

CHAPTER 6 – THE MUSCULAR SYSTEM

× Movement

- × Muscles move bones by pulling on them. Muscles can never push on bones. As the muscle gets shorter the insertion bone moves toward the origin bone.
- × Several muscles move at once and work together to move the body in a very smooth way. There are often many muscle involved in a body movement.

- × **prime mover** – the muscle mainly responsible for the movement

- × **synergists** – all of the muscles that assist in a movement
- × **antagonists** – are muscles that work in the opposite direction of a movement
- × The antagonists must relax for the movement to occur.

× Posture

- × tonic contraction – a special muscle contraction that does not move the body but maintains our body posture.
- × posture – muscle tone that maintains body position
- × We must have posture to maintain upright body that works against gravity.

✘ Heat production

- ✘ Contractions of muscle produce heat which keeps the body at about 98.6° F. A difference in only a couple of degrees usually means there is something wrong in the body.
- ✘ hypothermia – is a decrease in body temperature below normal
- ✘ Fatigue – is when a muscle is continuously contracted without a period of rest and the muscle contraction decreases
- ✘ Eventually if the muscle does not get rest it will not be able to contract at all.
- ✘ oxygen debt – is the term used for the body taking in oxygen to remove lactic acid build up in the muscles.

- ✘ The skeletal system, nervous system, respiratory system, and circulatory system all have to be functioning properly for normal muscle movement.
- ✘ paralysis – a disorder in which nerves shut off impulses to certain skeletal muscles
- ✘ Before a muscle can pull on a bone it has to be stimulated by a nervous impulse.

- ✘ motor neuron – a nerve fiber that stimulates a muscle cell
- ✘ neuromuscular junction – point of contact between the nerve ending and the muscle fiber
- ✘ Chemicals are released by a motor neuron and that generates a reaction that causes the muscle fiber to shorten or contract.
- ✘ motor unit – is the motor neuron and the muscle cell it reacts with

✘ The Steps of a Muscle Contraction:

- ✘ 1) A nerve on each muscle cell is stimulated by the brain.
- ✘ 2) Calcium is released from the sarcoplasmic reticulum onto the actin and myosin sections of the muscle fibers.
- ✘ 3) This calcium being released causes the myosin heads to react with the actin binding sites.

- ✘ 4) The myosin heads then pull back causing the muscle to shorten or contract.

- ✘ 5) The calcium is pumped back into the sarcoplasmic reticulum and the myosin heads are released from the actin binding sites.
- ✘ Energy obtained to contract muscles comes from the molecule ATP. This is obtained from the foods that we eat.

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- ✘ ATP is broken down using an enzyme called ATPase. This breaks it into ADP, a phosphate, and energy. The ATP molecule is put back together using a creatine phosphate. When the creatine phosphate runs out the muscles use glucose as a source of energy.

- ✘ Energy can be obtained one of two ways:
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- ✘ 1) anaerobic respiration – without oxygen. Here glucose is converted into lactic acid and energy.
 - ✘ 2) aerobic respiration – with oxygen. ATP production is normal.
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- ✘ When oxygen levels are very low and oxygen debt occurs. This needs to be replenished at a later time. This is why you breathe heavy after exercise.
 - ✘ The accumulation of lactic acid in the muscles is what cause muscle fatigue.

✘ When muscles contract they contract in a way that is described as all or none.

✘ all or none – means that a muscle fiber either contracts or it doesn't

✘ The reason we can lift different amounts is more or less fibers contract completely as we need them.

× Types of skeletal muscle contractions:

- × 1) twitch contraction – is a quick, jerky response to a stimulus
- × This does not occur very often.
- × 2) tetanic contraction – a sustained equal muscle contraction.
- × The contractions are said to all melt together and is a very smooth contraction.

- × 3) isotonic contractions – produce movement at a joint

- × Example: walking, breathing, twisting, lifting
- × 4) isometric contraction – occurs when there is muscle contraction but no movement
- × Muscles only increase in tension in these types of contractions.

