

Muscular System

A bodybuilder with dark, curly hair and a goatee is posing on a stage. He is wearing black briefs and is in a side-on pose, flexing his muscles. The background is dark with some stage lights and a large, ornate chandelier hanging from the ceiling.

Skye Curly, Rizal De Leon, and Nealon Guzman
AP Biology 2022-2023



Objectives

- Identify the 3 types of muscle
- Understand what makes up muscle tissue
- Understand how muscles move
- Understand the nervous system's influence on the muscle
- Understand how muscles grow

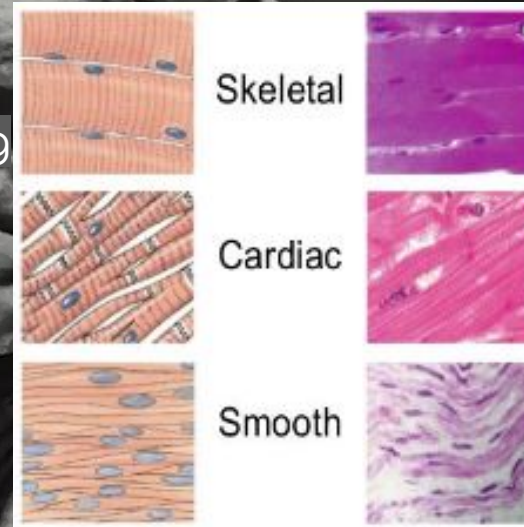
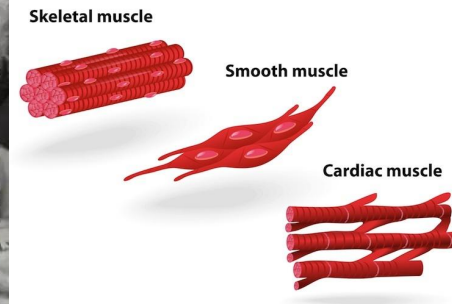
3 MUSCLE TYPES

Cardiac

- Makes up the thick, middle layer of the heart
- Uses involuntary movements to keep the heart pumping
- Striped pattern

Skeletal

- Can be seen
- Found attached to bones
- Muscle contractions pull the bones causing movement
- Striped pattern

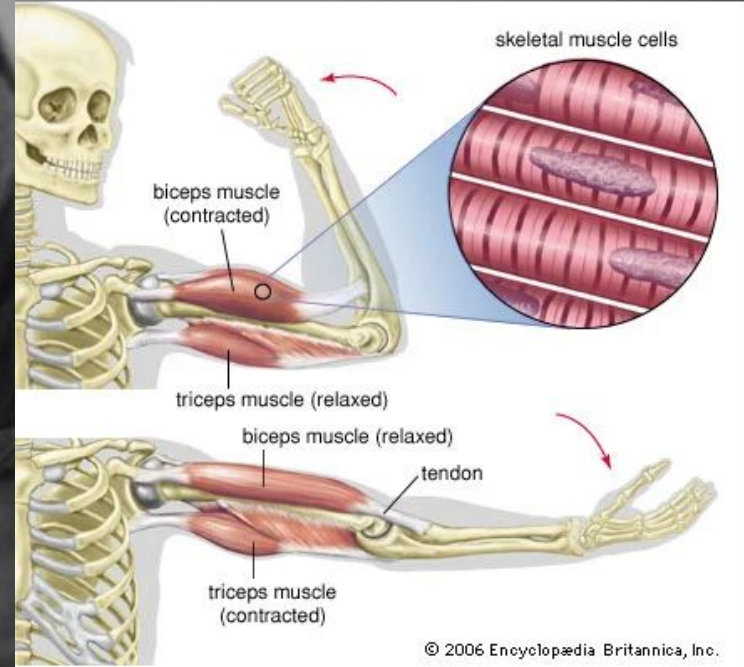


Smooth

- Found In the walls of hollow visceral organs (stomach, bladder, intestines)
- Contracts and relaxes to push fluid and other materials
- Fusiform pattern

Skeletal Muscle PT.1

- Over 650+ different skeletal muscles in a person
- Each muscle has its own:
 - Vein & Artery to give oxygen and nutrients
 - Personal Nerve to allow contractions
- What makes up skeletal muscles:
 - Sarcomeres → Myofibrils → Muscle Fibers
→ Fascicles → Muscle Organ
- Movement is caused by muscles contracting and relaxing



Skeletal Muscles PT.2

- Muscle fibers made of:

Nuclei - produces proteins and enzymes for muscle contractions and expansion

Mitochondria - Creates ATP that's used in the muscle cells.

