

# MUSCULAR SYSTEM



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## Function of Muscles

- Produce movement
- Maintain posture
- Stabilize joints
- Generate heat

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## The Muscular System

- 3 muscle types
  - Skeletal muscle
  - Cardiac muscle
  - Smooth muscle

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## Skeletal Muscle Characteristics

- Most are attached by tendons to bones
- Cells are multinucleate
- Striated - visible banding
- Voluntary - conscious control
- Many mitochondria present
- Cells are surrounded & bundled by connective tissue

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## Connective Tissue Wrappings

- Endomysium – surrounds single muscle fiber (muscle cell)
- Fascicle – bundle of fibers
- Perimysium – surrounds a fascicle
- Epimysium – covers the entire skeletal muscle
- Fascia – on the outside of the epimysium

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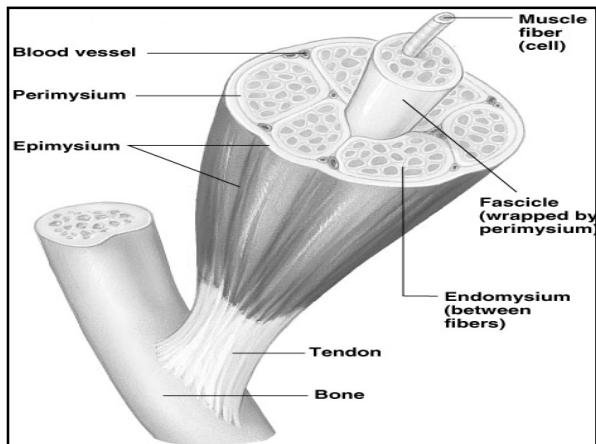
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## Skeletal Muscle Attachments

- Epimysium blends into a connective tissue attachment
  - Tendon – cord-like structure
  - Aponeuroses – sheet-like structure
- Sites of muscle attachment
  - Bones
  - Cartilages
  - Connective tissue

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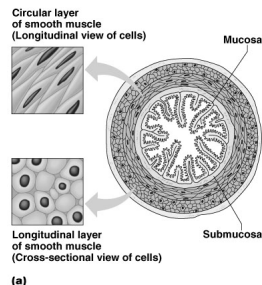
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## Smooth Muscle Characteristics

- No striations
- Spindle-shaped cells
- Single nucleus
- Involuntary – no conscious control
- Found mainly in the walls of hollow organs; intestines, artery




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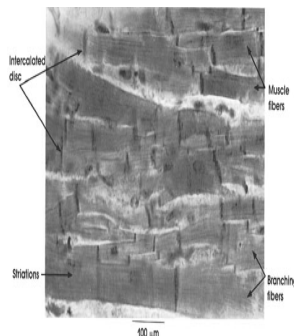
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## Cardiac Muscle Characteristics

- Has striations
- Usually has a single nucleus
- Joined to another cell at intercalated disc
- Involuntary
- Only in the heart




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## Microscopic Anatomy of Skeletal Muscle

- Sarcolemma – plasma membrane
- Nuclei just beneath sarcolemma
- Sarcoplasmic reticulum –smooth ER; regulates Ca ion conc.
- Sarcomere -contractile unit of muscle fiber
- Myofibril -Bundles of myofilaments

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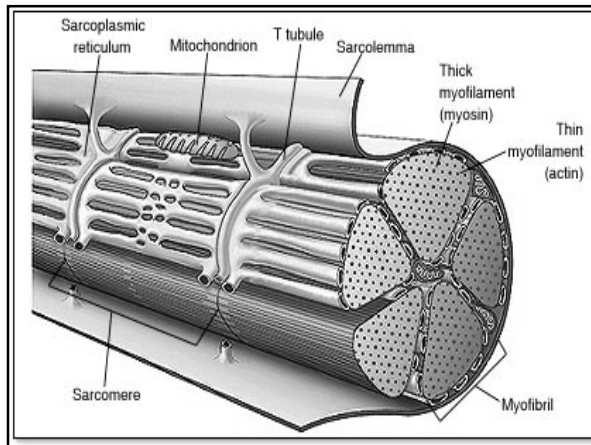
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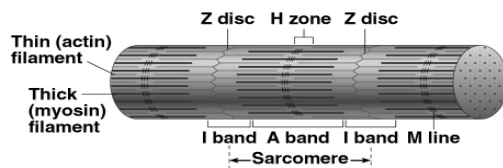
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## Microscopic Anatomy of Skeletal Muscle

- Myofibrils of sarcomere are aligned to form bands
- I band = light bands made of ACTIN
- A band = dark band made of MYOSIN




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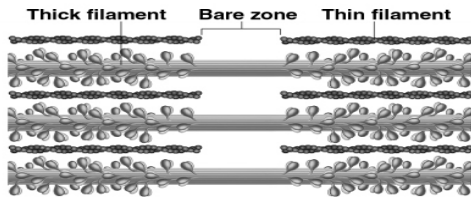
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### Microscopic Anatomy of Skeletal Muscle

