

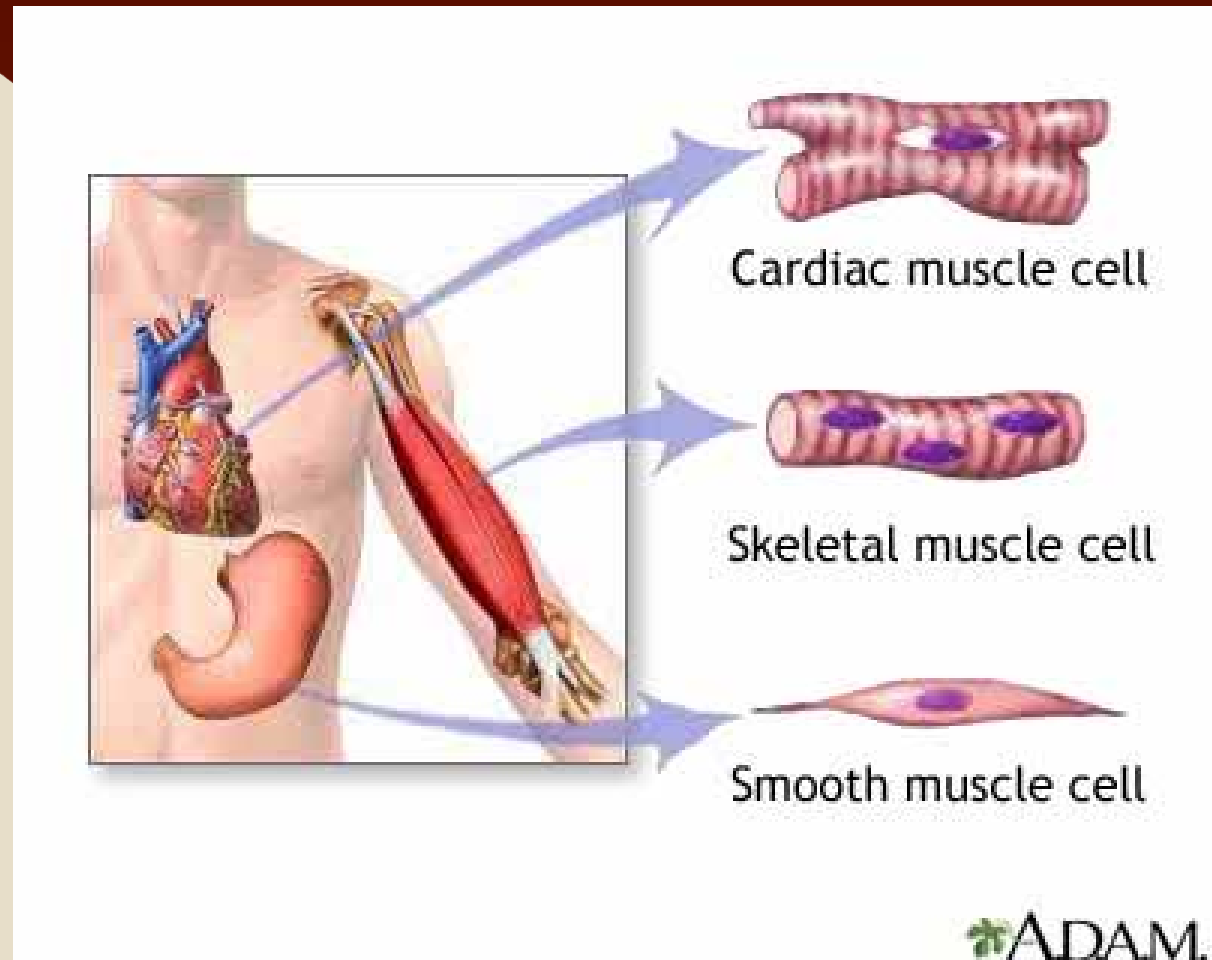
Muscular System



Body-building is great,
unfortunately, now I'm stuck in my shell...

