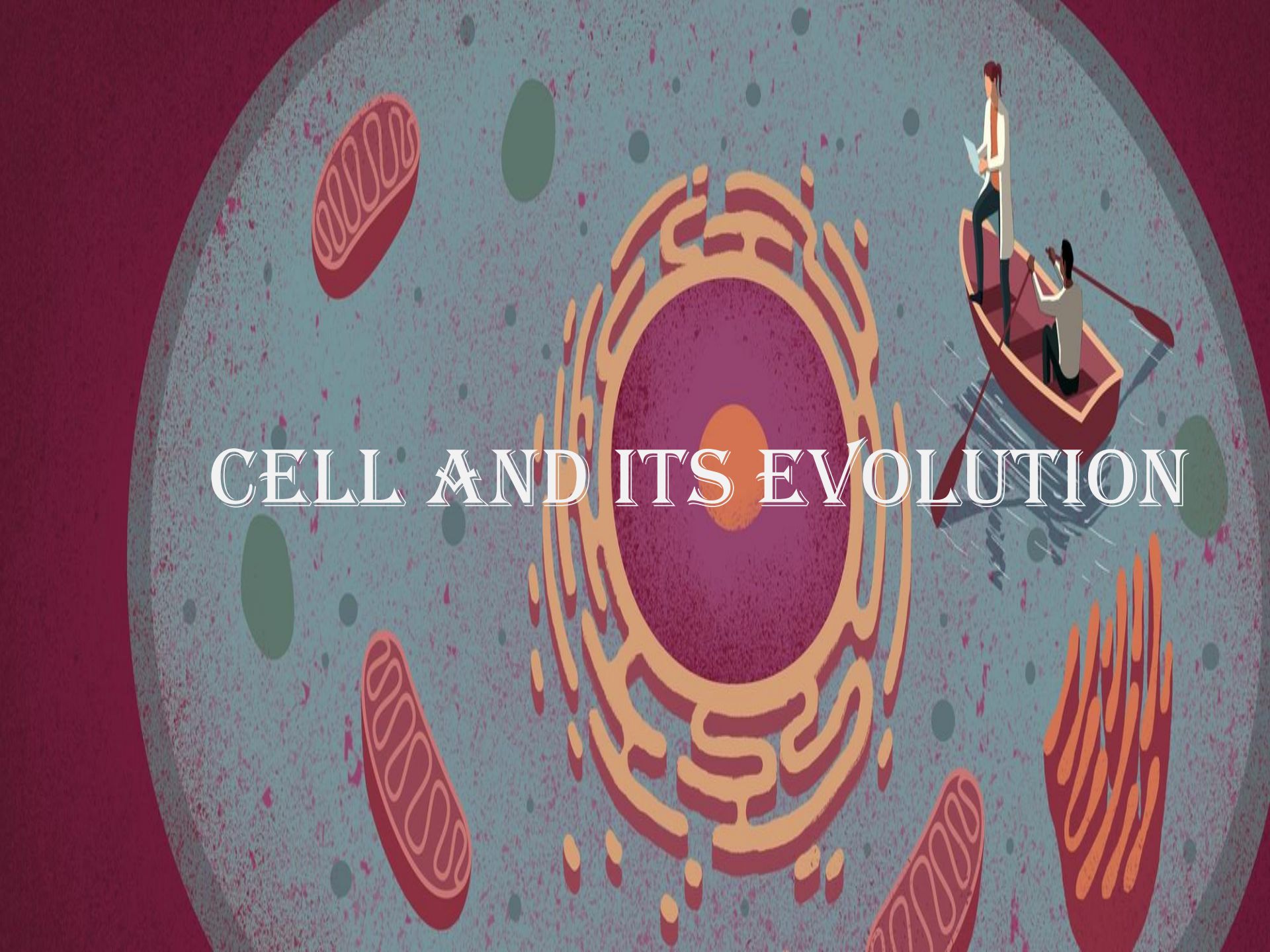
CELL AND ITS EVOLUTION

INTRODUCTORY BIOCHEMISTRY

Chapter: 3
Cell and Its Evolution
Lecture - 10

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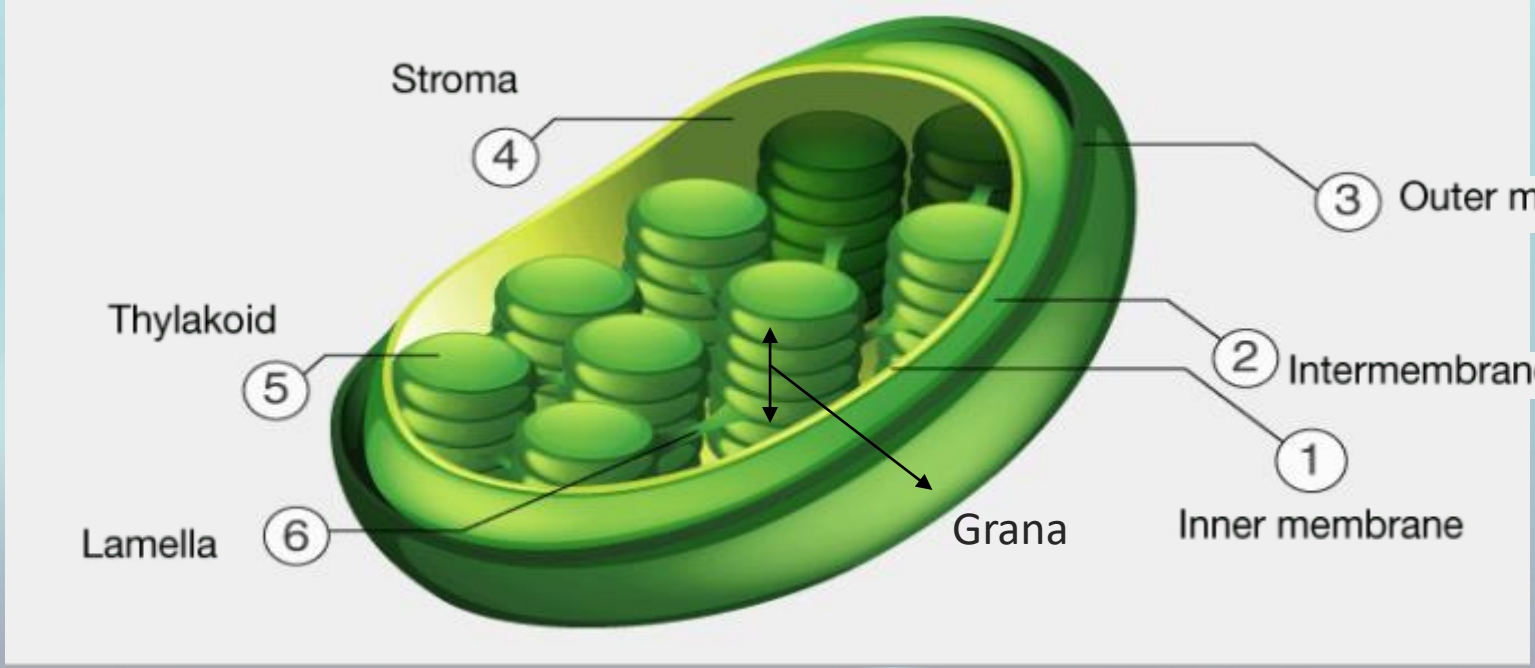
Chloroplasts

The most talked-about type of plastid is the chloroplast. These organelles are responsible for making plants green and producing energy for the cells and the plants as a whole.

The size of the chloroplast usually varies between 4-6 µm in diameter and 1-3 µm in thickness. They are double-membrane organelle

The chloroplast structure consists of the following parts:



