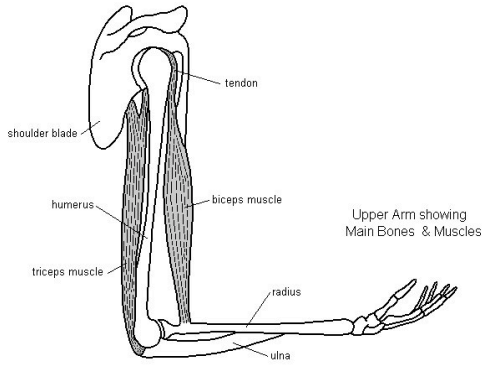
Chapter 38
Muscles and Movement

- The Skeletal system provides support, protection, and locomotion (the ability to move).
- Endoskeleton – skeleton of bone, nonliving
- Exoskeleton – on top of epidermis, not living, mutable (i.e. grasshopper)

Elbow Joint
- Humerus – upper arm
- Ulna – off pinky
- Radius – off thumb
- Long bones, made of compact/spongy material

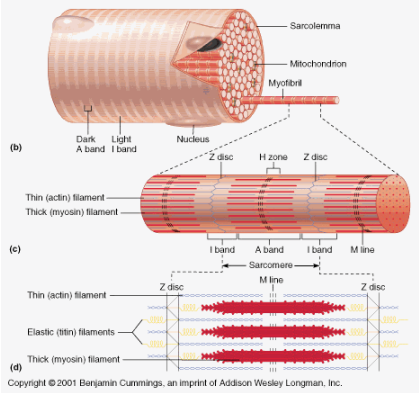


Joints – where two or more bones meet
- Immovable joints – the human skull
- Slightly movable joints – between the vertebrae, cartilage, helps to absorb shock
- Freely movable joints – enclosed by joint capsule used with membrain which secretes synovial fluid (synovial membrane)
- Joint capsule reinforced by ligaments

Muscle Types
- 1. epithelial – stomach
- 2. nervous – nerves
- 3. connective – joints/supports, i.e. ligaments/tendons/collagen/blood
- 4. muscle tissue – generates movement, specialized cell

- Actin and myosin – two types of protein present in muscle tissue
- Three types or muscle
    - Skeletal – pulls on bones, voluntary
    - Smooth – involuntary, i.e. pupil dilation
    - Cardial – only present in heart, involuntary

-Muscle Cell – muscle fiber, not more than one cell
-Each fiber – long with many nuclei



*"sacro" – refers to muscle

Steps to Muscle Contraction – Sliding Filament Model

1. Motor neuron releases acetylocholine.
2. Acetylocholine combines with receptors on muscle fiber.
3. Depolarization of sacrolema
4. Action potential spreads through T tubules.
5. Ca^{2+} released from sacroplasmic reticulum.
6. Ca^{2+} binds to tropomin, causing confrontational change
7. Tropomin pushes tropomyosin away, exposing active sites on actin filaments.
8. ATP (attached to myosin) is split.
9. Myosin head binds to exposed active sites on actin filament, forming crossbridge.
10. Potassium and ATP released from myosin head.
11. Crossbridge flexes and actin filament pulled toward center of sacromere.
12. Myosin head binds ATP and detaches from actin.
13. If sufficient Ca^{2+}, sequence repeats from Step 8.

ATP

- immediate source of energy
- only 1-3 seconds worth of work (strenuous activity, per molecule on cell)
- secondary phosphate – secondary ATP
    - creatine phosphate → phosphate
    - glycogen → glucose → ATP
- only if oxygen present (aerobic)
- oxygen debt – circulatory system cannot keep up with demand for rate of metabolism (glycogen → ATP)
- fermentation
    - anaerobic
    - sometimes able to produce ATP
        - can be broken down
- 40% of chemical energy of glucose is converted to mean energy (rest goes to heat)
- Antagonistic muscles
    - Antagonistic – contracting
    - Agonistic – relaxing
    - Cannot be both at same time