THE MUSCULAR SYSTEM

FUNCTION

Facts: The 600 muscles in your body that function to move the skeleton are called skeletal muscles. The skeletal muscles make up the voluntary muscle system. They are called *voluntary* muscles because you have conscious control over movement in these muscles.
A second type of muscle tissue is called the *involuntary* tissue. Such muscle controls respiration, circulation and digestion. One has no 'real' control over these systems, they function independently of conscious control.

Types of Muscle Tissue

The muscular system, by means of contraction and relaxation produces the movements in the body as a whole and as parts. On the basis of structure and function muscle tissue is classified into three types; **smooth, cardiac and striated.**

1. **Smooth muscle**, sometimes called unstriated muscle, is located in the gastrointestinal tract and blood vessels. Smooth muscles are involuntary because they work without a person's conscious control. Smooth muscle fibers are less than one-thousandth of an inch long.

2. **Striated muscle** is skeletal muscle. Skeletal muscles account for about 40% of the body weight.

3. **Cardiac muscle**, or heart muscle, is a special type of striated cell forming the fibers for the walls of the heart.

How a skeletal muscle moves:

Bones form the body's framework. Joints allow for the bones to move. But all body movements depend upon the most outstanding characteristic of muscles - the ability to contract or shorten. Muscle tissue can shorten in length to a greater degree than any other type of tissue. The 600 muscles in your body are responsible for the movement of bones, pumping blood and carrying nutrients to all parts of the body, and controlling air movement in and out of the lungs. The muscle action in the esophagus, stomach, and intestine helps to break down food and to eliminate waste. Almost all of the individual muscle fibers a person will ever have are present at birth. General muscle growth is an increase in the size of the muscles rather than an increase in the number of them.

Flexing and Extending

Many muscles work in pairs. While one flexes, its counterpart extends. Muscle contraction is started by the triggering action of nerve impulses. Nerves supplying most of the skeletal muscles originate at the spinal cord.

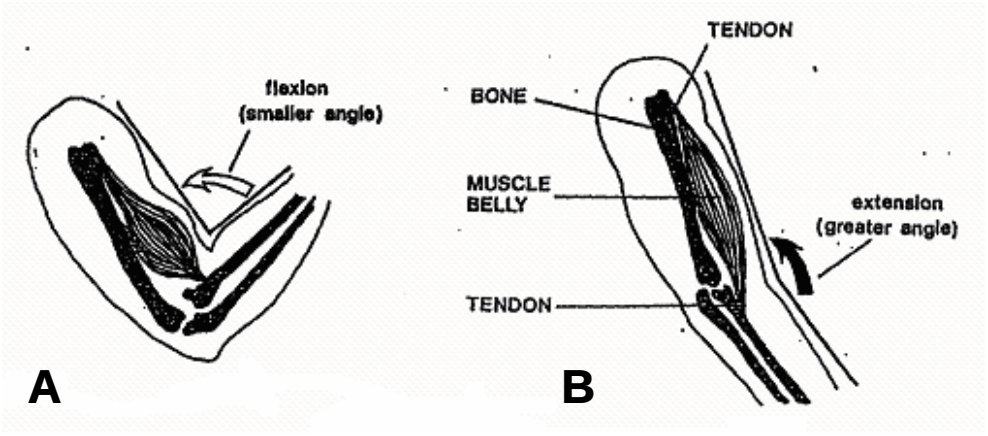
At the point where the nerve enters a muscle, it breaks up into numerous branch neurons, which in turn contact muscle fibers by means of tiny button like endings called motor end plates. A neuron may branch to supply as many as 100 muscle fibers.

Muscles that bend a limb at the joint are called flexors, while those that straighten a limb are called extensors. The tendons that connect muscle to bone must be connected to different bones, so that there is something to pull against when there is a contraction. If the flexors and extensors both contracted at the same time, they would work against each other, and there would be no movement.

Muscles are required to do a tremendous amount of work and, therefore need large quantities of energy, supplied by oxygen. Muscles have a rich stock of arteries that supply them with food and oxygen via the blood.

