HUMAN ANATOMY

THE MUSCULAR SYSTEM

AYDIN ÇÖL

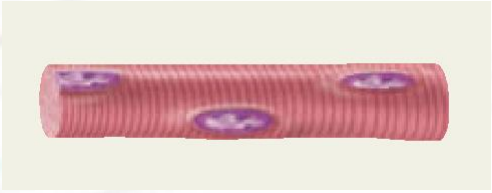
The Muscular System

- Overview of Muscular Tissue
- Types of Muscular Tissue
  - Skeletal Muscle Tissue
    - Contraction and Relaxation of Skeletal Muscle Fibers
    - Control of Muscle Tension
    - Types of Skeletal Muscle Fibers
  - Cardiac Muscle Tissue
  - Smooth Muscle Tissue
- How Skeletal Muscles Produce Movements
- How Skeletal Muscles Are Named
- Principal Skeletal Muscles

Types of Muscular Tissue

Skeletal muscle tissue

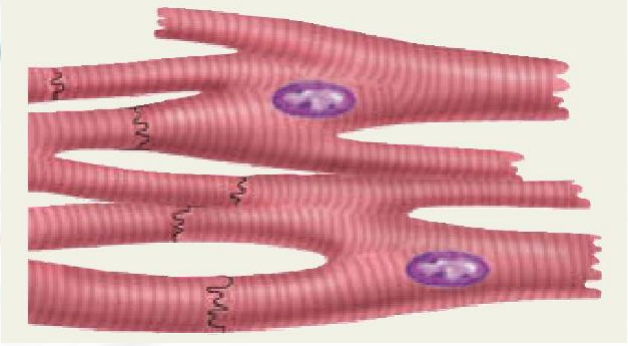
Most skeletal muscles move the bones of the **skeleton**.
Skeletal muscle tissue is **striated**: Alternating light and dark protein bands (striations)
Skeletal muscle tissue works mainly in a **voluntary** manner. Its activity can be **consciously** controlled by Neurons.
Most skeletal muscles also are controlled **subconsciously** to some extent.
You do not need to consciously think about contracting the skeletal muscles that maintain your posture or stabilize body positions.



Types of Muscular Tissue

Cardiac muscle tissue

Only the heart contains cardiac muscle tissue, which forms most of the **heart wall**.
Cardiac muscle is also striated, but its action is **involuntary**.
The alternating contraction and relaxation of the heart is **not consciously** controlled.



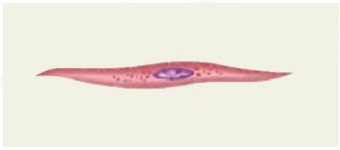
Types of Muscular Tissue

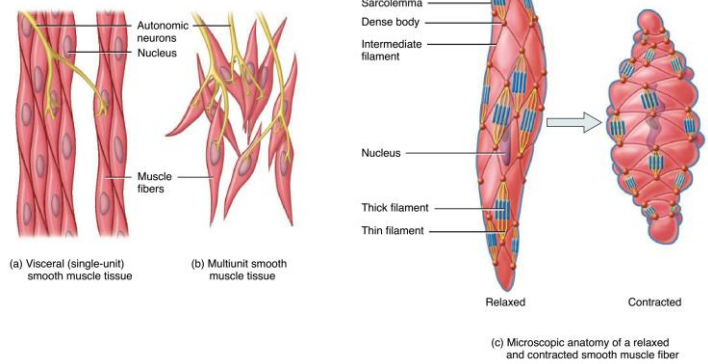
Smooth muscle tissue

It is located in the walls of hollow **internal** structures, such as blood vessels, airways, and most organs in the abdominopelvic cavity. It is also found in the skin, attached to hair follicles.

Under a microscope, this tissue lacks the striations of skeletal and cardiac muscle tissue. For this reason, it looks nonstriated, which is why it is referred to as smooth.

The action of smooth muscle is usually involuntary and some smooth muscle tissue has autorhythmicity.





Functions of Muscular Tissue

Through sustained contraction or alternating contraction and relaxation, muscular tissue has four key functions:

1. Producing body movements.
2. Stabilizing body positions.
3. Storing and moving substances within the body.
4. Generating heat.

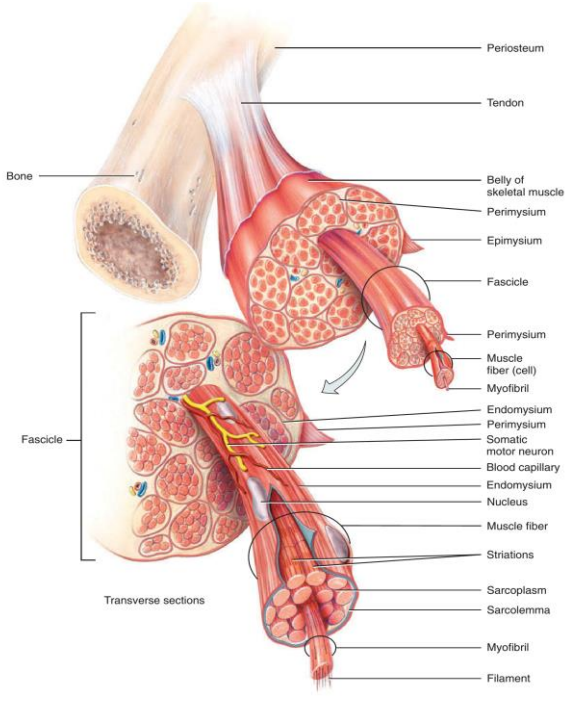
Properties of Muscular Tissue

Muscular tissue has four special properties that enable it to function and contribute to homeostasis:

1. Electrical excitability
2. Contractility
3. Extensibility
4. Elasticity

Skeletal Muscle Tissue

Each of your skeletal muscles is a separate organ composed of hundreds to thousands of cells, which are called muscle fibers because of their elongated shapes.
Thus, muscle cell and muscle fiber are two terms for the same structure.
Skeletal muscle also contains connective tissues surrounding muscle fibers and whole muscles, and blood vessels and nerves.



Components of a skeletal muscle

Skeletal Muscle Tissue

Connective tissue surrounds and protects muscular tissue.
The subcutaneous layer or hypodermis, which separates muscle from skin, is composed of **areolar connective tissue** and **adipose** tissue.
It provides a pathway for nerves, blood vessels, and lymphatic vessels to enter and exit muscles.
Fascia is a dense sheet or broad band of irregular connective tissue that lines the body wall and limbs and supports and surrounds muscles and other organs of the body.
As you will see, fascia holds muscles with similar functions together.
Fascia allows free movement of muscles; carries nerves, blood vessels, and lymphatic vessels; and fills spaces between muscles.

Skeletal Muscle Tissue

Three layers of connective tissue extend from the fascia to protect and strengthen skeletal muscle

- **Epimysium** (epi-upon) is the outer layer, encircling the entire muscle. It consists of dense irregular connective tissue.
- **Perimysium** (peri-around) is also a layer of dense irregular connective tissue, but it surrounds groups of 10 to 100 or more muscle fibers, separating them into bundles called **fascicles**.

Many fascicles are large enough to be seen with the naked eye.
They give a cut of meat its characteristic “grain”; if you tear a piece of meat, it rips apart along the fascicles.

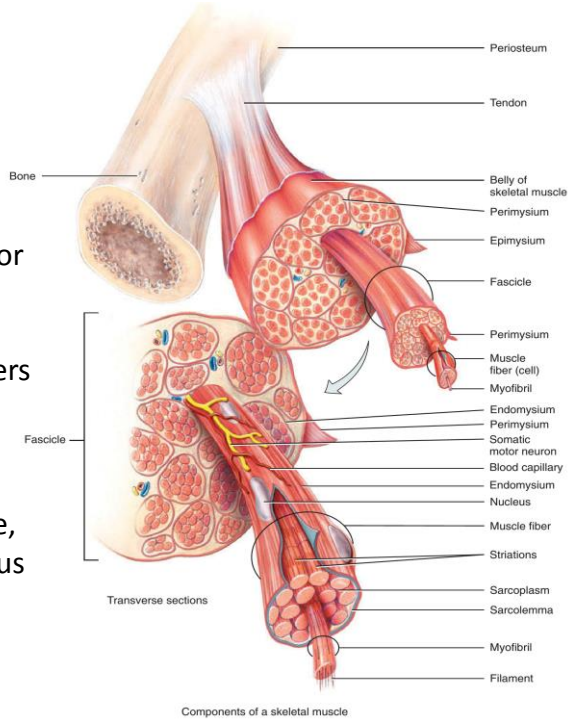
- **Endomysium** (endo-within) penetrates the interior of each fascicle and separates individual muscle fibers from one another. The endomysium is mostly reticular fibers.

