

Difference Between Protoplast and Protoplasm

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Key Difference - Protoplast vs Protoplasm

Protoplasts are cells of plants, bacteria, and fungi with removed cell walls. Since they lack a cell wall, they are enclosed by plasmalemma. They are utilized for different purposes which include plant breeding, somaclonal variation, and membrane biology. Protoplasm contains all the components that are essential for all life processes. It includes proteins, fats, and other essential compounds. **Protoplast is a naked cell in which the cell wall is removed through enzymatic degradation while the protoplasm is the collective term that is used to refer to both cytoplasm and the nucleus.** This is the **key difference** between protoplast and protoplasm.

What is Protoplast?

Protoplast is a type of cell which could be either plant, bacterial or fungal where the cell wall has been completely or partially degraded. The degradation is done using either mechanical or enzymatic actions. Cell walls are made up of different polysaccharides. Therefore, its degradation depends on the enzymes which have the capacity in degrading polysaccharide components. To achieve this, different enzymes are involved. Plants cell walls could be degraded by enzyme types which include cellulase, pectinase, and xylanase. In the context of bacterial and fungal cell wall degradation, enzymes such as lysozymes and chitinases are involved respectively. During cell wall degradation, the cell is exposed to high osmotic stress. Therefore, to prevent the rupture of cell membrane due to high osmotic pressure, cell wall degradation should be conducted in an isotonic solution.

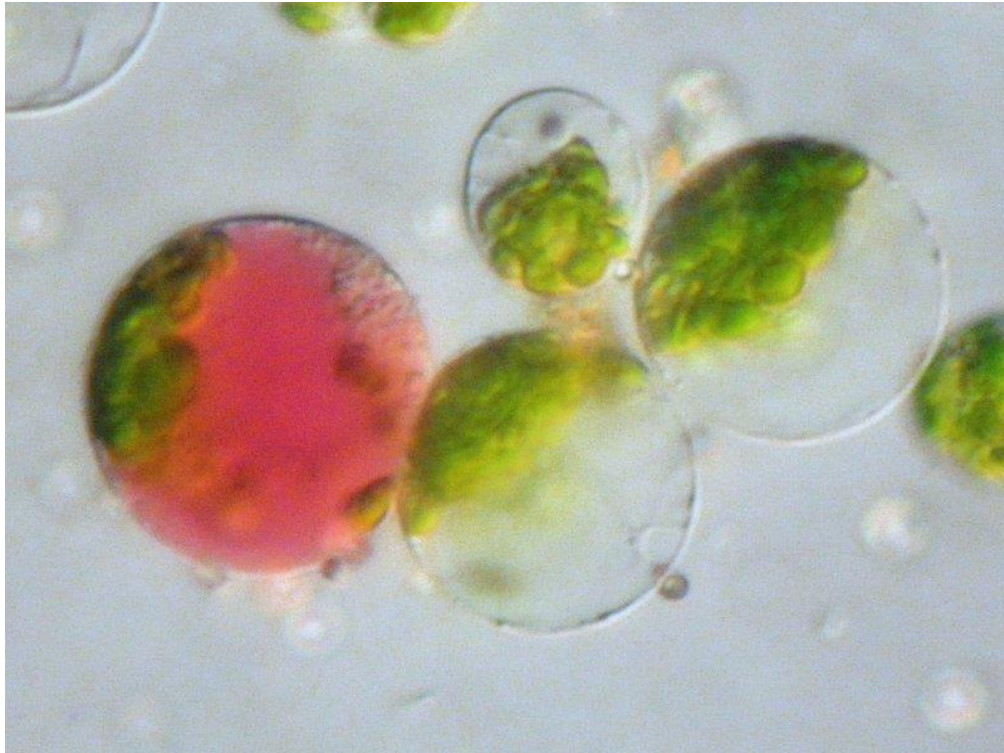
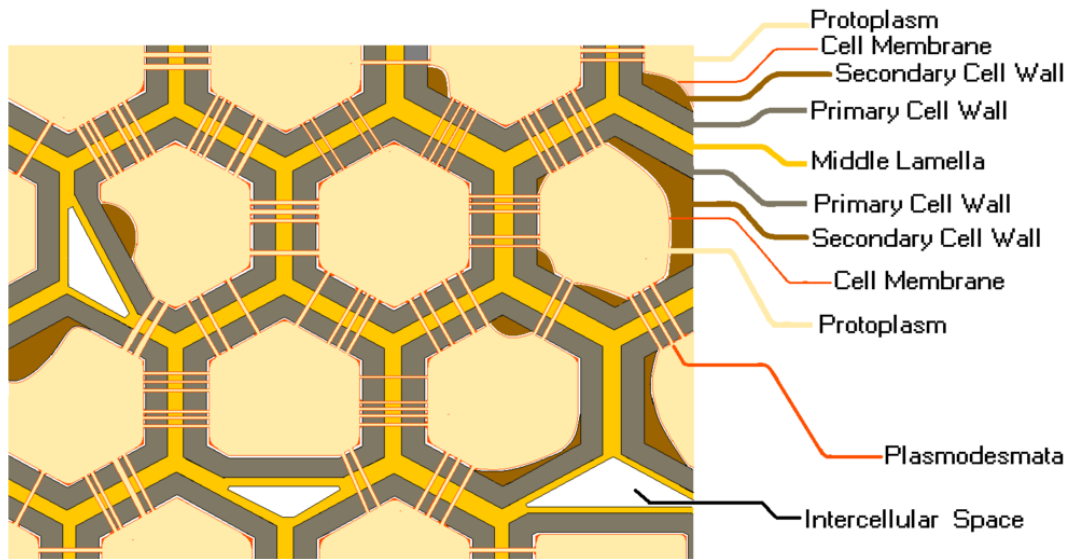


