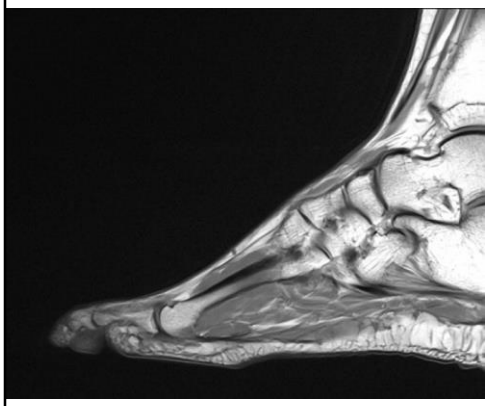

3T MRI image of a human ankle of a 33 year old male.
Muscle tissue can clearly be attached to the bones.
MRI © Nuada Medical, Wellcome Images CC-BY-NC-ND 4.0.

Overview of the Muscular System

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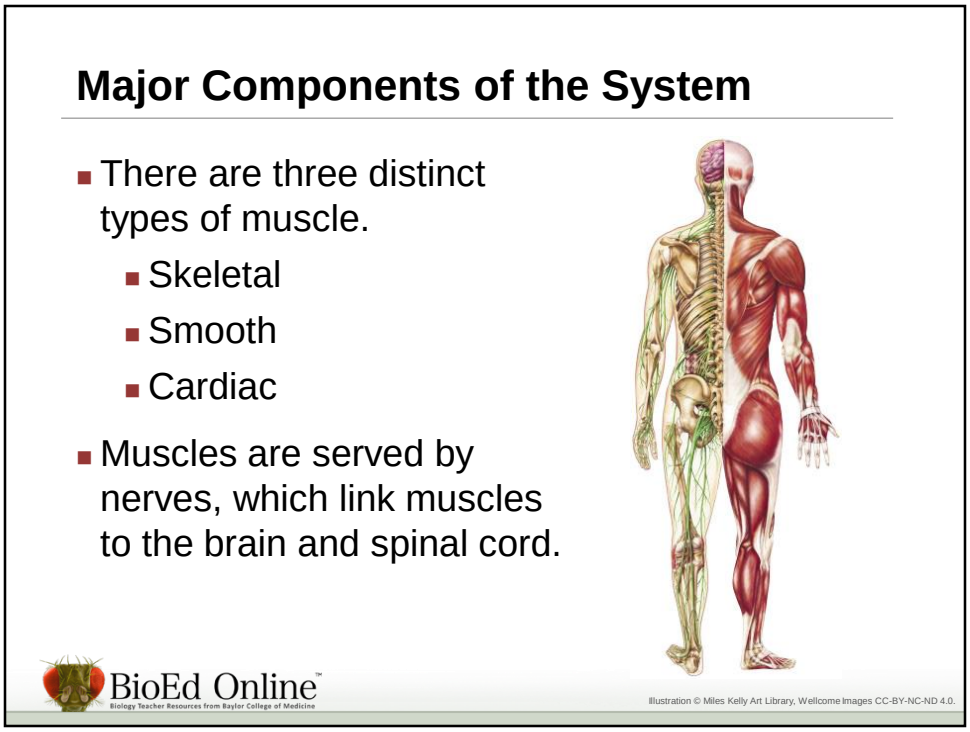
Overview of the Muscular System

Image Reference

MRI N0036723 © Nuada Medical, Wellcome Images CC-BY-NC-ND 4.0.
http://www.wellcomeimages.org

Key Words

muscular system, muscles, brain, nerves, bones, ligaments



Major Components of the System

There are three distinct types of muscle in the human body. Smooth muscle surrounds—or is part of—internal organs and the blood vessels that fuel them. Cardiac muscle, found only in the heart, is responsible for the heart's pumping action. Skeletal muscle is anchored to bones and pulls them to initiate movement.

Each muscle is served by nerves which link muscles to the brain and spinal cord. This network of nerves carries signals to and from the muscles, and also direct muscular energy.

Cardiac and skeletal muscle are striated, with a "striped" appearance caused by myofibrils. Smooth muscle is not striated, and instead has a smooth appearance.

Reference

Clark, Joe O.E. (1999). *A Visual Guide to the Human Body.* London: Barnes

and Noble, Inc.

Image Reference

Illustration N0027745 © Miles Kelly Art Library, Wellcome Images CC-BY-NC-ND 4.0. http://www.wellcomeimages.org

Key Words

muscular system, muscles, cardiac muscle, smooth muscle, skeletal muscle, motor neuron, axon, muscle fiber,

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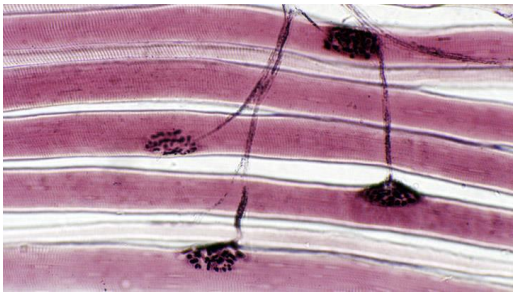
Skeletal Muscle

- Skeletal muscle, the most prevalent type of muscle in the body, is attached to bones by tendons.
- It is made up of individual muscle fibers.