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- × disuse atrophy – muscles shrink do to inactivity
 - × hypertrophy - muscles increasing in size

× Two types of training

- × 1) strength training – causes muscles to get bigger. example: lifting weights
- × 2) endurance training – makes muscles more efficient. This type of training increases blood vessels to the muscles and doesn't increase their size.
- × Example; bicycling and running

✘ Types of Movements:

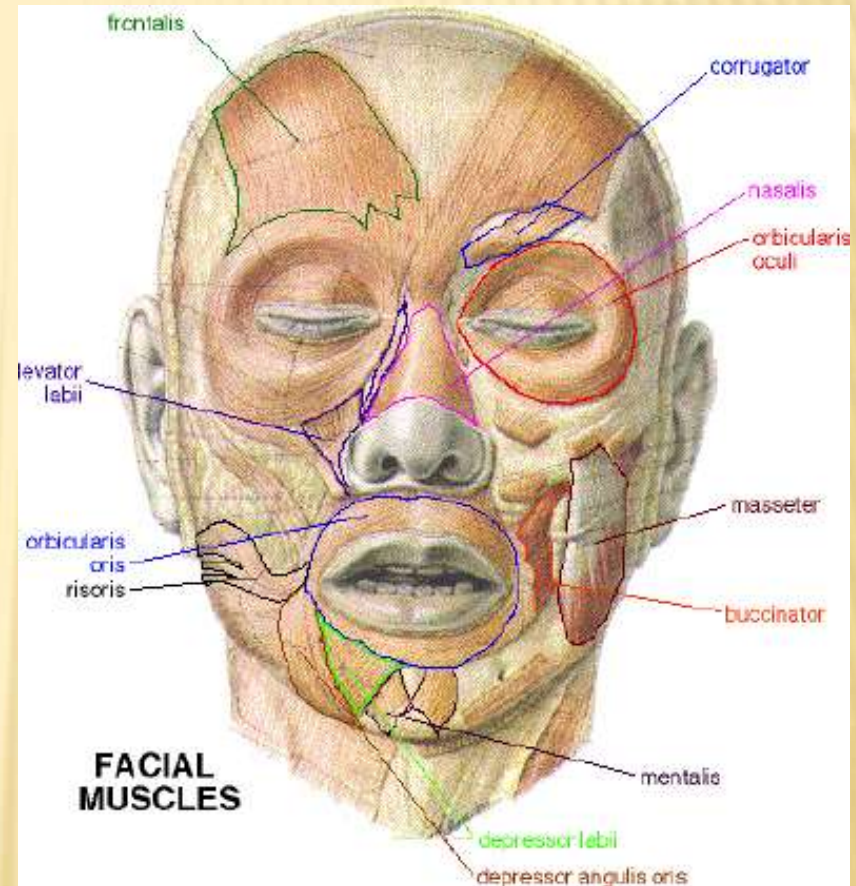
- ✘ **flexion** – movement that makes the angle between two bones at their joint smaller than it was at the beginning of the movement
- ✘ **extension** – movements that are opposite of flexions. They make the angle between two bones at their joint larger than it was at the beginning of the movement.
- ✘ **abduction** – moving a body part away from the midline of the body
- ✘ **adduction** – moving a body part toward the midline of the body

- ✘ **rotation** – is a movement around a longitudinal axis

- ✘ **supination** – hand position with the palm turned in the anterior position
- ✘ **pronation** – hand position with the palm turned to the posterior position
- ✘ **dorsiflexion** – is when the foot is elevated and the toes are pointed upward
- ✘ **plantar flexion** – is when the bottom of the foot is directed downward and the toes are pointed downward

