IMPORTANT REMINDERS

- Updated contact details
  Rpanggat@hartnell.edu
- Faculty Webpage active

http://www.hartnell.edu/faculty/homepage.html

- Take-home Assignment #1 due on

02/13/2012

Endocytosis

- Active transport wherein atoms, ions, molecules and certain pathogens are taken into the cell via vesicle formation
- Endocytosis vs. Exocytosis
- Three types – Phagocytosis (WBC chasing bacteria), Pinocytosis (Cell Drinking) and Receptor-mediated Endocytosis

Skeleton-Muscular System
BIO 42
Human Biology

Rosser Panggat, M.D.

Learning Objectives

- ✓ List the functions of the skeleto-muscular system
- ✓ Define the two main divisions of the skeletal system
- ✓ Identify major bones in the body
- ✓ Discuss the different types of joint and the movement provided by each
- ✓ Describe the appearance of the neuromuscular junction (NMJ)

Learning Objectives

- ✓ Describe the appearance of the neuromuscular junction (NMJ)
- ✓ Define the all-or-nothing basis of muscle
- ✓ Compare aerobic and anaerobic energy pathways

Skeletal System

- The skeletal system makes up approximately 12-15% of total body weight

Several key functions of the Skeleto-Muscular System

- Provide movement and locomotion
- Manipulate the environment
- Protect the organs in the thoracic and abdominopelvic cavities
- Help maintain homeostasis by generating internal heat

Several key functions of the Skeleto-Muscular System

- Maintain our upright posture and bipedal way of life
- Produce red blood cells (Hematopoesis)
- Stores and releases minerals, such as calcium and phosphorous, used in muscular contraction

Skeletal System

- At birth – more than 300 bones
- Adult – 206 bones

Axial vs. Appendicular skeleton

Axial Skeleton

- Central axis of the body
- Skeleton that protects the major organs (NS, RS & CVS)
- Consists of 80 bones
- Consist of the skull, facial bones, hyoid bone, ribs and vertebrae (SFHBRV)

Appendicular Skeleton

- Appendages
- Skeleton that makes body movement
- Consists of 126 bones
- Consists of the pectoral girdle, upper appendages (arms & hands), pelvic girdle and lower appendages (legs & feet)