Microscopic image of a group of motor neuron end plates (dark spots) on muscle fibers. Each end plate is part of nerve endings extending from the axon of a motor neuron (one end plate per muscle cell).

- Skeletal muscle is one of the two forms of striated muscle. Cardiac muscle, restricted to the heart, also is striated muscle.

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Skeletal Muscle

Skeletal muscle is is the body's most abundant tissue. It is anchored to bones, which it pulls to initiate voluntary or conscious movement. Skeletal muscle cells often have several nuclei.

Reference

Clark, Joe O.E. (1999). *A Visual Guide to the Human Body.* London: Barnes and Noble, Inc.

Image Reference

Photo © Thomas Caceci, PhD. Lab 10 Exercise: Smooth and Skeletal Muscle. Virginia-Maryland Regional College of Veterinary Medicine. Used with permission.
http://www.vetmed.vt.edu/education/curriculum/vm8054/Labs/Lab10/lab10.htm

Key Words

muscular system, muscles, muscle cells, skeletal muscle, muscle fibers, tendons, striated muscle

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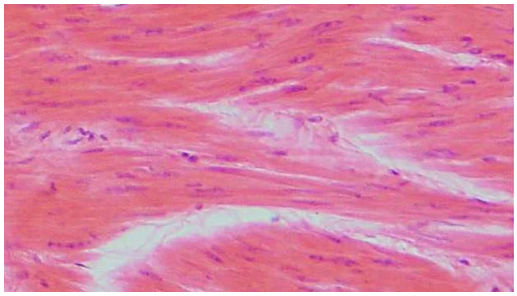
Smooth Muscle

- Smooth muscle is found in blood vessels and many organs.
- It enables stretching, yet maintains its contractility. This feature is important in organs such as the intestines and bladder.



Light micrograph of smooth muscle cells.

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Smooth Muscle

Smooth muscle surrounds—or is part of—internal organs and the blood vessels that fuel them. Responsible for sustained contractions in the gastrointestinal tract, it is critical to the peristalsis of the digestive system.

Both cardiac and smooth muscles are involuntary muscles that contract in response to non-conscious brain activity. Their cells usually consist of one nucleus (mononuclear).

Reference

Clark, Joe O.E. (1999). *A Visual Guide to the Human Body.* London: Barnes and Noble, Inc.

Image Reference

Photo © Polarlys CC-BY-SA 3.0.
http://commons.wikimedia.org/wiki/File:Glatte_Muskelzellen.jpg

Key Words

muscular system, muscles, muscle cells, smooth muscle, organ muscles

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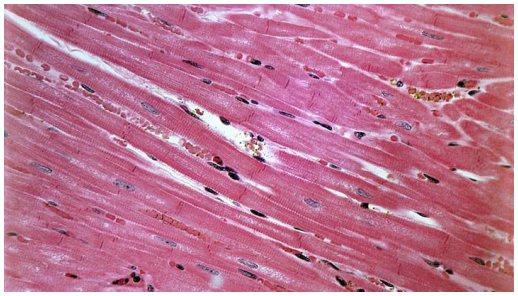
Cardiac Muscle

- Cardiac muscle is found in the myocardium of the heart.
- Contraction of cardiac muscle cells help to propel blood through the cardiovascular system.



Light micrograph of a longitudinal section of cardiac muscle.

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Cardiac Muscle

Cardiac muscle, found only in the heart, is responsible for the heart's pumping action. One distinguishing feature of cardiac muscle cells is that they are joined by intercalated discs.

Both cardiac and smooth muscles are involuntary muscles that contract in response to non-conscious brain activity. Their cells usually consist of one nucleus (mononuclear).

Reference

Clark, Joe O.E. (1999). *A Visual Guide to the Human Body.* London: Barnes and Noble, Inc.