Example:

The skeletal muscle attaches across a joint and attaches to the bones by means of tendons. When the brain sends a message to bend your arm, the muscle contracts. As it contracts the muscle shortens and pulls on the tendon in turn which moves the lever, in this case, a bone. Muscles work in pairs. When one shortens, the other relaxes. When the bicep muscle shortens it raises the forearm. This is called flexion (A). (The tricep is relaxed.) When the arm straightens out the triceps shorten. This is called extension (B). (The biceps are now relaxed.)



MUSCLE AND JOINT MOVEMENT

Muscles work as teams to cause movement. They are arranged in opposing pairs or antagonistic groups. Three common types of movement are: FLEXION - EXTENSION, ADDUCTION - ABDUCTION, and ROTATION. In the following pictures the muscles work in opposing pairs to cause movement:

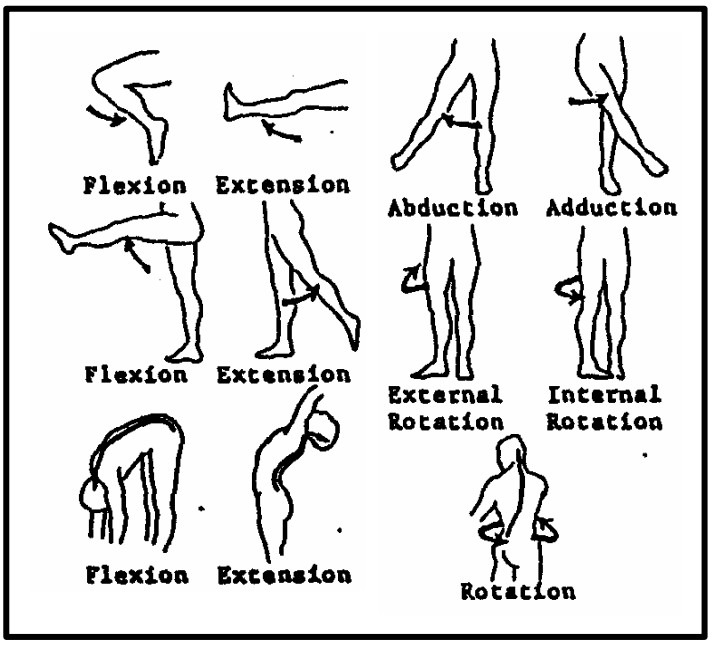
Flexion is defined as the decreasing of the angle between two parts of the body.

Extension is the increasing of the angle between two parts of the body.

