

- I. Somatic motor system (voluntary motor)
 - A. Delivers impulses to skeletal muscle.
 - B. Motor neuron pathway
 1. Begins at the **primary motor cortex** (precentral gyrus) and is a 2 neuron pathway to any skeletal muscle in the body.
 2. The first neuron is known as an **upper motor neuron** and its cell body is located in the primary motor cortex.
 - a. The axon of the upper motor neuron descends into the spinal cord (crossing over to the opposite side of the body at the medulla oblongata) to eventually terminate and synapse at an **anterior horn of gray matter**.
 - b. As the axon of the upper motor neuron descends within the spinal cord it travels in the **corticospinal tract** of the white matter.
 3. These upper motor neurons synapse with a **lower motor neuron**, the second neuron in the pathway.
 - a. The cell body of the lower motor neuron is located in the **anterior horn of gray matter**.
 - b. The axon of the lower motor neuron exits the spinal cord through the **ventral root** of a spinal nerve (may also travel in cranial nerves to feed muscles of the head and neck).
 - c. These axons ultimately synapse with skeletal muscles where an impulse triggers the release of **acetylcholine**.
 - C. Damage
 1. Flaccid paralysis
 - a. Occurs when there is damage or disease to a lower motor neuron such that skeletal muscle is unable to receive any stimuli.
 - b. Muscle lacks any voluntary control, reflexes or muscle tone.
 2. Spastic paralysis
 - a. Occurs when there is damage or disease to an upper motor neuron or to the primary motor cortex.
 - b. There is no voluntary control but reflexes are still present, however exaggerated.
 - D. Somatic reflexes: involuntary reflexes of skeletal muscle
 1. Reflexes occur over highly specific neural paths called reflex arcs.
 2. The components of a reflex arc
 - a. A **sensory receptor** detects some form of stimulation (pain, stretch in a muscle or tendon, etc.) and initiates an impulse.
 - b. A **sensory neuron** carries the impulse to the brain or spinal cord.
 - c. The synapses between the sensory and motor neurons within the central nervous system are called the **integrating center (interneurons)**.
 - d. A **motor neuron** carries the impulse away from the brain or spinal cord towards an **effector**.
 - e. The **effector** muscle responds.
 3. Some reflexes are **direct (monosynaptic)** reflexes.
 - a. A sensory neuron directly synapses with a lower motor neuron, transmitting the impulse out to a skeletal muscle.
 - b. Example: Stretch reflex**
 - i. The elongation of a muscle stimulates a receptor to generate an impulse.

- ii. The impulse travels on a sensory neuron to the spinal cord to directly synapse with the cell body of a lower motor neuron.
 - iii. The lower motor neuron transmits the impulse back to the original elongated muscle stimulating it to contract (knee jerk reflex).
 - iv. Important in maintaining posture.
4. **Indirect (polysynaptic) reflexes**
- a. An **association (internuncial)** neuron connects the sensory and the lower motor neuron within the spinal cord.
 - b. Example: **Flexor withdrawal reflex**
 - i. A painful stimulus causes a receptor to generate an impulse.
 - ii. The impulse travels on a sensory neuron to the spinal cord where it synapses with an association neuron.
 - iii. The association neuron synapses with the lower motor neuron.
 - iv. The lower motor neuron transmits the impulse to a flexor muscle to withdraw the body part away from the painful stimuli.