Skeletal Muscle Tissue

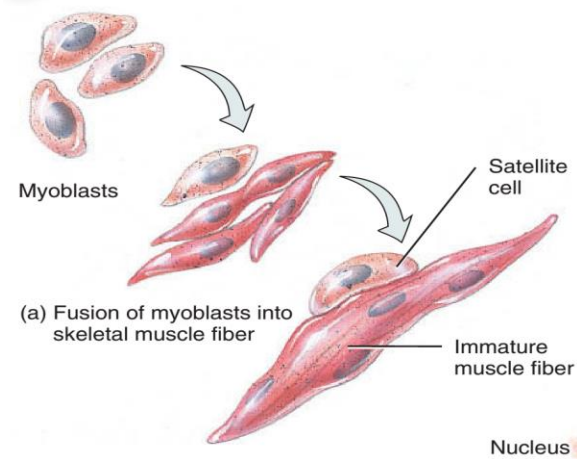
The epimysium, perimysium, and endomysium are all continuous with the connective tissue that attaches skeletal muscle to other structures, such as bone or another muscle.

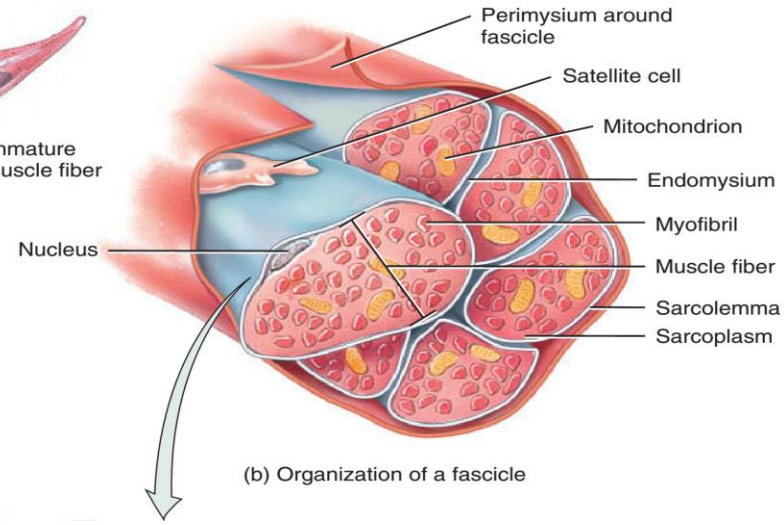
For example, all three connective tissue layers may extend beyond the muscle fibers to form a ropelike tendon that attaches a muscle to the periosteum of a bone.

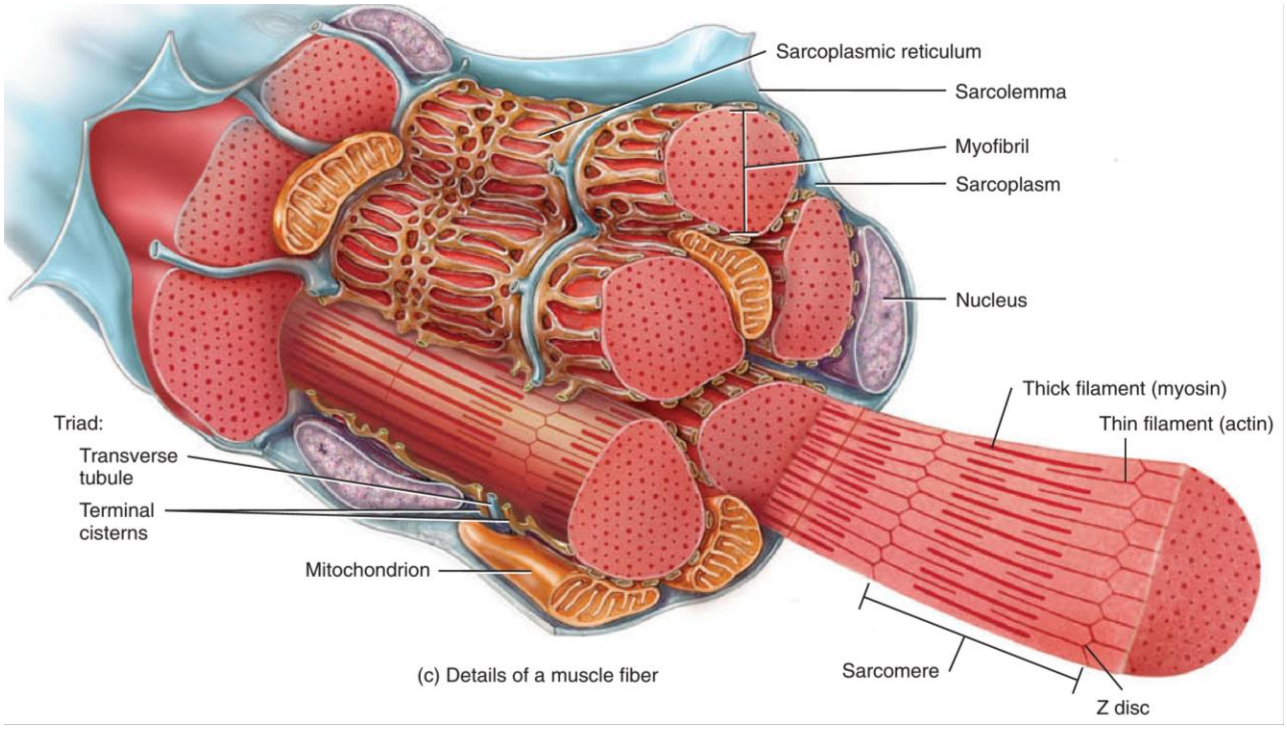
An example is the calcaneal (Achilles) tendon of the gastrocnemius (calf) muscle, which attaches the muscle to the calcaneus (heel bone)