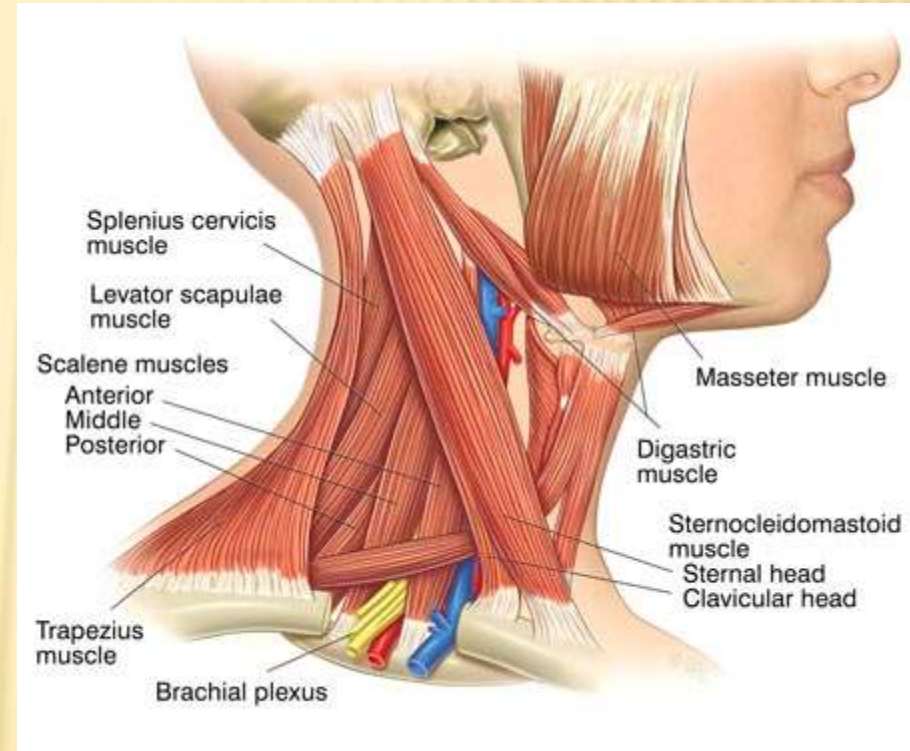
FACIAL MUSCLES

- ✘ orbicularis oculi – the muscles around the eye, it closes the eye
- ✘ orbicularis oris – around the lips, closes and protrudes the lips
- ✘ masseter – on the side of the face and closes the jaw



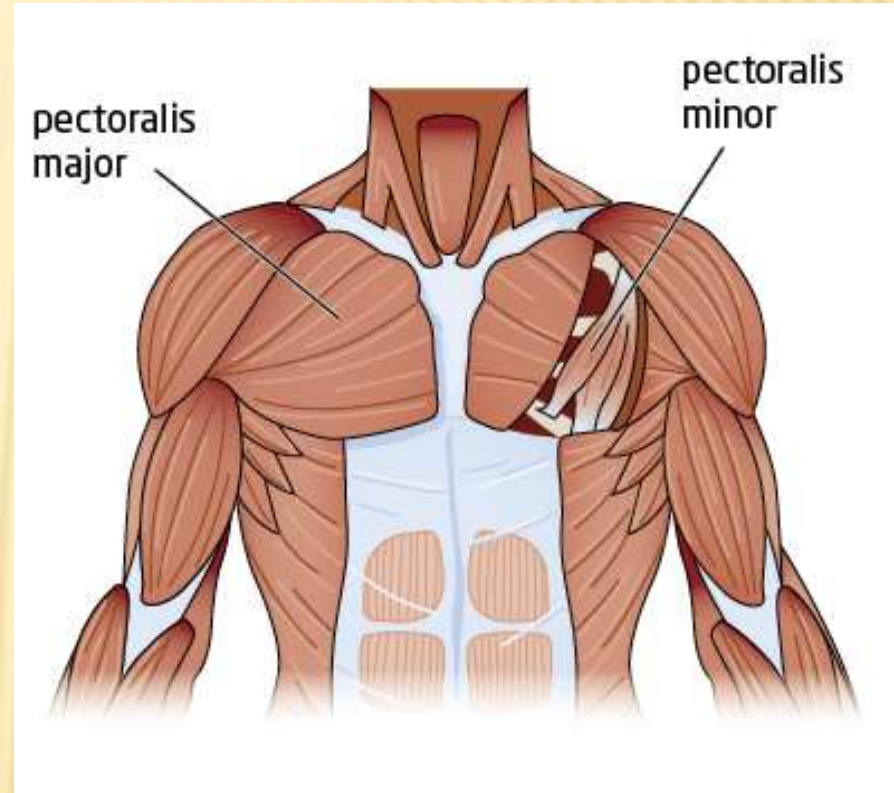
MUSCLES OF THE NECK

- ✘ sternocleidomastoid – in the neck and pulls the head to the side and toward the chest
- ✘ trapezius – upper back and moves the scapula



