

Guided Notes: Unit 3 - The Muscular System (Muscles and Muscle Tissue)

Part 1: Overview of Muscle Tissues

Functions of Muscles: Think S.M.A.R.T.

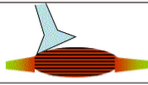
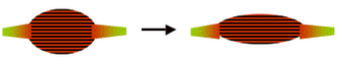
Fill in the main role each function plays in the body.

1. **Support:** To _____.
2. **Movement:** To allow for _____.
3. **Assist:** To assist in the movement of _____ and _____.
4. **Regulation:** To maintain _____.
5. **Target Protection:** To _____ and stabilize joints.

Muscle Characteristics: How Do Muscles Work?

Muscles share four key functional characteristics. Define each one.

Characteristic	Definition
Excitability (Responsiveness)	The ability to
Contractility	The ability to
Extensibility	The ability to
Elasticity	The ability to

Contractility	
Excitability	
Extensibility	
Elasticity	

The Three Muscle Types: A Comparative Table

Complete the table below using the slides to compare the three types of muscle tissue.

Characteristic	Skeletal Muscle	Cardiac Muscle	Smooth Muscle
Body Location	Attached to _____ _____.	Walls of the _____ _____.	Mostly in walls of _____ _____.
Cell Shape/Appearance	_____, multinucleate cells with _____.	_____ chains of cells, single nucleus, _____, and _____.	_____ (spindle-shaped) cells with a single nucleus, and _____.
Voluntary/Involuntary	_____ _____	_____ _____	_____ _____

Key Prefixes to Know:

- **myo** and **mys** refer to _____.
- **sarco** refers to _____.

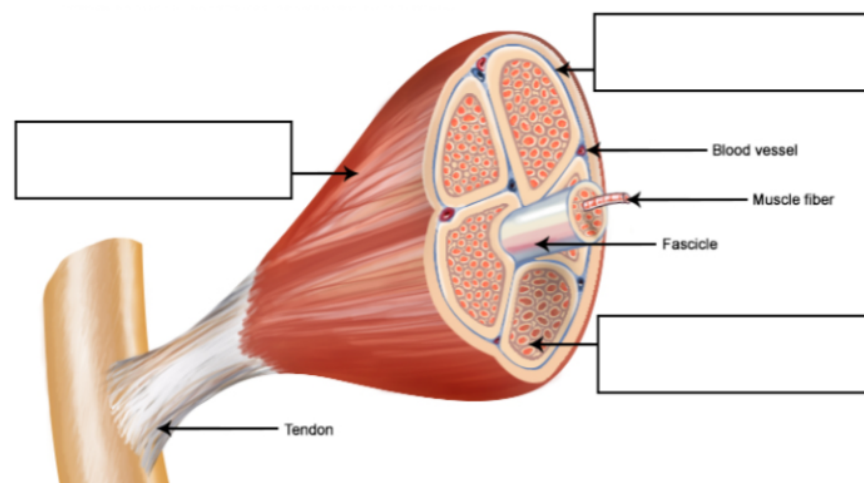
Part 2: Gross Anatomy of Skeletal Muscle

Connective Tissue Wrappings

Identify what each layer of connective tissue covers in the organization of a skeletal muscle.

Connective Tissue Layer	Location/What it Covers
Endomysium	Encloses a _____ (muscle cell).
Perimysium	Wraps around a _____ (bundle of muscle fibers).
Epimysium	Covers the _____.
Fascia	Found on the _____ of the epimysium.

In the image below, label the three connective tissue layers and indicate what a fascicle is.

