Memorize your Muscle Man diagrams

You will have a quiz over these later on in this unit.

Major Muscles

- Memorize the location of the muscles using the diagrams you were provided - (these are the muscles on your worksheet)
  - **Hamstrings**: biceps femoris, semimembranosus, semitendinosus
  - **Quadriceps**: rectus femoris, vastus lateralis, vastus medialis, vastus intermedius (all insert into tibial tuberosity through quadriceps tendon and patellar ligament)

Hamstrings

Locations of IM injections

- deltoid muscle
- gluteus medius – superior lateral quadrant used in order to avoid damaging underlying sciatic nerve
- vastus lateralis
- vastus lateralis and rectus femoris are used for infant injections due to poor development of gluteal muscles and deltoid muscles
Location of IM injections

IM injections in children

Naming of Skeletal Muscles

- You are responsible for knowing all examples in your textbook & notes !!!
- Location of the muscle – named for a bone or region with which they are associated
  - Temporalis
- Shape – named for a distinctive shape
  - Deltoid (triangular)

Naming of Skeletal Muscles

- Relative size of the muscle
  - maximus (largest)
  - Minimus (smallest)
  - Longus (longer in length than in diameter)
- Direction of muscle fibers
  - rectus (straight)
  - Oblique (at an angle)

Naming of Skeletal Muscles

- Number of origins
  - Biceps, triceps, quadriceps (# of heads)
Naming of Skeletal Muscles
- Location of the muscles origin and insertion
  - Example: sternocleidomastoid (on the sternum, clavicle, and mastoid process)
- Action of the muscle
  - Example: flexor and extensor (flexes or extends a bone)

Skeletal Muscle
- A muscle is an ORGAN containing muscle fibers (cells), connective tissue, blood vessels & nerves

Connective Tissue Wrappings of Skeletal Muscle
- Epimysium – covers the entire skeletal muscle – dense fibrous CT
- Deep fascia – on the outside of the epimysium

Connective Tissue Wrappings of Skeletal Muscle
- Perimysium – around a fascicle (bundle) of fibers - collagen
- Endomysium – around single muscle fiber – reticular tissue

Importance of CT Wrappings
- Supports & reinforces each cell and the whole muscle
- Provides entry and exit points for:
  - Blood vessels
  - Nerves

Nerve Supply
- Each muscle fiber has its own motor end plate (nerve ending)
Blood Supply

• Each muscle is served by one major artery and one or more veins

IMPORTANT: Dependence

• Skeletal muscle is dependent on its:
  – Nerve supply because skeletal muscle cannot contract without nerve stimulation
  – Blood supply because Muscles use tremendous amounts of energy so must have lots of oxygen, etc. and wastes must be removed

Muscle Attachments

• Sites of muscle attachment
  • Bones
  • Cartilages
  • Connective tissue coverings

Types of Muscle Attachments

• Direct attachments
  • Muscle is fused directly to bone or cartilage covering (periosteum or perichondrium)

• Indirect attachments
  • Connective sheaths of muscle extend beyond muscle as a:
    • Tendon – cord-like structure
    • Aponeuroses – sheet-like structure
IMPORTANT

• Indirect is most common due to:
  — Size
  — Durability - Resistance against friction as muscle moves

Fascicle Arrangement – see notes

ROM vs. Power

• Range of Motion
  — Longer muscle fibers along muscle axis = greater range of motion
  — Parallel fascicle arrangement gives greatest ROM

• Power
  — Depends on # of Muscle fibers
  — Greater # = greater power
  — Bipennate – shorten very little but very powerful

End of Quiz #1 Material

Overview of Muscle Tissue

• Nearly 40% of body mass
• Transforms chemical energy (ATP) into mechanical energy (motion)
• myo-, mys- (muscle) and sarco- (flesh) all refer to muscle
• Contraction of muscles is due to the movement of microfilaments – actin & myosin that slide & overlap each other

Functional Characteristics of Muscles

• Contractility – ability to shorten forcibly
• Excitability – ability to receive and respond to stimuli
• Elasticity – ability to resume resting length (recoil)
• Extensibility – ability to be stretched or extended
Function of Muscles

- Responsible for all locomotion & manipulation
  - Smooth: vasoconstriction, peristalsis
  - Skeletal: locomotion & manipulation
  - Cardiac: pump