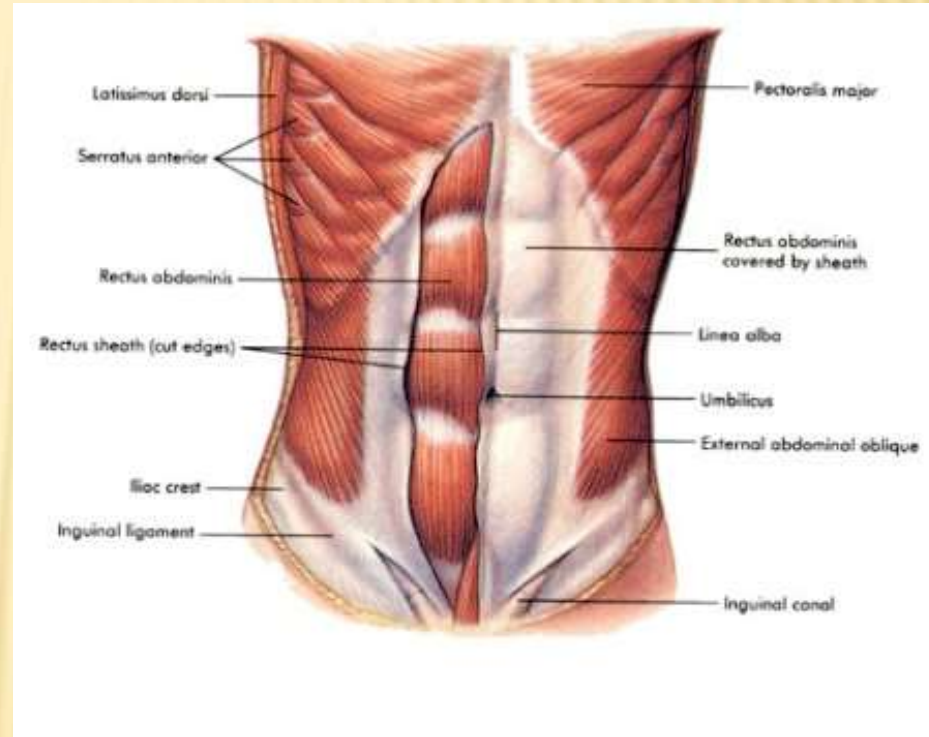
MUSCLES OF THE CHEST

- ✘ pectoralis minor – in the chest and pulls the scapula forward and down
- ✘ pectoralis major – in the chest and raises the upper arm and rotates the humerus



