MECHANICS OF MOVEMENT

- Tissues and Structures Involved
  - Muscle
  - Nerve
  - Bone
  - Cartilage
- What are Tendons?
- Role of Joints
- Mechanics of Joints
- Making it all work
Nerve and Muscle--the Motor Unit

- Motor neurons review
  - Ventral horn spinal cord
  - Ventral root to spinal nerve to dorsal or ventral ramus
  - Nerve is bundle mixed neurons
  - One motor neuron synapses with several muscle cells

- Motor Unit is one motor neuron plus the muscle cells it synapses

- "Action potential"--controlled conduction of electrical messages in neurons and muscle by depolarization of cell membrane
Neuro-Muscular Junction

Action potential in nerves triggers chemical release at synapse which triggers action potential in muscle.
See also photo in Fig. 10.2 from M&M to see capillaries around muscle cells
Bone and Cartilage

- Bone as tissue
- Bones as structures formed from bone, cartilage and other tissues
- Location of cartilage in skeleton and relation to joints

Fig. 6.1, M&M
HOW MOVEMENT HAPPENS: Muscles Pull on Tendons to Move Bones at Connections called Joints or Articulations
- Generally regular connective tissue
- Musculo-skeletal connections
  - Muscle to bone
  - Muscle to muscle
  - Bone to bone

Fig. 4.15f, M&M
Tendons are structures that connect bone to muscle and are made up of tendon tissue. Can have various shapes. Typical is cord-like tendon of biceps. Sheeths are common—"aponeuroses" e.g. acromiotrapezius origin from thoracic vertebral spines.

Fig. 10.3, M&M
• Ligaments connect bone-to-bone or reinforce joints—they are made up of tendinous tissue as well.

• E.g. knee ligaments

Fig. 9.12, M&M
Joints or Articulations

- Connections between bones
- Usually, but not always allow for movement
- Formed from various connective tissues
  - Fibrous
  - Cartilaginous
  - Synovial (most complex—typical limb joints)
Fibrous joints

- **Suture**
  - Bones tightly bound by minimal fiber
  - Only found in skull

- **Syndemoses**
  - Bones connected by ligaments
  - E.g. tibiofibular ligament, interosseous membrane of radius/ulna

- **Gomphoses**
  - Peg in socket joint
  - Only found in teeth/alveoli

Fig. 9.1 a, M&M
Fibrous Joints

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Fig. 8.4, M&M

Fig. 9.1b, M&M
**Fibrous joints**

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Fig. 9.1 c, M&M
Cartilaginous Joints

- **Synchondrosis**
  - Hyaline cartilage unites bones
  - Epiphyseal growth plates
  - Costal cartilage-sternum

- **Symphyses**
  - Fibrocartilage unites bones
  - Pubic symphysis
  - Intervertebral disc

Fig. 9.2, M&M
Synovial Joints

- Most common joints in body
- Most mobile joints
- Have
  - Articular surfaces on bone with hyaline cartilage
  - Completely enclosed joint capsule formed from ligamentous connective tissue
  - Synovial fluid within capsule lubricates joint
  - Some have meniscus or articular disc (e.g. knee, jaw joint)
Periosteum
Ligament
Joint cavity (contains synovial fluid)
Articular (hyaline) cartilage
Fibrous capsule
Synovial membrane
Articular capsule

Synovial Joint Shape Types

- **Plane joints** -- intercarpal joints
- **Hinge joints** -- elbow, ankle, interj-phalangeal
- **Pivot joints** -- radio-ulnar joint
- **Condyloid joints** (egg into oval) -- metacarpo-phalangeal
- **Saddle joints** -- carpo-metacarpal joint of thumb
- **Ball-and-socket** -- hip, shoulder

The type of joint, in part, determines the range and direction of movement.
Fig. 9.9, M&M
X-ray of hand affected by arthritis
Photograph of a hip prosthesis.
Arthritis Information

- From American Physical Therapists Association (good preventative info)
- Arthritis stats from CDC (leading cause of disability)
- Health Info from NIAMS (National Institute of Arthritis, Musculoskeletal and Skin Diseases)