Three Types of Muscles

- Skeletal
- Smooth
- Cardiac



Skeletal Muscle

- Makes up 40-50% of your body mass; muscle cells are elongated and often called muscle fibers; can only contract; work in “antagonistic” pairs.

◎ Functions:

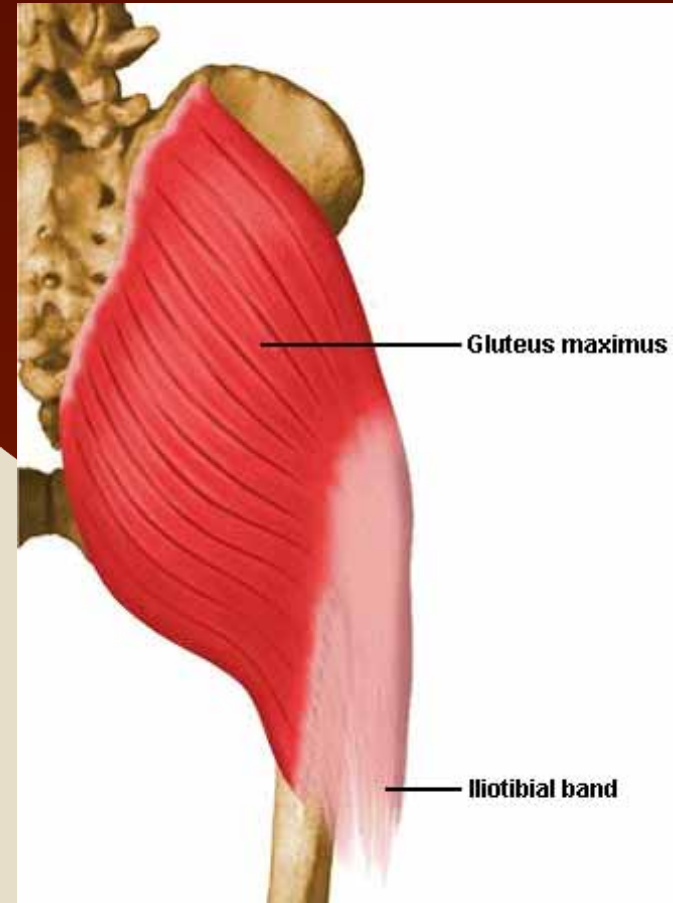
- › Support the body
- › Movement
- › Maintain body temperature
- › Aid in movement of blood in veins and lymph in lymphatic vessels
- › Protect organs and joints

◎ Structure:

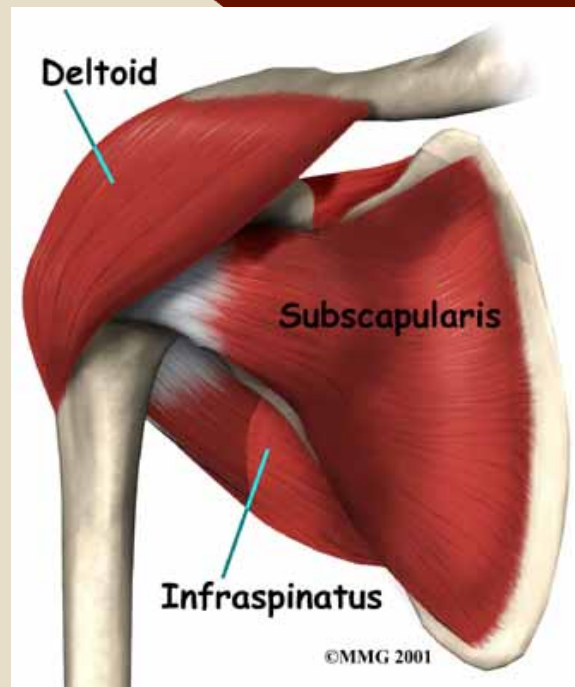
- › Muscles fiber – muscle cell
- › Fascia – outer covering of muscle made up of fibrous connective tissue.
- › Tendons – Attach muscles to bone
- › Ligaments attach bone to bone

- ◎ Attachment of muscles to skeleton:
 - > Origin of a muscle is on the stationary bone
 - > Insertion of a muscle is on the bone that moves
 - > Contraction of a muscle moves a bone at a joint
 - > Antagonistic pairs are muscle that work in opposite direction of each other to bring about movement in opposite directions.

