

# Difference Between Sarcolemma and Sarcoplasmic Reticulum

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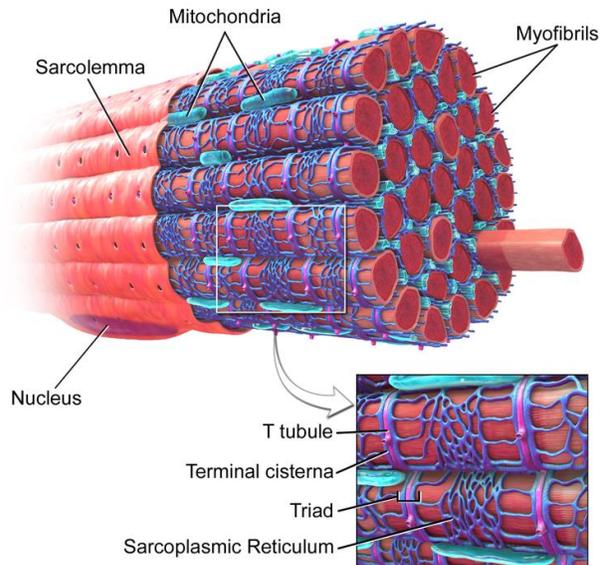
## Key Difference - Sarcolemma vs Sarcoplasmic Reticulum

Muscle cells are composed of different [organelles](#) that are specialized to perform their functions. The main function of the muscle is to facilitate contraction and relaxation movements and thereby facilitating [movement and locomotion](#). The muscle cell is composed of different organelles including sarcolemma, sarcomere, sarcoplasm and sarcoplasmic reticulum, transverse tubules and cisternae. Sarcolemma of the muscle cell refers to the [plasma membrane](#) of the muscle cell composed of a [phospholipid](#) bilayer and other special biomolecules. Sarcoplasmic reticulum (SR) refers to the smooth [endoplasmic reticulum](#) of the muscle cell that acts as the inter-connecting tubules of the [myofibrils](#). The sarcolemma and the SR are, therefore, two organelles in the muscle cell. **The sarcolemma is the plasma membrane that surrounds the muscle cell whereas, SR is the smooth endoplasmic reticulum of the muscle cell.** This is the **key difference** between sarcolemma and sarcoplasmic reticulum.

## What is Sarcolemma?

Sarcolemma is the plasma membrane of the muscle cell. It is composed of a phospholipid bilayer comprising of hydrophilic heads and hydrophobic tails. The sarcolemma also contains an outer polysaccharide layer known as the glycocalyx. The sarcolemma forms the dynamic outer membrane and is the boundary to the muscle cell contents. The muscle cell contents are embedded in the sarcoplasm.

The muscle cell plasma membrane (sarcolemma) has specialized structures known as transverse tubules. Transverse tubules are invaginations of the sarcolemma. These membranous invaginations extend longitudinally into the [cytoplasm](#) of the muscle cell. The transverse tubules are also referred to as T tubules. The terminal cisternae are formed on either side of the t tubules. When two cisterna surrounds the t tubule, it is referred to as a triad.



**Figure 01: Sarcolemma**

The main function of the sarcolemma, with regard to the muscle contraction, is to facilitate the permeability of Calcium ions required for the contraction process. The Calcium ions are transported across the sarcolemma via ion channels and are transported into the cytoplasm of the muscle cell (sarcoplasm) via the transverse tubules. This will initiate the muscle action potential to bring about muscle contraction. Sarcolemma also contains various signal receiving receptors that are required in controlling the muscle cell activities.