Figure 01: Protoplast Fusion

Protoplasts could be used to investigate membrane biology and somaclonal variation. Somaclonal variation is used to observe variations in plants that are produced through plant tissue culture. In membrane, biology protoplasts are used to identify different pathways that are used in the uptake of macromolecules and also to detect different types of viruses. DNA transformation technology utilizes protoplasts widely. This is because these cells lack a cell wall and hence, assist the movement of DNA into the cell without any blockage. Plant regeneration also utilizes protoplasts widely. They are initially grown into a group of plant cells that later develops into calli. In the context of plant breeding, protoplasts are involved in the technique called protoplast fusion.

What is Protoplasm?

Protoplasm is the living content of plant and animal cells. It is a complex translucent matrix which is semisolid. Both cytoplasm and nucleus are collectively known as the protoplasm. Therefore, the contents present in both cytoplasm and nucleus are present in the protoplasm. The cytoplasmic component of protoplasm contains different embedded cellular organelles. A cell membrane encloses it. Different proteins are present in the cytoplasm which lead to the formation of the cytoskeleton. The cytoplasm contains membrane-bound organelles such as mitochondria, chloroplast, lysosomes, Golgi apparatus and endoplasmic reticulum. It provides a location for many metabolic pathways such as cell division, glycolysis, and translation, etc.



Placement of plant's cell wall (extracellular matrix) and its major parts (highly diagrammatic)

Figure 02: Protoplasm of a Plant Cell

The nuclear envelope surrounds the nucleoplasmic component of the protoplasm. The nuclear envelope is a double membranous structure. The nucleoplasm contains nucleolus and chromatin. It involves in providing different functions to the protoplasm and the cell. It provides a shape to the nucleus and contains different enzymes needed for DNA replication and transcription. Nucleoplasm provides a location for the synthesis of ribosomes and post-transcriptional modifications.

What are the Similarities Between Protoplast and Protoplasm?

- Cytoplasm and nucleus are parts of both protoplast and protoplasm.
- Both protoplast and protoplasm contain living materials.

What is the Difference Between Protoplast and Protoplasm?

Protoplast vs Protoplasm	
Protoplasts are a plant, bacterial or fungal cells in which the cell wall is removed through enzymatic degradation.	Protoplasm is the collective term for both nucleoplasm and the cytoplasm of all cells including plant and animal cells.
Parts	
Cell membrane, cytoplasm, and nucleus are the parts of protoplast.	Cytoplasm and nucleus are the parts of protoplasm.
Development	
Scientists purposely create protoplasts for various purposes.	Protoplasm is a natural one.

Summary - Protoplast vs Protoplasm

Protoplast is a type of cells that could be either plant, bacterial or fungal in which the cell wall is completely or partially degraded. Cell walls are made up of different polysaccharides. Therefore, its degradation depends on the enzymes which have the capacity in degrading polysaccharide components. Protoplasts could be used to investigate membrane biology, somaclonal variation, and plant regeneration. Protoplasm is the living matter of cells. Both cytoplasm and nucleus are collectively known as the protoplasm. Everything that belongs to cytoplasm and nucleus is present in the protoplasm. The cytoplasmic component of protoplasm contains different embedded cellular organelles. A cell membrane encloses it. The cell membrane is a part of protoplast. But it is not considered as a part of protoplasm. This is the difference between protoplast and protoplasm.

Reference:

1. "Protoplast." Encyclopædia Britannica, Encyclopædia Britannica, inc. [Available here](#)
2. "Protoplasm." Encyclopædia Britannica, Encyclopædia Britannica, inc., 29 Jan. 2015. [Available here](#)

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