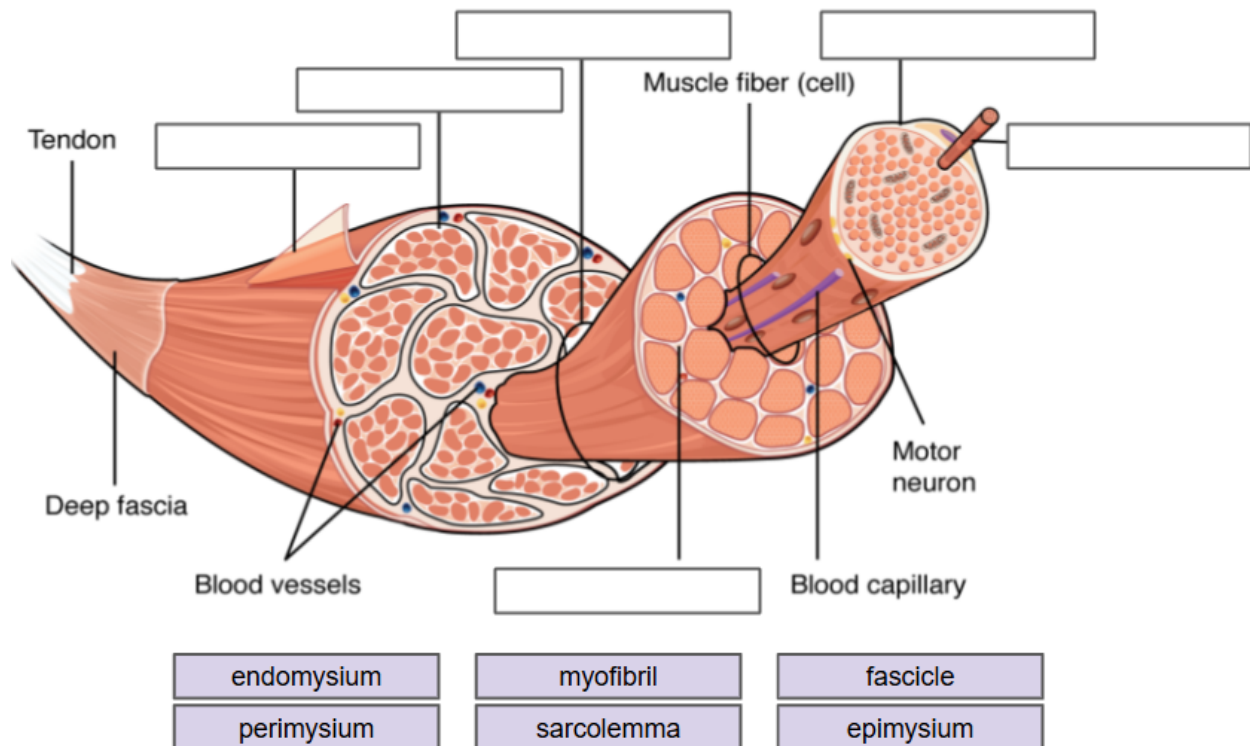


Perimysium

Endomysium

Epimysium

In the image below, labeled the indicated terms.



Muscle Attachments

Muscle attachments can be direct or indirect.

1. **Direct Attachment:** The _____ of the muscle blends directly into the connective tissue attachment.
2. **Indirect Attachment:** Connective tissues extend beyond the muscle to attach to the bone.
 - **Tendons:** _____ structures made mostly of _____ fibers.
 - **Aponeuroses:** _____ structures that attach muscles indirectly.