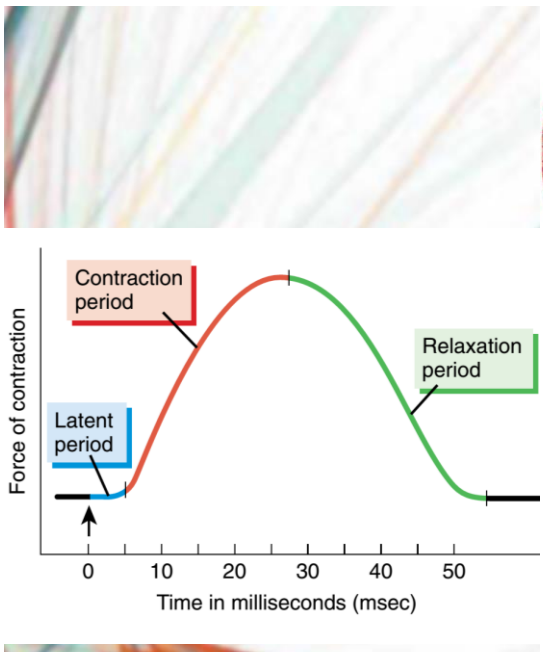


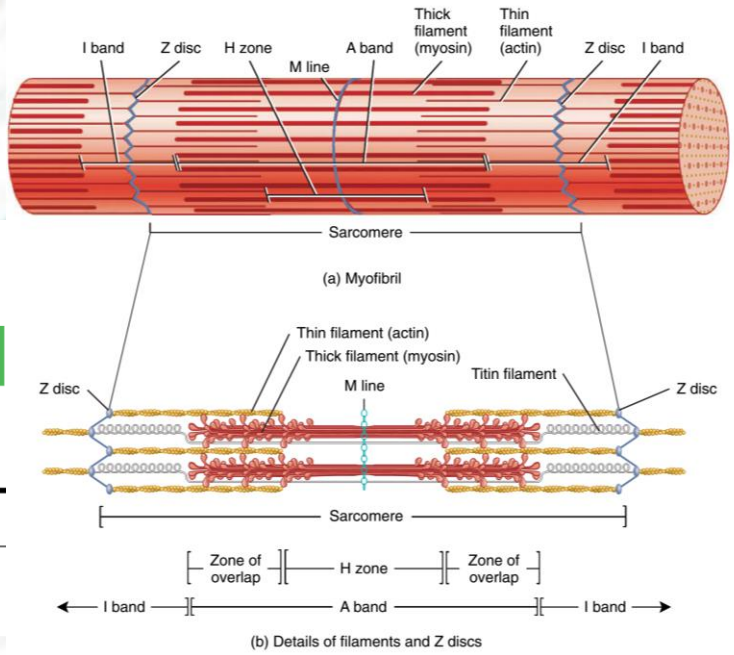
Components of a skeletal muscle

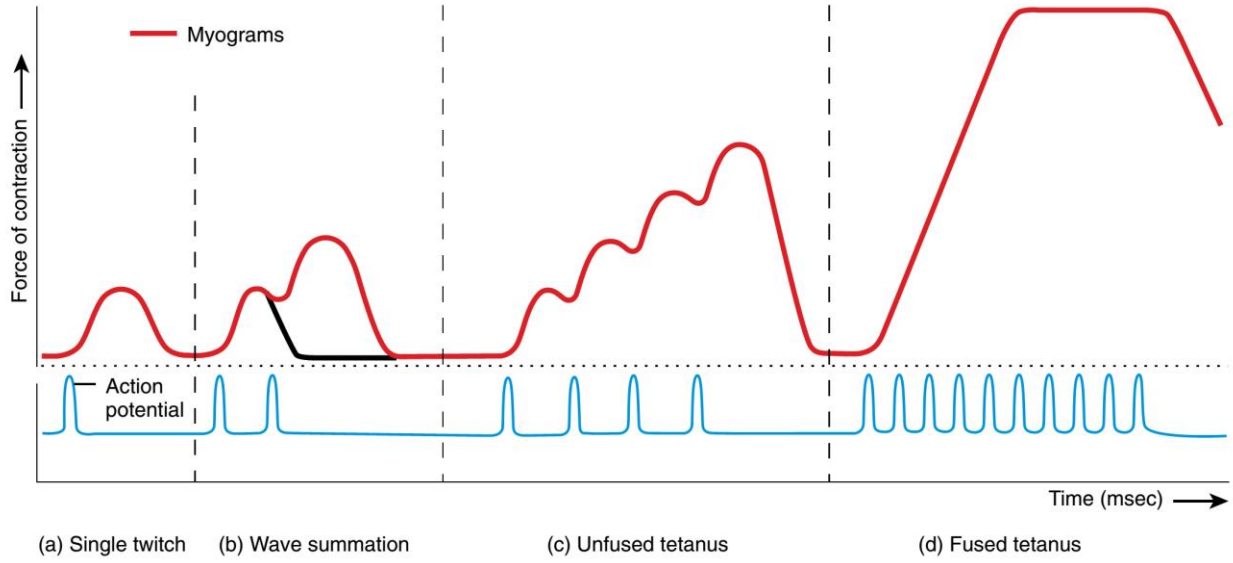





Sarcoplasmic reticulum
Sarcolemma
Myofibril
Sarcoplasm
Nucleus
Thick filament (myosin)
Thin filament (actin)
Triad:
Transverse tubule
Terminal cisterns
Mitochondrion
Sarcomere
Z disc
(c) Details of a muscle fiber

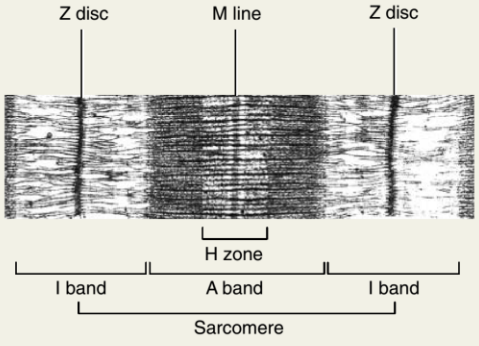

Contraction period
Relaxation period
Latent period
Force of contraction
0
10
20
30
40
50
Time in milliseconds (msec)

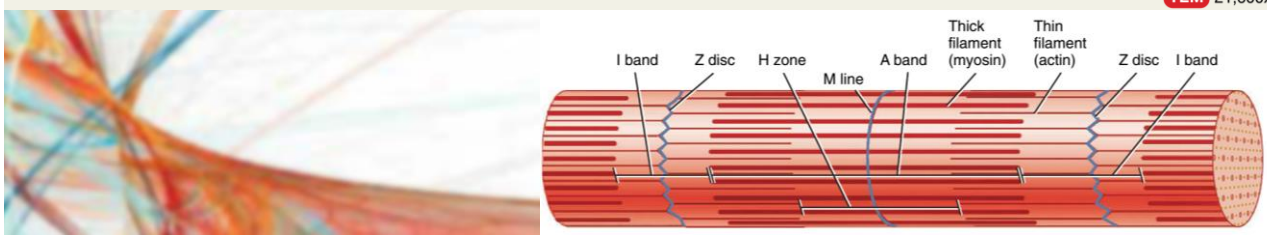

I band
Z disc
H zone
M line
A band
Thick filament (myosin)
Thin filament (actin)
Z disc
I band
Sarcomere
(a) Myofibril
Thin filament (actin)
Thick filament (myosin)
Titin filament
Z disc
M line
Z disc
Sarcomere
Zone of overlap
H zone
Zone of overlap
I band
A band
I band
(b) Details of filaments and Z discs



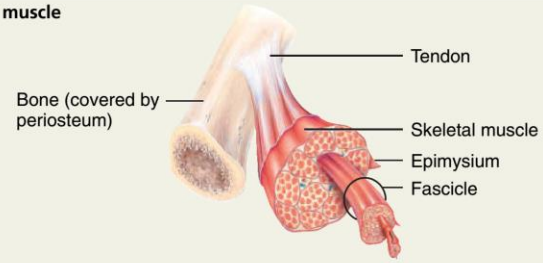
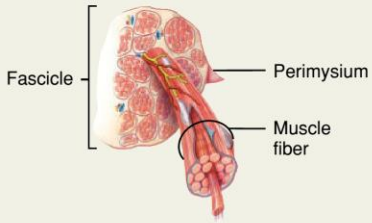
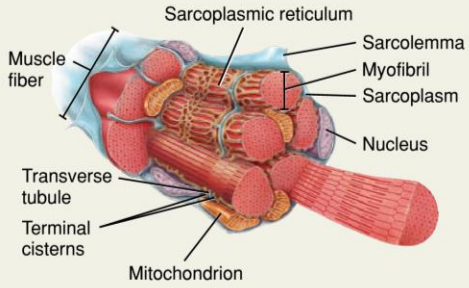
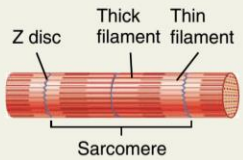
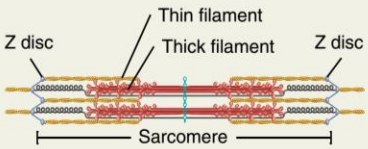
Components of a Sarcomere

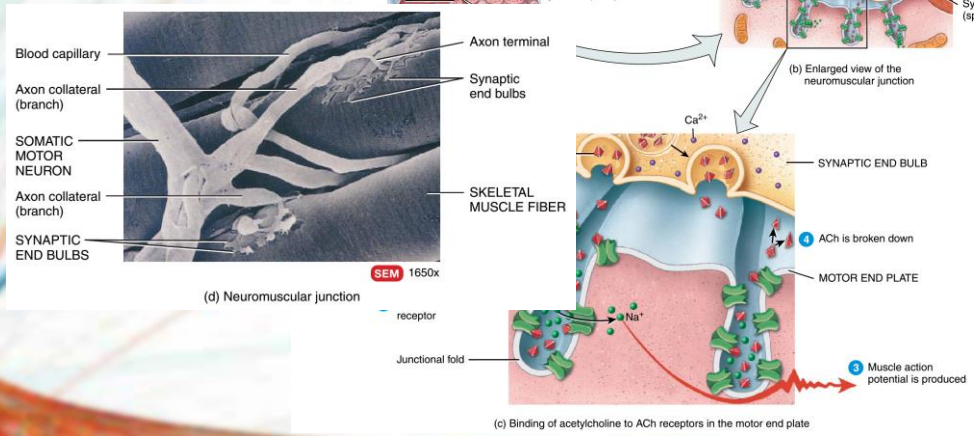
COMPONENT	DESCRIPTION
Z discs	Narrow, plate-shaped regions of dense material that separate one sarcomere from the next.
A band	Dark, middle part of sarcomere that extends entire length of thick filaments and includes those parts of thin filaments that overlap thick filaments.
I band	Lighter, less dense area of sarcomere that contains remainder of thin filaments but no thick filaments. A Z disc passes through center of each I band.
H zone	Narrow region in center of each A band that contains thick filaments but no thin filaments.
M line	Region in center of H zone that contains proteins that hold thick filaments together at center of sarcomere.