Axial vs. Appendicular

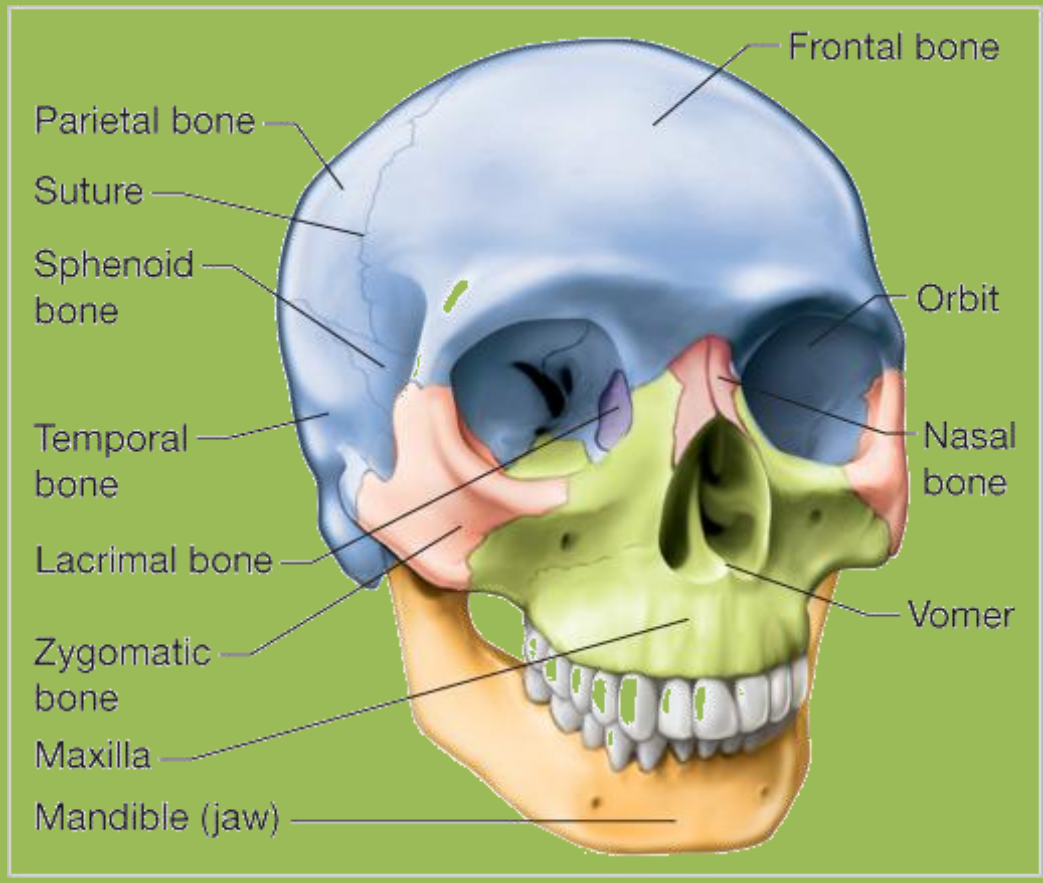
Axial Skeleton

Appendicular Skeleton

Axial Skeleton

Skull / Cranium

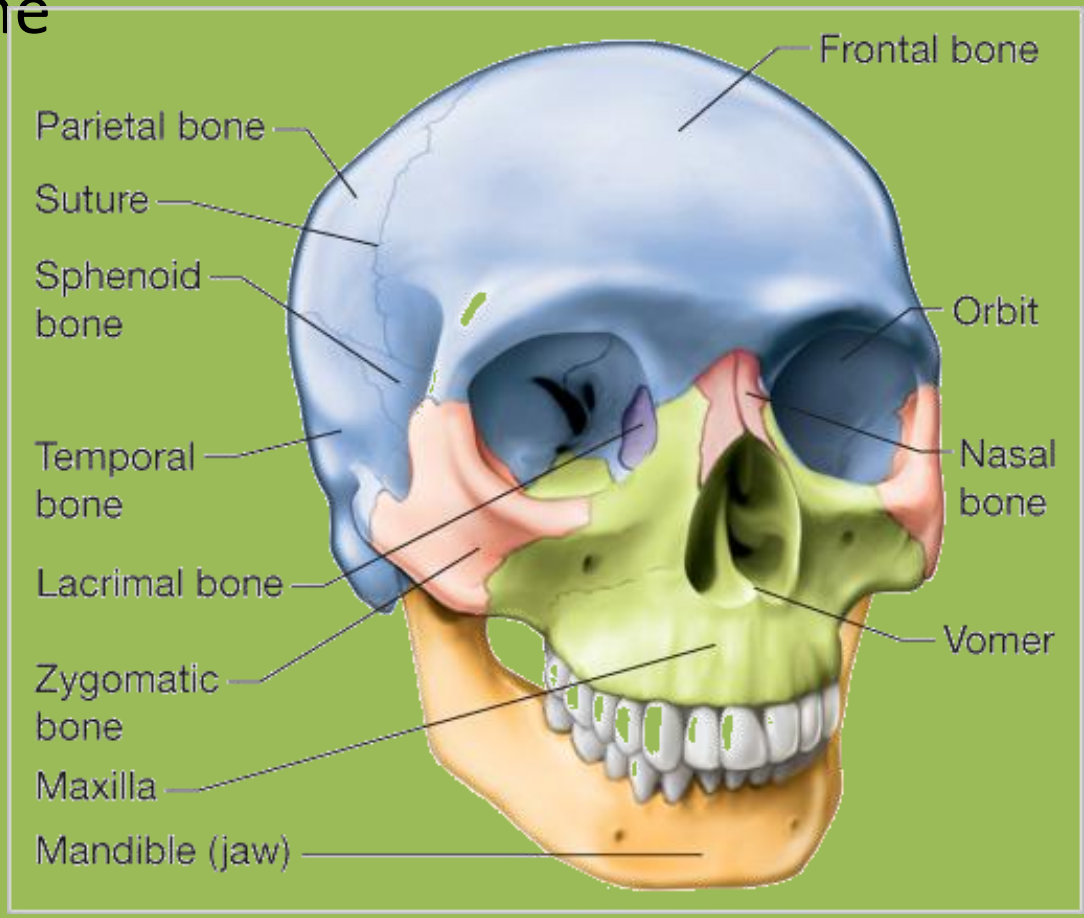
- Surround and protect the brain



Axial Skeleton

Facial bones

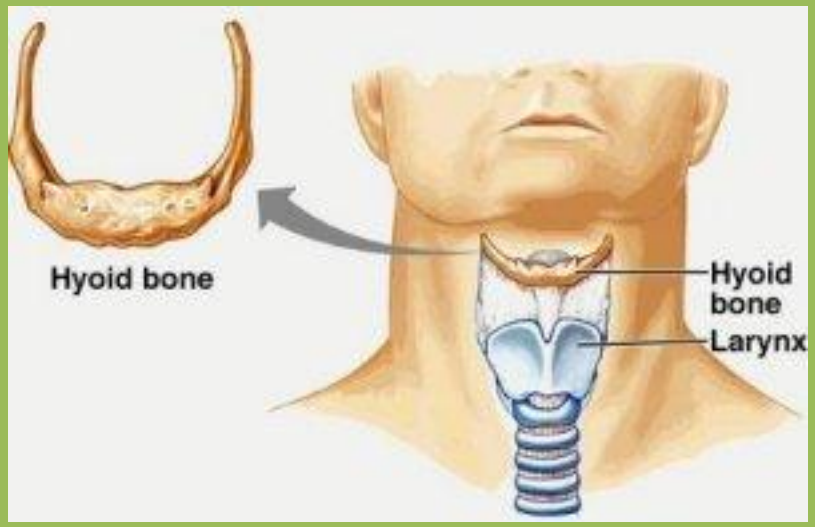
- Protect entrances of the respiratory, digestive and sensory system



Axial Skeleton

Hyoid bone

- Is the only bone that is not attached to any other bone
- Is of forensic value because is can reveal death by strangulation (pressure applied to the throat)



