- Skeletal (voluntary muscle): contractions pull on bones or skin and cause movement. They are striated, and their cells are called muscle fibers and they are long, cylindrical cells with many "peripherally located" nuclei.
- Cardiac (involuntary muscle): *striated* muscles found *only* in the walls of the heart
- Smooth (involuntary muscle): spindle shaped cells with central nuclei; found mainly in walls of hollow organs excluding the heart.

4.5 Nervous Tissue

Two major cell types: neurons and supporting cells
Neurons are nerve cells that generate and conduct nerve impulse.

- Respond to stimuli via *dendrites*
- Transmit electrical impulses via *axons*

Supporting cells (aka. Glial cells or neuroglia) support, insulate, and protect the delicate neurons.

4.6 Cutaneous membrane is dry; mucous and serous membranes are wet

Covering and lining membranes are continuous multicellular sheets composed of at least two primary tissues: an epithelium bound to an underlying layer of connective tissue proper. There are three types:

1. Cutaneous membrane is the skin. It's composed of keratinized stratified squamous epithelium (epidermis) attached to thick layer of connective tissue (dermis)
2. Mucous membranes (mucosae) line all body cavities open to the outside. Most are stratified squamous or simple columnar epithelia over (*lamina propria mucosae*: a thin layer of loose connective tissue or dense regular tissue)
3. Serous membranes (serosae) lines closed ventral body cavities. They consist of simple squamous epithelium (mesothelium) resting on areolar tissue: a thin layer of loose connective tissue

4.7 Tissue Repair

Tissue repair occurs in two major ways: Regeneration or Fibrosis
The type of tissue damage and the severity of the damage determine which process occurs.
Steps of tissue repair:

1. Inflammation: inflammatory cells are released by injured tissue; clotting occurs
2. Organization: granulation tissue restores blood supply by replacing the clotting
3. *Regeneration/Fibrosis: depends on severity of damage*
    - Regeneration: replaces dead or damaged cell with the same cell type, thus restoring normal function of the tissue
    - Fibrosis: replaces damage or dead cells with scar tissue, which holds tissue together but does not restore function.

In nonregenerating tissues and exceptionally severe wounds, fibrosis totally replaces the lost tissue

Developmental aspect of tissue

One of the first events of embryonic development is the formation of the three *primary germ layers,* which are layered like a stack of pancakes. From *superficial to deep* these layers are the *ectoderm, mesoderm, and endoderm.* These primary germ layers hen specialize to form the four primary tissues that make up all of the body organs. By the end of the second month of development, the primary tissues have appeared, and all major organs are in place.

CHAPTER 5: The Integumentary System

The integumentary system is a collection of organs that include skin, hair, nails, horns, hooves etc.

5.1 Skin (Integument)

Skin makes up approx. 7% of body weight in avg. adult. It consists of two layers:

- Protraction/Retraction
- Supination/ Pronation

8.5 Diversity of Synovial Joints (5 examples)

- *Knee joint* is a hinge joint, and the largest and most complex joint in the body. It consists of 3 joints, and it only has a one joint cavity.
    - Tibiofemoral joint (2 in1) is a hinge joint that permits flexion and extension
    - Femoropatellar joint is a plane joint (patella glides across distal end of femur during knee flexion)

  The extracapsular, capsular, and intracapsular ligaments help to stabilize it.
- *Shoulder (Glenohumeral) joint* is a ball-and-socket joint that allows all angular and rotational movements. Head of humerus fits in glenoid cavity of scapula. The tendons of the biceps brachii and rotator cuff help to stabilize it.
- *Elbow joint:* hinge joint that allows only flexion and extension.
- *Hip joint* is a ball-and-socket joint that can move in every plane possible. Head of femur fits in the acetabulum of the hip bone.
- *Temporomandibular (jaw) joint* is a modified hinge joint. The condylar process of the mandible articulates with the inferior surface of the squamous part of the temporal bone. Two movements occur: (1) depression/elevation of mandible while open and closing mouth, (2) grinding teeth side to side.