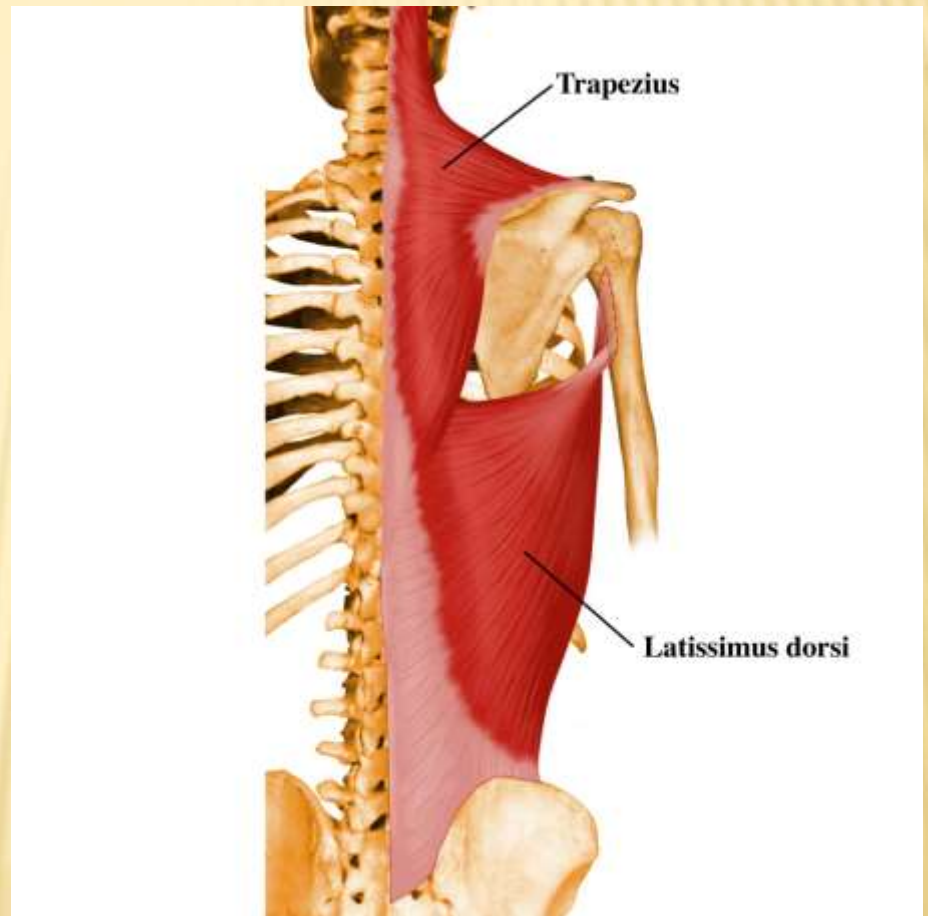
ABDOMINAL MUSCLES

- ✘ Rectus abdominus – Large muscle in abdominal region
- ✘ External oblique – muscles on the lateral sides of the abdomen



MUSCLES OF THE BACK

- ✘ latissimus dorsi – muscles in the back and moves the arms down
- ✘ trapezius – upper back and moves the scapula



