Difference Between Thylakoid and Stroma

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Key Difference - Thylakoid vs Stroma

In the context of photosynthesis, chloroplasts are the major organelles which initiate the process providing necessary conditions for photosynthesis. The structure of the chloroplast is developed to assist the process of photosynthesis. A chloroplast is a plastid which is spherical in structure. Thylakoid and stroma are two unique structures present in the chloroplast. A thylakoid is a membrane-bound compartment in the chloroplast which consists of different embedded molecules to initiate the light-dependent reaction of photosynthesis. Stroma is the cytoplasm of the chloroplast which is composed of a transparent liquid, in which thylakoid (grana), sub organelles, DNA, ribosome, lipid droplets and starch grains are present. Thus, primarily the **key difference** between thylakoid and stroma is **Thylakloid is a membrane-bound compartment situated in the chloroplast whereas the Stroma is the cytoplasm of the Chloroplast.**

What is a Thylakoid?

Thylakoid is an organelle found in the chloroplasts as well as in cyanobacteria. It consists of a membrane which is surrounded by a thylakoid lumen. This thylakoid in the chloroplast usually forms stacks which are called grana. The grana are linked with other grana by intergranal lamellae to form single functional compartments. There can be about 10 to 100 grana in chloroplasts. The thylakoid is anchored in the stroma.

The light-dependent reaction in photosynthesis is carried out in the thylakoid as it contains the photosynthetic pigments like chlorophyll. The grana which are stacked in the chloroplast gives a high surface area to the volume ratio of the chloroplast while increasing the efficiency of photosynthesis. The membrane of the thylakoid contains a lipid bilayer which consists of distinctive features of the inner membrane of chloroplast and prokaryotic membranes. This lipid bilayer is involved in the interrelationship of the structure and the function of photosystems.

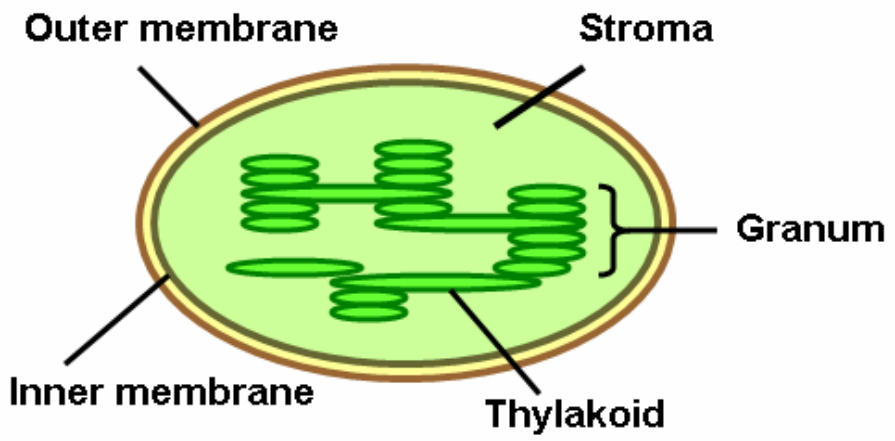

Figure 01: Thylakoid

In higher plants, the thylakoid membranes are primarily composed of phospholipids and galactolipids. The thylakoid lumen which is enclosed by the thylakoid membrane is a continuous aqueous phase. It is important especially for photophosphorylation in photosynthesis. The protons are pumped into the lumen via the membrane while reducing the pH level.

The reactions which take place in a thylakoid include water photolysis, the electron transport chain and ATP synthesis. The initial step is water photolysis. It takes place in the thylakoid lumen. Here, the energy from light is used to reduce or split the water molecules to produce electrons needed for the electron transport chain. The electrons are moved to the photosystems. These photosystems contain a light-harvesting complex called the antenna complex. The antenna complex uses chlorophyll and other photosynthetic pigments to gather light at various wavelengths. ATP is produced in photosystems, using an ATP synthase enzyme thylakoid synthesize ATP. This ATP synthase enzyme is assimilated in the thylakoid membrane.

Although the thylakoid in plants forms stacks called grana, thylakoid is not stacked in some algae even if they are eukaryotes. Cyanobacteria do not contain chloroplasts, but the cell itself acts as a thylakoid. A cyanobacterium has a cell wall, a cell membrane, and a thylakoid membrane. This thylakoid membrane does not form grana but forms sheet-like structures in parallel that create enough space for light harvesting structures to carry out photosynthesis.

What is Stroma?

