Muscles
Cells

- Muscle cells are called myocytes

- 3 different types:
  - Skeletal
  - Cardiac
  - Smooth
Cells continued

- **Smooth**
  - Long Spindle shaped
  - One Central Nucleus

- **Cardiac**
  - Branched, 1 or 2 Nuclei
  - Intercalated disks
  - Striated

- **Skeletal**
  - Long
  - Nuclei on periphery (multiple)
  - Striated
Fibers

- Muscles are broken down into fascicles
- Within each fascicle you will find many fibers
- Within each fiber you will find numerous myofibrils
- Myofibrils are broken down into sarcomeres (skeletal and cardiac muscle)
- Striated
The Sarcomere

- The sarcomere is then broken down into 2 filaments:
  - Actin = Thin (green here)
  - Myosin = Thick (Blue here)
  - Elastin = Middle of myofibril
- Z discs border sarcomeres and make up the I band
- In between I bands you will have the A band
- On the far outside sarcoplasmic reticulum
Myofibrils

- Myosin, actin and elastin
- Myosin (thick) is a protein with a golf club like head
  - Some point to left, some point to right
- Actin (thin) is another protein
  - F and G, G has active sites where myosin attaches
- Elastin is mostly made of titin, a protein
  - Anchors myosin to z line
Motor Units

- In order for muscles to contract and allow us to move, what must they be attached to?
- Smooth muscles and cardiac muscles are linked to autonomic nervous system
  - Controls muscle movements that we don’t think about (heart beat, GI tract, blood vessels)
- Skeletal muscle linked to somatic nervous system
  - Allows for conscious movement of skeletal muscles

A motor unit = motor neuron and skeletal muscles controlled by the neuron
Contraction

- Two Types:
  - Isometric - muscle tension changes, but length stays the same
  - Isotonic - muscle tension stays the same, but length of muscle changes
    - Muscle shortens = concentric
    - Muscle lengthens = eccentric
Neuromuscular Junction

- Chemical synapse between motor neuron and muscle fiber
- Here an action potential occurs due to ion movement
- This causes contraction
- Sliding filament theory - Thin filaments (actin) slide over thick filaments (myosin), elastin remains same. (generates tension)
- Cross bridge cycling - Myosin heads bind to actin. ATP allows “powerstroke” to happen, pulling actin in and shortening sarcomere.
Summary

- Types of contractions?
- In order for a skeletal muscle to contract an action potential needs to be reached.
  - What is needed for this to happen (Ions)
- Also need ATP
  - How do cells generate ATP?
  - What is needed in order for cellular respiration to happen?
- How are these components going to get there?
Types of Skeletal Muscle

- **Fast Twitch - Two types: IIA and IIB**
  - Both are used for jumping, powerlifting, sprinting, agility training, etc.
  - They have very quick powerful responses and thick fibers
  - They are also quick to exhaust, have low mitochondrial densities

- **Slow Twitch**
  - Used for jogging, swimming, cycling, walking, or endurance training.
  - Slower, less powerful responses.
  - Slow to exhaust high mitochondrial densities.
  - Dark meat
Skeletal Muscles -(Forehead and eyes)

- Remember from the video muscles can be attached to tendons or....?
- On the top of your head you have an epicranial aponeurosis
- Your forehead has the occipitofrontalis muscle
- Around your eyes orbicularis oculi
- Your nose has the muscle nasalis
Mouth and Cheeks

- Levator labii superioris - raises lips
- Zygomaticus major and minor - manipulate lips (up/down)
- Risorius - manipulates lips to sides
- Depressor anguli oris
- Depressor labii inferioris
  - Both assist in bringing the lower lip down and to the side
Mouth and Cheeks Cont.