Know your 3 muscle slides

Also know the main features of each type of tissue – review your tissue chart and tissue unit notes
Function of Muscles

- Generate heat
  - By product of muscle metabolism & contractile activity (40% of body mass)
  - 25% cellular activities and 75% heat
  - Example: shivering uses muscle activity to generate heat when you are cold
- Stabilize joints – muscle tone & tendons extremely important to stabilize joints

Muscles and Body Movements

- The bulk of the muscle typically lies proximal to the joint crossed
- All muscles cross at least one joint

Muscles and Body Movements

- Muscles are attached to at least two points
  - Origin – attachment to the immovable or less movable bone
  - Insertion – attachment to the movable bone

Muscles and Body Movements

- Muscles can only pull, they never push
- During contraction, the muscle insertion moves toward the origin

Muscle Interactions

- Prime mover (Agonist) – muscle with the major responsibility for a certain movement
- Antagonist – muscle that opposes or reverses a prime mover
Muscle Interactions

- Synergist – muscle that aids an agonist in a movement and helps prevent rotation (stabilize the motion)
- Fixator – synergists that helps immobilize a bone or muscle origin (while the insertion point moves)

Coordination

- Actions of antagonistic and synergistic muscles are important in causing smooth, coordinated, and precise muscle motions.

Levers

- Exerts force by use of lever action
- Bones act as levers for muscles to pull on. Each type of lever has advantages and disadvantages in either the strength required to move the body part or the distance (ROM) that the body part can be moved or the speed of the motion.

Modifying muscle activity

- Differences in the positioning of the fulcrum, load, and effort modify muscle activity with respect to:
  - speed of contraction
  - Direction of motion
  - range of motion (ROM)
  - Strength - weight that can be lifted

Terms to understand

- Effort – applied force – provided by muscle contraction
- Load – resistance – bone, overlying tissues, and any other object you are trying to move
- Fulcrum – fixed point - joints
Application

- Understanding lever action, angles and position, and muscle fiber direction is extremely important:
  - To maximize the effectiveness of your workouts
  - To prevent injury

First class lever

- Fulcrum is in the middle - between load and effort
- The main advantage is the change in direction of the force – force exerted is equal to force lifted
- Example: Muscle pulls downward to lift body part upward or vice versa
- Example: Extension of head

Second class lever

- Load is in the middle - between effort and fulcrum
- Uncommon in the body
- The main advantage is multiplication of force (strength) – force exerted is less than force lifted
- Levers of strength BUT Range of motion is sacrificed
- Example:
  - Standing on your toes (contraction of calf muscle) lifts your whole body but only a small distance

Third class lever

- Effort is in the middle - between load and fulcrum
- Most common in the body
- The main advantage is range of motion
  - Strength is sacrificed
  - Speed is gained
- Example:
  - Flexing at elbow using bicep muscle

Examples

End of Quiz #2 Material
Disorders

Torticollis – a twisting of the neck which causes rotation and tilting of the head to one side – caused by injury to one of the sternocleidomastoid muscles

Pulled groin muscles – Strain or stretching of adductor muscles (magnus, longus, brevis)

Foot drop – paralysis of anterior muscles in lower leg – caused by injury to the peroneal nerve

Shin splints – inflammation of the anterior muscle group of the lower leg (& the periosteum they pull on) – caused by trauma or strain – usually felt on the medial &/or anterior borders of the tibia

Charley horse – officially a trauma induced tearing of muscles followed by bleeding into the tissues (NOT just a cramp)
Halux valgus – permanent displacement of the great toe – caused by wearing pointy toed shoes

Duchenne Muscular Dystrophy

- Page 194
- Genetic – affects primarily males – X linked trait
- Dystrophin protein not produced correctly – leads to muscle fiber degeneration & atrophy
- Progresses from extremities upward
- Generally do not live beyond young adulthood

Myasthenia gravis

- Probably autoimmune
- Shortage of neurotransmitter receptors in muscle
- Muscles not stimulated properly & grow progressively weaker
- Death occurs when respiratory muscles fail to function

Myasthenia Gravis

Drooping of eyebrow & eyelid called Ptosis

Superficial Muscles: Anterior

Know your muscle diagrams for QUIZ!!!
Force, velocity, and duration of muscle contraction are affected by several factors. A main factor is fiber type (genetically determined)

- Fiber types in humans do not have a lot of good research due to the need to take muscle biopsies — this can damage the muscle — there are new techniques that can provide some info through muscle density studies.