Chloroplasts

Membrane Envelope

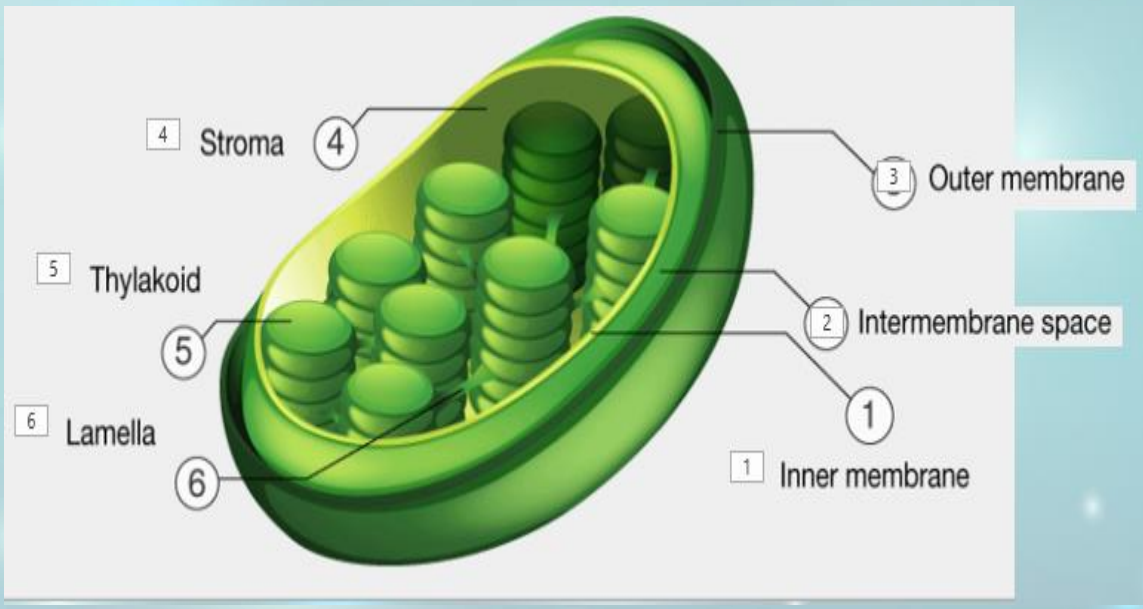
It comprises inner and outer lipid bilayer membranes. The inner membrane separates the stroma from the intermembrane space.

Intermembrane Space

The space between inner and outer membranes.

Thylakoid System (Lamellae)

The system is suspended in the stroma. It is a collection of membranous sacs called thylakoids. The green colored pigments called chlorophyll are found in the thylakoid membranes.



It is the sight for the process of light-dependent reactions of the photosynthesis process.

Chloroplasts

Grana

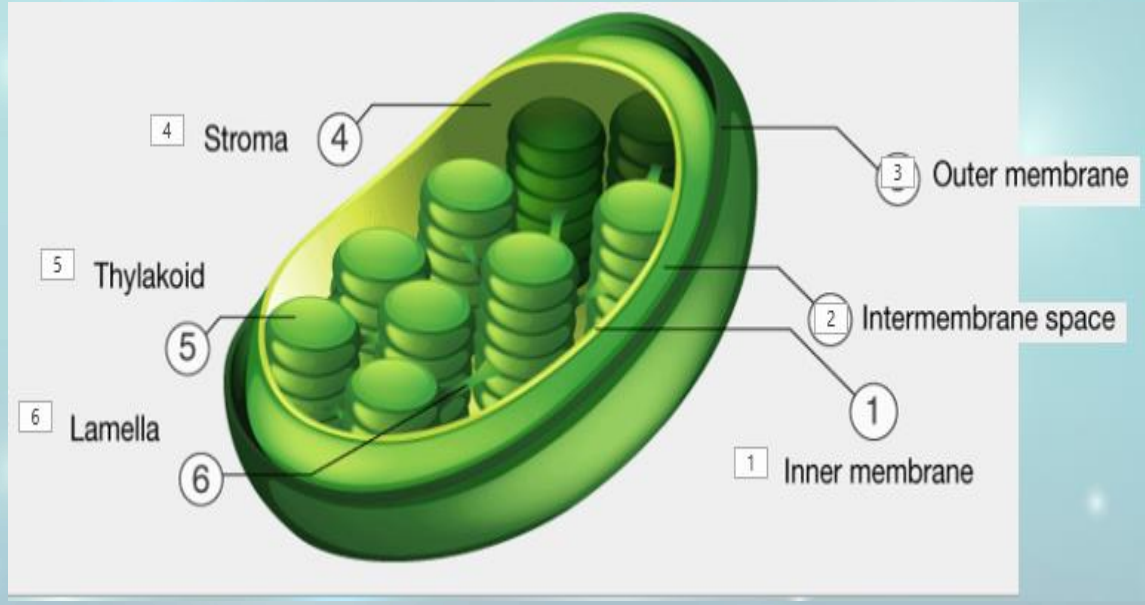
The thylakoids are arranged in stacks known as grana and each granum contains around 10-20 thylakoids. These are the sites of conversion of light energy into chemical energy.

