The board examination will likely have several questions on basic anatomy of muscle and bone structures. This PowerPage will cover basic anatomy and physiology of the muscles.

**Types of Muscle (3 types)**

**Skeletal Muscle:**
- **Striated muscle** fibers, *actin and myosin*, create the striped appearance
- **Provide motor** to the body (limbs, trunk, face, etc.) via sliding filament mechanism
- **Voluntary**
- Attached to the skeletal system (bones) by tendons (connective tissue)
- **ATP (energy) and calcium** are required for **muscle contraction**
- The **neurotransmitter for skeletal muscles is acetylcholine** (Ach)
- The **Ach is located** at the ends of the motor neuron (the **neuromuscular junction**)
- **Motor nerves** innervate the muscle and branch to supply the individual myofibrils
- Muscle activity is ceased by acetylcholinesterase
- Muscle fibers are **long and striated** with multiple nuclei
- **Has an origin and insertion** (i.e. triceps originates on the humerus and inserts via a tendon to the ulna)
- Part of the **Somatic Nervous System** (skeletal muscle (motor) and sensory nerves)

**Smooth Muscle:**
- May also be called **visceral muscle** (*found in the walls of all hollow organs except the heart*)
- Contains **no neuromuscular junctions**; the transmitters are sent via interstitial fluid
- The neurotransmitter is acetylcholine (excitatory - causes muscle contraction) or norepinephrine (inhibits contractions)
- Muscle **relaxation occurs when calcium is moved out** of the smooth muscle fibers
- Muscle fibers are **spindle shaped** with single nucleus
- Contraction occurs without conscious thought (**involuntary**)

**Cardiac Muscle:**
- Functions to **pump blood** in the circulatory system
- Cells are **branching and striated**
- Located in the **wall of the heart**
- Also utilize the sliding filament process
- **Involuntary**
Contraction of Muscle

- When muscles are at rest, calcium is stored in the sarcoplasmic reticulum. Action potentials (nerve impulses) trigger calcium release. The calcium then binds to troponin on the thin filaments, which turns on actin and myosin interaction. This results in contraction of the sarcomere. After the contraction, calcium is pumped back into the sarcoplasmic reticulum via Calcium ATPase.

- When the action potential reaches an axon terminal, acetylcholine is released from the vesicles, which opens transmembrane channels and allows sodium to diffuse in.

- The junction between the motor neuron terminal and the muscle fiber is the neuromuscular junction (a kind of synapse). To create the action potential as described above, influx of sodium ions decreases the resting potential at the end plate. When sodium ions rush in, the action potential is created in the muscle fiber. After the action potential, the latent period occurs when acetylcholinesterase breaks down the acetylcholine at the neuromuscular junction. The sodium channels then close, and resting potential is restored by outflow of potassium.

Terms to Know

- **Sarcomere** - contractile unit of a muscle fiber
- **Myofibril** - muscle fiber
- **Sarcoplasmic reticulum** - endoplasmic reticulum that is needed for muscle contraction
- **Z-line** - protein bands where actin filaments attach in a striated muscle fiber and mark the boundaries of adjoining contractile units
- **Sarcolemma** - thin plasma cell membrane of a muscle cell