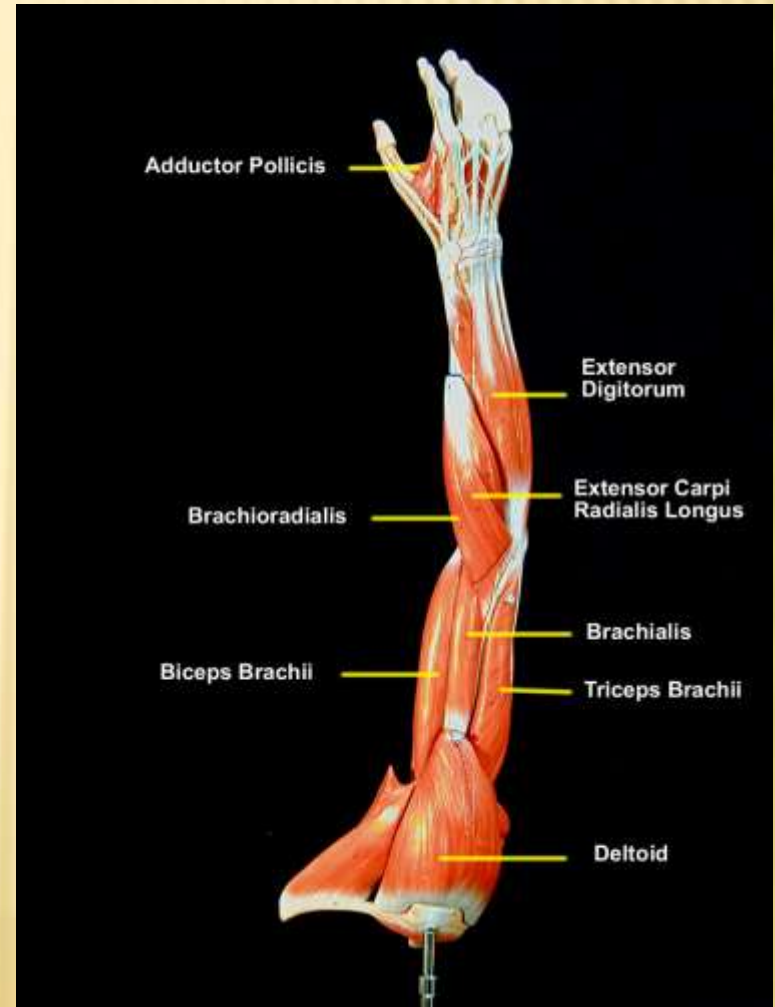
MUSCLES OF THE ARM

deltoid – on the top of the shoulders and raises the arms

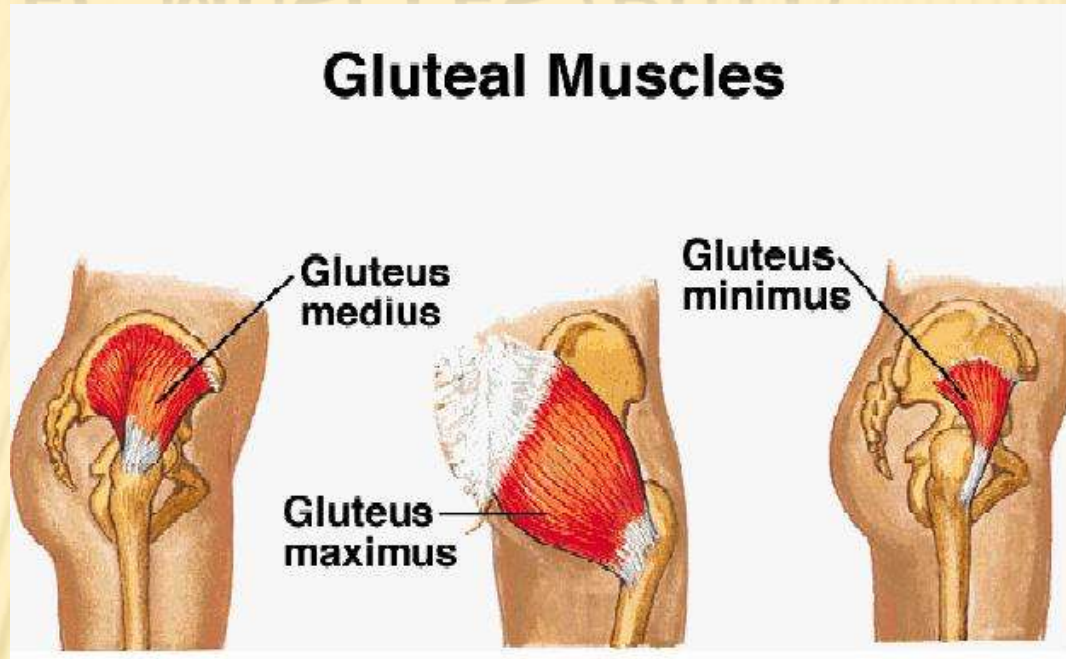
biceps brachii – on the top of the humerus and flexes the elbow

brachialis – assists in flexing the elbow

triceps brachii – back of the humerus and extends the elbow



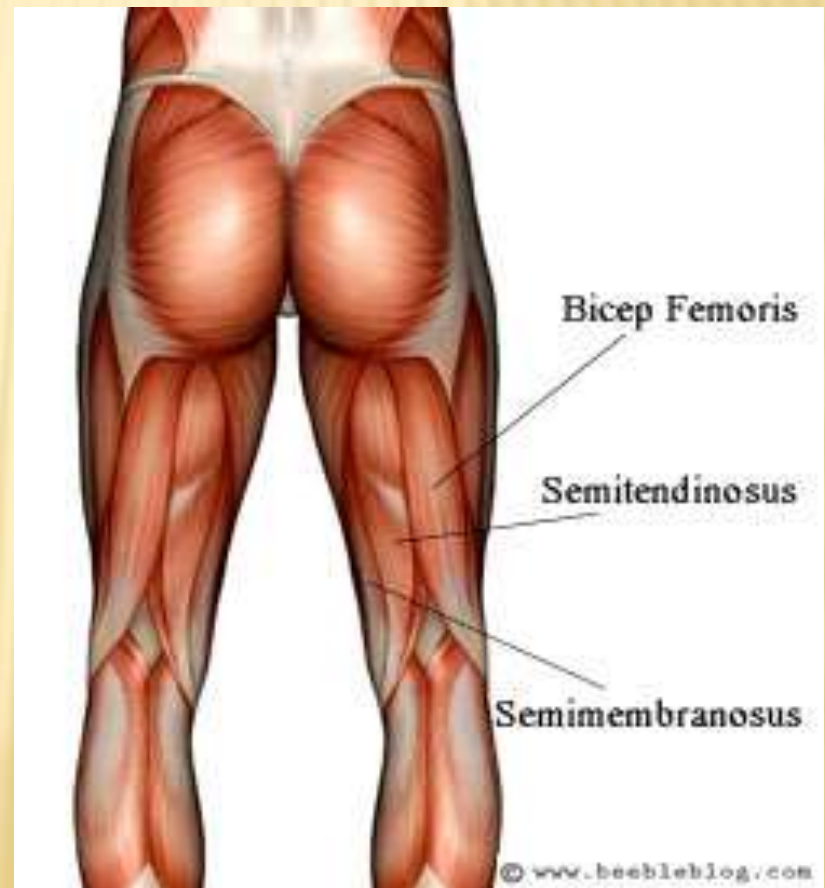
UPPER LEG MUSCLES (BUTT)