Axial Skeleton

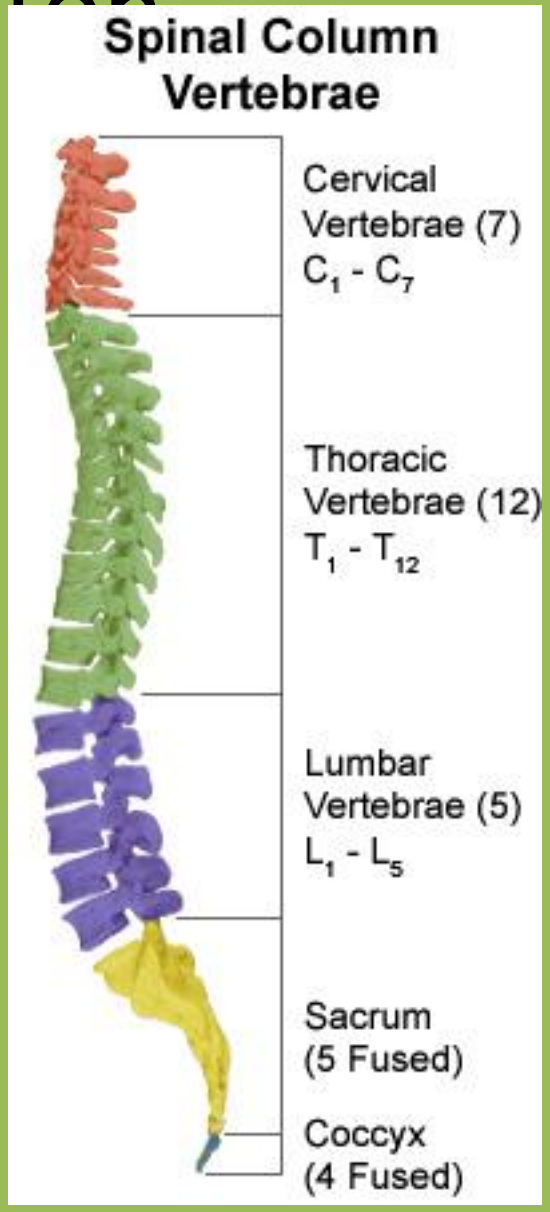
Ribs / Thoracic cage

- Protects the lungs and the heart
- 12 pairs (7 pairs of true ribs, 3 pairs of false ribs and 2 floating ribs)

Axial Skeleton

Vertebrae / Spinal Column

1. Cervical vertebrae (7)
2. Thoracic vertebrae (12)
3. Lumbosacral vertebrae (5)



Axial Skeleton

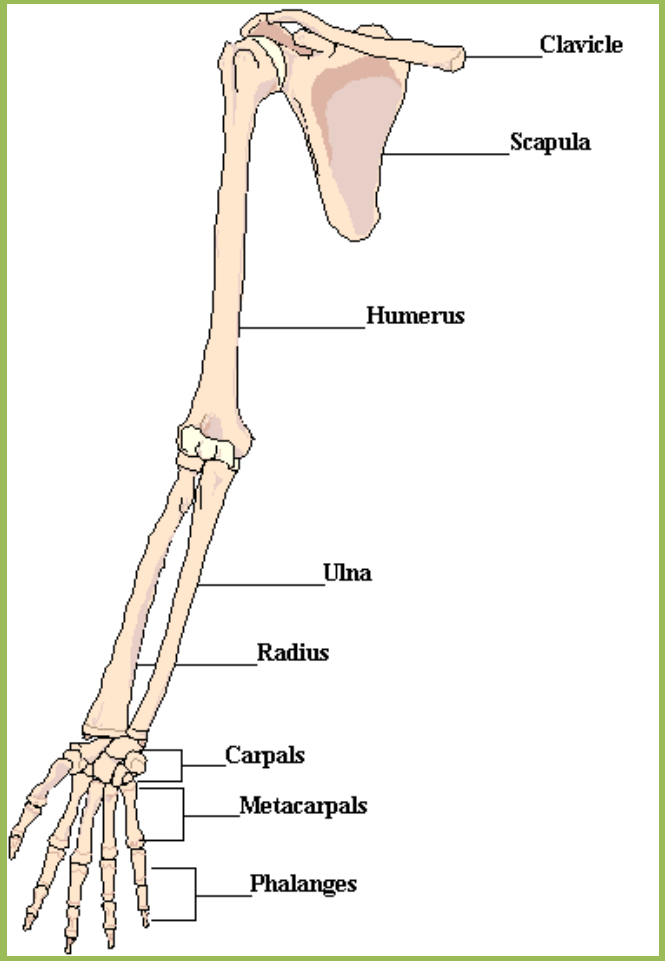
Sternum / Breastbone

- Protect the anterior of the chest
- Point of interest in Cardiopulmonary Resuscitation (CPR)