Levels of Organization within a Skeletal Muscle

LEVEL	DESCRIPTION
Skeletal muscle 	Organ made up of fascicles that contain muscle fibers (cells), blood vessels, and nerves; wrapped in epimysium.
Fascicle 	Bundle of muscle fibers wrapped in perimysium.
Muscle fiber (cell) 	Long cylindrical cell covered by endomysium and sarcolemma; contains sarcoplasm, myofibrils, many peripherally located nuclei, mitochondria, transverse tubules, sarcoplasmic reticulum, and terminal cisterns. The fiber has a striated appearance.
Myofibril 	Threadlike contractile elements within sarcoplasm of muscle fiber that extend entire length of fiber; composed of filaments.
Filaments (myofilaments) 	Contractile proteins within myofibrils that are of two types: thick filaments composed of myosin and thin filaments composed of actin, tropomyosin, and troponin; sliding of thin filaments past thick filaments produces muscle shortening.



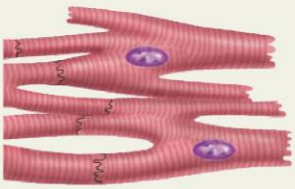
Cardiac Muscle Tissue

The principal tissue in the heart wall is cardiac muscle tissue.
Between the layers of cardiac muscle fibers, the contractile cells of the heart, are sheets of connective tissue that contain blood vessels, nerves, and the conduction system of the heart.
Cardiac muscle fibers have the same arrangement of **actin** and **myosin** and the same bands, zones, and Z discs as skeletal muscle fibers.

Smooth Muscle Tissue

Like cardiac muscle tissue, smooth muscle tissue is usually activated **involuntarily**.
Of the two types of smooth muscle tissue, the more common type is **visceral (single-unit) smooth muscle tissue.**
It is found in the **skin** and in **tubular arrangements** that form part of the walls of small arteries and veins and of hollow organs such as the stomach, intestines, uterus, and urinary bladder.
Like cardiac muscle, visceral smooth muscle is **autorhythmic**.
The second type of smooth muscle tissue, **multiunit smooth muscle tissue.**
Multiunit smooth muscle tissue is found in the **walls of large arteries**, in **airways** to the lungs, in the **arrector pili muscles** that attach to hair follicles, in the **muscles of the iris** that adjust pupil diameter, and in the **ciliary body** that adjusts focus of the lens in the eye.

Summary of the Major Features of the Three Types of Muscular Tissue

CHARACTERISTIC	SKELETAL MUSCLE	CARDIAC MUSCLE	SMOOTH MUSCLE
Microscopic appearance and features	Long cylindrical fiber with many peripherally located nuclei; unbranched; striated. 	Branched cylindrical fiber with one centrally located nucleus; intercalated discs join neighboring fibers; striated. 	Fiber thickest in middle, tapered at each end, and with one centrally positioned nucleus; not striated. 
Location	Most commonly attached by tendons to bones.	Heart.	Walls of hollow viscera, airways, blood vessels, iris and ciliary body of eye, arrector pili muscles of hair follicles.
Fiber diameter	Very large (10–100 μm).	Large (10–20 μm).	Small (3–8 μm).
Connective tissue components	Endomysium, perimysium, and epimysium.	Endomysium and perimysium.	Endomysium.
Fiber length	Very large (100 μm–30 cm = 12 in.).	Large (50–100 μm).	Intermediate (30–200 μm).
Contractile proteins organized into sarcomeres	Yes.	Yes.	No.
Sarcoplasmic reticulum	Abundant.	Some.	Very little.

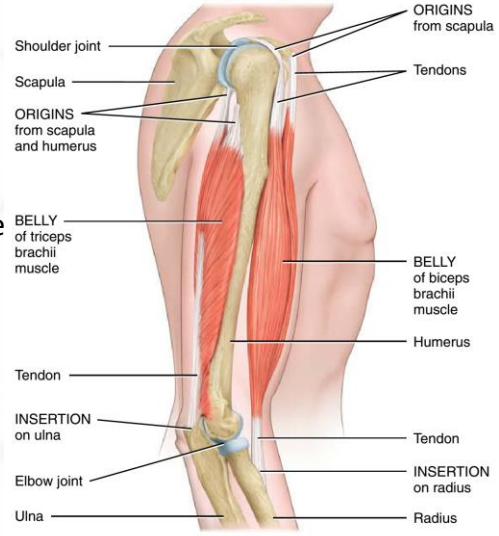
Summary of the Major Features of the Three Types of Muscular Tissue

CHARACTERISTIC	SKELETAL MUSCLE	CARDIAC MUSCLE	SMOOTH MUSCLE
Transverse tubules present	Yes, aligned with each A–I band junction.	Yes, aligned with each Z disc.	No.
Junctions between fibers	None.	Intercalated discs contain gap junctions and desmosomes.	Gap junctions in visceral smooth muscle; none in multiunit smooth muscle.
Autorhythmicity	No.	Yes.	Yes, in visceral smooth muscle.
Source of Ca^{2+} for contraction	Sarcoplasmic reticulum.	Sarcoplasmic reticulum and interstitial fluid.	Sarcoplasmic reticulum and interstitial fluid.
Regulator proteins for contraction	Troponin and tropomyosin.	Troponin and tropomyosin.	Calmodulin and myosin light chain kinase.
Speed of contraction	Fast.	Moderate.	Slow.
Nervous control	Voluntary (somatic nervous system).	Involuntary (autonomic nervous system).	Involuntary (autonomic nervous system).
Contraction regulation	Acetylcholine released by somatic motor neurons.	Acetylcholine and norepinephrine released by autonomic motor neurons; several hormones.	Acetylcholine and norepinephrine released by autonomic motor neurons; several hormones; local chemical changes; stretching.
Capacity for regeneration	Limited, via satellite cells.	Limited, under certain conditions.	Considerable (compared with other muscle tissues, but limited compared with epithelium), via pericytes.

Muscle Attachment Sites: Origin and Insertion

The attachment of a muscle's tendon to the stationary bone is called the **origin**;
The attachment of the muscle's other tendon to the movable bone is called the **insertion**
A good analogy is a spring on a door. In this example, the part of the spring attached to the frame is the origin; the part attached to the door represents the insertion.

Muscles are attached to bones by tendons at their **origins** and **insertions**.
Skeletal muscles produce movements by **pulling** on bones.



(a) Origin and insertion of a skeletal muscle

Coordination among Muscles

Movements often are the result of several skeletal muscles acting as a group.
Most skeletal muscles are arranged in opposing (antagonistic) pairs at joints—that is, flexors–extensors, abductors– adductors, and so on.
Within opposing pairs, one muscle, called the **prime mover** or **agonist** (=leader), contracts to cause an action while the other muscle, the antagonist (anti- =against), stretches and yields to the effects of the prime mover.
In the process of flexing the forearm at the elbow, for instance, the biceps brachii is the prime mover, and the triceps brachii is the antagonist.
The **antagonist** and **prime mover** are usually located on opposite sides of the bone or joint, as is the case in this example.
With an opposing pair of muscles, the roles of the prime mover and antagonist can switch for different movements.
For example, while extending the forearm at the elbow against resistance, the triceps brachii becomes the prime mover, and the biceps brachii is the antagonist.
If a prime mover and its antagonist contract at the same time with equal force, there will be no movement.