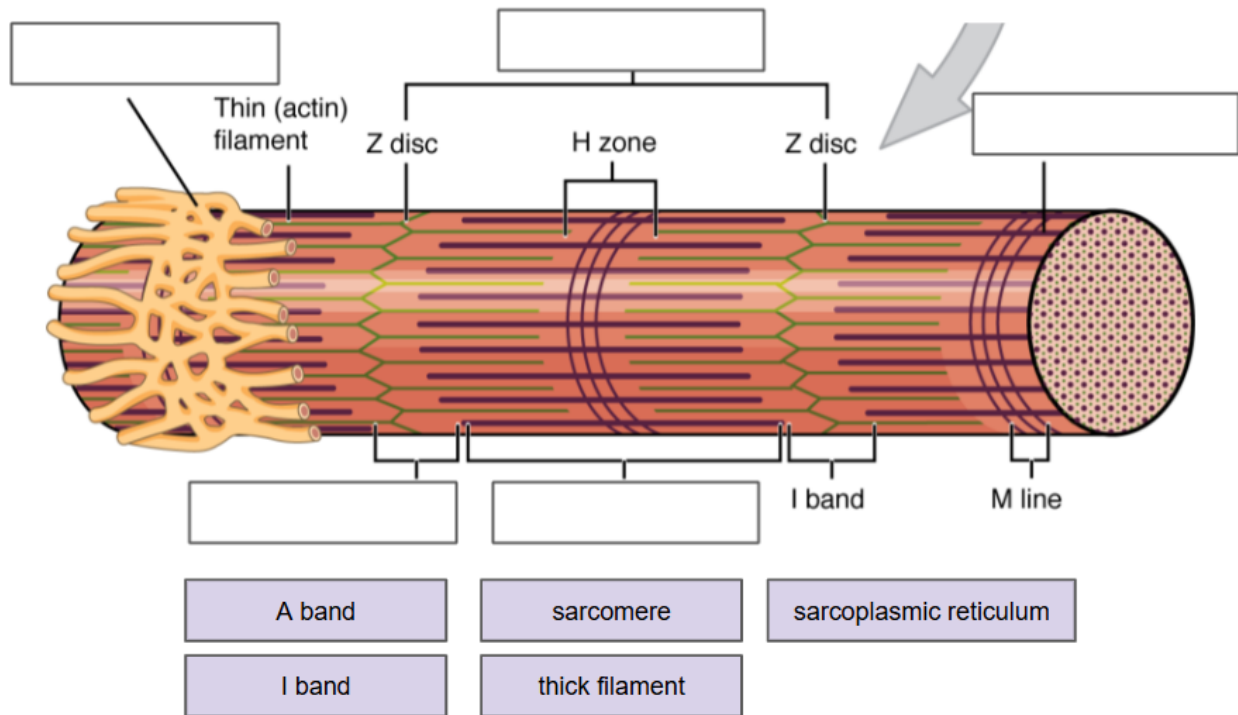
Part 3: Microscopic Anatomy of Skeletal Muscle

The functional, contractile unit of a muscle fiber is the _____.

The Sarcomere Structure

The striated appearance comes from the alternating _____ (**I**) bands and _____ (**A**) bands.

Label the indicated structures on the image below:



Sarcomere Band/Line	Composition	Location
I band (Light band)	Contains only _____ (_____) filaments.	_____
A band (Dark band)	Contains the entire length of the _____ (_____) filaments.	_____
Z disc (line)	The midline interruption within the _____ (where actin is anchored).	_____

H zone	A lighter _____ within the A band that lacks _____ filaments at rest.	_____
M line	The center of the _____.	_____

Myofilaments (Filaments that cause contraction)

1. Thick Filaments

- Composed of the protein _____.
- Possess _____ which are called _____ when they link to thin filaments.

2. Thin Filaments

- Composed of the contractile protein _____.
- Anchored to the _____.

