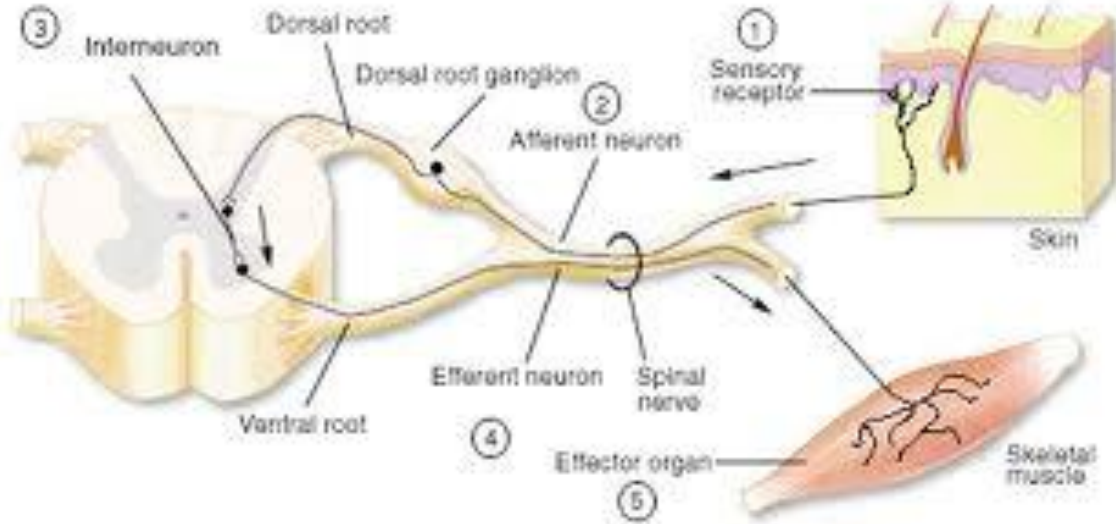


The Reflex Arc



Reflex Arc continued

- There are 5 parts to a reflex arc
- 1) **The receptor** – receives the initial stimulus (ie touching a thorn on a rosebush)
- 2) **the Sensory (afferent) Nerve** – carries the impulse to the spinal column or brain
- 3) **Intermediate Nerve Fiber** – (the adjuster or interneuron) which interprets the signal and issues an appropriate response
- 4) **Motor (efferent) Nerve** – which then carries the response message from the spinal cord to the muscle or organ
- 5) **Effector Organ** – carries out the response (removal of the hand from the bush)

Proprioceptors and the Control of Movement

- In the tendons, muscles and joints there are receptors called proprioceptors which provide sensory information about muscle contraction, position of the limbs, and posture and balance.
- This information is mostly provided through afferent (sensory) input from two main sensory receptors: tendon organs and muscle spindles.
- Tendon organ and muscle spindles continuously monitor muscle actions and are essential components of the neuromuscular system. They tell the nervous system about the state of muscle contraction

Golgi Tendon Organs

- Are sensory receptors that terminate where the tendons join to muscle fibers
- Aligned in series with the tendon so that when the tendon is stretched the GTO is also being stretched.
- Detect increased tension exerted on the tendon.

GTO continued

- When a change in tension is detected an impulse is sent along the afferent nerves to the CNS where they synapse with motor neurons of the same muscle.
- The efferent neurons instantly transmit an impulse, causing the muscle to relax thereby preventing injury
- Serves as a tension detection device for the muscle system. They help prevent the muscle from excessive tension that could damage the muscle or joint or both.

Muscle Spindles

- Lie parallel to the main muscle fibers and send constant signals to the spinal cord.
- The spindle is about 5 mm long and about 5 intrafusal muscle fibers run through it.
- Help to maintain muscle tension but are sensitive to changes in muscle length.

Muscle spindles continued

- Contains two afferent and one efferent nerve fibers
- The spindle detects changes in the muscle fiber length and responds to it by sending a message to the spinal cord, leading to the appropriate motor responses. The resulting contraction allows the muscle to maintain proper muscle tension or tone
- The two sensory nerves helps to increase its sensitivity
- Also play a crucial role in maintaining posture and balance

Muscle Spindles Continued

- Are involved in the reflex contraction of muscles (stretch reflex).
- Stretch reflex action is present in all muscles and plays an especially important role in the major extensor muscles of the limbs
- Eg – knee jerk reflex (patella reflex)
- Also responsible for overcompensation response when additional weight is placed on weight bearing muscles.

Polysynaptic Reflexes

- Slower – involve interneurons
- Withdrawal reflex – withdrawal of a body part from a painful stimulus
- Involves the transfer of information from a sensory neuron to a motor through a connecting interneuron in the spinal cord.
- Very rapid – occurs before the brain itself has time to interpret the information

Crossed Extensor Reflex

- Happens when one limb automatically compensates for a reflex of the opposing limb
- Involves multiple synapses and muscle groups
- 1) stimulus is detected
- 2) The receptors initiate nerve impulses in the sensory neurons leading from the receptors
- 3) The impulses travel into the spinal cord where the sensory nerve terminals synapse with interneurons
- 4) some of these interneurons synapse with motor neurons that travel out from the spinal cord to the effector organ
- 5) The knee flexors withdraw the foot from the danger zone
- 6) Other sensory neurons synapse with interneurons that affect motor neurons in the opposing leg and cause these muscles to come into action