

Chapter 8: Control of Movement

General Principles of Motor Behavior

Skeletal Muscle Anatomy and Physiology

Proprioception and Reflexes

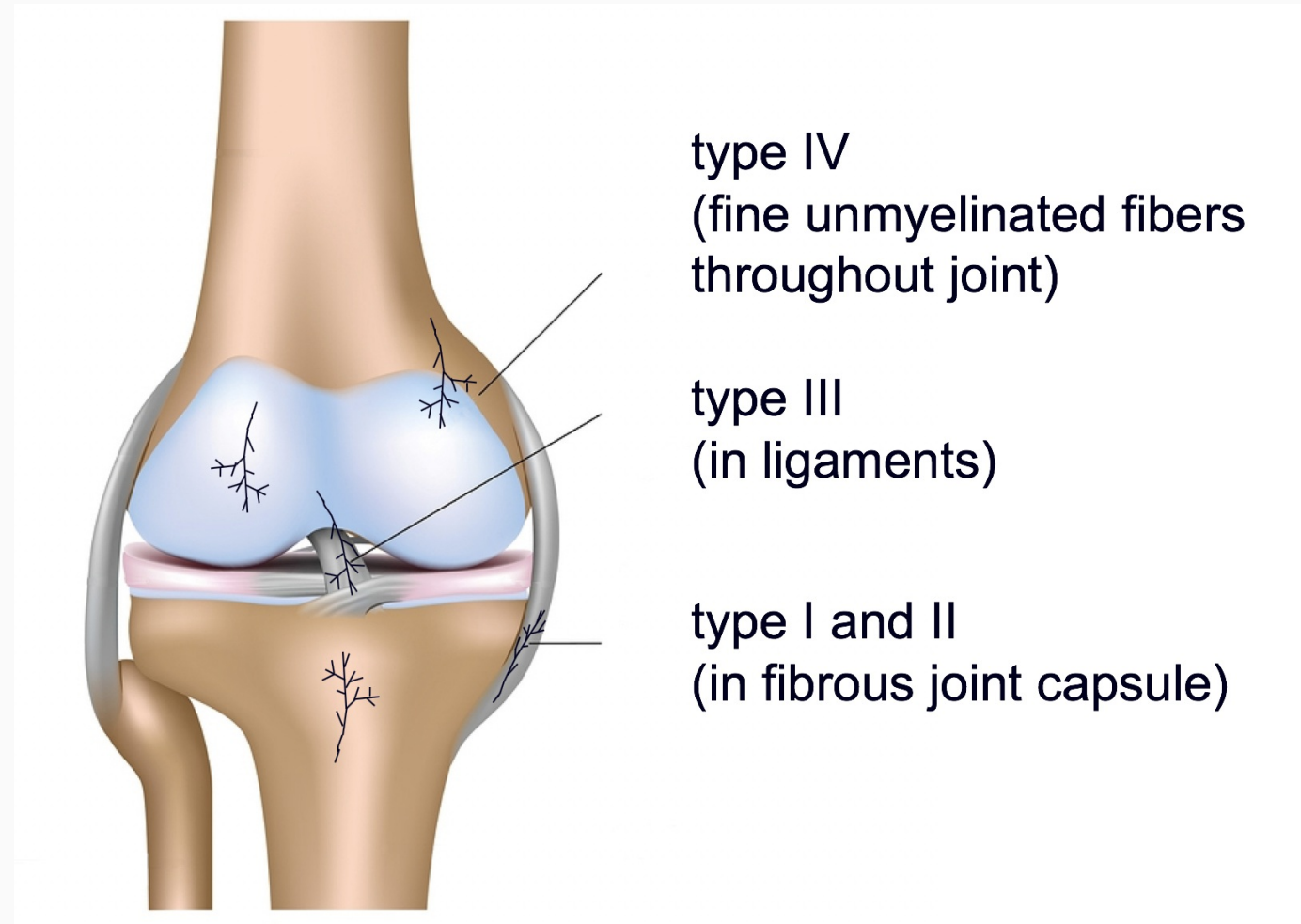
Control of Movement by the Brain

Movement Disorders

Proprioception and Reflexes

Proprioception.