Part 4: The Sliding Filament Model of Contraction

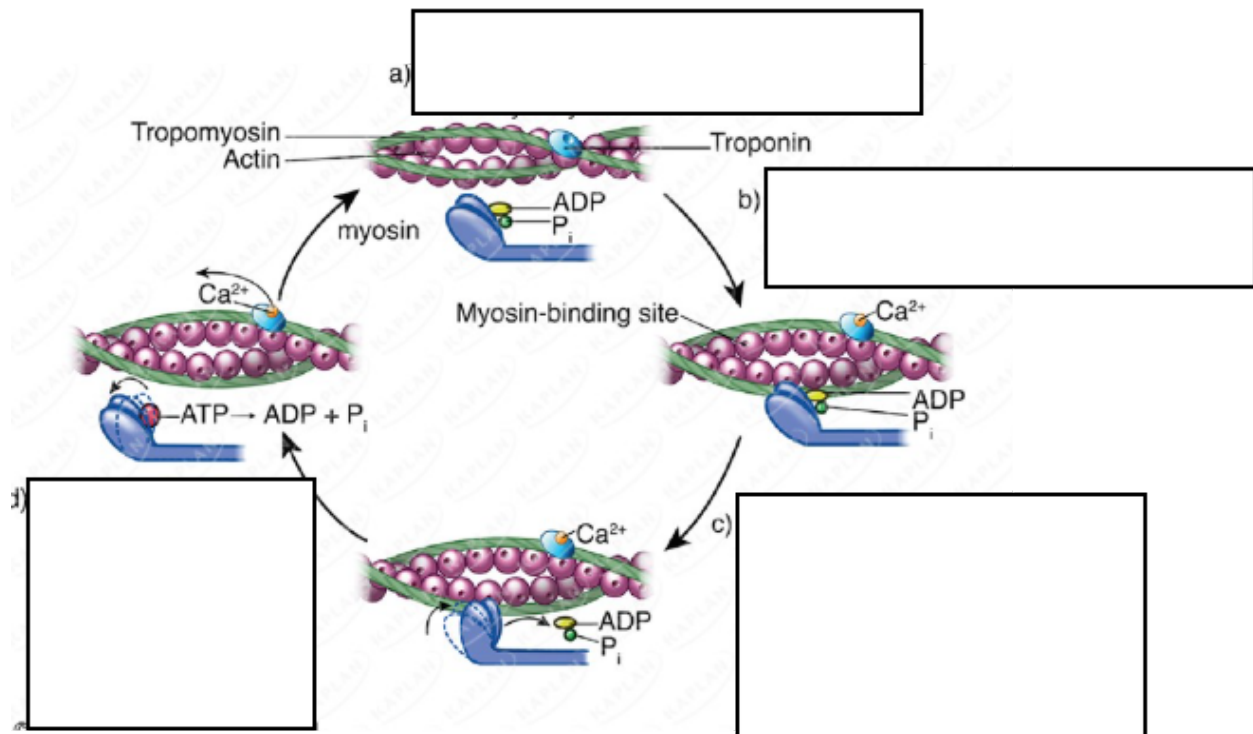
Muscle contraction occurs when the _____ filaments slide over the _____ filaments. This process is activated by _____ and _____ ions.

Fill in the blanks to complete the four steps of the Cross Bridge Cycle:

Step	Myosin Head State (High/low energy)	Action/Event
1. Cross Bridge Formation		Myosin head attaches to an exposed binding site on _____.
2. Power Stroke		The myosin head pivots, pulling the _____ filament toward the center of the sarcomere. _____ are released.

3. Cross Bridge Detachment		A new _____ molecule binds to the myosin head.
4. Cocking of the Myosin Head		_____ is hydrolyzed (split), releasing the energy needed to reset the myosin head.

Explain what is happening at the steps labeled a, b, c, and d in the diagram below:



Part 5: Physiology of Skeletal Muscle Fibers (Excitation)

A. The Neuromuscular Junction (NMJ)

- **NMJ:** The site where a _____ neuron's axon terminal meets the sarcolemma of a muscle fiber.
- **Synaptic Cleft:** The _____ between the nerve terminal and the muscle fiber.
- **Neurotransmitter:** The specific chemical released by the nerve to stimulate the muscle is _____ (ACh).

B. Sequence of a Muscle Contraction

The muscle cell must be stimulated by a nerve impulse (Action Potential) to contract. Place the following events in the correct sequence (1-7):

Sequence (1-7)	Event
	ACh diffuses across the synaptic cleft and binds to receptors on the sarcolemma.
	The muscle cell relaxes as calcium is actively reabsorbed into the _____ (SR).
	Depolarization occurs, and an _____ (AP) is generated and travels along the sarcolemma.
	The AP travels deep into the cell, causing the SR to release (55) _____ ions.
	ACh is released by the axonal terminal into the NMJ.
	The thin filaments slide past the thick filaments, and the muscle cell _____
	The muscle cell _____ and lengthens.