Appendicular Skeleton

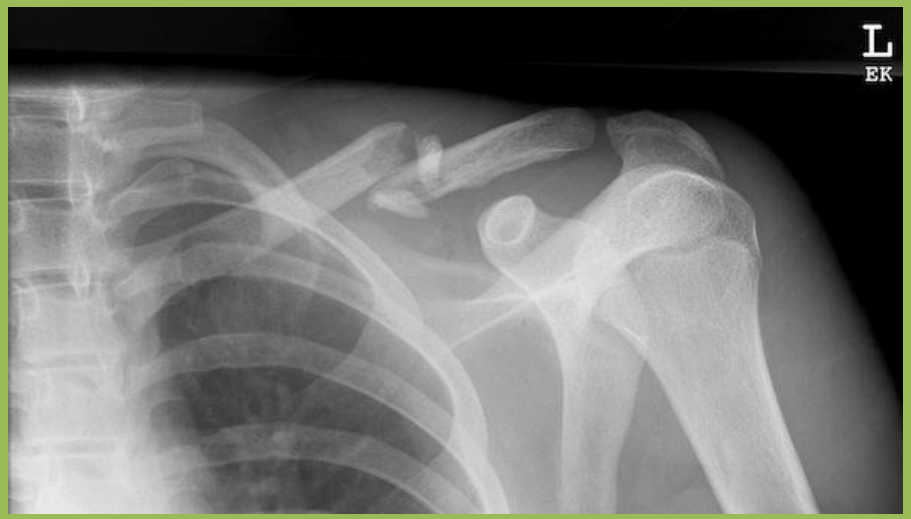
Pectoral Girdle

- 2 pectoral girdles
- Clavicle / Collar bone
- Scapula/Chicken wings



Appendicular Skeleton

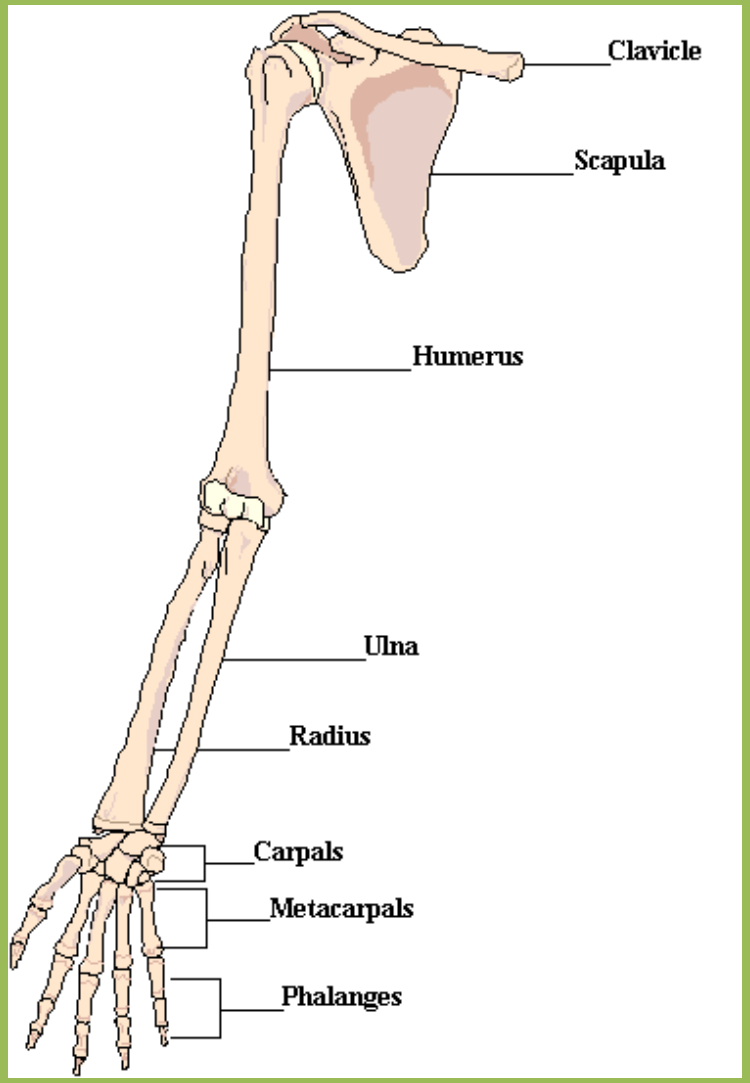
Clavicle Fracture



Appendicular Skeleton

Upper Appendages

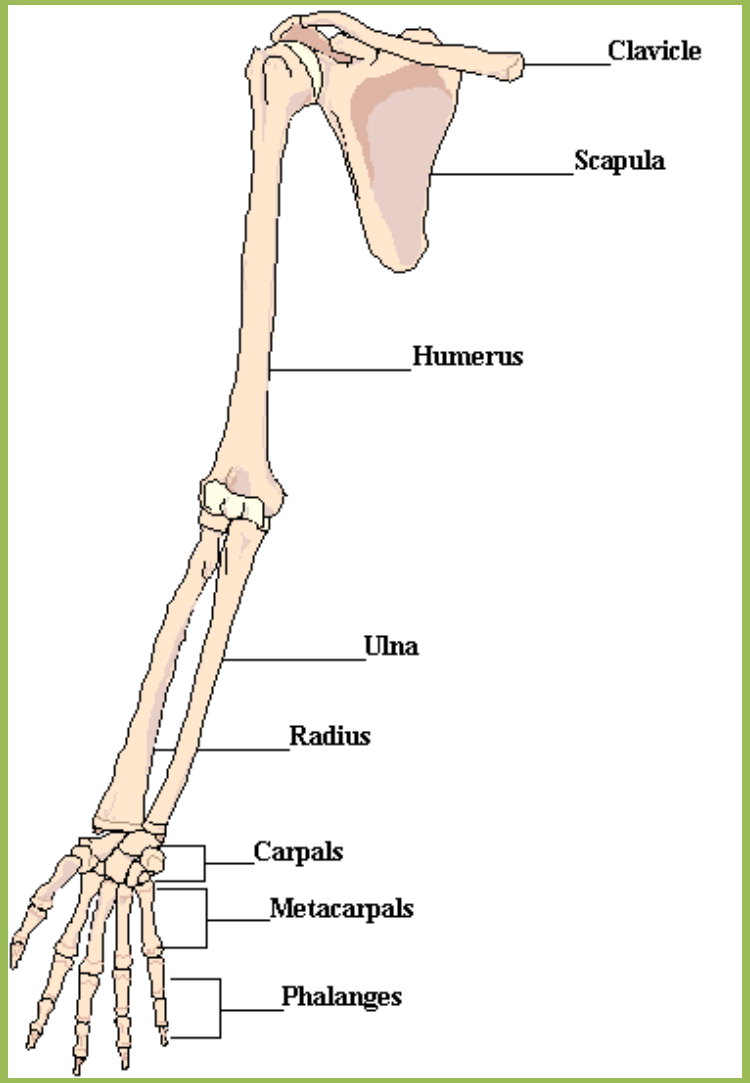
- Humerus (strongest and longest bone in the upper appendicular skeleton)
- Ulna (medial side of the forearm, side of the pinky finger)
- Radius (lateral side of the forearm, side of the thumb)



Appendicular Skeleton

Upper Appendages

- Carpals (wrist bones)
- Metacarpals (knuckles)
- Phalanges (finger bones)



