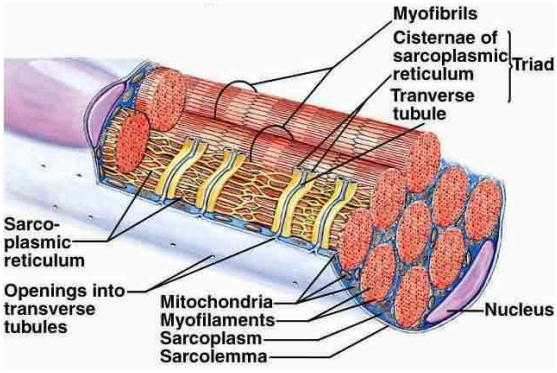
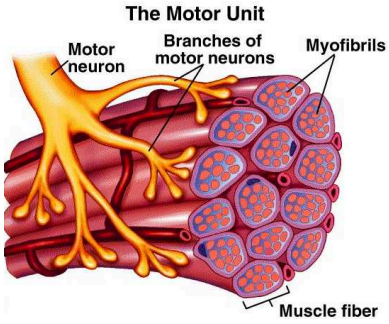
Muscular System Workout

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.



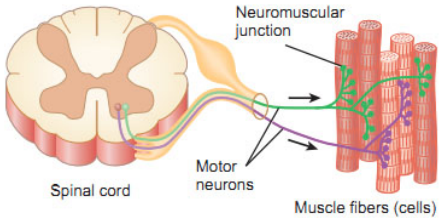
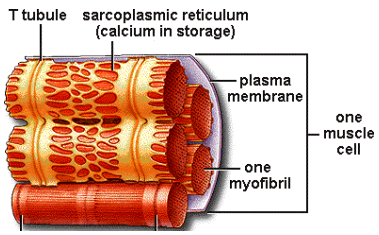
http://www.exerbotics.com/storage/motor-unit-lg.jpg?__SQUARESPACE_CACHEVERSION=1314629974992

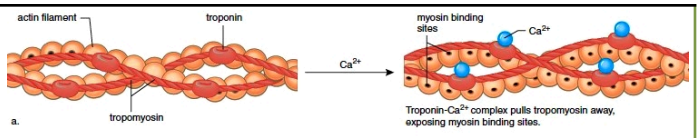
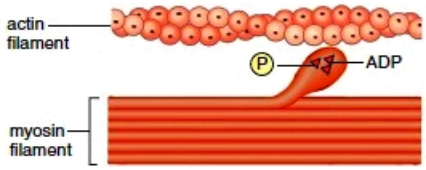
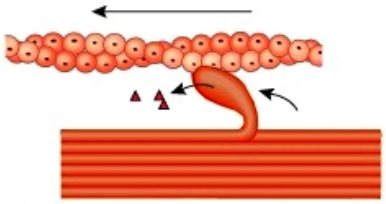
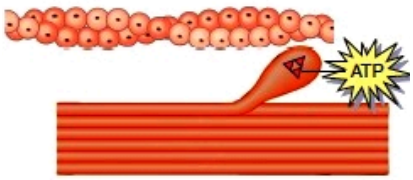
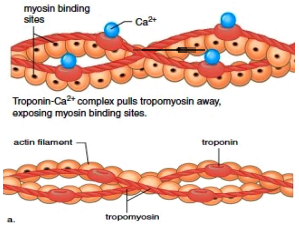
The Motor Unit

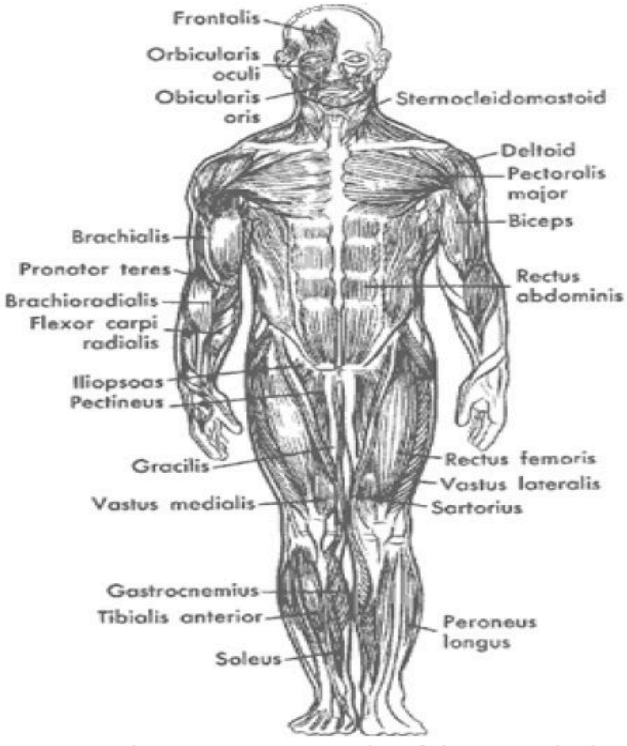
Motor neurons connect to skeletal muscles to control movement. Each motor neuron actually controls a group of muscle cells called a motor unit. All of the cells in the motor unit will be stimulated by the motor neuron at the same time. Movements that need fine motor skills, like writing with a pencil, 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