Stroma is referred to a transparent fluid which is filled in the inner space of chloroplast. The stroma surrounds the thylakoid and grana within the chloroplast. The stroma contains starch, grana, organelles like chloroplast DNA and ribosomes and also enzymes which are needed for the light-independent reactions of photosynthesis. As the stroma consists of Chloroplast DNA and ribosomes, it is also the site of chloroplast DNA replication, transcription, and translation of some chloroplast proteins. The biochemical reactions of photosynthesis take place in the stroma, and these reactions are called light-independent reactions or the Calvin cycle. These reactions include three phases namely, carbon fixation, reduction reactions and ribulose 1.5- bisphosphate regeneration.

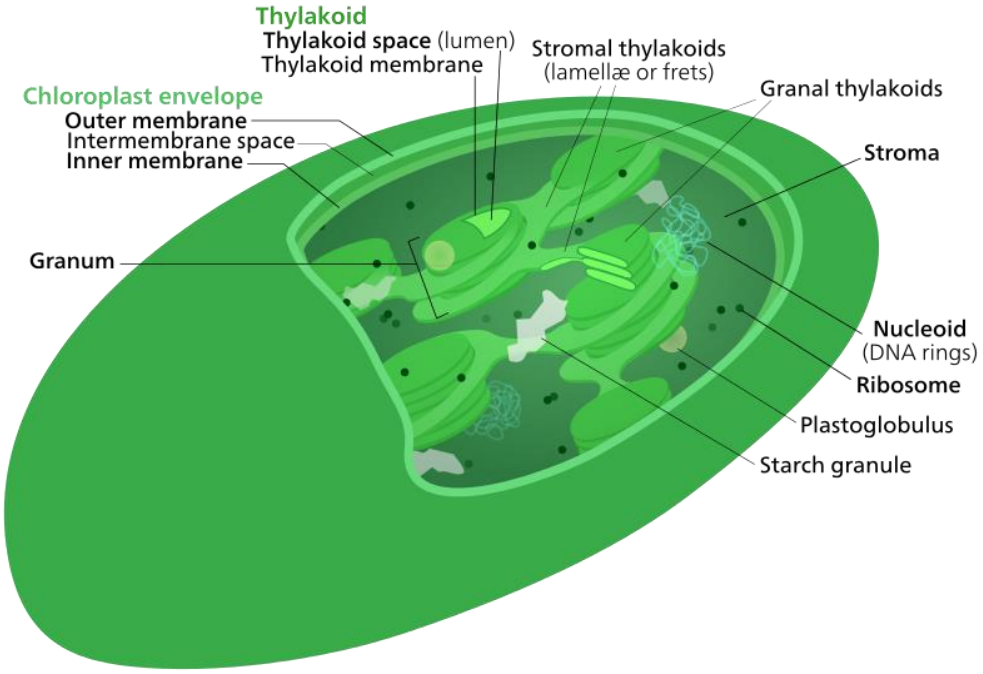

Figure 02: Stroma

The proteins which are present in the stroma are important in the light-independent reactions of photosynthesis and also in reactions which fix inorganic minerals in organic molecules. Chloroplast being an unusual organ also has the ability to carry out important activities of the cell. The stroma is needed for this because it not only carries out the light-independent reactions but also controls the chloroplast to withstand cellular stress conditions simultaneously signaling between different organelles. The stroma undergoes autophagy under extreme stress conditions without damaging or destroying the inner structures and pigment molecules. Finger-like projections from the stroma do not contain thylakoid but, are correlated with the nucleus and the endoplasmic reticulum to carry out regulatory mechanisms in the chloroplast.

What are the Similarities Between Thylakoid and Stroma?

- Both structures are present inside the chloroplast.
- Enzymes and pigments which are essential for photosynthesis are usually embedded in both thylakoid and stroma.

What is the Difference Between Thylakoid and Stroma?

Thylakoid vs Stroma	
Thylakoid is a membranous organelle present in the chloroplast.	Stroma is the cytoplasm of the chloroplast.
Function	
Thylakoid provides necessary factors and conditions to initiate the light-dependent reaction of photosynthesis.	The light-independent reaction of photosynthesis is taken place in the stroma of the chloroplast.

Summary - Thylakoid vs Stroma

The chloroplasts are flat structures found in the cytoplasm of plant cells. They consist of thylakoids which are small membrane-bound compartments. They are the sites of the light-dependent reaction of photosynthesis. Thylakoid is usually stacked to form structures called grana. Stroma is also an important component of the chloroplast. It is a colorless fluid matrix situated in the inner portion of the chloroplast. The thylakoids are surrounded by stroma. The stroma is the site where the light-independent reactions of photosynthesis take place. The enzymes and pigments which are essential for photosynthesis are usually embedded in both thylakoid and stroma. This can be described as the difference between Thylakoids and Stroma.

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