Sarcoplasmic Reticulum - Contains calcium channels attached to voltage sensitive proteins.

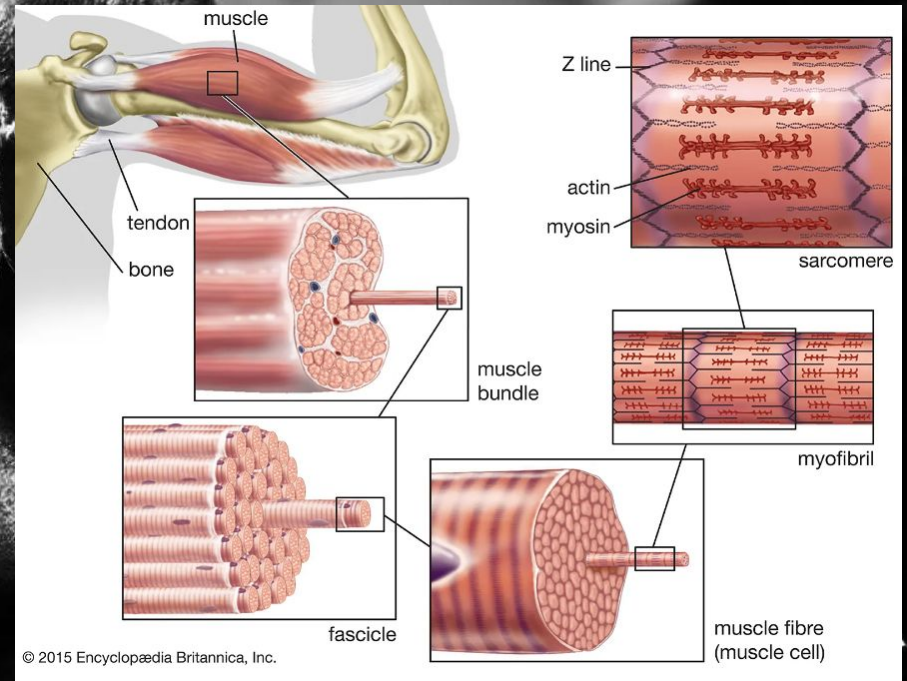
- Sarcomeres contain :

Actin- A spherical protein that is found in the muscle plasma & forms long filaments

Myosin- A motor protein that causes contraction.

Troponin- Protein that binds to Calcium ion and pulls Tropomyosin away from Actin