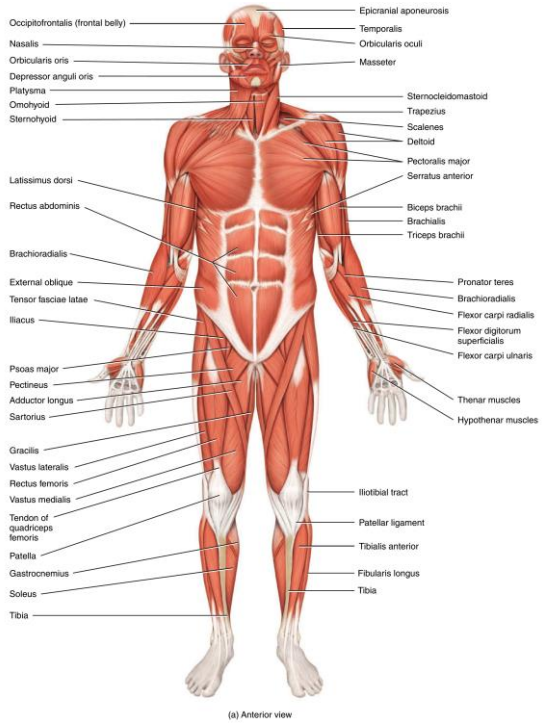
Skeletal Muscles Naming

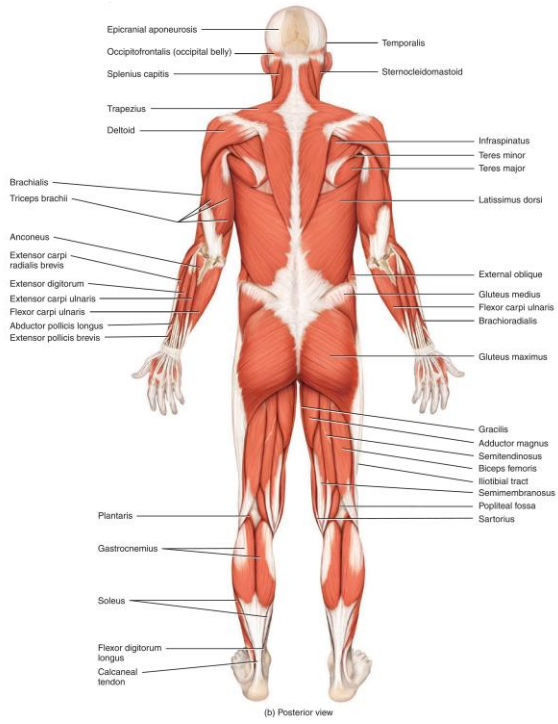
The names of most of the skeletal muscles contain combinations of the word roots of their distinctive features.
This works two ways.
You can learn the names of muscles by remembering the terms that refer to muscle features, such as

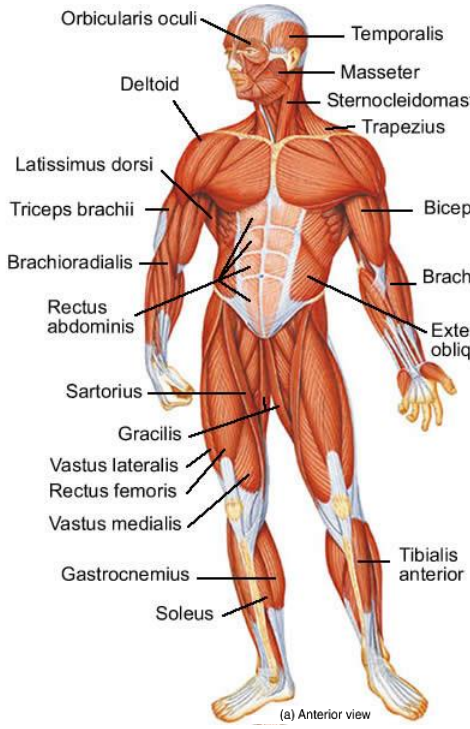
- the pattern of the muscle's fascicles;
- the size,
- shape,
- action,
- number of origins, and
- location of the muscle; and
- the sites of origin and insertion of the muscle.

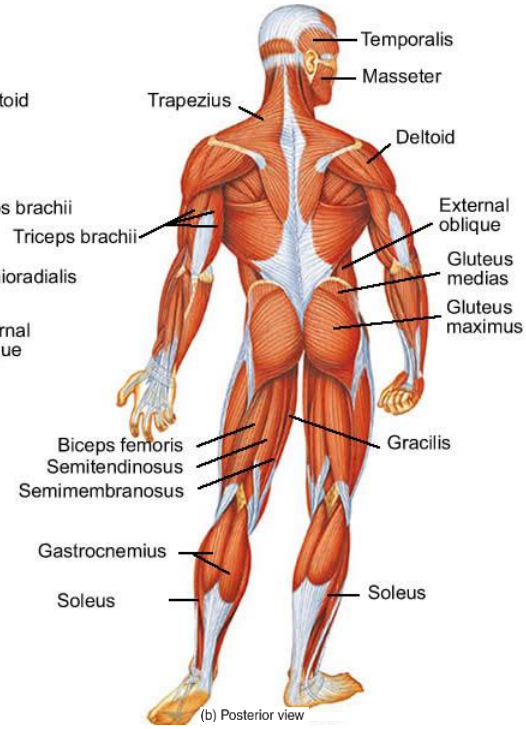
Knowing the names of a muscle will then give you clues about its features.

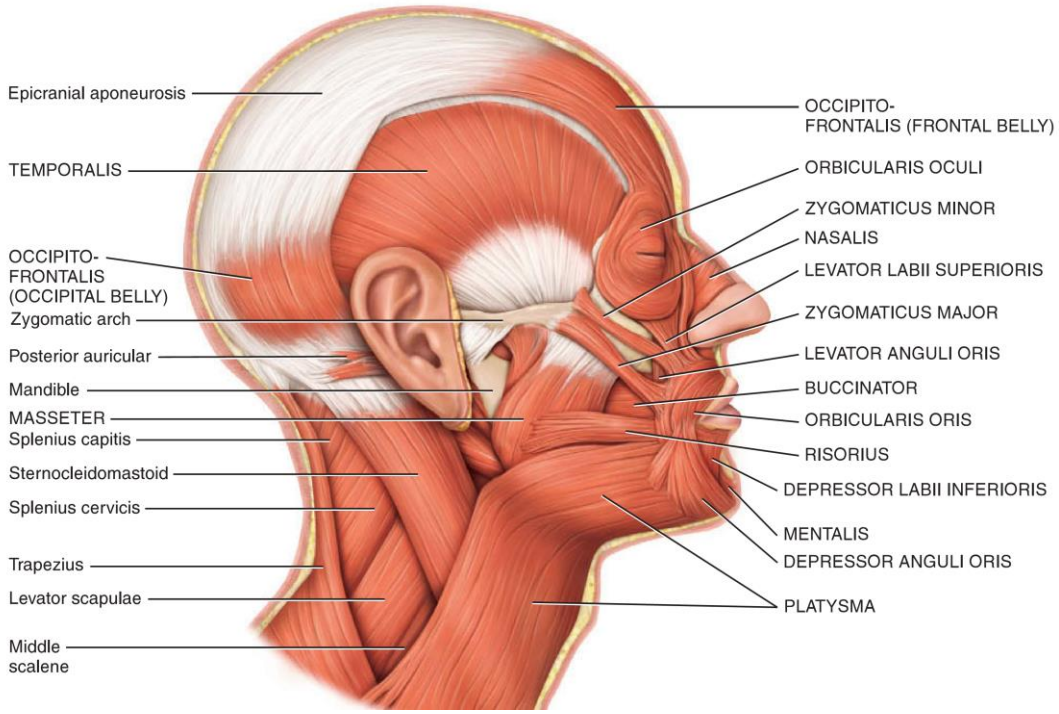
NAME	MEANING	EXAMPLE
DIRECTION: Orientation of muscle fascicles relative to the body's midline		
Rectus	Parallel to midline	Rectus abdominis
Transverse	Perpendicular to midline	Transversus abdominis
Oblique	Diagonal to midline	External oblique
SIZE: Relative size of the muscle		
Maximus	Largest	Gluteus maximus
Minimus	Smallest	Gluteus minimus
Longus	Long	Adductor longus
Brevis	Short	Adductor brevis
Latissimus	Widest	Latissimus dorsi
Longissimus	Longest	Longissimus capitis
Magnus	Large	Adductor magnus
Major	Larger	Pectoralis major
Minor	Smaller	Pectoralis minor
Vastus	Huge	Vastus lateralis
SHAPE: Relative shape of the muscle		
Deltoid	Triangular	Deltoid
Trapezius	Trapezoid	Trapezius
Serratus	Saw-toothed	Serratus anterior
Rhomboid	Diamond-shaped	Rhomboid major
Orbicularis	Circular	Orbicularis oculi
Pectinate	Combline	Pectineus
Piriformis	Pear-shaped	Piriformis
Platys	Flat	Platysma
Quadratus	Square, four-sided	Quadratus femoris
Gracilis	Slender	Gracilis
ACTION: Principal action of the muscle		
Flexor	Decreases joint angle	Flexor carpi radialis
Extensor	Increases joint angle	Extensor carpi ulnaris
Abductor	Moves bone away from midline	Abductor pollicis longus
Adductor	Moves bone closer to midline	Adductor longus
Levator	Raises or elevates body part	Levator scapulae
Depressor	Lowers or depresses body part	Depressor labii inferioris
Supinator	Turns palm anteriorly	Supinator
Pronator	Turns palm posteriorly	Pronator teres
Sphincter	Decreases size of an opening	External anal sphincter
Tensor	Makes body part rigid	Tensor fasciae latae
Rotator	Rotates bone around longitudinal axis	Rotatore
NUMBER OF ORIGINS: Number of tendons of origin		
Biceps	Two origins	Biceps brachii
Triceps	Three origins	Triceps brachii
Quadriceps	Four origins	Quadriceps femoris
LOCATION: Structure near which a muscle is found		
Example: Temporalis, muscle near temporal bone.		
ORIGIN AND INSERTION: Sites where muscle originates and inserts		
Example: Sternocleidomastoid, originating on sternum and clavicle and inserting on mastoid process of temporal bone.		

