

## Answer on Question#47890 - Biology - Other

What is role of calcium in muscle contraction?

**Answer:**

The role of calcium is to bind to troponin and change its shape, un hiding myosin binding sites on actin filaments.

A muscle's contractile units lie within individual muscle cells, also called muscle fibers. Each muscle fiber contains numerous bundles of protein filaments. These bundles, called myofibrils, are organized into repeating contractile units called sarcomeres. A sarcomere contains two types of protein filaments: actin filaments and myosin filaments. The thin actin filaments are attached to Z line, the end of sarcomere. The thick myosin filaments lie between Z lines, but are not attached to them. According to sliding filament theory (accepted theory of contraction), during contraction sarcomeres shorten. Actin and myosin filaments remain the same size – they simply slide past each other, changing their relative position as the muscle contracts and relaxes.

Contraction is triggered when an action potential (the electric signal from neurons that tells muscles to contract) reaches the junction between neuron and muscle. Depolarization of the axon terminal causes the release of neurotransmitter acetylcholine into the synaptic cleft between the neuron and muscle. The neurotransmitter causes the action potential on the muscle cell. This electrical signal propagates along the muscle fiber's plasma membrane, and also into the plasma membrane's tubular invaginations, called T tubules. The T tubules lie near to the sarcoplasmic reticulum, which stores calcium ions. When action potential passes through the T tubules, the sarcoplasmic reticulum releases calcium into the cytoplasm of muscle fiber. Calcium ions reaches actin filaments, which are decorated with two types of proteins: troponin and tropomyosin. Troponin lies at regular interval along the actin filaments and prevents the binding of actin and myosin. Calcium ions bind to troponin and induce its conformational changes. Now troponin does not prevent actin and myosin binding and they form a structure referred as crossbridge. When actin and myosin bind, myosin head moves, forcing the actin and myosin filaments to slide past each other. Then ATP binds to myosin heaads, and the heads release the actin filament. ATP is quickly hydrolyzed into ADP and Pi, and this energy turns myosin heads, preparing them for another cycle of contraction. Soon after the action potential ceases, the sarcoplasmic reticulum pumps the calcium back into its interior. As calcium level drops, it become unbound from troponin, and troponin hides the myosin-binding sites. Actin and myosin filaments slide back to their original positions.