Label the following terms on the diagram below: mitochondrion, synaptic vesicles, T tubule, synaptic cleft, sarcomere. Add small arrows to indicate the location of Ach receptors and label appropriately.

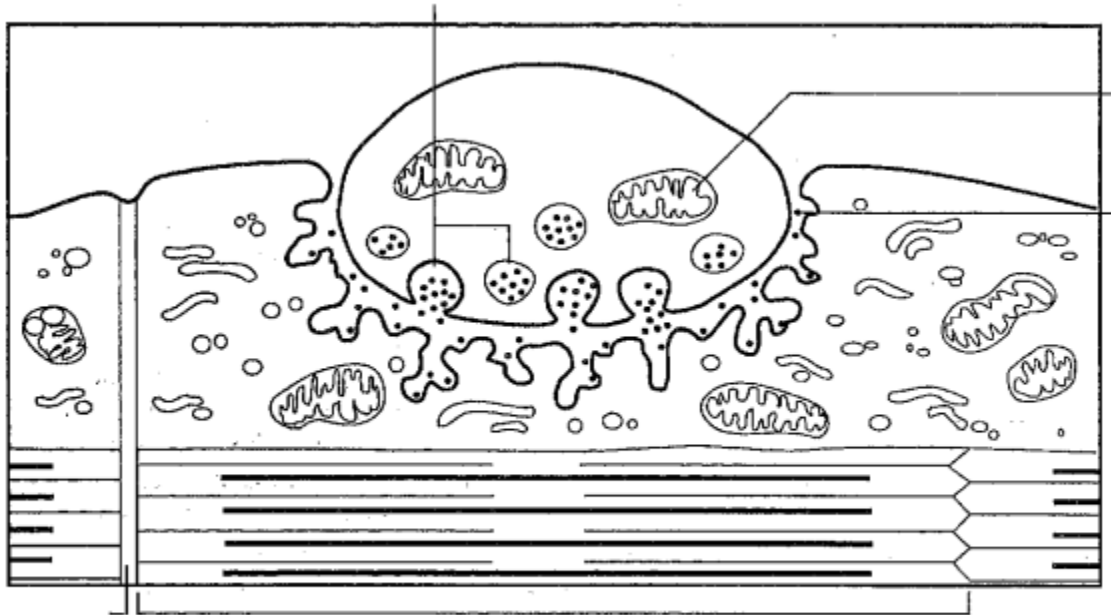


Figure 6-4

Part 6: Muscle Contraction and Metabolism

A. Types of Contractions

Complete the table to compare the two main contraction types:

Contraction Type	Muscle Length	Movement Occurs?	Tension (Force)	Example
Isotonic				
Isometric				

B. Generating ATP (Energy)

The only molecule that directly powers muscle contraction is

_____. It is regenerated through three main pathways:

1. **Direct Phosphorylation** of ADP by _____.
2. **Aerobic Respiration**: Requires _____ and produces the most _____ per glucose molecule.
3. **Anaerobic Glycolysis**: Does not require oxygen, but produces _____ acid as a byproduct, leading to muscle _____.

C. Muscle Fiber Types

Skeletal muscle fibers can be classified based on speed and primary pathway.

Characteristic	Type I (Slow Oxidative)	Type II A (Fast Oxidative)	Type II X (Fast Glycolytic)
Contraction Speed			
Primary Pathway			
Fatigue Resistance			
Myoglobin Content			

Part 7: Disorders and Injuries

A. Muscular Disorders

Disorder	Description	Cause
Muscular Dystrophy	An _____ disorder where muscle fibers degenerate and _____	Lacking a protein to maintain the _____.
_____ Gravis	Progressive weakness due to a shortage of _____ receptors.	Autoimmune condition

B. Common Injuries

- **Strain:** _____ of a _____ near a joint.
- **Sprain:** _____ of a _____ leading to injury to ligaments and tendons.
- **Myalgia** _____ of muscle tissue.
- **Tendinitis:** of a tendon due to strain of repeated activity.