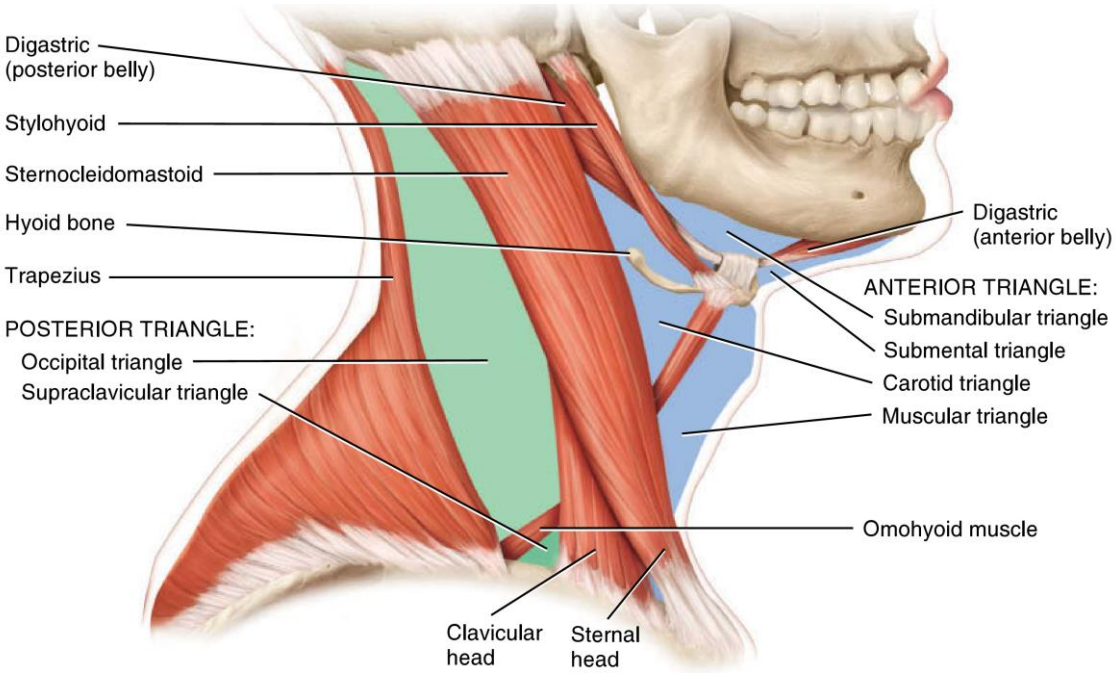

Occipitofrontalis (frontal belly)
Nasalis
Orbicularis oris
Depressor anguli oris
Platysma
Omohyoid
Sternohyoid
Latissimus dorsi
Rectus abdominis
Brachioradialis
External oblique
Tensor fasciae latae
Iliacus
Psoas major
Pectineus
Adductor longus
Sartorius
Gracilis
Vastus lateralis
Rectus femoris
Vastus medialis
Tendon of quadriceps femoris
Patella
Gastrocnemius
Soleus
Tibia
Epicranial aponeurosis
Temporalis
Orbicularis oculi
Masseter
Sternocleidomastoid
Trapezius
Scalenes
Deltoid
Pectoralis major
Serratus anterior
Biceps brachii
Brachialis
Triceps brachii
Pronator teres
Brachioradialis
Flexor carpi radialis
Flexor digitorum superficialis
Flexor carpi ulnaris
Thenar muscles
Hypothenar muscles
Iliotibial tract
Patellar ligament
Tibialis anterior
Fibularis longus
Tibia
(a) Anterior view


Epicranial aponeurosis
Occipitofrontalis (occipital belly)
Splenius capitis
Trapezius
Deltoid
Brachialis
Triceps brachii
Anconeus
Extensor carpi radialis brevis
Extensor digitorum
Extensor carpi ulnaris
Flexor carpi ulnaris
Abductor pollicis longus
Extensor pollicis brevis
Temporalis
Sternocleidomastoid
Infraspinatus
Teres minor
Teres major
Latissimus dorsi
External oblique
Gluteus medius
Flexor carpi ulnaris
Brachioradialis
Gluteus maximus
Gracilis
Adductor magnus
Semitendinosus
Biceps femoris
Iliotibial tract
Semimembranosus
Popliteal fossa
Sartorius
Plantaris
Gastrocnemius
Soleus
Flexor digitorum longus
Calcaneal tendon
(b) Posterior view

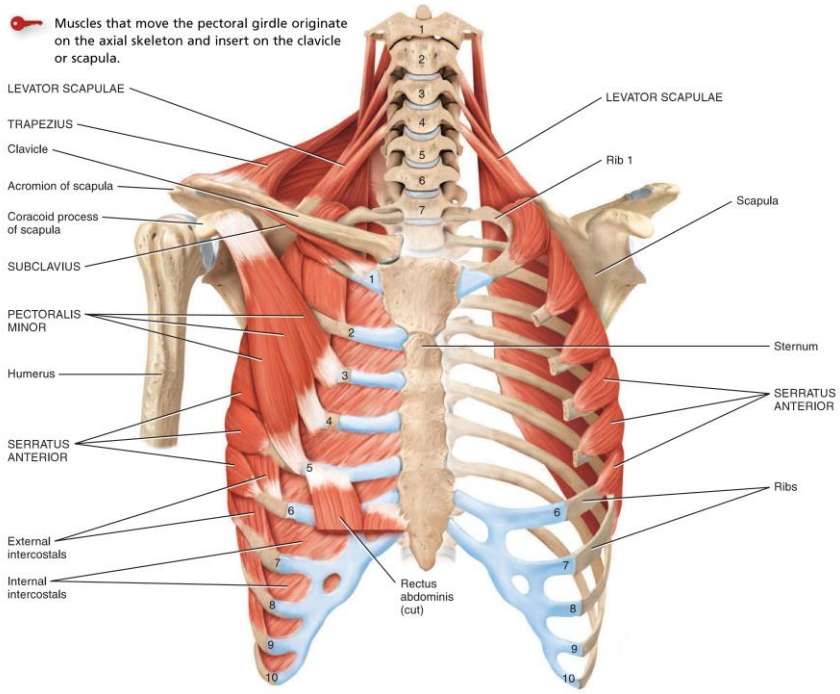

Orbicularis oculi
Temporalis
Masseter
Deltoid
Sternocleidomastoid
Trapezius
Latissimus dorsi
Triceps brachii
Biceps brachii
Brachioradialis
Brachioradialis
Rectus abdominis
External oblique
Sartorius
Gracilis
Vastus lateralis
Rectus femoris
Vastus medialis
Tibialis anterior
Gastrocnemius
Soleus
(a) Anterior view

