Muscle Fiber: A muscle fiber (long cylindrical (in skeletal, cardiac muscles) or spindle-shaped (in smooth muscle) is a muscle cell. Muscle fibers in a muscle are arranged in a bundle called **Fascicle**.

Connective Tissue Layers (fibrous connective tissue) of a muscle:

Endomysium encloses and wraps each individual muscle fiber or muscle cell, and separates the adjacent muscle fibers.

Perimysium encloses and wraps each fascicle (bundle), and separates the adjacent fascicles.

Epimysium encloses and wraps the entire muscle, and **Fascia** is the outermost layer of epimysium which separates the adjacent muscles. **Tendon**, an extension of the epimysium found at the ends of bones helps to attach a muscle to a bone or body part. (Note: Ligament attaches bone/part to another bone/part)

TEST YOURSELF (match the words below the figure with the alphabets)

- A (attaches to bone)
- B (wraps/muscles separates muscle cells)
- C (wraps entire muscle)
- D (wraps fascicle)
- E (bundle of muscle fibers cells)
- F (muscle cell)
- G (endomysium)
- H (fascicle)
- I (epimysium)
- J (deep fascia)
- K (muscle fiber)
- L (tendon)
ORIGIN/INSERTION

A muscle attaches at its both ends to a bone/part. **Origin** is the attachment site (end) of a muscle to an immovable bone/part or relatively less movable bone/part. **Insertion** is the attachment site (end) of a muscle to a movable bone/part or relatively more movable bone/part. Some muscles have more than one origin/insertion as in the case of Biceps brachii.

Examples:

<table>
<thead>
<tr>
<th>Sternoceildomastoid</th>
<th>Brachioradialis</th>
</tr>
</thead>
<tbody>
<tr>
<td>Origin: Sternum, Clavicle (cleido)</td>
<td>Origin: Brachial region (Humerus)</td>
</tr>
<tr>
<td>Insertion: Mastoid Process of the skull</td>
<td>Insertion: Radius (styloid process)</td>
</tr>
<tr>
<td>Action: Flexes neck anteriorly or to the side</td>
<td>Action: Flexes arm</td>
</tr>
</tbody>
</table>
AGONIST/SYNERGIST/ANTAGONIST

When certain muscles function as a group, **agonist** muscle will be the **prime mover for the specific action**, a **synergist** muscle **helps the agonist** (prime mover) and an **antagonist** muscle **opposes the action of the agonist**.

Example:

**Flexion** of arm (agonist-biceps brachii; synergist(s)-brachialis, brachioradialis; antagonist-triceps brachii).

**Extension** of arm (agonist-triceps brachii, antagonist-biceps brachii)

Animation:

[http://www.google.com/imgres?imgurl=&imgrefurl=http%3A%2F%2Fletsmakerobots.com%2Frobot%2Fproject%2Fpolymorph-hand%3Fpage%3D1&h=0&w=0&tbnid=aUVydWjYyKC65M&zoom=1&tbnh=152&tbnw=209&docid=4eSXY4bMxTY0fM&tbm=isch&ei=HGiXU-qkEoKpsATnzYCoDA&ved=0CAgQsCUoAg](http://www.google.com/imgres?imgurl=&imgrefurl=http%3A%2F%2Fletsmakerobots.com%2Frobot%2Fproject%2Fpolymorph-hand%3Fpage%3D1&h=0&w=0&tbnid=aUVydWjYyKC65M&zoom=1&tbnh=152&tbnw=209&docid=4eSXY4bMxTY0fM&tbm=isch&ei=HGiXU-qkEoKpsATnzYCoDA&ved=0CAgQsCUoAg)
MUSCLE MOVEMENTS – TEST YOURSELF

(IDENTIFY THE MOVEMENTS using figures below, and moving your muscles)

Flexion (bending a joint), Extension (straightening a joint), Abduction (away from midline), Adduction (toward midline), Elevation (raising), Depression (lowering), Rotation (around an axis), Circumduction (circular/conical), Dorsiflexion (bending ankle), Plantar Flexion (straightening or extending ankle), Inversion (soles facing inward), Eversion (soles facing outward). MOVE YOUR MUSCLES & LEARN.

