

Muscle Contraction

H&SP! Medical Anatomy & Physiology 09b
Lab Activity

Background

Muscle Cell Structure

Muscle cells are specialized to contract. An individual muscle is actually a bundle of hundreds to thousands of long cylindrical muscle fibers or cells. The cell membrane of muscle cells is called the sarcolemma, the cytoplasm is the sarcoplasm, and the endoplasmic reticulum is modified into the sarcoplasmic reticulum (SR). Channels from the sarcolemma into the sarcoplasm and SR are called transverse (T) tubules. The T tubules allow for electrical impulses from motor neurons to be channeled directly to the SR, causing it to release calcium ions and initiate a contraction. Muscle cells are made up of bundles of myofibrils that contain the contracting units, called sarcomeres, made up of two main proteins - myosin and actin.

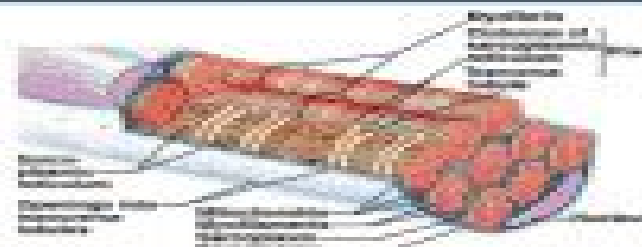


Figure 35.10 The structure of skeletal muscle fibers. © 2011 Sinauer Associates, Inc. and W. H. Freeman & Co.



The Motor Unit

Motor neurons connect to skeletal muscles to control movement. Each motor neuron actually controls a group of muscle cells called a motor unit. All of the cells in the motor unit will be stimulated by the motor neuron at the same time. Movements that need fine motor skills, like writing with a pencil, have only a few muscle cells for each motor unit, which allows for precision. Larger movements, like picking up a bag, have many muscle cells for each motor unit.

Muscle Contraction

A muscle contraction is a complicated cycle and can differ according to the type of contraction and the type of muscle tissue. The following chart describes and diagrams the steps of a muscle contraction according to the sliding filament theory.

Steps of a Muscle Contraction

1	The brain or spinal cord sends an impulse to the muscle.	<p>A diagram of a neuromuscular junction. It shows a cross-section of a motor neuron (labeled 'Motor neuron') with its axon terminal (labeled 'Axon terminal') releasing neurotransmitters (labeled 'Neurotransmitter') into the synaptic cleft (labeled 'Synaptic cleft') to reach the sarcolemma of a muscle fiber (labeled 'Sarcolemma').</p>
2	The impulse travels down the motor neuron and reaches a neuromuscular junction where it releases acetylcholine, which triggers the impulse in the muscle.	
3	The impulse travels through the plasma membrane (sarcolemma) and down T tubules surrounding the myofibrils.	<p>A diagram showing an impulse traveling down a T-tubule. It shows a cross-section of a muscle fiber with a T-tubule (labeled 'T-tubule') extending from the sarcolemma (labeled 'Sarcolemma') into the sarcoplasm (labeled 'Sarcoplasm'). The impulse is shown as a wave moving along the T-tubule.</p>
4	As the impulse passes through the T tubules, it causes the sarcoplasmic reticulum (SR) surrounding the T tubule to release calcium ions (Ca^{2+}) into the sarcoplasm, eventually reaching the sarcomere.	

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