- ✘ gluteus maximus – upper back of the leg (butt) and extends the leg
- ✘ gluteus medius and gluteus minimus -upper back of the leg (butt) and moves the leg back and rotates the leg

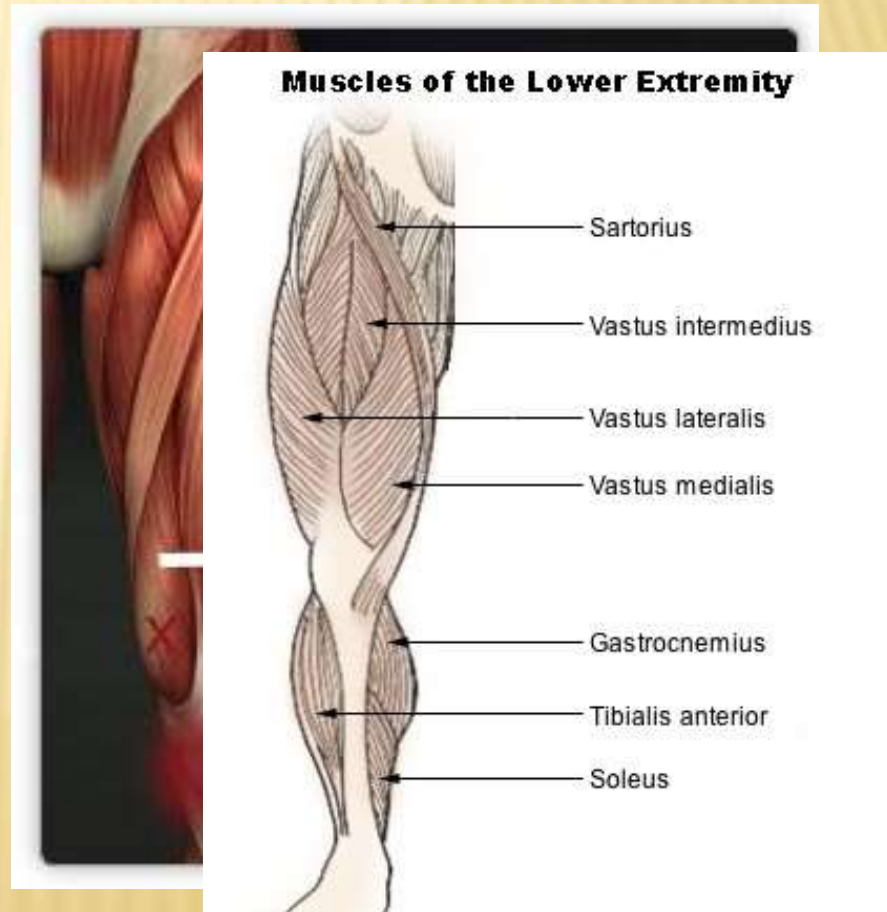
HAMSTRINGS

- ✘ hamstrings – back of the leg and flexes the leg
- ✘ The three hamstrings:
 - ✘ 1) biceps femoris
 - ✘ 2) semitendinosus
 - ✘ 3) semimembranosus



QUADRICEPS

- ✘ quadriceps – front of the leg and extends the leg
- ✘ the four quadriceps
- ✘ 1) rectus femoris
- ✘ 2) vastus lateralis
- ✘ 3) vastus medialis
- ✘ 4) vastus intermedius



LOWER LEG

- ✘ gastrocnemius – back of lower leg and raises (extends) the foot
- ✘ soleus – assists the gastrocnemius
- ✘ “Calf Muscle”