8.6 Joint Damage

- Arthritis
- Bursitis and tendonitis
- Cartilage tears
- Dislocation
- Lyme disease
- Sprains

Developmental aspect of joints

Joints develop from mesenchyme parallel to the bones; active joints have thicker capsules, ligaments, and larger bony supports. Also, water exercises help relieve and prevent joint stress/damage.

In class notes:
Table 8.1 pg. 255
Table 8.2
Focus Figure 8.1 pg. 262
Will have to know movements allowed by synovial joints and special movements (pg. 258- 261)

CHAPTER 9: Muscles and Muscle Tissue

Joints are formed when ligaments connect two bones together. Tendons connect muscle to bone.

Muscles turn chemical energy ATP in mechanical energy. Thus, they generate force.

9.1 Types, Characteristics, and Functions of Muscle Tissue

- Skeletal "muscle fibers": elongated, striated, voluntary, adaptable, and responsible for mobility; long, cylindrical cell with many nuclei.
- Cardiac: found only in the heart, striated, involuntary; chains of cells uni or binucleate.
- Smooth "muscle fibers": found in walls of hollow organs (excluding the heart), elongated, smooth, involuntary, forces fluids and other substances through internal body channels, constricts and dilates pupils of your eyes, and forms arrector pili muscles. Cells are uninucleate.

Characteristics (4): enable tissue to perform its duties

- Excitability: receive/respond to stimuli
- Contractility: shorten when stimulated
- Extensibility: can be stretched/extended
- Elasticity: can recoil

Functions (4):

- Movement
- Maintain posture and body position

- Stabilize joints
- Generate heat

9.2 Skeletal Muscle

Made up of "muscle fibers", nerves, blood vessels, and connective tissue.

A. Nerve endings controls its activity: it has a rich blood supply to provide continuous oxygen and nutrients to muscle fibers. Muscle capillaries are the smallest of the body's blood vessels; they accommodate changes in muscle length.
B. Connective tissue sheaths supports each cell and holds the muscle together; they provide entrance and exit to blood vessels and nerve fibers.
   - Epimysium:" layer of dense irregular connective tissue surrounding the entire muscle
   - Perimysium and Fascicles: muscle fibers grouped into fascicles (i.e., "bundle of sticks") that are wrapped in a layer of dense irregular connective tissue (perimysium)
   - Endomysium: layer of areolar connective tissue that surrounds each individual muscle fiber

*Muscle fibers contract → pulls on ct sheaths →ct sheaths transmit pulling force to bone → bones move

C. Attachment: when muscles contract, the movable bone (muscle's point of insertion) moves towards the immovable bone (muscle's point of origin); in limbs, origin lies proximal to insertion.

Origin/Insertion can be either direct or indirect:

- Direct (fleshy attachments): the epimysium of a muscle is directly fused to the periosteum of a bone, or perichondrium of a cartilage.
- Indirect attachments: a continuation of ct sheaths of a muscle i.e., a tendon (rope-like) or aponeurosis (sheet-like); they are more common due to their durability and small size,

9.3 Skeletal Muscle Fibers

Long, cylindrical multinucleate cells that lies beneath the *sarcolemma* (plasma membrane of muscle cell)
Sacroplasma (cytoplasm of muscle cell) has large amounts of glycosomes and myoglobin
Muscle fibers contains 3 highly modified structures important for muscle contraction:

- Myofibrils
- Sacroplamsic reticulum
- T tubules

A. Myofibrils: rod-like structures wrapped in sarcolemma that connected to each other by intermediate (desmin) filaments which extend from the z discs. Also, they contain *sacromeres*, which contains *myofilaments*.
   a) *Sarcomeres are* the functional units of skeletal muscle, and the smallest contractile units of a muscle fiber. It is the region of myofibril between two successive Z discs, and it contains myofilaments.
   b) Myofilaments are connected to the sarcolemma and held in alignment at the Z discs and M lines.
      i. Thick: composed of protein myosin
      ii. Thin: composed of protein actin
      iii. Elastic: core of thick filament that helps form its structure; composed of the protein titin
   c) Molecular composition of myofilaments: Actin and myosin play a role in motility and shape of nearly every cell in the body
      i. Regulatory proteins bound to actin/thin filament: tropomyosin (blocks active binding site on actin strand; prevents cross bridge formation) and troponin (calcium binds to)
   d) Striations: alternating dark (A) and light (I) bands along length of myofibril
      i. Dark A Band: has lighter region in midsection called H Zone which are bisected vertically by a dark lines called M Line "m for middle and myomesin" whom are formed by molecules of protein called myomesin. Thick/myosin filaments extends the entire length of the A band, they are connected in the middle of the sacromere at the M line, and they contain *myosin*.
      ii. Dark I Bands: has darker region in midsection called Z disc (Z Line). Thin/actin filaments extends the I band and part of the A band, and they are anchored up by Z discs.

- Muscle action: They are named for the action they produce, i.e., flexor or extensor

10.3 Muscle Shape

Some muscles have distinctive shapes (e.g., deltoid muscle (deltoid=triangle)
Fascicles (bundles of fiber) vary in shape and function, and the more fibers present → more powerful the muscle. Most common shapes include: circular "sphincters" (orbicularis oris), convergent (pectoralis major), parallel (sartorious), and pennate (extensor digitorium)

10.4 Muscles and Bones form "Lever System"

Relationship between muscle and skeletal systems

Lever: rigid bar **(bone)** that moves on a fixed point called a **fulcrum (joint)**
Effort: occurs at muscle insertion point; it is the force (supplied by **muscle contraction**) applied to lever to *move resistance (load)*
Load: resistance (bone + tissues + any added weight) moved by effort
Lever → power vs. speed; relationship between load and effort relative to the fulcrum

- **Mechanical <u>advantage</u> (power):** small effort can move large load b/c load is close to fulcrum and effort is far from fulcrum. (e.g. using a jack to lift a car)
- **Mechanical <u>disadvantage</u> (speed):** load move rapidly over large distance (wide range of motion) b/c load is far from fulcrum and effort is close to fulcrum (e.g. using a shovel to pick up snow)
    - First class: fulcrum is between load and effort, i.e., a seesaw or scissors
        - *In the body*: the posterior neck muscles (effort), the atlanto-occipital joint (fulcrum) and the facial skeleton (load) __ "tilt's head back"
    - Second class: load is between fulcrum and effort (e.g. wheelbarrow)
        - *In the body*: the calf muscles (effort), the joints on ball of foot (fulcrum, and weight of body (load)___ "standing on toes"
    - Third class: effort is between load and fulcrum (e.g. tweezers)
        - *In the body*: the proximal radius of forearm (effort), the elbow joint (fulcrum), and the hand/ distal end of forearm (load)___ "flexing forearm"

10.5 Determination of Muscle Function

A muscles origin and insertion determine its action:

1. A muscle that crosses on the anterior side of a joint produces flexion.
2. A muscle that crosses on the posterior side of a joint produces extension.
3. A muscle that crosses on the lateral side of a joint produces abduction.
4. A muscle that crosses on the medial side of a joint produces adduction.

CHAPTER 11: Fundamentals of the Nervous System and Nervous Tissue

The nervous system is the master controlling and communicating system of the body; it receives, integrates, and responds to information

11.1 Nervous System Structure & Function

Functions: 3 overlapping

1. Sensory input → information received
2. Integration → information is processed
3. Motor output→ (effector organs)

Structure: two principle parts

1. Central Nervous system (CNS): brain and spinal cord (dorsal body cavity); main integration/control center. Thinking, emotions, etc
2. Peripheral Nervous system (PNS)- outside "peripheral" CNS – 12 pairs cranial, and 31 pairs spinal nerves
    I. Sensory (Afferent) division: detects changes and send information Away from the body to the CNS