<table>
<thead>
<tr>
<th>Fiber Types</th>
<th>STFR – type 1</th>
<th>FTF – type 2x</th>
<th>FTFR – type 2a</th>
</tr>
</thead>
<tbody>
<tr>
<td>Color</td>
<td>Red fibers</td>
<td>White fibers</td>
<td>Light red fibers</td>
</tr>
<tr>
<td>Pathway for ATP syn.</td>
<td>Aerobic</td>
<td>Anaerobic</td>
<td>Aerobic</td>
</tr>
<tr>
<td>Rate of fatigue</td>
<td>Slow</td>
<td>Fast</td>
<td>Intermediate</td>
</tr>
<tr>
<td>Mito., cap., myoglobin</td>
<td>Lots</td>
<td>Few</td>
<td>Lots</td>
</tr>
</tbody>
</table>
Dark meat vs. White meat

Developmental Aspects

- Progresses superior to inferior direction
  - Baby can lift head before walking
- Progresses proximal to distal
  - Baby can move arm before grasping object
  - This is due to the way that neural pathways are built in your brain.

Men vs. women

- Women’s skeletal muscles make up 36% of body weight
- Men’s is 42% due to effects of testosterone
- Muscle strength per unit mass is equal

Building Muscle Mass

- Type of joint involved in motions
- Direction of muscle fibers (contained in fascicle)
- Anatomy of the muscle
- Angles of body parts

- In order to work a muscle effectively & to minimize risk of injury, the above factors must be considered. Number of reps and amount of weight depends on purpose of exercise (building vs. toning).

Aerobic vs. Anaerobic

- 3 main factors affect your respiration type:
  - Your nutrition
  - Your respiratory efficiency
  - Your cardiovascular fitness
- IMPORTANT NOTE TO UNDERSTAND:
  - The type of respiration that is happening depends on what is going on in a particular muscle at a particular time. You will have some muscles doing aerobic and others doing anaerobic AT THE SAME TIME!
Aerobic Respiration

- Is the most efficient type of respiration – producing the most ATP per glucose molecule
  - Glucose + oxygen produce 36-38 ATP + carbon dioxide + water
- It is slower and requires continuous delivery of oxygen & nutrients to the muscle

- Duration of energy produced can be hours
- This type of energy production is used for activities that require endurance rather than power
  - Jogging, marathon running, walking, etc

Anaerobic Respiration

- Muscle uses up oxygen faster than circulatory and respiratory systems can deliver it
- Glucose gets converted to lactic acid in that muscle
- Lactic acid will get converted to pyruvic acid and enter aerobic mechanism when oxygen becomes available

- Circulatory and respiratory system cannot deliver oxygen as fast as muscles are using it up.
- This leads to lactic acid buildup - when oxygen is again available – lactic acid is converted to pyruvic acid and oxidized

Anaerobic Respiration

- For muscle to be restored to resting state:
  - Oxygen stores must be replenished
  - Lactic acid converted to pyruvic acid
  - Glycogen stores replaced
  - ATP & creatine phosphate reserves replenished
  - Liver must reconvert the pyruvic acid produced to glucose or glycogen
  - ALL of these processes require oxygen

Oxygen Debt

- The amount of oxygen that must be taken into the body to provide for these restorative processes
  - The difference between amount of oxygen needed for totally aerobic respiration during muscle activity AND the amount that is actually used.
- All nonaerobic sources of ATP used during muscle activity contribute to this debt
Oxygen Debt

- Repaid by rapid, deep breathing (hyperventilation) triggered by change in pH from lactic acid after exertion is ended.
- Breathing pure oxygen does not help recovery time – oxygen has to have time to get to the muscles that require it. There are limitations due to your circulatory and respiratory systems.

Efficiency of Oxygen Use

- Athlete: ~10% greater rate and efficiency of oxygen use than normal person
- Marathon runner: ~45% greater
- Working your muscles, heart, lungs, etc out on a regular basis increases your efficiency
  - Things like smoking, poor nutrition, too much sugar, etc. decreases your efficiency