Difference Between Troponin and Tropomyosin

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Key Difference – Troponin vs Tropomyosin

It is important to understand the mechanism of muscle contraction and relaxation properly before learning the difference between troponin and tropomyosin. Muscle fibers are composed of myofibrils. Myofibrils are made up of long proteins arranged in sections called sarcomeres, which are the basic building blocks of striated muscle tissue. Sarcomere has two components called thin and thick filaments made up of actin and myosin proteins respectively. Thick and thin filaments of myosin and actin are arranged next to each other within the sarcomere. The interaction of these two proteins within each sarcomere causes the sarcomere to shorten, which in turn, causes muscle contraction. During sarcomere contraction, myosin heads in the thick filaments bind with actin in the thin filaments and pull the thin filaments towards the center. The ends of the sarcomeres are pulled closer together, shortening the length of the muscle fiber. Calcium ions are required for the contraction of the sarcomere. When calcium ion concentration rises, the muscle contracts and when it is low, the muscle relaxes. Troponin and tropomyosin are two proteins which regulate sarcomere contraction via calcium binding. When calcium ions are present, calcium binds with troponin and removes tropomyosin. It exposes the myosin binding site in actin. When the muscle is relaxed, tropomyosin blocks the myosin binding sites in the actin filaments. The key difference between troponin and tropomyosin is that **troponin frees the myosin binding sites of actin filaments** while **tropomyosin blocks the binding sites.**

What is Troponin?

As explained above, Troponin is a type of protein that regulates sarcomere contraction via calcium binding. Troponin is thus associated with actin filaments.

When the calcium ions and ATP are present, calcium ions bind with troponins. When calcium ions are bound to troponin, it triggers the exposure of myosin binding sites on actin filaments by removing the tropomyosins from the actin filaments. Hence, myosins (thick filaments) bind with actin (thin filaments) and pull thin filaments towards the center. It causes sarcomere to contract and shorten its length.

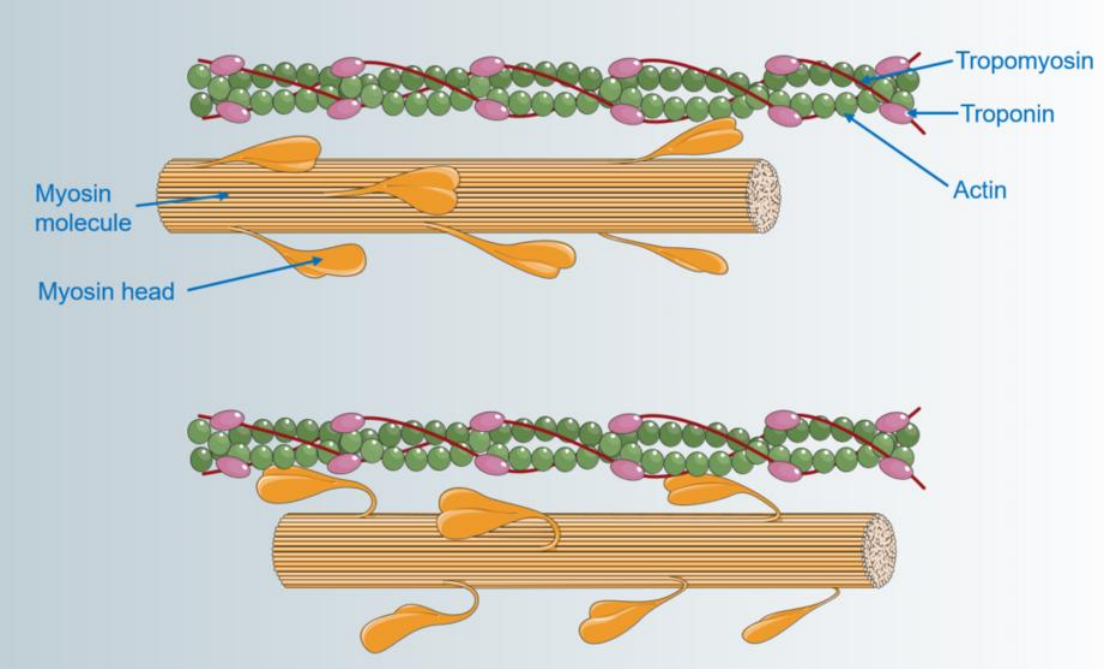

Figure 01: Troponin and Tropomyosin

Troponin exists as a complex of three regulatory proteins (troponin C, troponin I, and troponin T). Troponin is responsible for muscle contraction.

What is Tropomyosin?

Tropomyosin is another type of regulatory protein associated with thin filaments of myofibrils. When the muscle is in a relaxed form, tropomyosins block the myosin binding sites on the actin filaments. Tropomyosins are positioned on the actin filaments in such a way that the binding of myosin heads to binding sites on the actin filaments is prevented. When the contact between myosin and actin is prevented, muscle contraction stops. However, when there are enough calcium ions and ATP, tropomyosin is able to roll away tropomyosin from the actin filaments. When tropomyosins are detached from the actin filaments, myosin binding sites are exposed and interaction between actin and myosin is facilitated. Myosin's binding to actin causes cross bridge formation and contraction of the muscle.

Tropomyosin is a two stranded alpha helical coiled coil protein. Tropomyosins are often classified into two groups; muscle tropomyosin isoforms and nonmuscle tropomyosin isoforms.

What are the similarities between Troponin and Tropomyosin?

- Troponin and tropomyosin are regulatory proteins of muscle contraction.
- Troponin and tropomyosin are attached to actin filaments.
- Both are present in myofibrils.

What is the difference between Troponin and Tropomyosin?

Sinus vs Allergies	
Troponin exposes the myosin binding sites in the actin filaments.	Tropomyosin covers the active sites on actin to which myosin binds.
Muscle Movement	
Troponin facilitates contraction.	Tropomyosin prevents contraction and makes the muscle relaxed.

Summary – Troponin vs Tropomyosin

Troponin and tropomyosin are two regulatory proteins associated with actin filaments of myofibrils. Both are involved in the regulation of muscle cell contraction. Troponin causes the removal of tropomyosin from the actin filaments and exposure of myosin binding sites on actin filaments. Tropomyosins block myosin binding sites on actin filaments. Troponin facilitates sarcomere contraction while tropomyosin facilitates muscle relaxation. This is the difference between troponin and tropomyosin.

References:

1. "Troponin." Wikipedia. Wikimedia Foundation, 20 June 2017. Web. Available here. 08 July 2017.
2. "The Sliding Filament Model of Contraction." Muscle Fiber Contraction and Relaxation. N.p., n.d. Web. Available here. 08 July 2017.

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