 Movements: (match the letters)
- Flexion
- Abduction
- Elevation
- Rotation
- Inversion
- Extension
- Abduction
- Depression
- Circumduction
- Eversion
- Plantar Flexion
- Dorsiflexion
NAMING OF MUSCLES

Muscles can be learnt easily by examining models, locating your own muscles and using them to perform any specific movement.

Muscles can have one word (examples: deltoid, trapezius, buccinator, masseter, etc.) as the name or multiple words in a name (examples: rectus abdominis, flexor carpi radialis, etc.) like people have first, middle and last names. Also, recalling anatomical terminology and bone markings will help.

Muscles are named on the basis of shape, direction of muscle fibers with reference to midline of body (straight/parallel, horizontal, or diagonal), where they are located (location), size (Large/Medium/Small/Long/Short), number of heads (or bellies or origins), as to what they do (action), etc.

The names are derived based on certain criteria as listed below:

To learn the muscle action – insertion – origin:

Learn action-insertion-origin in that order. It will make sense, because if you know what a muscle does (i.e., action), it has to insert where action is needed, and origin will be the hard one to learn (for some muscles). When you study the tables for muscle action-insertion-origin, use a picture that shows muscles and bones to which they attach. You will be able to relate the information in the tables for most of the superficial muscles.
**MUSCLE TISSUE TYPES**

- [http://www.smartdraw.com/examples/view/3+types+of+muscles+in+the+muscular+system/](http://www.smartdraw.com/examples/view/3+types+of+muscles+in+the+muscular+system/)

**SMOOTH MUSCLE**

- **Appearance:** Smooth (i.e., lack of striations)
- **Action:** Involuntary
- **Cell shape:** Flat, fusiform or spindle-shaped cell (light purple colored, thread-like) **with single long nucleus** (dark purple colored)
- **Location:** walls of hollow visceral organs (esophagus, stomach, intestines, bronchi, uterus, urethra, bladder, blood vessels, and the **arrector pili** muscle in the skin)

**SKELETAL MUSCLE**

- **Appearance:** Striated (striations/stripes visible as short, dark lines across the long muscle fibers)
- **Action:** Voluntary (skeletal movements/posture)
- **Cell shape:** long, cylindrical
- **Location:** attached to bones/body parts (via tendons or aponeurosis)

**CARDIAC MUSCLE**

- **Appearance:** Striated with branching fibers and **intercalated discs** (see blue arrow, seen randomly as short, dark lines)
- **Action:** Involuntary
- **Cell shape:** same as skeletal muscle (long, cylindrical), but branching
- **Location:** wall of heart (myocardium)
**TEST YOURSELF**

**IDENTIFY THE TISSUE**

Hint: No Striations, Flat, fusiform or spindle-shaped cell (light purple colored, thread-like) with single long nucleus (dark purple colored)
TEST YOURSELF
IDENTIFY THE TISSUE

Hint: Striated (striations-stripes visible as short, dark lines across the long muscle fibers) with long, cylindrical muscle fibers.
TEST YOURSELF
IDENTIFY THE TISSUE

Hint: Striated with branching fibers and intercalated discs (see blue arrow, seen randomly as short, dark lines) with long, cylindrical muscle fibers, but branching is seen.
Muscleman video links: [YouTube Video 1](http://www.youtube.com/watch?v=gXqryA4J2_U)
[YouTube Video 2](http://www.youtube.com/watch?v=4dSFLQxCNw&feature=channel&list=UL)

Muscle names:
- Temporalis
- Orbicularis oculi
- Frontalis
- Orbicularis oris
- Masseter
- Rectus abdominis
- Sartorius
- Rectus femoris
- Vastus medialis
- Vastus lateralis
- Gastrocnemius
- Tibialis anterior
- Brachioradialis
- Pectoralis major
- Deltoid
- Triceps brachii
- Biceps brachii
- Vastus lateralis
- Brachialis
- Adductor longus
- Gracilis
- Sartorius
TEST YOURSELF
(use your arrows)
TEST YOURSELF
(use your arrows)
LOCATE & MOVE YOUR MUSCLES, WHEN YOU LEARN A MUSCLE’S ACTION, INSERTION AND ORIGIN

If you know where a muscle is located on your body, and its action (what it does), insertion will be the end of muscle attached to the bone marking/body part where action occurs, origin will be the end of muscle attached to the fixed (immovable) or less movable bone/body part. (Recalling names of bones and their parts (markings) will help you.)