Lamellae

Grana are connected by stromal lamellae, extensions that run from one granum, through the stroma, into a neighbouring *granum*

Stroma

It is a colorless, alkaline, aqueous, protein-rich fluid present within the inner membrane of the chloroplast present surrounding the grana. It contains copies of the chloroplast genome.



https://byjus.com/biology/chloroplasts/#:~:text=Chloroplast%20has%20a%20structure%20called,by%20the%20process%20of%20photosynthesis.

https://www.britannica.com/science/chloroplast

Chloroplasts

Functions of Chloroplast

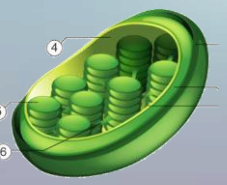
•The most important function of the chloroplast is to synthesize food by the process of photosynthesis.

•Absorbs light energy and converts it into chemical energy.

•Produces NADPH and molecular oxygen (O_2) by photolysis of water.

•Produces ATP – Adenosine triphosphate by the process of photosynthesis.

•The carbon dioxide (CO2) obtained from the air is used to generate carbon and sugar during the Calvin Cycle or dark reaction of photosynthesis.



Cell wall

A cell wall is a rigid, semi-permeable protective layer in some cell types. This outer covering is positioned next to the cell membrane (plasma membrane) in most plant cells, fungi, bacteria, algae, and some archaea.

Animal cells however, do not have a cell wall.

Cell wall composition varies depending on the organism. In plants, the cell wall is composed mainly of strong fibers of the carbohydrate polymer cellulose.

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.

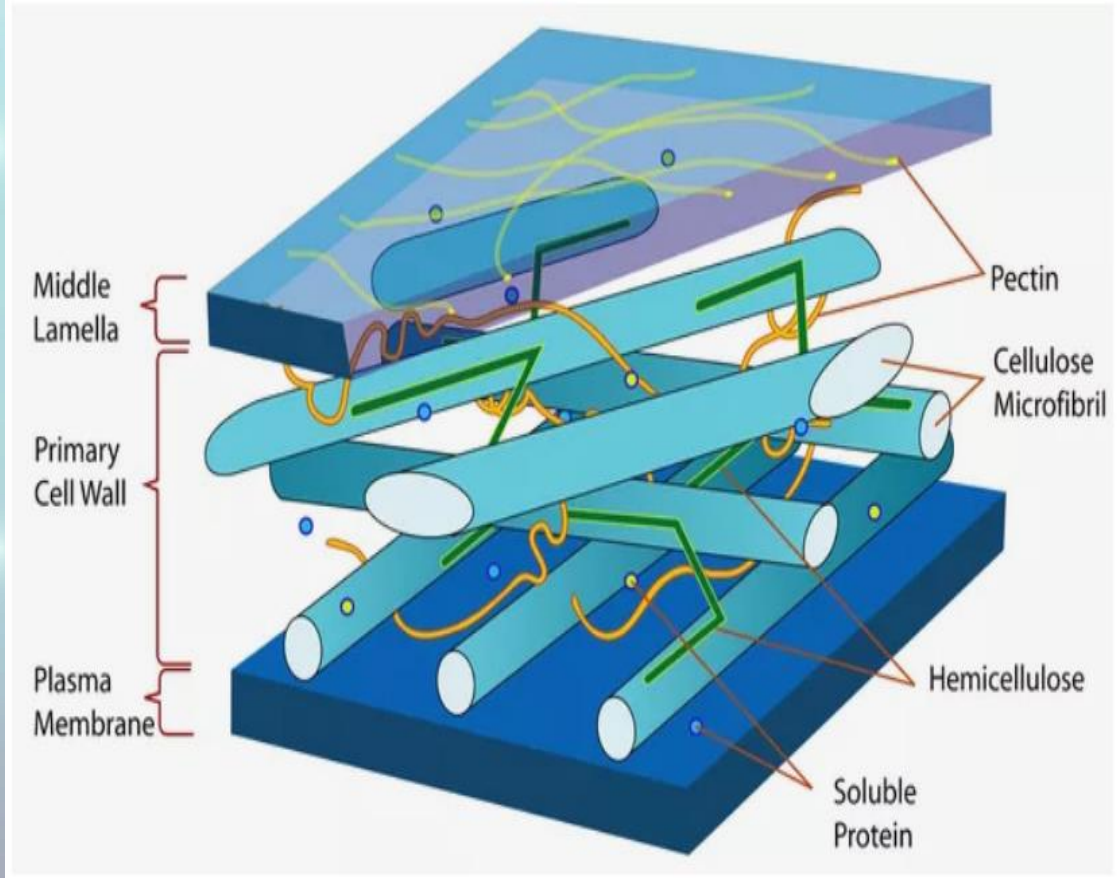
Cell wall

Plant Cell Wall Structure

The plant cell wall is multi-layered and consists of up to three sections. 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.

