

Principles of Anatomy and Physiology
14th Edition

CHAPTER 11
The Muscular System

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How Skeletal Muscles Produce Movement

Skeletal muscles produce movements by exerting force on tendons. Tendons attach to and pull on bones, and movement occurs

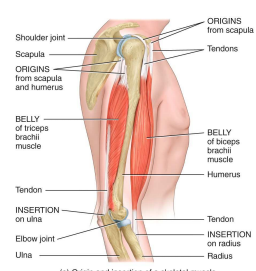
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Origin and Insertion

Most muscles cross at least one joint and are attached at the articulating bones

When a muscle contracts, it draws one articulating bone toward the other

- Origin – the attachment to the stationary bone
- Insertion – the attachment to the moveable bone



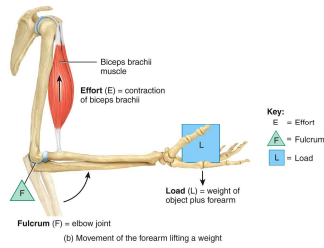
(a) Origin and insertion of a skeletal muscle

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Lever Systems and Leverage

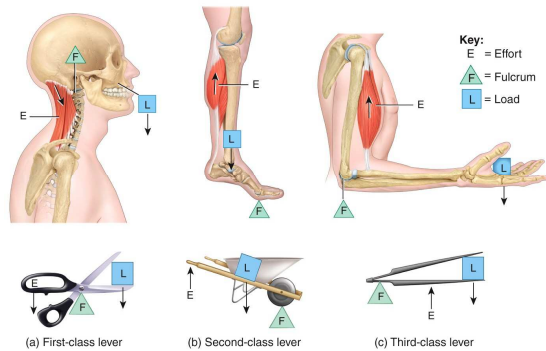
Bones serve as levers and joint serve as fulcrums

- The lever is acted on by:
 - Resistance
 - Effort



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Types of Levers



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Effects of Fascicle Arrangement

Muscle fibers are arranged in parallel bundles within fascicles but the arrangement of fasciculi in relation to the tendon can vary








Fascicular arrangement is correlated with:

- The amount of power of a muscle can produce
- The range of motion a muscle can produce

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Arrangement of Fascicles

TABLE 11.1
Arrangement of Fascicles

<p>PARALLEL</p> <p>Fascicles parallel to longitudinal axis of muscle; terminate at either end in flat tendons.</p>  <p>Example: Sternohyoid muscle (see Figure 11.8a)</p>	<p>FUSIFORM</p> <p>Fascicles nearly parallel to longitudinal axis of muscle; terminate in flat tendons; muscle tapers toward tendons, where diameter is less than at belly.</p>  <p>Example: Digastric muscle (see Figure 11.8a)</p>	
<p>CIRCULAR</p> <p>Fascicles in concentric circular arrangements form sphincter muscles that enclose an orifice (opening).</p>  <p>Example: Orbits and oculi muscles (see Figure 11.4d)</p>	<p>TRIANGULAR</p> <p>Fascicles spread over broad area coverage at thick central tendon; gives muscle a triangular appearance.</p>  <p>Example: Pectoralis major muscle (see Figure 11.3d)</p>	
<p>PENNATE</p> <p>Short fascicles in relation to total muscle length; tendon extends nearly entire length of muscle.</p>		
<p>UNIPENNATE</p> <p>Fascicles arranged on only one side of tendon.</p>  <p>Example: Extensor digitorum longus muscle (see Figure 11.23a)</p>	<p>BIPENNATE</p> <p>Fascicles arranged on both sides of centrally positioned tendon.</p>  <p>Example: Rectus femoris muscle (see Figure 11.20a)</p>	<p>MULTIPENNATE</p> <p>Fascicles attach obliquely from many directions to several tendons.</p>  <p>Example: Deltoid muscle (see Figure 11.10a)</p>

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Coordination Within Muscle Groups

Most muscle movements are coordinated by several skeletal muscles acting in groups rather than individually, and most skeletal muscles are arranged in opposing pairs at joints

- Agonist/prime mover
- Antagonist
- Synergist

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How Skeletal Muscles are Named

A muscle may be named based on:

- Location
- Size
- Number of origins
- Appearance
- Direction of fibers
- Origin and insertion
- Muscle action

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How Skeletal Muscles are Named