VIDEO LINKS FOR MUSCLE IDENTIFICATION

Muscles: Identification http://www.youtube.com/watch?v=C7vBN4aM-gk&list=PLMaKVmvUYmGyRo7xFdan2X-_cqTlsSabW

Muscles: models (closeup view) http://www.youtube.com/watch?v=FSP52QLsQ4k&list=PLMaKVmvUYmGzd1eD2fILSE8XwxD5iuud
MUSCLE MODELS – TEST YOURSELF
(LEARN & IDENTIFY THE LABELLED MUSCLES (SEE ARROWS))

Muscles of head, face and neck: Frontalis (1), Occipitalis (2), Temporalis (3), Mssseter (4) (posterior end of mandible), Buccinator (5), Orbicularis oculi (6) (circular, around eye), Orbicularis Oris (7) (circular, around mouth/lips), Zygomaticus major (8) and Zygomaticus minor (9) (Z. bone to corner of mouth), Sternocleidomastoid (10).
MUSCLES OF CHEST (pectoral region), ABDOMEN (abdominal region)
Muscle models – test yourself
(learn & identify the labelled muscles (see arrows))

Muscles of chest and abdomen: Pectoralis major (1) (not seen), Pectoralis Minor (2) (Pectoralis Major is superficial to Pectoralis minor), Serratus Anterior (3) (serrated edge seen), Rectus Abdominis (4), Extrenal Abdominal Oblique (5) (Internal Abdominal Oblique is located deeper, Transverse Abdominis is the deepest abdominal muscle)
**Muscle Models – Test Yourself**

*Learn & Identify the Labelled Muscles (See Arrows)*

**Muscles of chest and abdomen:** External Abdominal Oblique (5), Internal Abdominal Oblique (6) is located deeper, Transverse Abdominis (7) is the deepest abdominal muscle. Diaphragm (8) is located between thorax and abdomen.
Muscles of back: Trapezius (1) (trapezium-shaped, seen partially), Teres muscles (near armpit): Teres Major (2) (larger), Teres Minor (3) (smaller), Latissimus Dorsi (4) (in lumbar region), Deltoid (5) (triangular, located on the shoulder)
MUSCLES OF ARM (Left arm: anterior and posterior views)

Deltoid (1), Biceps brachii (2a), Brachialis (2b), Triceps brachii (2c), Palmaris longus (3), Flexor carpi radialis (4), Flexor carpi ulnaris (5), Pronator teres (6), Extensor digitorum (7), Extensor carpi ulnaris (8), Extensor carpi radialis (9), Brachioradialis (10).
Deltoid (1), Biceps brachii (2a), Brachialis (2b), Triceps brachii (2c), Extensor digitorum (7), Extensor carpi ulnaris (8) (not seen), Extensor carpi radialis (9a, 9b), Brachioradialis (10).
MUSCLES OF ARM (Left arm: posterior view)
TEST YOURSELF

Closer view of extensor muscles of arm
TEST YOURSELF
Note: It is important to know the orientation of the leg model. In the picture above, anterior view of left leg is seen with the Quadriceps Group of 4 Muscles (Rectus Femoris (a), Vastus Medialis (b), Vastus Intermedius (c) (deeper to Rectus Femoris (not seen)), and Vastus Lateralis (d)). Match the model with your own leg, try to understand and locate the muscles with reference to bones (tibia, fibula, femur) and orientation/location (medial vs. lateral, anterior vs. posterior, etc.). For example, Tibialis anterior (e), Tibialis posterior (f), Extensor digitorum (g), and Fibularis longus/brevis (h), sartorius (i), adductor longus (j), tensor fascia latae (k), gluteus maximus (l) (not seen, found in the gluteal region (buttocks)).
**Quadriiceps Group**

(4 Muscles)