Primary cell wall:
This layer is formed between the middle lamella and plasma membrane 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.



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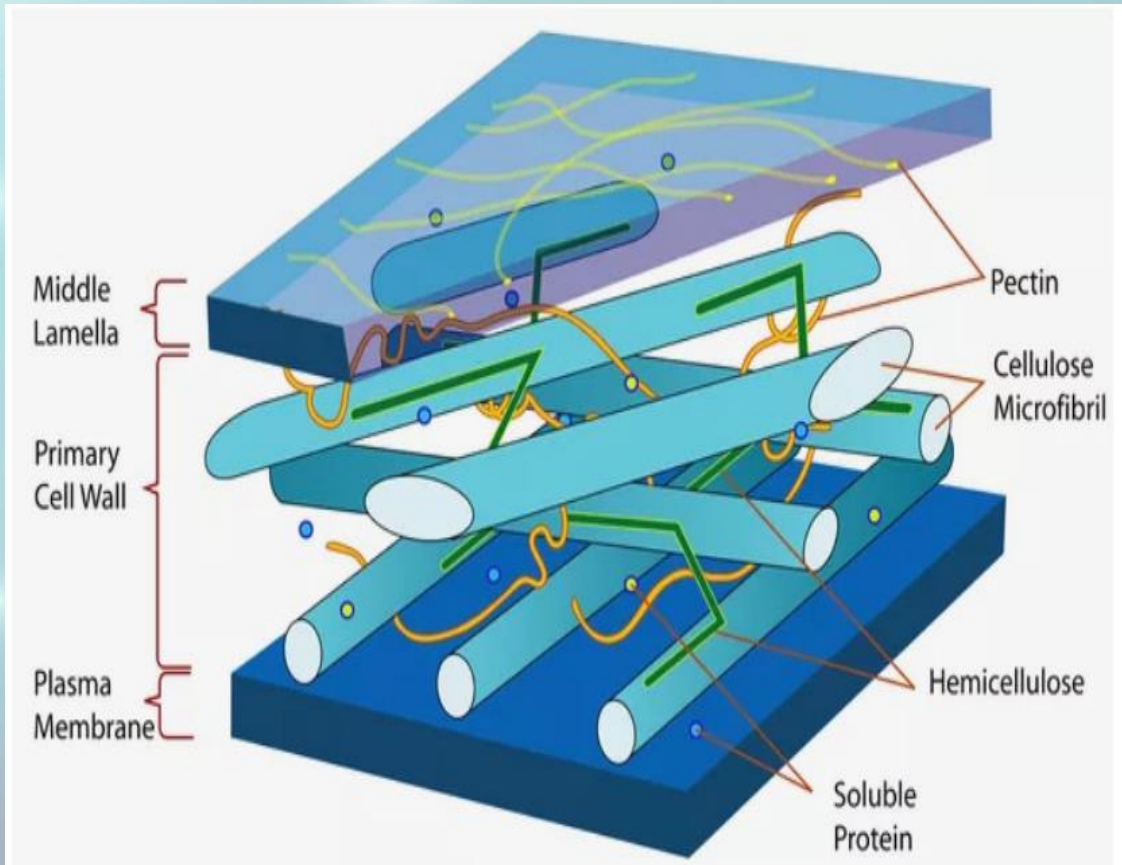
Cell wall

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.

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 cells.



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Cell wall

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 in order to divide and grow.

Cell wall

Regulate diffusion: The cell wall is porous allowing some substances, including proteins, 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 and other pathogens. It also helps to prevent water loss.
Storage: The cell wall stores carbohydrates for use in plant growth, especially in seeds.

https://www.thoughtco.com/cell-wall-373613