Tropomyosin- Protein that blocks Actin binding sites

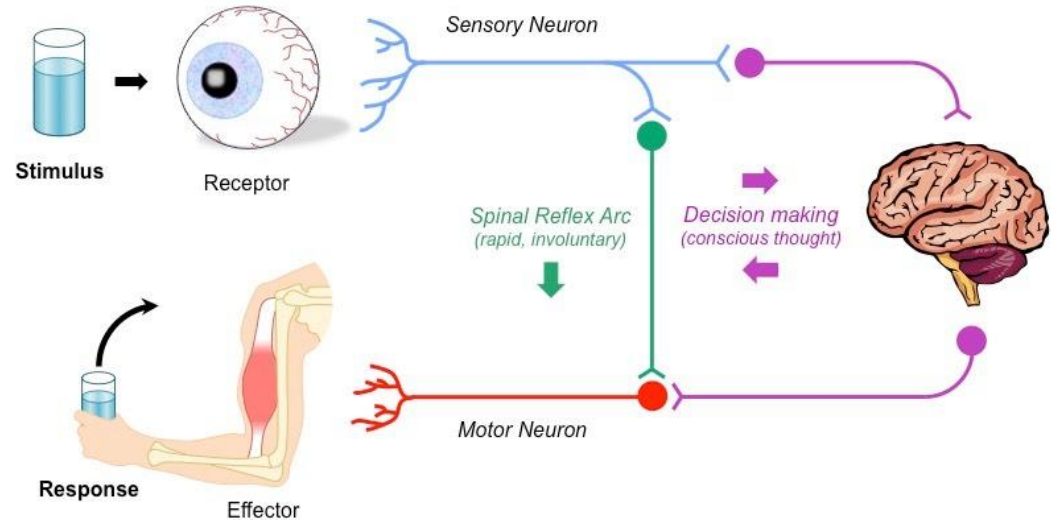


Reflexes/Mind Muscle Connection

- Neurons carry messages to effectors, from the stimulated receptor.
- Sensory neurons transmit the information to the spinal cord/brain (Central Nervous System)
- The motor neuron carries the information to the muscle (reactor)

Stimuli → Receptor → Sensory Neuron → Relay Neuron → Motor Neuron → Muscle movement

Stimulus → sensory neuron
→ integration (brain) →
motor neuron → response



How The Muscle Moves



Step 1. Acetylcholine (uh·seh·tuhl·kow·leen) (ACh), neurotransmitter, is released from the motor neuron.

Step 2. Acetylcholine creates action potential on the muscle fiber.

Step 3. If action potential is strong enough, it will open the calcium channels allowing calcium and ATP into the cell.

Step 4. Calcium then attaches to the Troponin which is sitting on top of Tropomyosin, which inhibits the movement of Actin.

Step 5. Tropomyosin is lifted away from Actin binding sites. Allowing Myosin to bind with Actin.

Step 6. Myosin bonds with an ATP and breaks it down into ADP and a leftover phosphate.

Step 6. Myosin bonds with an ATP and breaks it down into ADP and a leftover phosphate.

Step 7. Using the energy gained from the ATP, Myosin binds to Actin. This causes muscle contraction.

Step 8. The ADP and phosphate unbinds to the Myosin and is replaced with a new ATP.

Step 9. Myosin finally unbinds to Actin and the cycle repeats again.

More in depth of muscle movement

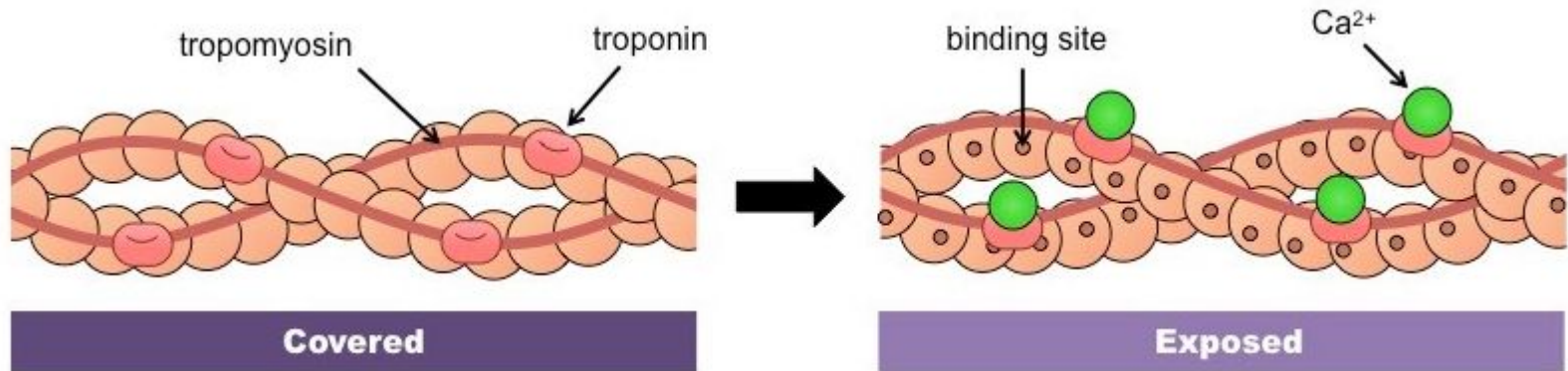
Troponin - Pink oval looking shape

Acetylcholine - neurotransmitter, chemical messenger (not pictured)