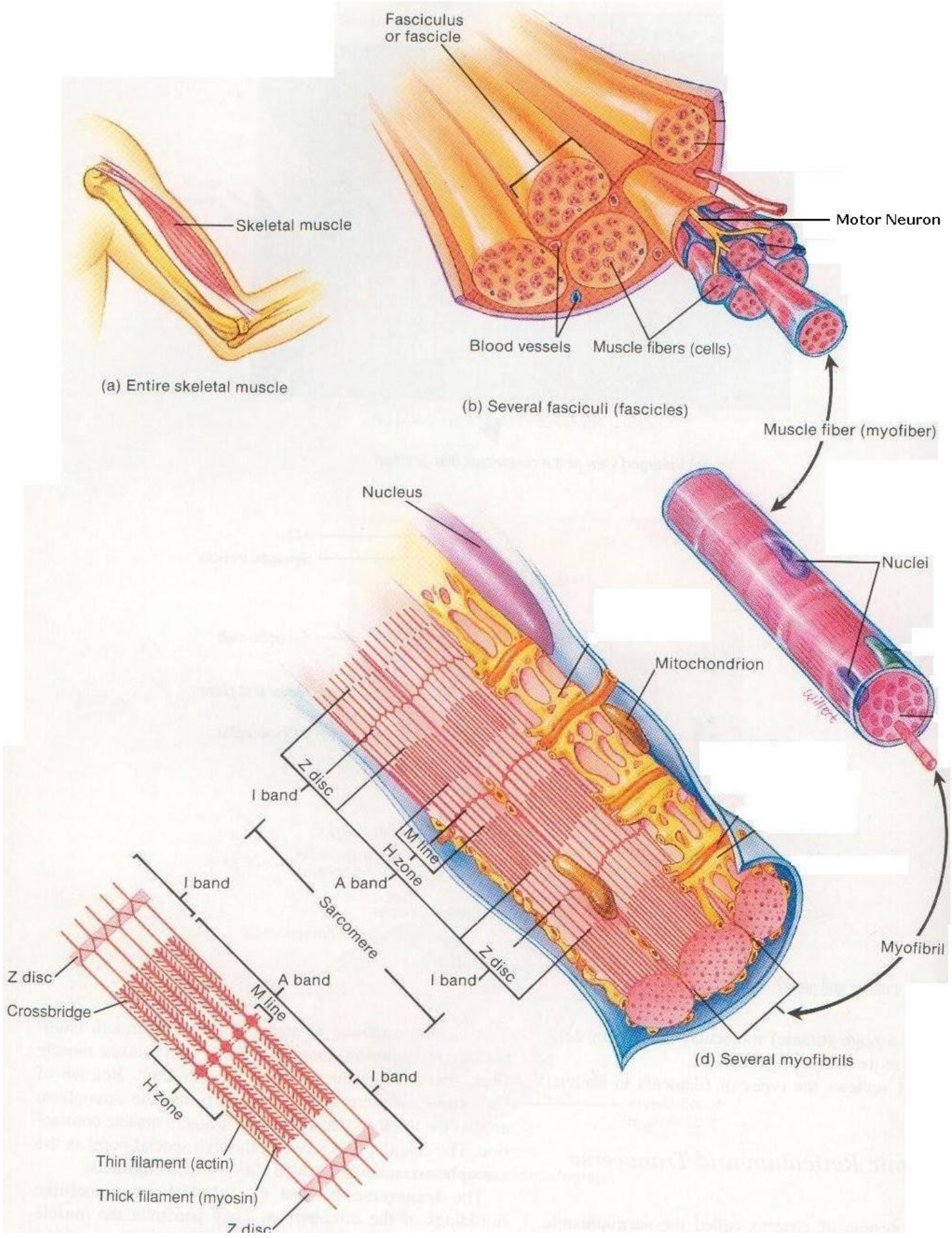
Abduction is when part of the body moves from the midline of the body.

Adduction is when part of the body moves towards the midline.

Rotation is part of the body moving on its longitudinal axis.



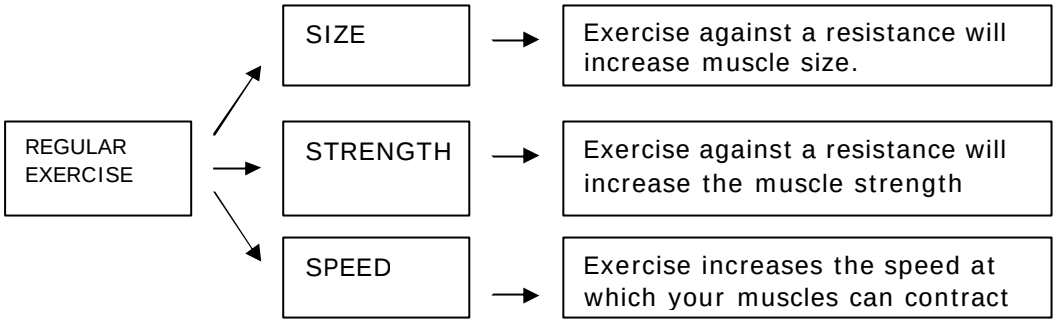
ORGANIZATION OF A SKELETAL MUSCLE FROM GROSS TO MOLECULAR



The Structure of Muscles

The muscle consists of long cells bundled together. These long cells are called fibers. Fibers are controlled by a motor nerve. There may be one fiber to one nerve or as many as 150 fibers for each nerve. These groups are called motor units. Each fiber is composed of smaller units called myofibrils and filaments.