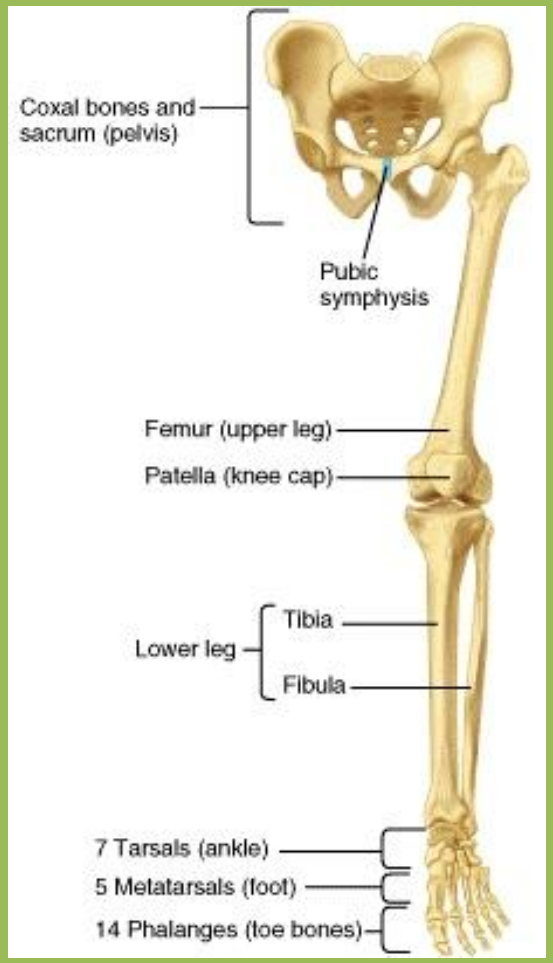
Appendicular Skeleton

Humeral Fracture

Appendicular Skeleton

Pelvic Girdle

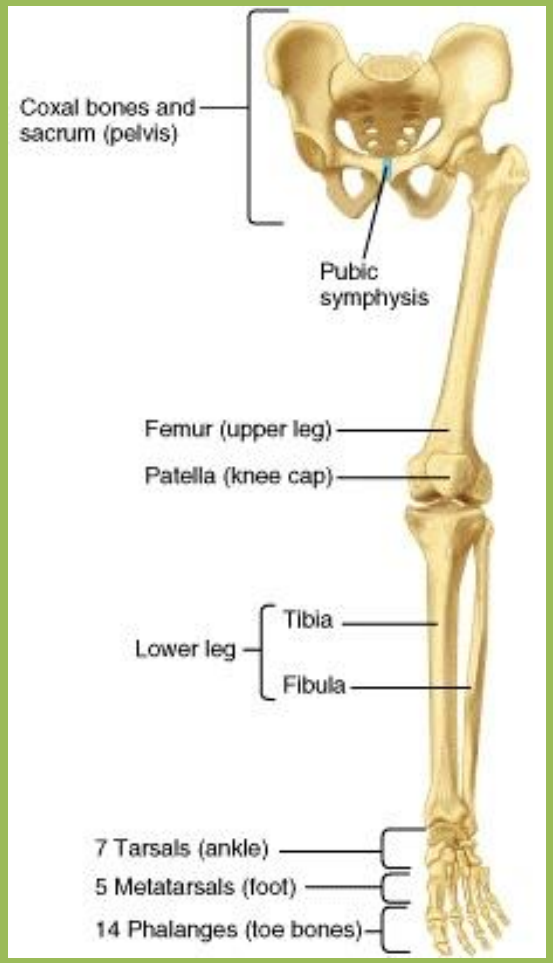
- 2 pelvic girdles
- Hipbone (Ilium, Ischium& pubic bone)
- Femur (longest and heaviest bone in the body)
- Patella / Kneecap



Appendicular Skeleton

Pelvic Girdle

- Tibia
- Fibula
- Tarsals
- Metatarsals
- Phalanges



Types of joints (based on function)

- Synarthrotic (immovable)
- Amphiarthrotic (semi movable)
- Diarthrotic (freely movable)

Types of joints (based on function)

- Synarthrotic (immovable)

Types of joints (based on function)

- Amphiarthrotic (semi movable)

Types of joints (based on function)

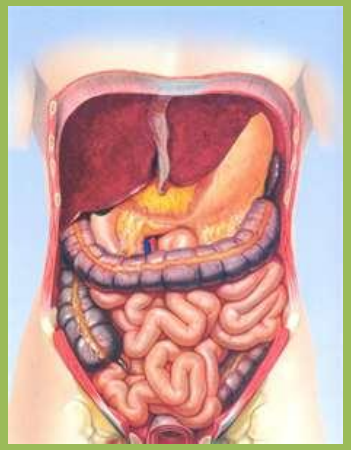
- Diarthrotic (freely movable)

Muscular System

- Muscle makes up approximately 40-45% of total body weight in males and 30-35% of total body weight
- Muscular tissues are contractile tissues
- Three types of muscles tissue (Skeletal, Smooth and Cardiac muscles)

Muscular System

- Skeletal Muscles (**voluntary** muscles and **striated** in appearance)
- Smooth Muscles (**involuntary** muscles and **unstraited** in appearance
- Cardiac Muscles (**involuntary** muscles and **striated** in appearance)



How does muscles contract

- Microfilaments composed of **actin** and **myosin** (units called sarcomere) interact and causes muscle tissue to shorten, therefore produce movement

Neuromuscular Junction (NMJ)

