

Lecture 4

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Structure and Function of the Neuromuscular System

- Central nervous system - in your bones (skull, spine)
- Peripheral nervous system - branches out from spine
 - o Autonomic (controls self-regulated action of internal organs and glands)
 - Sympathetic (arousing)
 - Parasympathetic (calming)
 - o Somatic (controls voluntary movements of skeletal muscles)
 - ^ what this class is about
- Muscle recruitment begins in motor cortex
- Nerve impulses for voluntary muscle contraction are BORN
- *Premotor* cortex and *primary* cortex
- Primary - collection of Betz cells (Vladimir Betz was a 19th century Ukrainian scientist; first person to characterize the cells); largest in the CNS
 - o Project out the brain and send their axons down spinal cord to ventral horn
- Sensory info comes from dorsal part of brain
- Neural recruitments are electrical events
- Alpha motor nerves - huge, voluntary muscle control
- Gamma motor nerves - tiny, involuntary reactions (knee jerk reaction)
- Motor unit - a motor nerve and all of the muscle fibers it innervates
 - o Generally several hundred muscle fibers per motor unit
- If one motor unit is activated, all muscle fibers it influences fire maximally; all-or-none
- Charge gradients/neural activation
- K inside of cell high, outside of cell low
- Saltatory conduction - jumps from node to node (how cells send signals)
- Rate coding - the frequency of achieving an action potential (duration of inter-spike intervals); increase load/stimulus and you'll increase the firing rate (# of action potentials in a given duration)

- Linking nerve signals to muscle contractions
 - 1) Alpha motor neuron is excited (depolarized)
 - 2) Electrical signal leaves CNS through ventral horn
 - 3) Travels to axon terminal (or "terminal bouton")
 - 4) Ca enters bulb, activates synaptic vesicles
 - 5) Vesicles dock, fuse, and release their acetylcholine
 - 6) Acetylcholine travels across synaptic cleft; attaches to receptors on postsynaptic membrane
 - 7) Depolarizes sarcolemma, signal transmitted to the sarcoplasmic reticula