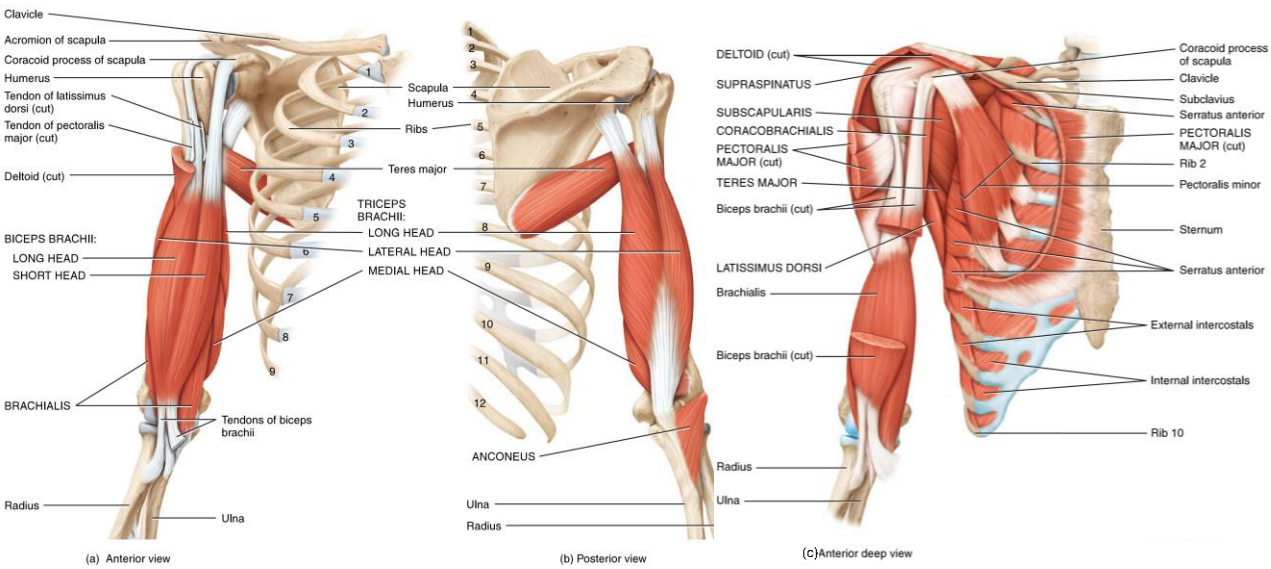

Temporalis
Masseter
Trapezius
Deltoid
Triceps brachii
External oblique
Gluteus medias
Gluteus maximus
Biceps femoris
Semitendinosus
Semimembranosus
Gracilis
Gastrocnemius
Soleus
Soleus
(b) Posterior view