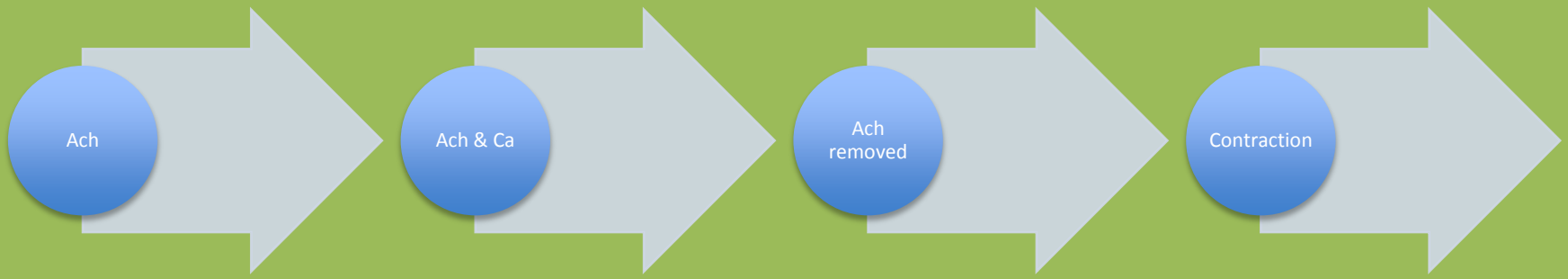
- Muscle contraction starts with a nerve impulse
- Junction between the nervous system (“neuro”) and the muscular system

Neuromuscular Junction (NMJ)

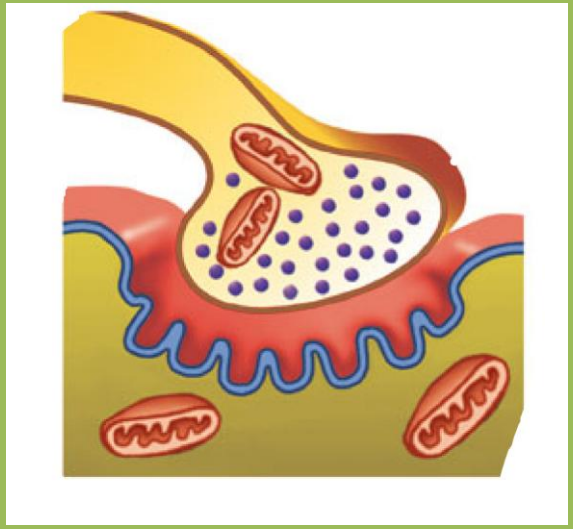
Steps in the transmission of impluse through the NMJ

1. Acetylcholine (Ach) is release from the end of the neuron into the junction
2. Ach binds to the receptors in the muscle cell wall in turns releases calcium inside the muscle cell
3. Ach is removed from the junction, hence ending its action
4. Contraction cycle begins

Neuromuscular Junction (NMJ)



Neuromuscular Junction (NMJ)



All-or-nothing basis of muscle contraction

- Nothing happens when the nerve stimuli is too weak to cause the release of calcium inside the muscle cell

Aerobic vs. Anaerobic

- Three types of muscle cells (Fast, Intermediate and Slow twitch)
- Determined by the breakdown of glycogen called glycolysis (storage form of glucose in the body) and oxygen supply of the cell (**aerobic** – more; **anaerobic** – less)

Aerobic vs. Anaerobic

Slow twitch muscles

- ✓ Red in appearance
- ✓ Large amount of blood supply (more oxygen)
- ✓ More **mitochondria** (powerhouse of the cell)
- ✓ Presence of **myoglobin** (oxygen carrying protein)
- ✓ Nonfatiguing / Aerobic cells

Fast twitch muscles

- ✓ White in appearance
- ✓ Less developed blood supply (less oxygen)
- ✓ Fewer mitochondria
- ✓ Easy fatiguing / Anaerobic cells

Aerobic vs. Anaerobic

Slow twitch muscles

- ✓ Long distance runners

Fast twitch muscles

- ✓ Sprinters

References

- Ireland, K.A. (2011). *Visualizing Human Biology (3rd ed.). Danvers, MA: Wiley & Sons Inc*
- *Video clips retrieved from you tube*