

## **Reflexes**

- A reflex is a rapid, predictable motor response to a stimulus
- Reflexes may:
  - Be inborn (intrinsic) or learned (acquired)
  - Involve only peripheral nerves and the spinal cord
  - Involve higher brain centers as well

## **Reflex Arc**

- There are five components of a reflex arc
  - Receptor – site of stimulus
  - Sensory neuron – transmits the afferent impulse to the CNS
  - Integration center – either monosynaptic or polysynaptic region within the CNS
  - Motor neuron – conducts efferent impulses from the integration center to an effector
  - Effector – muscle fiber or gland that responds to the efferent impulse

## **Reflex Arc**

### **Stretch and Deep Tendon Reflexes**

- For skeletal muscles to perform normally:
  - The Golgi tendon organs (proprioceptors) must constantly inform the brain as to the state of the muscle
  - Stretch reflexes initiated by muscle spindles must maintain healthy muscle tone

## **Muscle Spindles**

- Are composed of 3-10 intrafusal muscle fibers that lack myofilaments in their central regions, are noncontractile, and serve as receptive surfaces
- Muscle spindles are wrapped with two types of afferent endings: primary sensory endings of type Ia fibers and secondary sensory endings of type II fibers
- These regions are innervated by gamma ( $\gamma$ ) efferent fibers
- Note: contractile muscle fibers are extrafusal fibers and are innervated by alpha ( $\alpha$ ) efferent fibers

## **Muscle Spindles**

### **Operation of the Muscle Spindles**

- Stretching the muscles activates the muscle spindle
  - There is an increased rate of action potential in Ia fibers
- Contracting the muscle reduces tension on the muscle spindle
  - There is a decreased rate of action potential on Ia fibers

## **Operation of the Muscle Spindles**

### **Stretch Reflex**

- Stretching the muscle activates the muscle spindle
- Excited  $\gamma$  motor neurons of the spindle cause the stretched muscle to contract
- Afferent impulses from the spindle result in inhibition of the antagonist
- Example: patellar reflex
  - Tapping the patellar tendon stretches the quadriceps and starts the reflex action
  - The quadriceps contract and the antagonistic hamstrings relax

### **Stretch Reflex**