

## A&P Chapter 6 The Muscular System

1. List the functions of muscles.
  - essential function of muscle is **contraction** (or shortening)
  - separates it from any other body tissue
  - responsible for essentially all body movement
  - can be viewed as "machines" of the body
  - in all its forms, makes up nearly half the body's mass
2. Name the types of muscle in the human body.
  - skeletal, cardiac, and smooth**
  - share certain similarities; all muscle cells are elongated and are called **muscle fibers**
  - ability to shorten depends on two types of **myofilaments**
    - muscle cell equivalents of microfilaments of cytoskeleton
  - "myo," "mys," and "sarco" refer to muscle
    - "sarcoplasm" = cytoplasm in muscle cells
3. Describe skeletal muscle cells.
  - skeletal muscle fibers packaged into organs called **skeletal muscles** that attach to body's skeleton
  - known as **striated muscle** because fibers appear striped
  - is only muscle subject to **conscious** control
  - keys words are **skeletal, striated, and voluntary**
  - each muscle fiber enclosed in connective tissue sheath called **endomysium**
  - several sheathed muscle fibers wrapped by coarser fibrous membrane called **perimysium** to form bundle of fibers called a **fascicle**
  - many fascicles bound together by overcoat of connective tissue called **epimysium** which covers the entire muscle
  - epimysia blend into strong, cordlike **tendons** (sheetlike **aponeuroses**) which attach muscles indirectly to bones, cartilages, or connective tissue coverings of each other
  - observe and study overhead 6.1
4. Relate sarcomere to the myofibril.
  - muscle cell plasma membrane called **sarcolemma**
  - long ribbonlike organelles called **myofibrils** nearly fill cytoplasm
  - alternating **light (I)** and **dark (A)** bands along length of myofibrils give striped appearance
  - light I band** has midline interruption, a darker area called the **Z line**
  - dark A band** has lighter central area called the **H zone**
  - myofibrils are chains of tiny contractile units called **sarcomeres** which are aligned end to end like boxcars in train
  - is arrangement of smaller **myofilaments** within sarcomeres that actually produces banding pattern

5. Describe myofilament arrangement.

- two types of threadlike protein **myofilaments** within each **sarcomere**
- larger, thick filaments (myosin filaments)** extend entire length of **dark A band**
  - midparts of thick filaments are smooth but ends are studded with small projections (**myosin heads** or **cross bridges**)
- thin filaments (actin filaments)** are anchored to **Z line** which is actually disc-like membrane
- light I band** is area that includes parts of two adjacent sarcomeres and contains **ONLY** thin filaments
- thin filaments overlap ends of thick filaments, they do **NOT** extend into middle of relaxed sarcomere, thus central region (**H zone**) looks bit lighter
- when contraction occurs, actin containing filaments **slide** toward each other into center of sarcomere and light zones disappear because actin and myosin filaments completely overlap

6. List the events of sarcomere contraction.

- when muscle fibers activated by nervous system, cross bridges on myosin attach to myosin binding sites on the thin filaments (actin)
- each cross bridge attaches and detaches several times during contraction and pulls thin filaments toward the center of sarcomere
- as this event occurs simultaneously in sarcomeres throughout cell, muscle cell shortens
- Z lines move closer together
- H zone disappears
- A bands move closer together but do **NOT** change in length
- contraction of millions of sarcomeres in millions of fibers results in contraction of entire skeletal muscle

7. Describe the connective tissue wrappings of skeletal muscle.

- endomysium** wraps each individual muscle fiber (cell)
- perimysium** wraps bundles of fibers into a **fascicle**
- epimysium** covers the entire muscle
- the **epimysium** is continuous with tendons or aponeuroses

8. Briefly describe the smooth muscles.

- smooth muscle has **NO** striations and is involuntary
- found in walls of hollow visceral organs like stomach, urinary bladder, digestive tract, bronchi, uterus, blood vessels
- key terms are **visceral, nonstriated, and involuntary**
- are spindle-shaped, have single nucleus, and arranged in sheets or layers
- contractions are slow and sustained
  - does not tire easily

---movement of food through digestive tract, emptying bowels and bladder, maintenance of blood pressure

9. Briefly describe cardiac muscle.

---keys terms are **cardiac, striated, and involuntary**

---branching cells joined by special junctions called **intercalated disks**

---arranged in spiral shape

---allows contractions to closely coordinated

10. Summarize the nerve aspects of skeletal muscle contraction.

---each muscle fiber must be stimulated separately by nerve impulses to contract

---one motor neuron (nerve cell) and all skeletal muscle cells it stimulates are a **motor unit**

---threadlike extensions of neuron (nerve fiber/axon) branch into number of **axonal terminals** at muscle

--each axonal terminal forms junctions with sarcolemma of different muscle cell

---these junctions are called **neuromuscular junctions**

--nerve endings and muscle cells' membranes NEVER touch

--gap between them called **synaptic cleft** and is filled with **interstitial fluid**

---when nerve impulse reaches axonal terminals, **neurotransmitter** is released

--specific neurotransmitter that stimulates muscle cells is **acetylcholine (Ach)**

---**acetylcholine** diffuses across **synaptic cleft**

---attaches to receptors on sarcolemma

--if enough acetylcholine released, sarcolemma becomes temporarily permeable to sodium ions ( $\text{Na}^+$ ) which rush into muscle cell

---generates electrical current called **action potential**

---action potential travels over entire surface of sarcolemma conducting impulse from one end of cell to the other

---result is **contraction** of the cell

11. List the steps in the sliding-filament theory of muscle contraction.

---nerve impulse reaches neuromuscular junction

---acetylcholine released

---acetylcholine causes action potential in sarcolemma

---action potential in sarcolemma causes **sarcoplasmic reticulum** to release stored **calcium ions** into sarcoplasm

---calcium ions cause **cross-bridges** to form

---thin **myofilaments (actin)** pulled over thick (myosin) myofilaments

--energy provided by ATP

---**sarcomere contracts**

---action potential ends, calcium ions reabsorbed