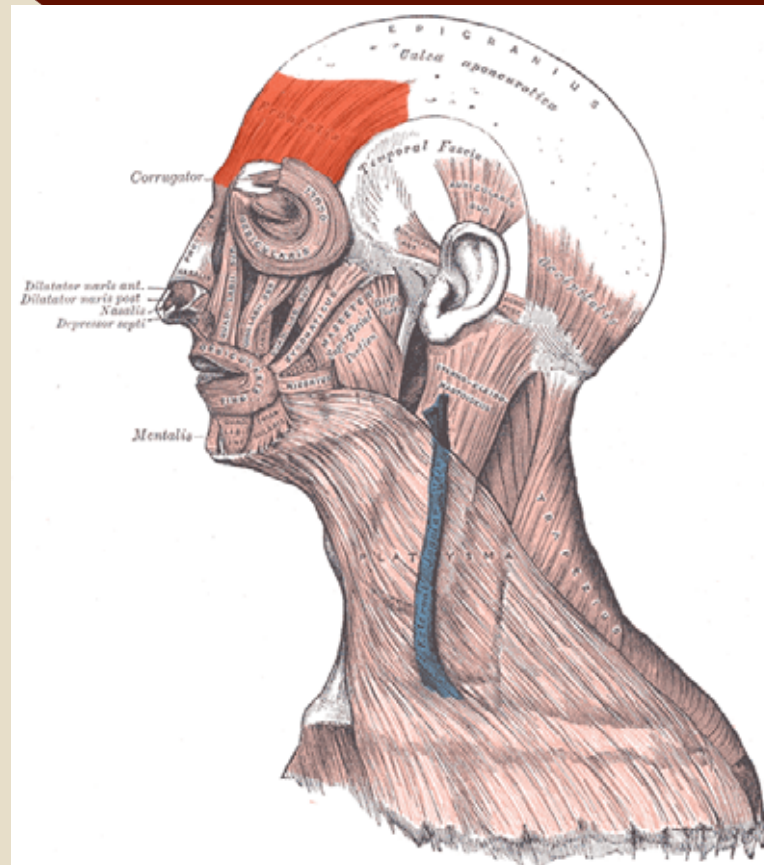
- Skeletal muscle of the body – named according to their characteristic (latin & greek terms)
 - > Size – ex: gluteus maximus