- Levator anguli oris - helps raise mouth medially (to side)
- Masseter - helps person bite down or chew
- Buccinator - Compresses cheeks to teeth, allows blowing or sucking actions.
- Temporalis - assists in chewing
Anterior Muscles of the Neck

- Hyoid bone separates them
- Supra- or above the hyoid:
  - Digastric
  - Mylohyoid
  - Geniohyoid
  - Stylohyoid
- All of them contribute to raising the hyoid bone for swallowing.
- Infra- or below the hyoid:
  - Thyrohyoid
  - Omohyoid
  - Sternohyoid
  - Sternothyroid
- These muscles lower the hyoid for swallowing or speech
Posterior Muscles of the Neck and Back

- Semispinalis capitis - functions to extend neck and allow you to turn head up.
- Sternocleidomastoid - Connects head to clavicle. Functions to move head to opposite side and extend neck.
- Splenius Capitis - Functions to extend head
- Levator Scapulae - Functions to lift shoulder (scapula).
- Trapezius - Functions to tilt or rotate head, shrug your shoulders, steady shoulders or twist your arms.
Anterior Skeletal Muscles of Trunk

- Deltoid - Shoulder muscle allows you to move your shoulders inward and abduct your arm.
  - abduction - is to move away from your body.
  - Adduction - is to move toward your body.
- Looking at the image to the right what is your sternum?
- Pectoralis major - Functions to flex, adduct, and internally rotate the humerus.
  - Where is the humerus?
- Latissimus dorsi - largest muscle in the upper body. It is responsible for adduction, extension, and medial rotation of the arm.
Terminology Checkpoint

Adduction - The movement of a limb toward the midline.

Abduction - The movement of a limb away from the midline.

Synergist - Assists the movement of a prime mover, but is less effective. (Biceps brachii and brachioradialis)

Agonist - Primary mover (biceps brachii)

Antagonist - Muscle that produces opposing joint torque (triceps brachii)
Muscles of the Arm

- **Biceps brachii** - Moves the elbow and shoulder.
  - Moves elbow up, like a biceps curl
  - Moves arm forward sideways and upward
- **Triceps brachii** - Main function is to extend forearm at the elbow joint.
  - Alternative function - pulls upper arm toward midline (adduction)
  - Also pulls upper arm backward
- **Brachioradialis** - synergist helps the bicep flex elbow joint bringing forearm up.
  - Also helps with supination (picture on the left)
  - And pronation (picture on the right)
Anterior Muscles of the Lower Arm

- Palmaris Longus - Allows flexion at the wrist joint.
- Flexor carpi radialis - Functions to flex and abduct the hand.
- Flexor carpi ulnaris - Assists in flexing and adducts the hand.
  - Three above all work synergistically
- Pronator teres - Functions to turn arm palm down (pronator)
- Wrist Flexors
Muscles of the Lower Trunk

Outside to inside:

- External intercostal - Raise ribs, expand chest cavity for inhalation.
- External Oblique - Responsible for twisting the trunk.
- Serratus Anterior - Pulls scapula toward thorax
- Rectus Abdominis - Flexes trunk and provides posterior pelvic tilt
Anterior Muscles of the Upper Leg

- Gracilis - Responsible for hip adduction and knee flexion.
- Adductor longus - Adducts thigh
- Rectus femoris - Raises knee, and flexes hip
- Vastus lateralis - Extends the lower leg
- Sartorius - Abducts hip, synergist for other muscles ex. Rectus femoris
Posterior Muscles of the Upper Leg

- Gluteus Maximus - Main extensor of the hip, functions to straighten leg.
- The “hamstring” is made up of three muscles:
  - Biceps femoris
  - Semitendinosus
  - Semimembranosus
  - All function to extend hip, flex the knee and move the knee laterally or medially.
Muscles of the Anterior Lower Leg

Extensor Digitorum Longus - this muscle allows you to extend your toes and (dorsi) flex them upward.

Tibialis Anterior - Also functions to allow dorsiflexion of foot.

Extensor Hallucis Longus - Functions to extend the big toe and assists in dorsiflexion.
Muscles of the Posterior Lower Leg

Gastrocnemius - Provides plantar flexion, downward flexion, and flexes knee at joint.

Soleus - Also provides plantar flexion

Both muscles are considered the “calf muscle” and are important in running and jumping.