- Myosin filaments have heads and form cross bridges with actin
- Myosin & actin overlap



**(d) Myofilament structure (within one sarcomere)**

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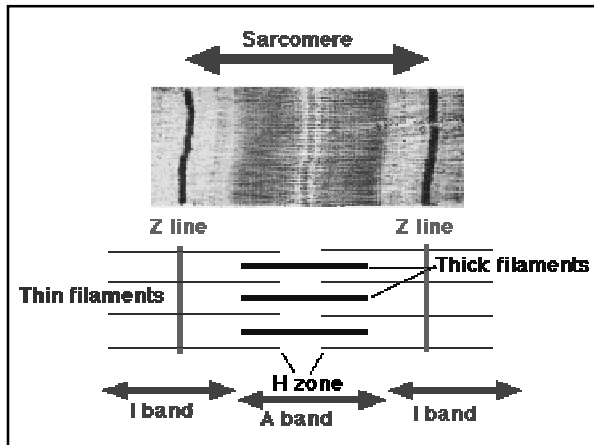
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### Nerve Stimulus to Muscles

- Muscles must be stimulated by nerve to contract
- Neuromuscular junctions – site of nerve & muscle interaction
- Synaptic cleft – gap between nerve & muscle
  - Nerve & muscle do not make contact
  - Neurotransmitters are released between

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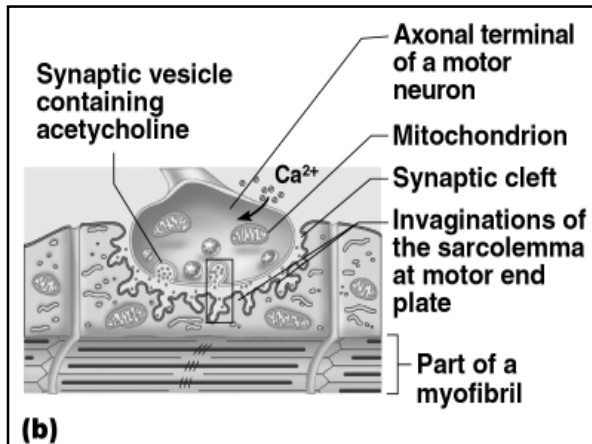
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**Transmission of Nerve Impulse to Muscle**

- Neurotransmitter – chemical released by nerve
  - The neurotransmitter for skeletal muscle is **acetylcholine**
- Neurotransmitter attaches to receptors on the sarcolemma
- Sarcolemma becomes permeable to sodium ( $\text{Na}^+$ )

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**Naming of Skeletal Muscles**

- Direction of muscle fibers
  - Example: *rectus* (straight)
- Relative size of the muscle
  - Example: *maximus* (largest)
- Location of the muscle
  - Example: muscles named for bones (*temporalis*)
- Number of origins
  - Example: *triceps* (3 heads)

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## Naming of Skeletal Muscles

- Location of the muscles origin & insertion
  - Example: *sterno* (on the sternum)
- Shape of the muscle
  - Example: *deltoid* (triangular)
- Action of the muscle
  - Example: *flexor* & *extensor*

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## FYI

- ~640 muscles in body
- Body weight is about 40% muscle
- 72 muscles used to speak
- Largest is gluteus maximus
- Strongest is masseter

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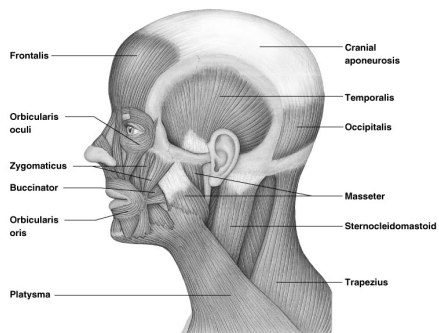
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## Head and Neck Muscles



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**Head Muscles**

- Frontalis –over frontal bone; raises eyebrows & wrinkles forehead
- Orbicularis oculi – circles eyes; blink, squint, wink
- Orbicularis oris – circles mouth; kissing muscle
- Buccinator – cheek muscle; used in whistle, blow horn, chew
- Zygomaticus – from cheeks to corner of mouth; smiling muscle

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**Chewing Muscles**

- Masseter – major chewing muscle (mastication)
- Temporalis – fan shaped above temporal

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**Neck Muscles**

- Platysma – thin sheet covering neck down to chest
- Sternocleidomastoid – found on side of neck;when both contract head bows. Prayer muscle

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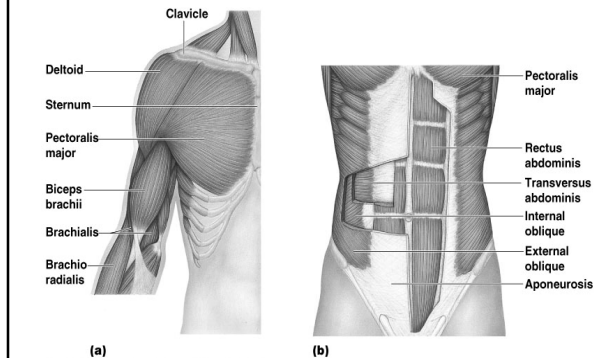
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## Trunk Muscles