Note: It is important to know the orientation of the leg model. In the picture above, anterior view of left leg is seen with the **Quadriiceps Group of 4 Muscles** (Rectus Femoris (a), Vastus Medialis (b), Vastus Intermedius (c) (deeper to Rectus Femoris (not seen)), and Vastus Lateralis (d)). Match the model with your own leg, try to understand and locate the muscles with reference to bones (tibia, fibula, femur) and orientation/location (medial vs. lateral, anterior vs. posterior, etc.).
Rectus Femoris (a), Vastus Lateralis (d), Sartorius (i), Tensor Fascia Latae (k),
Gluteus Muscles: Gluteus Maximus (l), Gluteus Medius (m) (seen partially), and Gluteus
Minimus (not seen, it is located deeper to Gluteus Medius).
Rectus Femoris (a), Vastus Medialis (b), Sartorius (j), Adductor Longus (j1), Adductor Magnus (j2), Gracilis (n).
Hamstring Group of Muscles of posterior thigh: Lateral to Intermediate to Medial location
Biceps Femoris (p), Semitendinosus (q), Semimembranosus (r)
(lateral)          (intermediate)       (medial)
Muscles of lower leg – medial view:
Extensor Digitorum (s), Tibialis Anterior (t), Tibialis Posterior (u), Gastrocnemius (v), Soleus (w)
Muscles of lower leg – lateral view:
*Extensor Digitorum* (s), *Tibialis Anterior* (t), *Tibialis Posterior* (u), *Gastrocnemius* (v), *Soleus* (w), *Fibularis longus* (x), *Fibularis brevis* (y).
<table>
<thead>
<tr>
<th>Muscle</th>
<th>Action</th>
<th>Insertion</th>
<th>Origin</th>
</tr>
</thead>
<tbody>
<tr>
<td>Orbicularis oculi</td>
<td>Blinks/Squints eye</td>
<td>skin of eyelids</td>
<td>Frontal bone and Maxilla</td>
</tr>
<tr>
<td>Orbicularis oris</td>
<td>compresses lips</td>
<td>lips</td>
<td>Maxilla and Mandible</td>
</tr>
<tr>
<td>Frontalis</td>
<td>raises eyebrows</td>
<td>skin of eyebrow</td>
<td>Galea aponeurotica</td>
</tr>
<tr>
<td></td>
<td>wrinkles forehead</td>
<td>or bridge of nose</td>
<td></td>
</tr>
<tr>
<td>Occipitalis</td>
<td>retracts scalp</td>
<td>Galea aponeurotica</td>
<td>Occipital bone or mastoid process</td>
</tr>
<tr>
<td>Temporalis</td>
<td>Elevates mandible</td>
<td>Mandible</td>
<td>Temporal, Frontal, Piccolo, Zygomatic arch</td>
</tr>
<tr>
<td>Masseter</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Buccinators</td>
<td>Compresses cheeks</td>
<td>Orbicularis oris</td>
<td>Maxilla and Mandible</td>
</tr>
<tr>
<td>Zygomaticus major</td>
<td>retracts</td>
<td>Corner of mouth</td>
<td>Zygomatic bone</td>
</tr>
<tr>
<td>Zygomaticus minor</td>
<td>elevates</td>
<td>Corner of mouth</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>upper lip</td>
<td></td>
</tr>
<tr>
<td>Sternocleidomastoid</td>
<td>flexes neck</td>
<td>mastoid process</td>
<td>Sternum clavicle</td>
</tr>
<tr>
<td>Muscle</td>
<td>Action</td>
<td>Insertion</td>
<td>Origin</td>
</tr>
<tr>
<td>-----------------</td>
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<td>-------------------------------------</td>
</tr>
<tr>
<td><strong>ARM</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Deltoid</td>
<td>Abducts shoulder</td>
<td>Deltoid tuberosity (Humerus)</td>
<td>Acromion</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Coronoid process (ulna)</td>
<td>Scapula spine</td>
</tr>
<tr>
<td>Brachialis</td>
<td>flexes elbow</td>
<td>Coronoid process (ulna)</td>
<td>Scapula</td>
</tr>
<tr>
<td>Brachioradialis</td>