## What is Sarcoplasmic Reticulum?

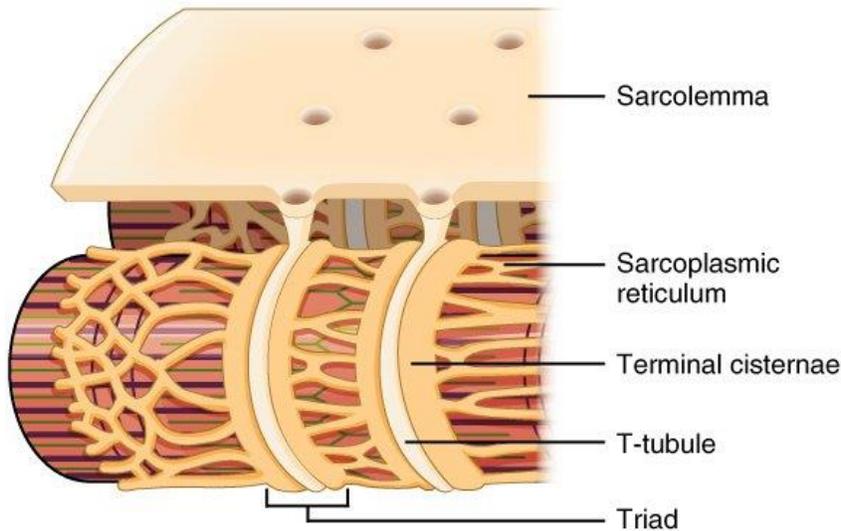
Sarcoplasmic reticulum is similar to the endoplasmic reticulum of normal cells. Due to the specialized location, the muscle cell endoplasmic reticulum is referred to as the sarcoplasmic reticulum. This belongs to the smooth endoplasmic reticulum. It plays an important role in the storage of calcium ions. The structure of the SR is composed of a network of tubules. They are extended throughout the muscle cell and are seen to be wrapped around the myofibrils. The SR is situated in close proximity to the T tubules, and they are associated via the terminal cisternae.

Three subfunctions can explain the overall function of calcium storage in the SR

1. Calcium Absorption
2. Calcium storage
3. Calcium release

In the phase of calcium absorption, the SR, absorb Calcium ions via the calcium pumps of the Sarcoplasmic Reticulum. The process of calcium absorption requires [ATP](#). Hence they are known as sarcoplasmic reticulum ATPases. Upon binding of Calcium to these receptors, a phosphorylation modification of the receptor causes a conformational change of the

transporter. This conformational change facilitates the transport of calcium ions into the muscle cell.



**Figure 02: Sarcoplasmic Reticulum**

The SR is composed of a [protein](#) which is referred to as Calsequestrin. This protein acts as a calcium-binding protein and can store calcium ions until the requirement arises. The final function of the SR is the release of calcium ions to be used for muscle contraction. Calcium ions are released from the terminal cisternae. Different receptors facilitate this process, and covalent modifications such as phosphorylation of receptors take place to release the calcium ions upon the muscle cell requirement.

## What are the Similarities Between Sarcolemma and Sarcoplasmic Reticulum?

- Both are organelles found in the muscle cell.
- Both are participating in the calcium physiology of the muscle cell.

## What is the Difference Between Sarcolemma and Sarcoplasmic Reticulum?

Sarcolemma vs Sarcoplasmic Reticulum	
Sarcolemma of the muscle cell refers to the plasma membrane of the muscle cell composed of a phospholipid bilayer and other special biomolecules.	SR refers to the smooth endoplasmic reticulum of the muscle cell which acts as the inter-connecting tubules of the myofibrils.
Function	

Sarcolemma acts as the outer boundary of the muscle cell and facilitates the entry of calcium ions.

Sarcoplasmic reticulum performs three main functions; calcium absorption, calcium storage and calcium release.

## Summary - Sarcolemma vs Sarcoplasmic Reticulum

The muscle cell is crucial as it performs one of the main physiological functions that are the contraction and relaxation. The muscle cell has many organelles in which the sarcolemma and the sarcoplasmic reticulum play a major role in calcium uptake and release. The sarcolemma resembles the plasma membrane and acts as the dynamic outer membrane of the muscle cell. The sarcolemma also allows calcium uptake, whereas the sarcoplasmic reticulum is in the sarcoplasm. It is involved mainly in the calcium absorption and storage. SR releases calcium upon the requirement. This is the difference between the sarcolemma and sarcoplasmic reticulum.

### Reference:

1. Rossi, A E, and R T Dirksen. "Sarcoplasmic reticulum: the dynamic calcium governor of muscle." *Muscle & nerve.*, U.S. National Library of Medicine, June 2006. [Available here](#)
2. "Sarcolemma." *Sarcolemma: Anatomy of Muscle Structure.* [Available here](#)

### Image Courtesy:

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