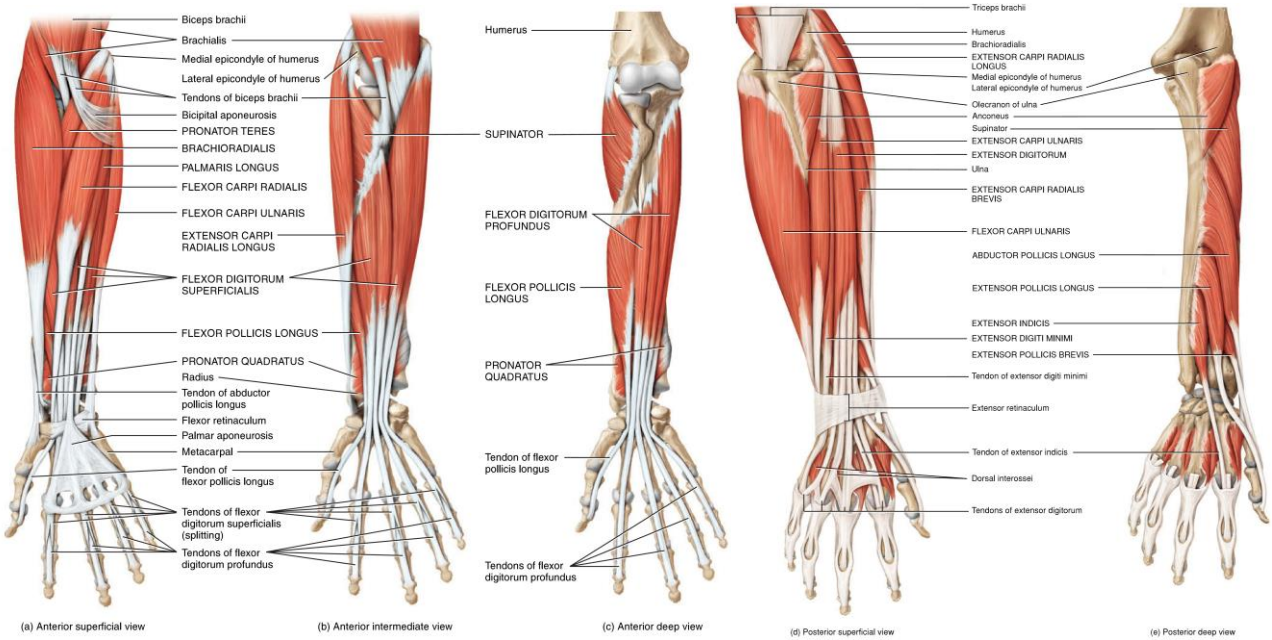


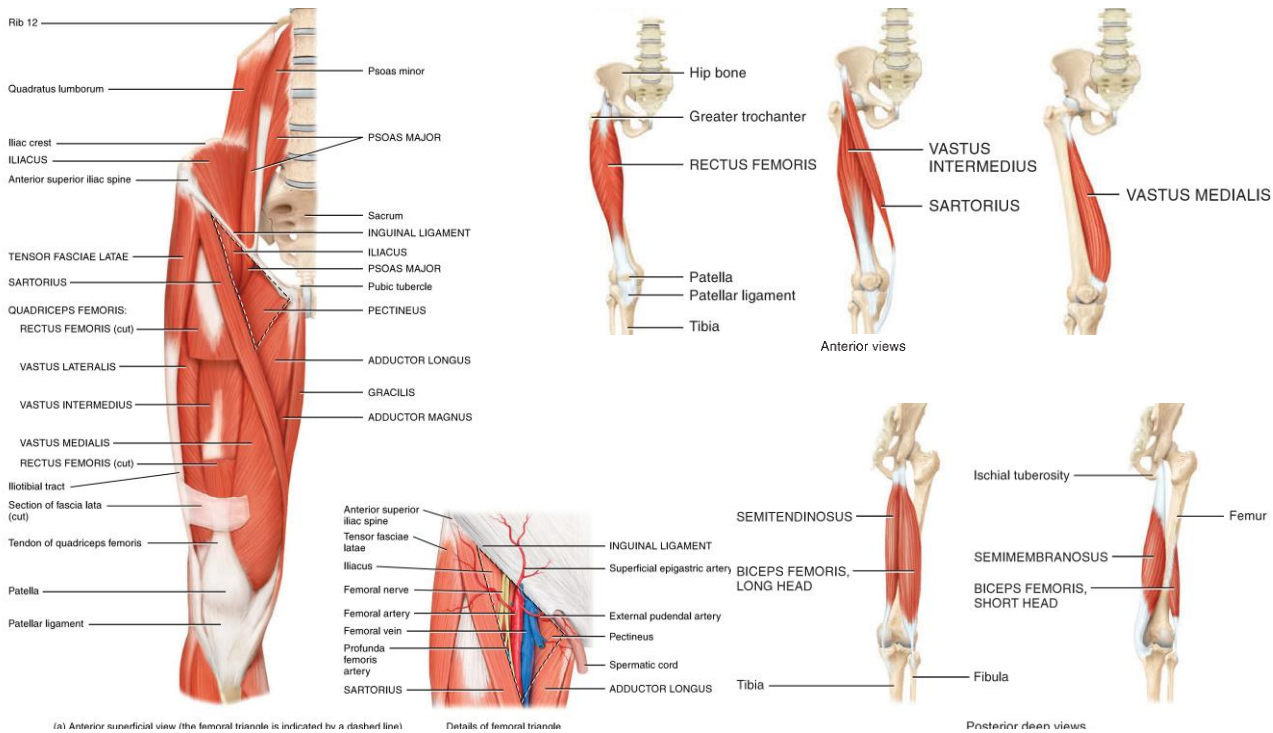


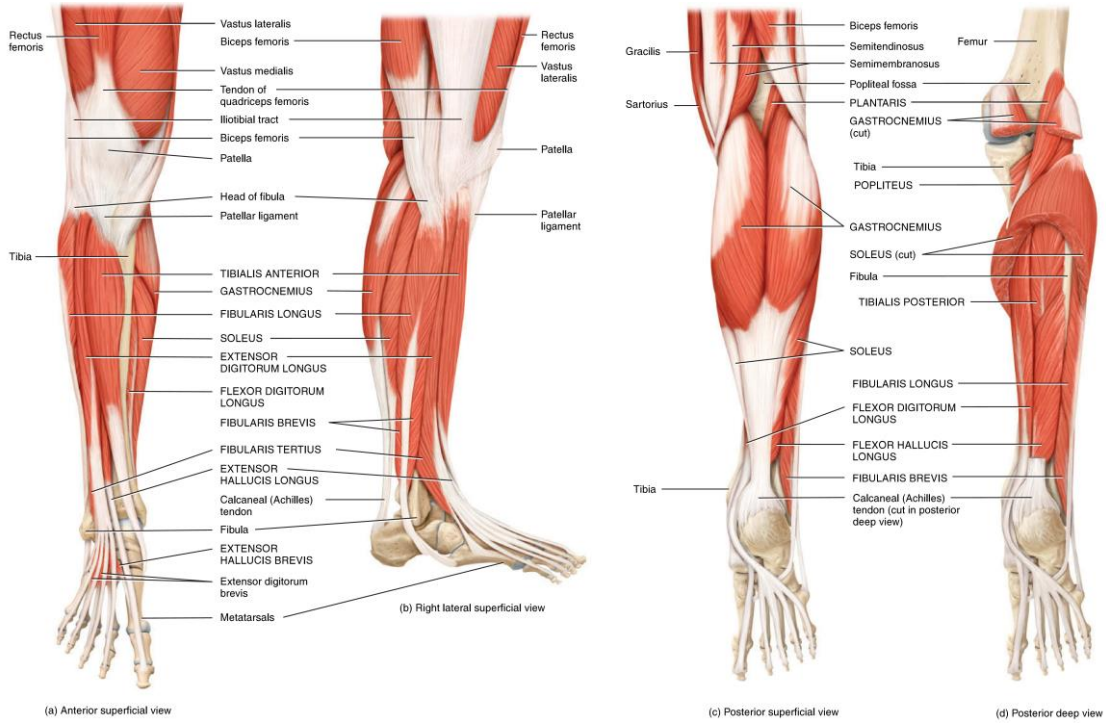
(c) Right lateral view of triangles of neck


Muscles that move the pectoral girdle originate on the axial skeleton and insert on the clavicle or scapula.
LEVATOR SCAPULAE
TRAPEZIUS
Clavicle
Acromion of scapula
Coracoid process of scapula
SUBCLAVIUS
PECTORALIS MINOR
Humerus
SERRATUS ANTERIOR
External intercostals
Internal intercostals
LEVATOR SCAPULAE
Rib 1
Scapula
Sternum
SERRATUS ANTERIOR
Ribs
Rectus abdominis (cut)
(a) Anterior deep view
(b) Anterior deeper view


Clavicle
Acromion of scapula
Coracoid process of scapula
Humerus
Tendon of latissimus dorsi (cut)
Tendon of pectoralis major (cut)
Deltoid (cut)
BICEPS BRACHII:
LONG HEAD
SHORT HEAD
BRACHIALIS
Tendons of biceps brachii
Radius
Ulna
(a) Anterior view
Scapula
Humerus
Ribs
Teres major
TRICEPS BRACHII:
LONG HEAD
LATERAL HEAD
MEDIAL HEAD
ANCONEUS
Ulna
Radius
(b) Posterior view
DELTOID (cut)
SUPRASPINATUS
SUBSCAPULARIS
CORACOBRACHIALIS
PECTORALIS MAJOR (cut)
TERES MAJOR
Biceps brachii (cut)
LATISSIMUS DORSI
Brachialis
Biceps brachii (cut)
Radius
Ulna
Coracoid process of scapula
Clavicle
Subclavius
Serratus anterior
PECTORALIS MAJOR (cut)
Rib 2
Pectoralis minor
Sternum
Serratus anterior
External intercostals
Internal intercostals
Rib 10
(c) Anterior deep view


Biceps brachii
Brachialis
Medial epicondyle of humerus
Lateral epicondyle of humerus
Tendons of biceps brachii
Bicipital aponeurosis
PRONATOR TERES
BRACHIORADIALIS
PALMARIS LONGUS
FLEXOR CARPI RADIALIS
FLEXOR CARPI ULNARIS
EXTENSOR CARPI RADIALIS LONGUS
FLEXOR DIGITORUM SUPERFICIALIS
FLEXOR POLLICIS LONGUS
PRONATOR QUADRATUS
Radius
Tendon of abductor pollicis longus
Flexor retinaculum
Palmar aponeurosis
Metacarpal
Tendon of flexor pollicis longus
Tendons of flexor digitorum superficialis (splitting)
Tendons of flexor digitorum profundus
(a) Anterior superficial view
(b) Anterior intermediate view
Humerus
SUPINATOR
FLEXOR DIGITORUM PROFUNDUS
FLEXOR POLLICIS LONGUS
PRONATOR QUADRATUS
Tendon of flexor pollicis longus
Tendons of flexor digitorum profundus
(c) Anterior deep view
Triceps brachii
Humerus
Brachioradialis
EXTENSOR CARPI RADIALIS LONGUS
Medial epicondyle of humerus
Lateral epicondyle of humerus
Olecranon of ulna
Anconeus
Supinator
EXTENSOR CARPI ULNARIS
EXTENSOR DIGITORUM
Ulna
EXTENSOR CARPI RADIALIS BREVIS
FLEXOR CARPI ULNARIS
ABDUCTOR POLLICIS LONGUS
EXTENSOR POLLICIS LONGUS
EXTENSOR INDICIS
EXTENSOR DIGITI MINIMI
EXTENSOR POLLICIS BREVIS
Tendon of extensor digiti minimi
Extensor retinaculum
Tendon of extensor indicis
Dorsal interossei
Tendons of extensor digitorum
(d) Posterior superficial view
(e) Posterior deep view


Rib 12
Quadratus lumborum
Iliac crest
ILIACUS
Anterior superior iliac spine
TENSOR FASCIAE LATAE
SARTORIUS
QUADRICEPS FEMORIS:
RECTUS FEMORIS (cut)
VASTUS LATERALIS
VASTUS INTERMEDIUS
VASTUS MEDIALIS
RECTUS FEMORIS (cut)
Iliotibial tract
Section of fascia lata (cut)
Tendon of quadriceps femoris
Patella
Patellar ligament
Psoas minor
PSOAS MAJOR
Sacrum
INGUINAL LIGAMENT
ILIACUS
PSOAS MAJOR
Pubic tubercle
PECTINEUS
ADDUCTOR LONGUS
GRACILIS
ADDUCTOR MAGNUS
(a) Anterior superficial view (the femoral triangle is indicated by a dashed line)
Anterior superior iliac spine
Tensor fasciae latae
Iliacus
Femoral nerve
Femoral artery
Femoral vein
Profunda femoris artery
SARTORIUS
INGUINAL LIGAMENT
Superficial epigastric artery
External pudendal artery
Pectineus
Spermatic cord
ADDUCTOR LONGUS
Details of femoral triangle
Hip bone
Greater trochanter
RECTUS FEMORIS
Patella
Patellar ligament
Tibia
VASTUS INTERMEDIUS
SARTORIUS
VASTUS MEDIALIS
Anterior views
SEMITENDINOSUS
BICEPS FEMORIS, LONG HEAD
Tibia
Ischial tuberosity
Femur
SEMIMEMBRANOSUS
BICEPS FEMORIS, SHORT HEAD
Fibula
Posterior deep views


Rectus femoris
Vastus lateralis
Biceps femoris
Vastus medialis
Tendon of quadriceps femoris
Iliotibial tract
Biceps femoris
Patella
Head of fibula
Patellar ligament
Tibia
TIBIALIS ANTERIOR
GASTROCNEMIUS
FIBULARIS LONGUS
SOLEUS
EXTENSOR DIGITORUM LONGUS
FLEXOR DIGITORUM LONGUS
FIBULARIS BREVIS
FIBULARIS TERTIUS
EXTENSOR HALLUCIS LONGUS
Calcaneal (Achilles) tendon
Fibula
EXTENSOR HALLUCIS BREVIS
Extensor digitorum brevis
Metatarsals
(a) Anterior superficial view
Rectus femoris
Vastus lateralis
Patella
Patellar ligament
(b) Right lateral superficial view
Gracilis
Sartorius
Biceps femoris
Semitendinosus
Semimembranosus
Popliteal fossa
PLANTARIS
GASTROCNEMIUS (cut)
Tibia
POPLITEUS
GASTROCNEMIUS
SOLEUS (cut)
Fibula
TIBIALIS POSTERIOR
SOLEUS
FIBULARIS LONGUS
FLEXOR DIGITORUM LONGUS
FLEXOR HALLUCIS LONGUS
FIBULARIS BREVIS
Tibia
Calcaneal (Achilles) tendon (cut in posterior deep view)
(c) Posterior superficial view
Femur
(d) Posterior deep view

QUESTIONS?


HAVE A
WONDERFUL
DAY
Thank you for being my students!