<td>&quot;</td>
<td>Styloid process (radius)</td>
<td>(Distal) Humerus</td>
</tr>
<tr>
<td>Biceps brachii</td>
<td>&quot;</td>
<td>Radial tuberosity (radius)</td>
<td>Coracoid process (Scapula)</td>
</tr>
<tr>
<td>Triceps brachii</td>
<td>extends elbow</td>
<td>Olecranon process (ulna)</td>
<td>Scapula and Humerus</td>
</tr>
<tr>
<td><strong>Pronator teres</strong></td>
<td>pronates forearm</td>
<td>Mid-shaft of radius</td>
<td>Medial epicondyle (Humerus)</td>
</tr>
<tr>
<td>Palmaris longus</td>
<td>(palm - posterior)</td>
<td>Palmar aponeurosis</td>
<td></td>
</tr>
<tr>
<td>Flexor carpi radialis</td>
<td>flexes wrist</td>
<td>Metacarpals</td>
<td></td>
</tr>
<tr>
<td>Flexor carpi ulnaris</td>
<td>&quot;</td>
<td>PISIFORM and Hamate</td>
<td></td>
</tr>
<tr>
<td><strong>Extensor digitorum</strong></td>
<td>extends (phalanges)</td>
<td></td>
<td>Lateral epicondyle (Humerus)</td>
</tr>
<tr>
<td>Extensor carpi radialis</td>
<td>extends wrist</td>
<td>Metacarpals</td>
<td></td>
</tr>
<tr>
<td>Extensor carpi ulnaris</td>
<td>extends wrist</td>
<td>5th metacarpal</td>
<td></td>
</tr>
<tr>
<td>Muscle</td>
<td>Action</td>
<td>Insertion</td>
<td>Origin</td>
</tr>
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<td>-----------------------------</td>
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<tr>
<td><strong>LEG</strong></td>
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<td></td>
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</tr>
<tr>
<td>Biceps femoris (lateral)</td>
<td>flexes knee</td>
<td>Head of Tibia</td>
<td>Ischial tuberosity</td>
</tr>
<tr>
<td>Semitendinosus</td>
<td></td>
<td></td>
<td>Tibia (medial condyle)</td>
</tr>
<tr>
<td>Semimembranosus (medial)</td>
<td>extends hip</td>
<td>Tibia (proximal)</td>
<td></td>
</tr>
<tr>
<td>Gastrocnemius</td>
<td></td>
<td>(medial) Tibia</td>
<td>Pubis</td>
</tr>
<tr>
<td>Sartorius</td>
<td></td>
<td>Tibia</td>
<td>iliac spine</td>
</tr>
<tr>
<td>Rectus femoris</td>
<td>extends knee</td>
<td>Tuberosity (Tibia)</td>
<td>Femur (proximal)</td>
</tr>
<tr>
<td>Vastus medialis</td>
<td></td>
<td></td>
<td>Femur (posterior)</td>
</tr>
<tr>
<td>Vastus intermedius</td>
<td></td>
<td></td>
<td>Ilium (crest)</td>
</tr>
<tr>
<td>Vastus lateralis</td>
<td>flexes hip</td>
<td>Tibia</td>
<td>Femur (Greater Trochanter)</td>
</tr>
<tr>
<td>Tensor fascia lata</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Gluteus maximus</td>
<td>extends/abducts hip</td>
<td>Femur (posterior)</td>
<td>Pubis</td>
</tr>
<tr>
<td>Gluteus medius</td>
<td></td>
<td>Ilium</td>
<td></td>
</tr>
<tr>
<td>Adductor longus</td>
<td>adducts (femur)</td>
<td>Femur (posterior)</td>
<td></td>
</tr>
<tr>
<td>Tibialis anterior</td>
<td>dorsiflexes foot</td>
<td>1st metatarsals Tibia</td>
<td></td>
</tr>
<tr>
<td>Gastrocnemius</td>
<td>plantar flexes foot</td>
<td>1st cuneiform (proximal)</td>
<td></td>
</tr>
</tbody>
</table>
MUSCLES OF SHOULDER ARTICULATION (Right: anterior)
IDENTIFY THE MUSCLES
MUSCLES OF SHOULDER ARTICULATION (Right: posterior)
MUSCLES OF SHOULDER ARTICULATION (Right: posterior)
IDENTIFY THE MUSCLES
MUSCLES OF HIP ARTICULATION (Right: anterior and posterior)
MUSCLES OF HIP ARTICULATION (Right: anterior & posterior)
IDENTIFY THE MUSCLES

ENJOY LEARNING YOUR MUSCLES AS YOU WORK OUT, EAT, DRINK, TALK, BREATHE, WALK, RUN, SMILE, etc. Must be Fun.