Actin - nude colored circles

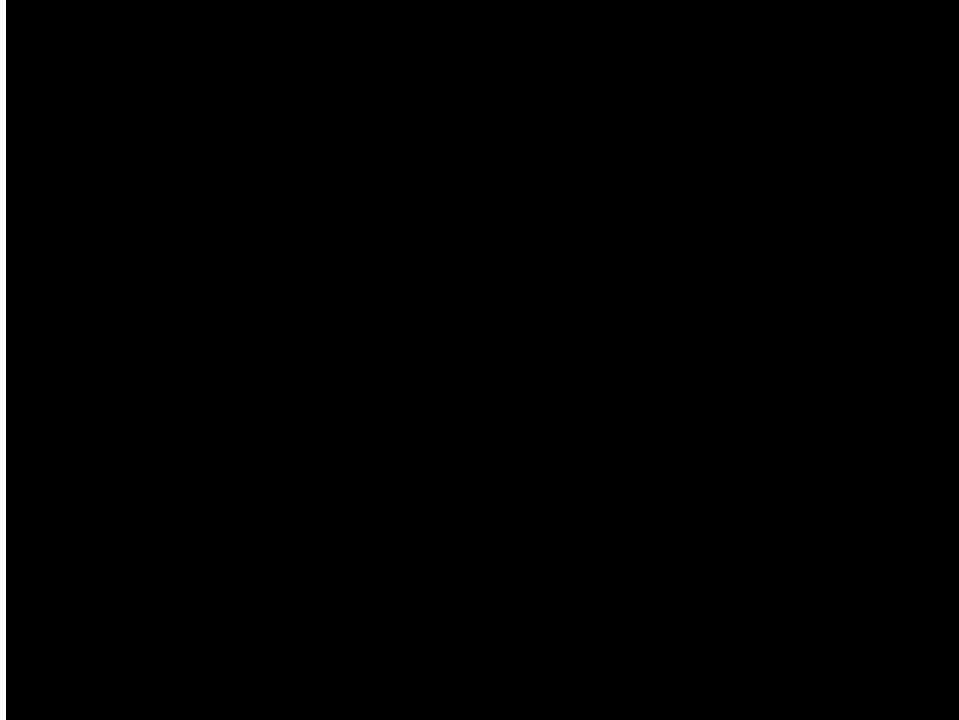
Tropomyosin - pink/redish tube

Myosin - the thing that binds to actin causing it to move (not pictured)