The Effects of Regular Exercise



FACTORS OF MUSCLE PHYSIOLOGY

FACTORS	**EFFECT OF EXERCISE**
'ALL or NONE' - A single muscle fiber con tracts to its maximum or not at all, This is called the all or none principle. How ever, the actual force of this contraction is dependent on the state of the fiber. If it is fatigued (repeated use) a weaker con traction will result although the fiber is still contracting as strongly as it can.	• A more efficient energy supply results from training. • The muscle does not fatigue as quickly
FAST TWITCH & SLOW TWITCH - The fibers with in a motor unit may be fast or slow twitch, Fast twitch fibers are fast to contract and fast to fatigue. Slow twitch are slow to contract sod fatigue.	• Heredity determines your proportion of fast to slow fibers. • Training improves the performance of either type.
NUMBER OF CONTRACTING FIBERS - The more motor units recruited, Else greeter the strength of the muscle contraction.	• Intense training improves the body's ability to recruit more motor units resulting in greater strength.
SIZE 0F MUSCLE - The larger the cross sectional area of a muscle the greater its strength. An increase in muscle cross section is called HYPERTROPHY. A decrease is called ATROPHY.	• Training which produces hypertrophy will increase the muscle's potential contractile force.
NATURAL ENDORSEMENT - Individuals who have been endowed with parents or close relatives possessing great physical strength may inherit this characteristic.	• Training will improve your relative strength.

INJURIES TO THE MUSCULAR SYSTEM

Some of the most common injuries to muscles are *bruises, strains, tendonitis, pulled and torn muscles and a condition called cramps*.

Bruises and Strains

A **bruise** is an injury to tissues under the skin. Bruises usually result from a blow to the muscle. The discoloration is a result of the capillaries breaking and oozing blood. If cold packs are applied immediately, swelling and discoloration will be reduced.

A muscle **strain** results when muscles are overworked. Have you ever participated in a strenuous activity you were not used to and then been sore the next day? You experienced muscle strain. Rest and heat to help the muscles relax are the best ways to treat muscle strains. You can prevent some strains by warming up properly and gradually building up your level of exertion. In other words, avoid going all out your first day of exercise.

Tendonitis and Pulled or Torn Muscles

Tendonitis occurs when a tendon - the connective tissue of the muscles and bones – is stretched or torn. The area becomes inflamed. A common example of tendonitis is tennis elbow. First, rest to decrease the inflammation and then medicines or physical therapy will help cure this injury.

A **pulled or torn muscle** can cause severe pain and require you to cease your activity. In a pulled or torn muscle, the large muscle is separated or torn from its point of attachment. This can result in damage to the blood vessels that supply nourishment to that muscle. Immediate medical care may be necessary. Cold packs should be put on the muscle area right away.
As with other muscle injuries, lack of warm-up and overexertion of an unprepared muscle are the major causes of a pulled or torn muscle.

Muscle Cramps

Muscle **cramps** occur when a muscle contracts tightly and will not relax. Usually in a bundle of muscles, some fibers are contracting while others are relaxed. When a muscle cramp occurs, all fibers are contracting at the same time. This may be caused by temporary lack of food or oxygen to the muscle. Sometimes cramping occurs as a result of a person's losing large amounts of sail and water through perspiration. Tired, overworked muscles sometimes cramp. Muscles sometimes cramp during very strenuous exercise.
Massaging the muscle area with firm pressure can help a cramp. Moving the muscle or continuing to work it lightly can help to relieve the cramp. Heat can also help the muscle to relax. You can help to prevent cramps by warming up properly and by drinking enough fluids before and during exercise.

Hernias

Hernias or ruptures are weak areas in the muscle sheet supporting various organs in the abdomen. Part of an organ like the intestine may push through this weak area. Hernias can be caused by lack of warm-up exercises, or by suddenly and improperly picking up heavy objects. Surgery is usually necessary it correct a hernia.