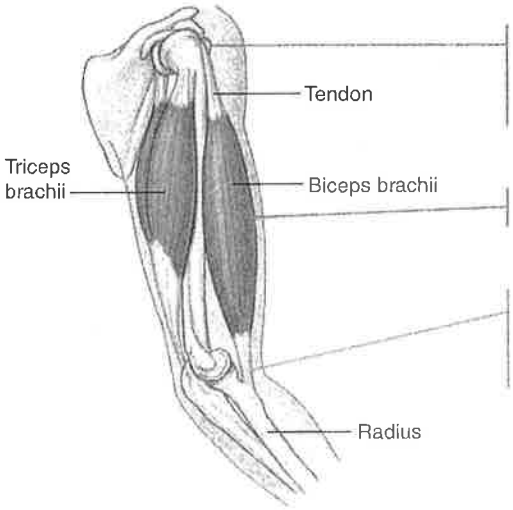
Muscle Function

The role of a muscle is to move a body part. Each end of most skeletal muscles adheres to a different bone. The contraction of the muscle causes one bone to move while the other remains relatively still.



The **origin** refers to the end of the muscle that attaches to the more stationary bone. For example, the origin of the biceps brachii is the scapula, which is relatively immobile.

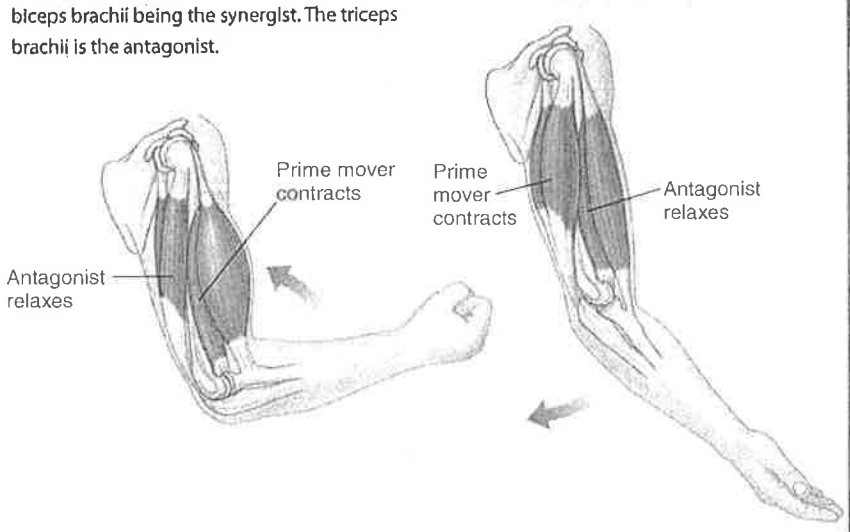
The **belly** is the thick mid-section of the muscle.

The **insertion** is the end of the muscle that attaches to the more movable bone. The insertion of the biceps brachii is the radius. When the muscle contracts, it pulls the radius toward the scapula.

Skeletal muscles typically work in groups to create movement. The main muscle triggering the movement is called the **prime mover;** the muscles that assist are called **synergists.** Muscles balancing these movements are called **antagonists.** Antagonists **oppose** the action of the prime mover. When the prime mover contracts, the antagonist must relax and give the prime mover control. Typically, the antagonist works to moderate the speed or range of movement, helping to prevent joint injury. The prime mover for one movement is the antagonist for the opposite movement.

The biceps brachii and brachialis muscles work together to flex the elbow, with the brachialis being the prime mover and the biceps brachii being the synergist. The triceps brachii is the antagonist.

When extending the arm, the triceps brachii is the prime mover and the brachialis is the antagonist.



The Body AT WORK

Exercise, or a lack of exercise, causes physiological changes in skeletal muscles. Strength training, such as lifting weights, causes a muscle to enlarge. This is called ***hypertrophy.*** *Specifically, intense exercise, such as from resistance training, slightly injures muscle fibers. As the body repairs the damage, the fibers enlarge, and consequently so does the muscle. In contrast, a lack of use causes the muscle fibers and therefore the entire muscle to shrink, or* ***atrophy.***

Endurance (aerobic) exercise stimulates the growth of blood vessels in the muscle. This allows for an increased supply of oxygen and glucose—two necessary ingredients for ATP production.

Life lesson: Sports and muscle fibers

Not all muscle fibers are alike, and not all muscle fibers are suited for the same task. Some muscle fibers, called slow-twitch, or type I, fibers, respond slowly to stimuli. These fibers contain abundant mitochondria and a rich blood supply, making them efficient at using oxygen to generate ATP for energy. Although these fibers respond slowly to stimuli, they can fire for a long time before becoming fatigued. Endurance athletes, such as marathon runners, tend to have a preponderance of slow-twitch fibers.

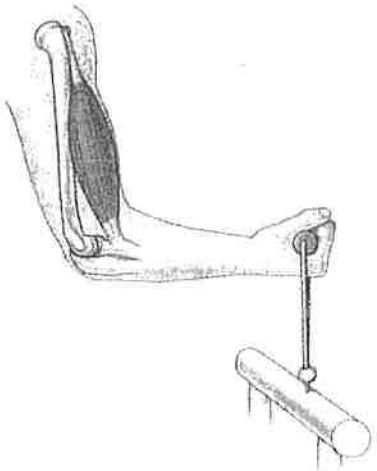
Other fibers, called fast-twitch, or type II, fibers, are better at generating short bursts of speed or strength. Although these fibers do not contain as many mitochondria and have a poorer supply of blood, they can absorb and release calcium quickly. This allows them to fire rapidly, although they fatigue more quickly than slow-twitch fibers do. Athletes such as sprinters tend to have an abundance of fast-twitch fibers.

Isotonic and Isometric Contraction

While muscle contraction often shortens the muscle (called isotonic contractions), sometimes muscles contract by increasing tension while the length stays the same. These are called isometric contractions.

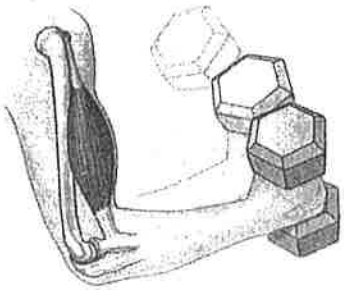
Isometric Contractions

In isometric contractions, the tension within a muscle increases while its length remains the same. For example, if you pull on a cable fastened to a stationary object, the muscle in your upper arm will tighten, but its length will remain the same.



Isotonic Contractions

In isotonic contractions, the muscle changes length and moves a load, while the tension within the muscle remains the same. For example, when you lift a barbell, the muscle in your upper arm shortens; as you lower the weight, the muscle lengthens.



That Makes Sense!

The prefix iso- *means "equal"; the suffix* -tonic *means "tension." Therefore,* isotonic *means "equal tension." The suffix* -metric *means "measurement"; therefore,* isometric *means "same measurement."*