- > Shape – ex: deltoid (Greek Delta = Δ)
triangular shaped



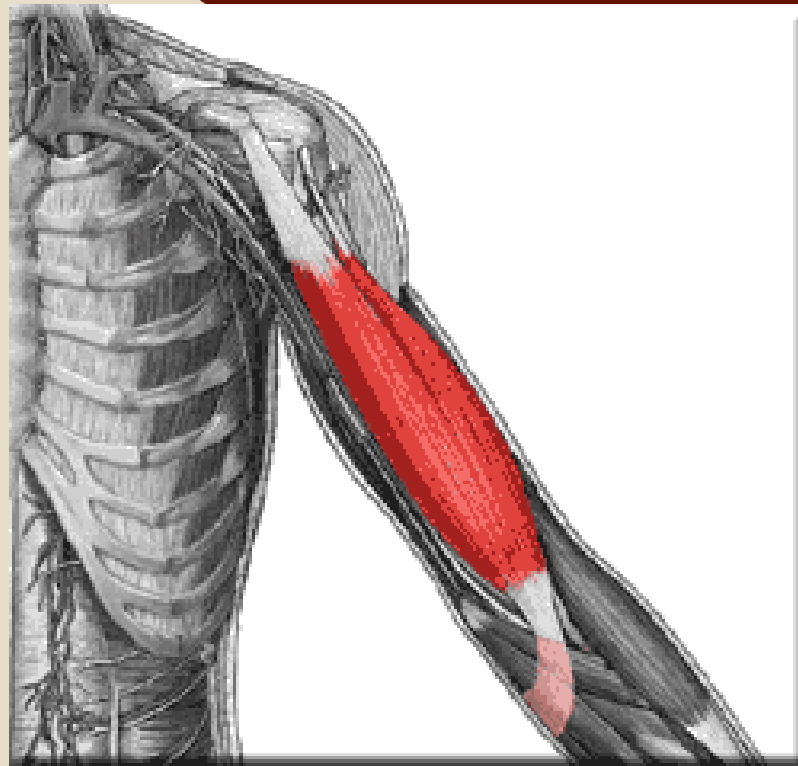
- > Location – ex: Frontalis is over the frontal bone



- > Direction of muscle fibers – ex: external oblique – on the diagonal angle



- > Number of attachments – ex: biceps brachii has two origins



- Action – ex: extensor digitorum extends fingers & digits



◎ Structure of muscle cells (fibers)

- > Sarcolemma = cell membrane
- > Sarcooplasm = cytoplasm
- > Sarcoplasmic reticulum = endoplasmic reticulum
- > T(transverse) tubules = tubules that extend from the sarcolemma down into the sarcooplasm
- > Myofibril = elongated cylinders in muscle cells made up of alternating filament strands of actin & myosin
- > Sarcomere = contractile units within a myofibril
- > Actin & myosin filaments = during stimulation these filaments slide past each other to cause contraction

● Muscle contraction

- Muscle cells/fibers – made up of multiple myofibrils which are the contractile units
- Myofibrils – are made up of actin & myosin filaments that slide past each other & cause contraction.
- Nerves send a stimulus to the muscle fiber via the chemical messenger ACh (acetylcholine)
- Impulses travel down the T tubules into the sarcoplasmic reticulum and Ca^+ ions are released that initiate the contraction of the muscle fiber.

- ATP is the energy source for all processes in muscle.

○ Muscle Movement

- › Muscle twitch – single muscle contraction lasting only a fraction of a second.
- › Tetanus – maximum, sustained muscle contraction
- › Muscle tone – even at rest some fibers in the muscle are always contracting.
- › Slow-twitch muscle fibers – steadier contraction & more endurance, aerobic – long distance sports
- › Fast-twitch muscle fibers – strength, explosions of energy, anaerobic – sprinting, weight lifting, swinging a bat/golf. club, throwing a shot.

- Atrophy – decrease in muscle size due to lack of use.
- Hypertrophy – increase in muscle size due to prolonged use.

◉ Energy Use

- Aerobic – used O₂ to release ATP through cellular respiration – CO₂ & H₂O are waste products, most efficient.
- Anaerobic – no O₂ used to release small amount of ATP – lactic acid builds up as a waste product of fermentation; causes muscles to fatigue.
- Oxygen Debt – after exercise continue to breathe heavy to replace O₂ that can be used to complete cell respiration.

Disorders of the Muscular System

1. Moebius syndrome – paralysis of facial muscles
2. Muscle spasms & cramps – involuntary contractions that occur suddenly & cause pain.
3. Tendonitis – inflammation of a tendon due to repeated strenuous athletic activity, “tennis elbow”

4. Tetanus – bacteria caused; toxins produced by bacteria cause muscles to contract & lock in paralysis – “lock jaw”
5. Muscular dystrophy – group of disorders that cause the progressive degeneration & weakening of muscles over time.
6. Myasthenia gravis – autoimmune disease that weakens the facial, neck, eyelid & extremity muscles “drooping eyelids”