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## Trunk Muscles

- Pectoralis major – covers upper chest
- Pectoral minor- below major
- Intercostal – found between ribs
- Serratus anterior – rotation movement
- Rectus abdominis – (6 pack) straight anterior bands
- External oblique – lateral walls of abdomen
- Internal oblique – behind external oblique
- Transverse abdominis – deepest muscle

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## Posterior Trunk Muscles

- Trapezius – triangular muscle from base of neck to shoulder to vertebrae
- Latissimus dorsi – large, flat muscle covering lower back
- Levator scapula – raises scapula
- Rhomboid major – retracts scapula
- Rhomboid minor - “ “
- Supraspinatus – shoulder joint /humerus movemnt
- Infraspinatus - “ “ “ “
- Deltoid – form rounded shoulders

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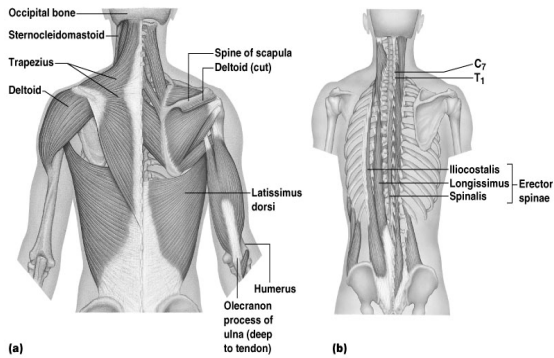


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## Deep Trunk and Arm Muscles




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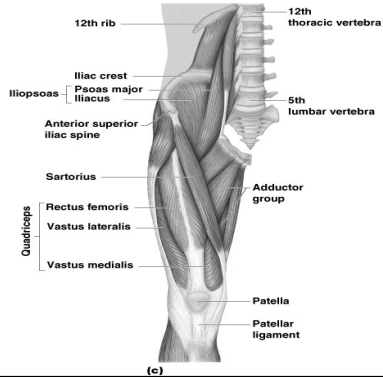
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## Muscles of the Pelvis, Hip, and Thigh




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## Muscle of lower limbs

- Gluteus maximus – buttocks
- Gluteus medius – from ilium to femur
- Hamstring group (posterior)
  - Biceps femoris
  - Semimembranosus
  - Semitendinosus
- Sartorius – oblique strap over femur
- Gracilis – inner thigh muscle
- Quadriceps group (anterior)
  - Rectus femoris
  - Vastus muscles – (lateralis, medialis)

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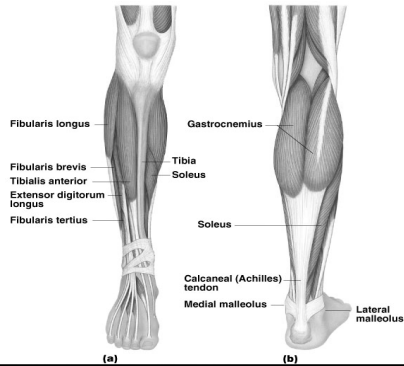
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## Muscles of the Lower Leg




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## Muscles of the Lower Leg

- Gastrocnemius - calf muscle
- Soleus – from calf to heel
- Fibularis longus -
- Tibialis anterior -

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## Arm & forearm muscles

- Biceps brachii – anterior arm
- Brachialis – behind biceps
- Brachioradialis – from brachialis to radius
- Triceps brachii – posterior arm
- Flexor digitorum – flex fingers
- Extensor digitorum – extend fingers

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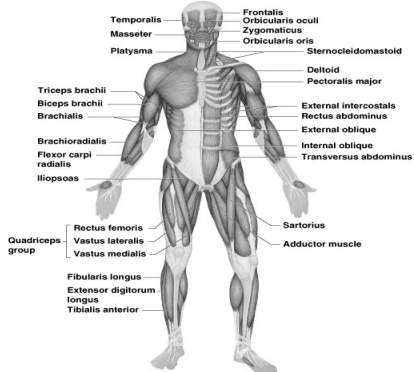
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## Superficial Muscles: Anterior




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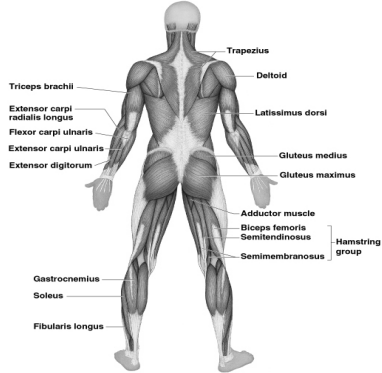


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## Superficial Muscles: Posterior




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