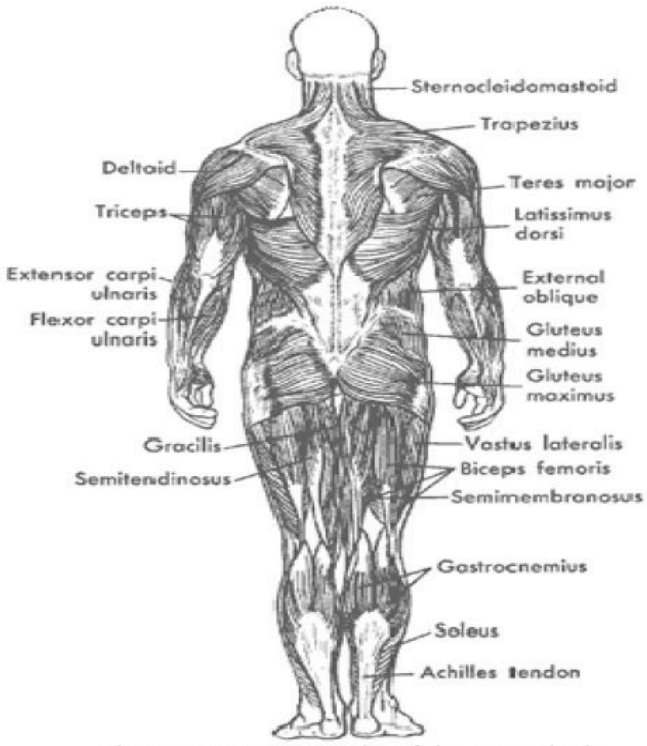
A muscle contraction is a complicated cycle and can differ according to the type of contraction and the type of muscle tissue. The following chart describes and diagrams the steps of a muscle contraction according to the sliding filament theory.

Steps of a Muscle Contraction		
1	The brain or spinal cord sends an impulse to the muscle.	 http://antranik.org/wp-content/uploads/2012/04/motor-unit-somatic-motor-neuron.jpg
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.	 http://www.student.loretto.org/humanbiology/BioLinks/chp4/media/c212f2.gif
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.	

5	The Ca^{2+} binds to troponin located on the actin filament, causing tropomyosin to move and expose binding sites for myosin.	
6	The myosin head now binds to actin and forms a crossbridge.	
7	ADP and P_i are released from myosin, which causes the myosin to move. This movement is called the power stroke.	
8	ATP binds to myosin causing it to release the actin and reverting ATP into ADP and P_i. The myosin is now ready to form another crossbridge and the cycle of contraction will continue until the impulse stops.	
9	Once the impulse stops, Ca^{2+} is released from troponin causing tropomyosin to cover the binding sites and prevent contraction. Ca^{2+} returns to the SR and waits for another impulse. This is relaxation.	



The Main Anterior Muscles of the Human body



The Main Posterior Muscles of the Human body

Part A. What is Happening When a Muscle Contracts?

What is happening within the muscle cells and tissues when a muscle contracts is extremely complex. Animations can help us better understand this concept.

Go to the following website:

http://highered.mheducation.com/sites/0072495855/student_view0/chapter10/animation__action_potentials_and_muscle_contraction.html

Click on the animation tab at the top of the page. Choose the step-through version at the bottom of the animation. Answer the following questions as you watch the muscle contraction animation.

Muscle Contraction Animation		
	Question	**Answer**
Muscle Cell Structure	What are myofibrils? How are they organized into sarcomeres?	
	What two protein filaments are found in the sarcomere?	
	How are the Z line and titin part of the sarcomere?	
	Draw a sarcomere and label the myosin, actin, Z-line, and titin.	

	What is the sliding filament theory?	
Steps of a Muscle Contraction		
Step 1	What triggers a contraction?	
Step 2	What neurotransmitter is released at a neuromuscular junction?	
Step 3	Where does the electrical signal propagate or travel?	
Step 4	What is released from the sarcoplasmic reticulum as the action potential passes through the T tubules?	
Step 5	Where does the calcium travel?	
Step 6	What two proteins are found on actin filaments?	
	What is bound to the	

	myosin heads?	
Step 7	What happens when calcium binds to troponin?	
Step 8	Onto what does the myosin head bind to? What is formed?	
Step 9	What happens to P_i and ADP when myosin binds?	
Step 10	What is the power stroke?	
Step 11	What happens when ATP binds to the myosin head?	
Step 12	What happens after the action potential ceases?	

Your Task:
You are starting a new gym in Eastlake and want to promote your gym with a short personal workout. You can create a workout video, website and/or brochure.

Requirements:

- An overview of the anatomy of the muscular system using all of the anatomical terms of the muscles.
- An explanation of how a muscle contracts during movement.
- Throughout the workout use anatomical terms, anatomical muscular terms and reference what is happening physiologically with the muscle contraction during the movement.

Draft an outline of your workout with terms below: