

*Supplementary Material*

The 12 pre- and post-test questions relating to reflex physiology and neuron function asked of the control and experimental group students. There were significant differences in pre-post test performance for the experimental group compared to the control group on questions 2, 8, 11, and 12 (See Figure 3 in Petto et al.).

#1

Place the following descriptions into the correct order to represent the sequence of events in a patellar reflex arc.

A tap on the patellar ligament excites nerve endings of muscle spindles in the quadriceps femoris.

Stretch signals travel to the spinal cord via a primary afferent neuron.

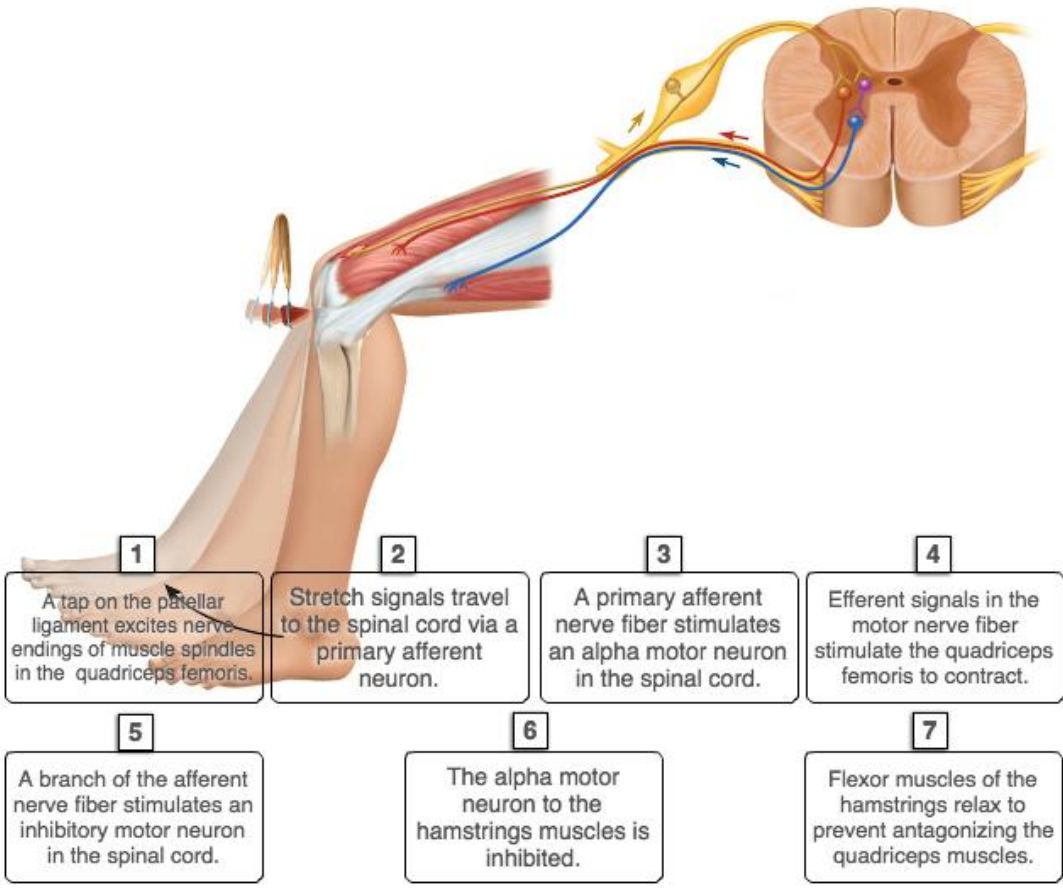
A primary afferent nerve fiber stimulates an alpha motor neuron in the spinal cord.

Efferent signals in the motor nerve fiber stimulate the quadriceps femoris to contract.

A branch of the afferent nerve fiber stimulates an inhibitory motor neuron in the spinal cord.

The alpha motor neuron to the hamstrings muscles is inhibited.

Flexor muscles of the hamstrings relax to prevent antagonizing the quadriceps muscles.



**1**  
 A tap on the patellar ligament excites nerve endings of muscle spindles in the quadriceps femoris.

**2**  
 Stretch signals travel to the spinal cord via a primary afferent neuron.

**3**  
 A primary afferent nerve fiber stimulates an alpha motor neuron in the spinal cord.

**4**  
 Efferent signals in the motor nerve fiber stimulate the quadriceps femoris to contract.

**5**  
 A branch of the afferent nerve fiber stimulates an inhibitory motor neuron in the spinal cord.

**6**  
 The alpha motor neuron to the hamstrings muscles is inhibited.

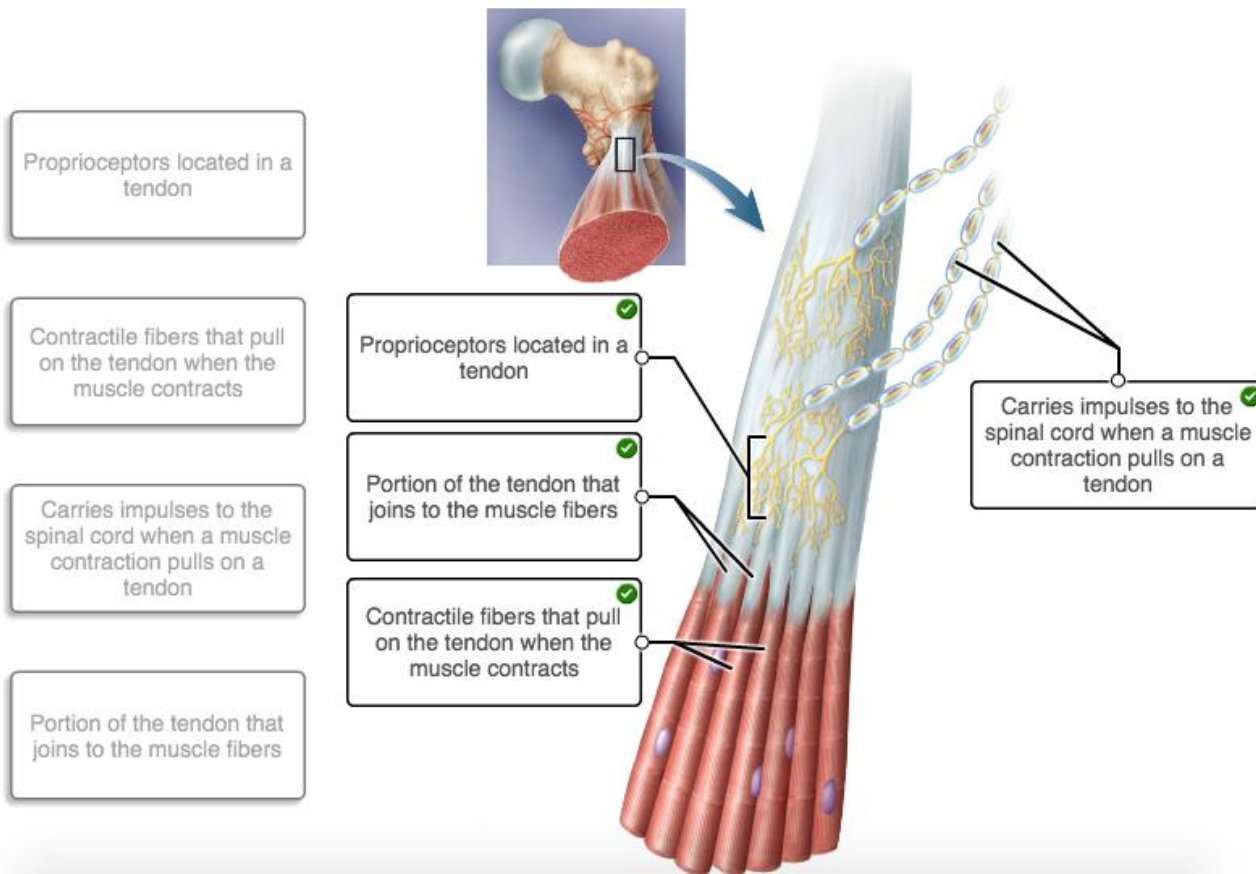
**7**  
 Flexor muscles of the hamstrings relax to prevent antagonizing the quadriceps muscles.

**Reset**

#2

## Applying the Functions of the Components of the Tendon Reflex

Correctly identify the function of each structure that comprises a tendon reflex by dragging the appropriate label into place.



#3

Reflexes have four important properties: they require stimulation, they are quick, they are involuntary, and they are stereotyped.

- True  
 False

#4

Which of the following statements describes a way that reflexes differ from other motor actions? Check all that apply.

- Reflexes are voluntary.
- Reflexes can occur even if the spinal cord has been severed.
- Reflexes involve efferent nerve fibers.
- Reflexes occur without intent and are difficult to suppress.
- Reflexes generally involve few or no interneurons.

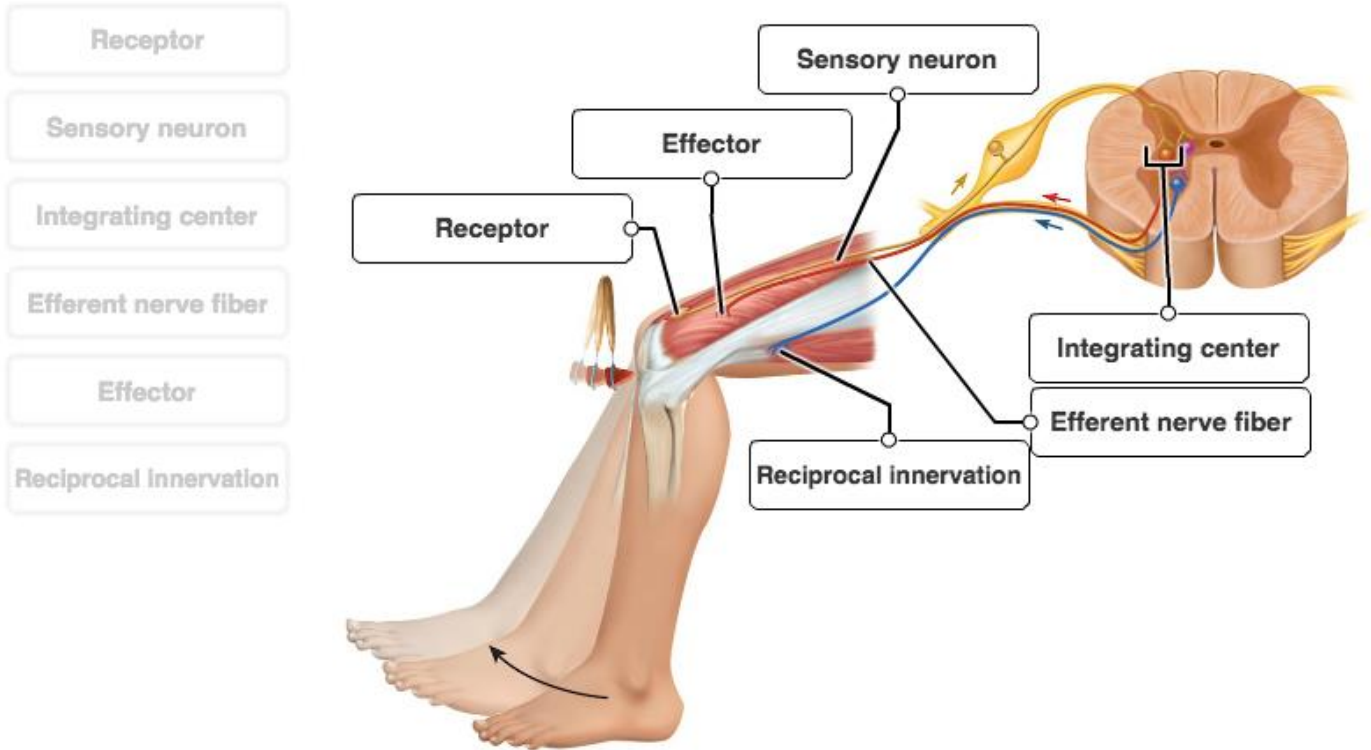
#5

Which portion of a reflex arc is most likely to be located entirely within the central nervous system?

- Sensory neuron
- Motor neuron
- Somatic receptor
- Interneuron
- Effector

#6

Accurately label the components of a reflex arc on this example.



#7

Drag each label into the appropriate category to designate which reflex is described by the following terms.

**Stretch Reflex**

- Muscle spindles are the receptor
- Initiated by an increase in muscle length
- Is monosynaptic

**All Reflexes**

- Utilizes an integrating center

**Tendon Reflex**

- Inhibits excessive muscle contraction
- Tendon organs are the receptors

**Flexor Reflex**

- Marked by removal of the body segment from injurious elements

**Crossed-extensor Reflex**

- Marked by actions to stabilize the limb opposite of injurious agents
- Is contralateral
- Marked by actions that stabilize the contralateral limb

**Reset**

#8

Which of the following is/are a component of all spinal reflex arcs? Check all that apply.

Which of the following is/are a component of all spinal reflex arcs? Check all that apply.

- Receptor
- Afferent neuron
- Interneuron
- Integrating center
- Efferent neuron

Interneurons are not a component of all reflex arcs. Monosynaptic reflexes, like the stretch reflex, have an integrating center that does not utilize an interneuron.

#9

In the patellar tendon reflex, which neuron directly receives the message that the patellar tendon has been struck by the physician's hammer?

- Hamstrings motor neuron
- Interneuron
- Quadriceps motor neuron
- Ventral horn neuron
- Dorsal horn neuron

#10

Which part of the patellar reflex circuitry directly changes the excitatory signal to an inhibitory signal?

- Interneuron
- Dorsal horn neuron
- Quadriceps motor neuron
- Patellar tendon
- Hamstrings motor neuron

#11

## Depol Chem

Movement of which chemical across the neuron membrane directly leads to the depolarization (rising membrane potential) phase of the action potential?

- Chloride ion ( $\text{Cl}^-$ )
- Glycine
- Potassium ( $\text{K}^+$ )
- Glutamate
- Sodium ( $\text{Na}^+$ )

#12

## Hyperpol Chem

Movement of which chemical across the neuron membrane directly leads to the hyperpolarization (lowering of membrane potential) phase of the action potential?

- Chloride ion ( $\text{Cl}^-$ )
- Potassium ( $\text{K}^+$ )
- Glutamate
- Sodium ( $\text{Na}^+$ )
- Glycine