Image Reference

Key Words

muscular system, muscles, muscle cells, cardiac muscle, cardiovascular system, heart, myocardium

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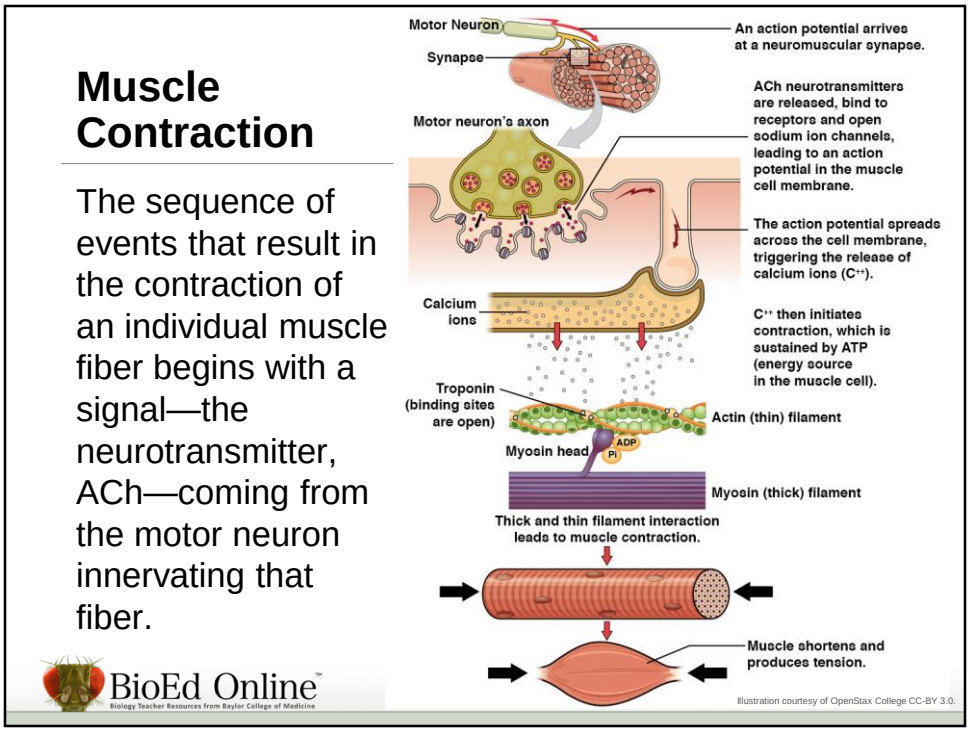

Muscle Contraction

ATP is an organic compound, derived from the food we eat, that provides the energy needed for muscle contraction. Myosin filaments within the muscle have a pair of rounded buds that form the myosin head. Each bud has a different function. One contains the enzyme ATPase, which can split ATP molecules and release energy. The other bud binds to the actin filament.

Myosin filaments and ATP molecules have a very high affinity for each other, and ATP binds to the myosin head. This allows the myosin to dissociate from the actin molecule. Without ATP, the actin and myosin filaments remain locked together and the muscle is unable to contract.

Next, the ATPase activity of the myosin head splits the ATP molecule into the lower-energy ADP and phosphate molecules. The myosin head swings over 90° to attach weakly to a new actin molecule. The phosphate molecule is then released from the myosin head, initiating the power stroke, during which the myosin head pushes the actin filament past it.

Reference

1.Clark, Joe O.E. (1999). *A Visual Guide to the Human Body.* London: Barnes and Noble, Inc.

2.OpenStax College, Muscle Fiber Contraction and Relaxation. OpenStax CNX CC-BY-3.0. June 4, 2013. http://cnx.org/content/m46447/1.3/

Image Reference

OpenStax College, Muscle Fiber Contraction and Relaxation. OpenStax CNX CC-BY-3.0. June 4, 2013. http://cnx.org/content/m46447/1.3/

Key Words

muscular system, muscles, muscle cell, muscle fiber, myosin, actin, ATP, ADP-Pi, motor neuron, axon, neurotransmitter, neuromuscular synapse

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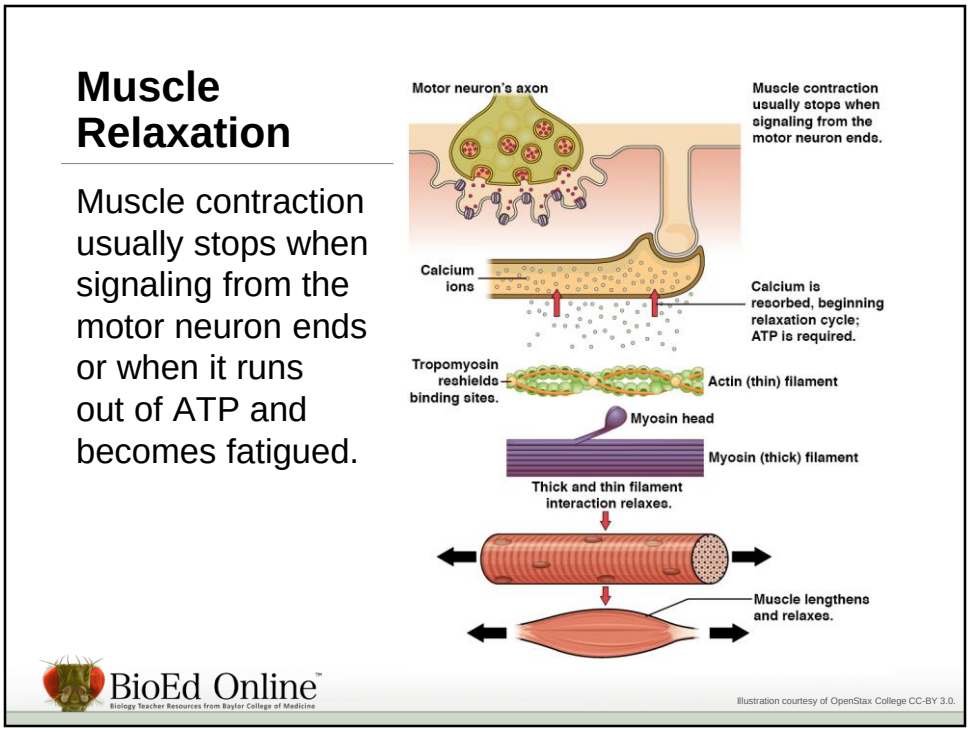

Muscle Relaxation

After the power stroke, the myosin head releases ADP and resumes its bound state to the actin filament. Another ATP molecule is needed to repeat the process.

Reference

1.Clark, Joe O.E. (1999). *A Visual Guide to the Human Body.* London: Barnes and Noble, Inc.

2.OpenStax College, Muscle Fiber Contraction and Relaxation. OpenStax CNX CC-BY-3.0. June 4, 2013. http://cnx.org/content/m46447/1.3/

Image Reference

OpenStax College, Muscle Fiber Contraction and Relaxation. OpenStax CNX CC-BY-3.0. June 4, 2013. http://cnx.org/content/m46447/1.3/

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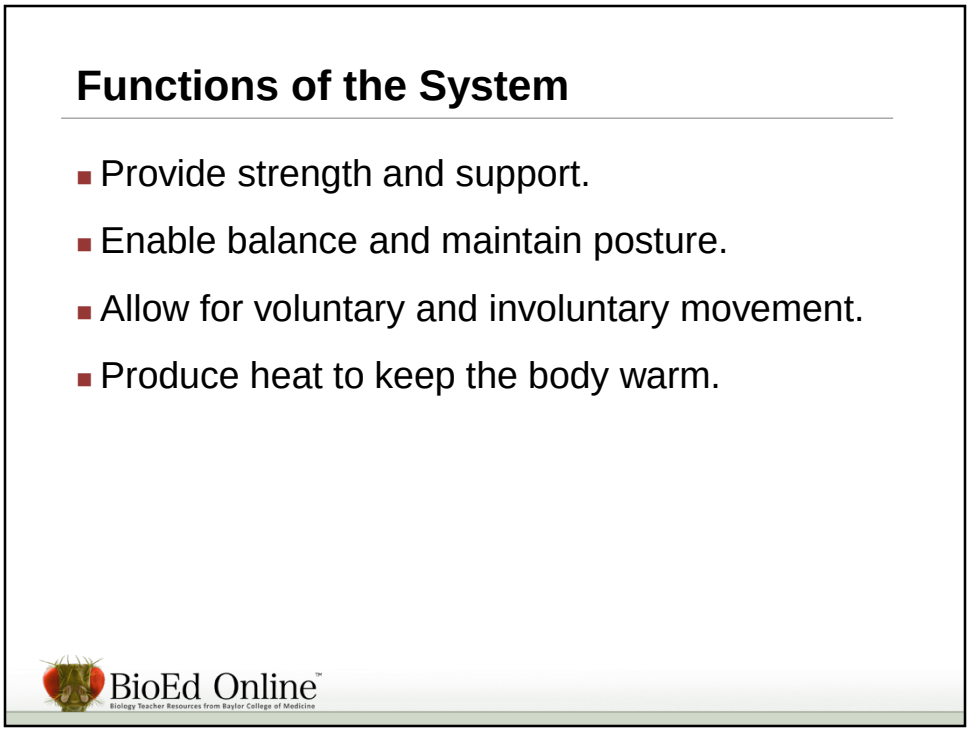

Functions of the System

Muscles provide strength and support to the skeletal system. They exert force and enable movement by converting chemical energy into tension and contraction. Muscle fiber shortens as it contracts, in many cases pulling bone like a lever, with joints acting as fulcrums. Muscles work in coordination to provide stability, enabling an individual to balance and maintain posture by counteracting gravity. Muscles may also provide the body with heat. Shivering, for example, generates heat with small muscle contractions.

Reference

Clark, Joe O.E. (1999). *A Visual Guide to the Human Body.* London: Barnes and Noble, Inc.

Key Words:

muscular system, muscles, human body, voluntary movement, involuntary movement

Overview of the Muscular System © Baylor College of Medicine.