TABLE 11.2

Characteristics Used to Name Muscles

NAME	MEANING	EXAMPLE	FIGURE
DIRECTION: Orientation of muscle fascicles relative to the body's midline			
Rectus	Parallel to midline	Rectus abdominis	11.10b
Transverse	Perpendicular to midline	Transversus abdominis	11.10b
Oblique	Diagonal to midline	External oblique	11.10a
SIZE: Relative size of the muscle			
Maximus	Largest	Gluteus maximus	11.20c
Minimus	Smallest	Gluteus minimus	11.20d
Longus	Long	Adductor longus	11.20a
Brevis	Short	Adductor brevis	11.20b
Latissimus	Widest	Latissimus dorsi	11.15b
Longissimus	Longest	Longissimus capitis	11.19a
Magnus	Large	Adductor magnus	11.20b
Major	Larger	Pectoralis major	11.10a
Minor	Smaller	Pectoralis minor	11.14a
Vastus	Huge	Vastus lateralis	11.20a
SHAPE: Relative shape of the muscle			
Deltoid	Triangular	Deltoid	11.15b
Trapezius	Trapezoid	Trapezius	11.3b
Serratus	Saw-toothed	Serratus anterior	11.44b
Rhomboid	Diamond-shaped	Rhomboid major	11.15c
Ocularis	Circular	Ocularis oculi	11.4a
Pectinate	Comblike	Pectineus	11.20a
Piriformis	Pear-shaped	Piriformis	11.20d
Platys	Flat	Platysma	11.4c
Quadratus	Square, four-sided	Quadratus femoris	11.20d
Gracilis	Slender	Gracilis	11.20a

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How Skeletal Muscles are Named

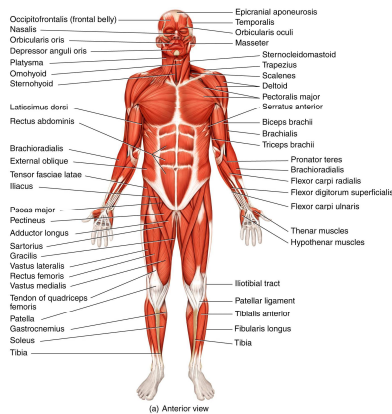
TABLE 11.2

Characteristics Used to Name Muscles

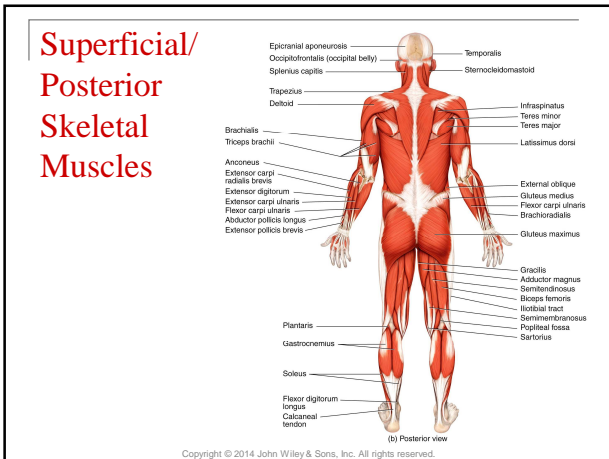
NAME	MEANING	EXAMPLE	FIGURE
ACTION: Principal action of the muscle			
Flexor	Decreases joint angle	Flexor carpi radialis	11.17a
Extensor	Increases joint angle	Extensor carpi ulnaris	11.17b
Abductor	Moves bone away from midline	Abductor pollicis longus	11.17e
Adductor	Moves bone closer to midline	Adductor longus	11.20a
Levator	Raises or elevates body part	Levator scapulae	11.4a
Depressor	Lowers or depresses body part	Depressor labii inferioris	11.4a
Supinator	Turns palm anteriorly	Supinator	11.17c
Pronator	Turns palm posteriorly	Pronator teres	11.17a
Sphincter	Decreases size of an opening	External anal sphincter	11.12
Tensor	Makes body part rigid	Tensor fasciae latae	11.20a
Rotator	Rotates bone around longitudinal axis	Rotator	11.19a
NUMBER OF ORIGINS: Number of tendons of origin			
Biceps	Two origins	Biceps brachii	11.16a
Triceps	Three origins	Triceps brachii	11.16a
Quadriceps	Four origins	Quadriceps femoris	11.20a
LOCATION: Structure near which a muscle is found			
Example: Temporalis, muscle near temporal bone.			11.4c
ORIGIN AND INSERTION: Sites where muscle originates and inserts			
Example: Sternocleidomastoid, originating on sternum and clavicle and inserting on mastoid process of temporal bone.			11.3a

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Superficial/ Anterior Skeletal Muscles



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Muscles and Their Movements

Anatomy Overview:

- Selected Muscles and Movements

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Running Injuries

- Most running injuries involve the knee
- Running injuries are usually related to faulty training techniques
- Running injuries can be treated with:
 - PRICE
 - NSAIDs or corticosteroid injections
 - Rehabilitative exercises

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Compartment Syndrome

- Pressure constricts the structures within a compartment resulting in damaged blood vessels
- Left untreated:
 - Nerves can suffer damage
 - Muscles can develop scar tissue and contracture may result

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Plantar Fasciitis

- This is a painful heel condition that results from chronic irritation of the plantar aponeurosis at its origin on the calcaneus
- Treatment includes ice, heat, stretching, weight loss, prosthetics, steroid injections, and/or surgery

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End of Chapter 11

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