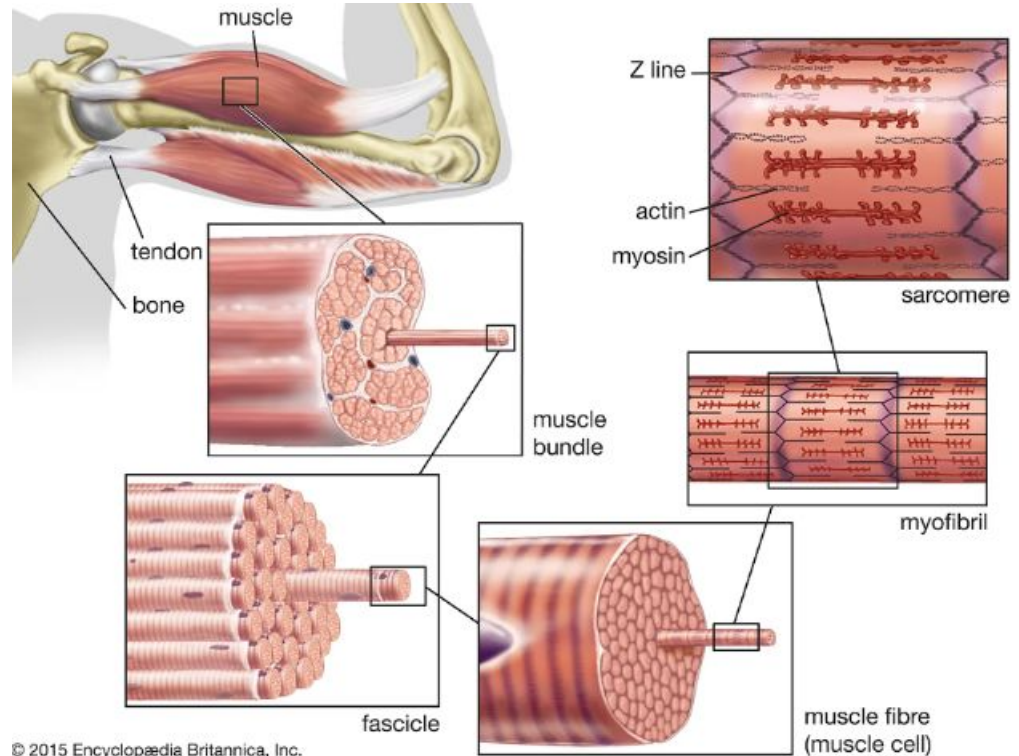
Calcium Video

[Video Link](#)



What does this mean?

As the the actin filament keeps being reorientated, it causes the z lines to contract, which makes your muscles move.



[KAHOOT :\)](#)

Kahoot!

How The Muscle Grows

After you workout your body repairs or replaces damaged muscle fibers

Muscle growth occurs whenever the rate of muscle synthesis greater than the rate of muscle protein breakdown

Does not actually happen when you lift, instead while you rest.

The response of muscle protein metabolism to a resistance exercise bout lasts for 24-48 hours; thus, the interaction between protein metabolism and any meals consumed in this period will determine the impact of the diet on muscle

Three mechanisms that make muscle grow

- 1. Muscle tension**
 - a. Lift progressively heavier weights
- 2. Muscle damage**
 - a. Local muscle damage causes a release
- 3. Metabolic stress**
 - a. Causes cell swelling around the muscle, which helps to contribute
 - b. From the addition glycogen which helps to swell the muscle

What you can achieve!!



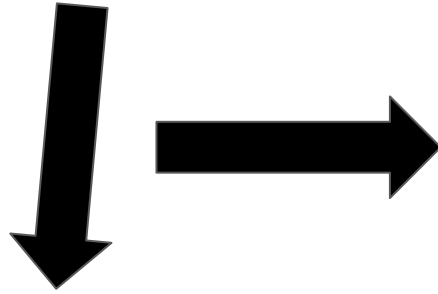
How to optimally grow muscles

Step 1: Cut all happiness from your life

Step 2: SARMS

Step 3: GET in A BREAKUP

Step 4: ur look like this now



Sources??

Slides

<https://www.youtube.com/watch?v=Ktv-Coat 6UQ>

<https://www.youtube.com/watch?v=l80Xx7pA9hQ>

https://docs.google.com/presentation/d/1Dc_KV7H6Miyg_w78m-s5pv5YuXlo5qAbP830ZVzfb0c/edit#slide=id.g630e2536c9_2_2088

[https://www.builtlean.com/muscles-grow/#:~:text=The%20Physiology%20Of%20Muscle%20Growth.create%20muscle%20hypertrophy%20\(growth\)](https://www.builtlean.com/muscles-grow/#:~:text=The%20Physiology%20Of%20Muscle%20Growth.create%20muscle%20hypertrophy%20(growth))

<https://ib.bioninja.com.au/Media/muscle-contraction-summary.mp4>

<https://ib.bioninja.com.au/higher-level/topic-11-animal-physiology/112-movement/muscle-contraction.html>

Quiz

<https://www.khanacademy.org/science/high-school-biology/hs-human-body-systems/hs-the-musculoskeletal-system/e/hs-the-musculoskeletal-system?classCode=6J29A6BF>

<https://secure-media.collegeboard.org/ap/pdf/ap18-sg-biology.pdf>

Images

<https://stock.adobe.com/images/back-double-biceps-pose-by-brutal-caucasian-bodybuilder-on-grunge-background/181985270>

<https://www.britannica.com/science/biceps-muscle>

<https://wallhere.com/en/wallpaper/185717>

<https://www.britannica.com/science/skeletal-muscle>

<https://ib.bioninja.com.au/options/option-a-neurobiology-and/a4-innate-and-learned-behav/reflex-arcs.html>