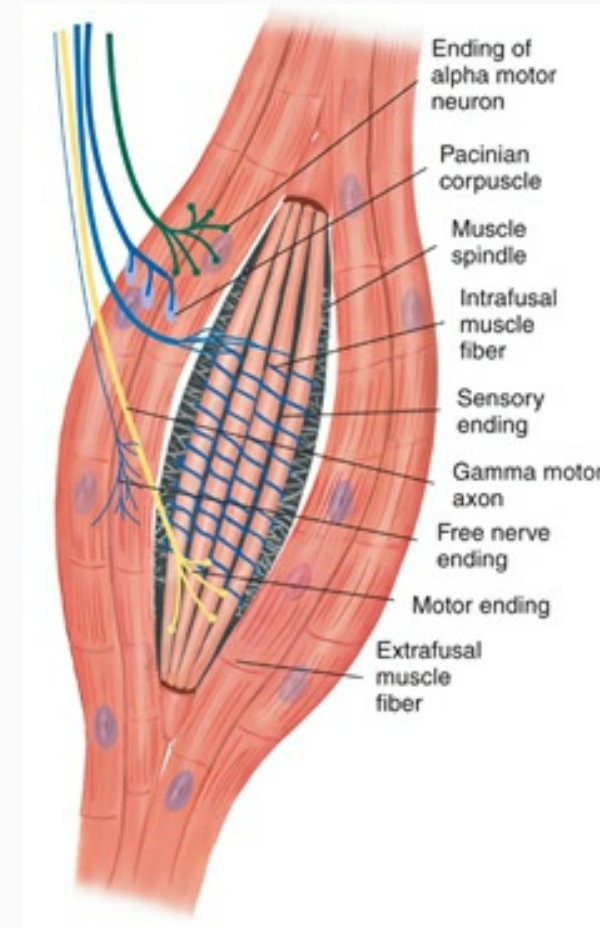
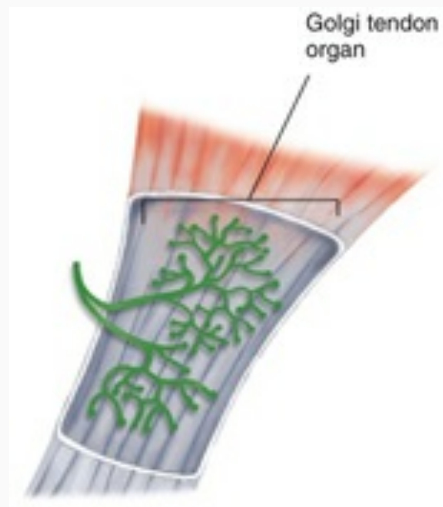
- sensory receptor sensitive to position and/or movement of body part (joints, ligaments, muscles, or tendons)
- 2 classes of proprioceptors:
 - joint proprioceptors
 - muscle/tendon proprioceptors



Proprioception and Reflexes

Proprioception.

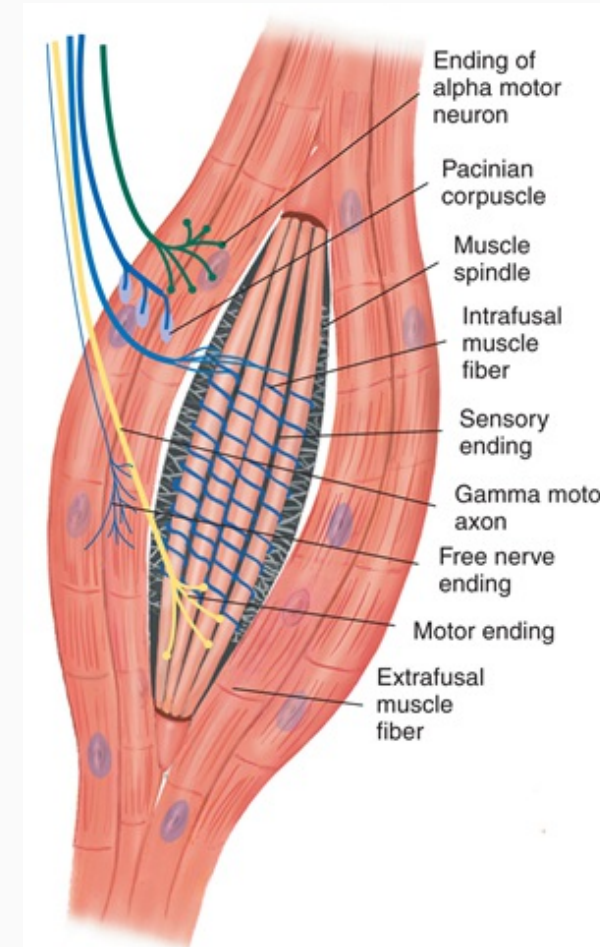
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Proprioception and Reflexes

Muscle Spindles.

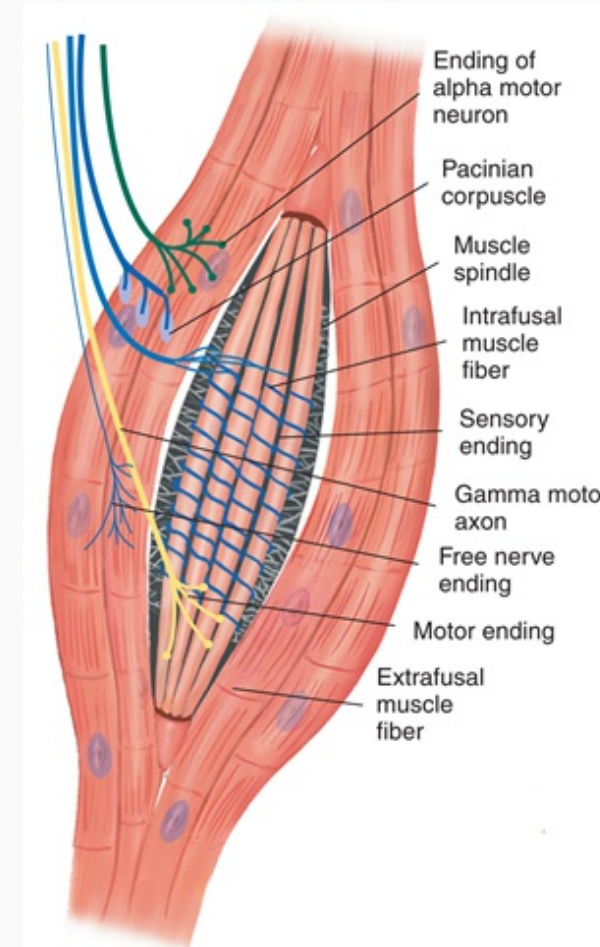
- located in muscles
- stretch receptors that parallel muscle fibers
- respond to changes in muscle length, not muscle tension



Proprioception and Reflexes

Muscle Spindles.

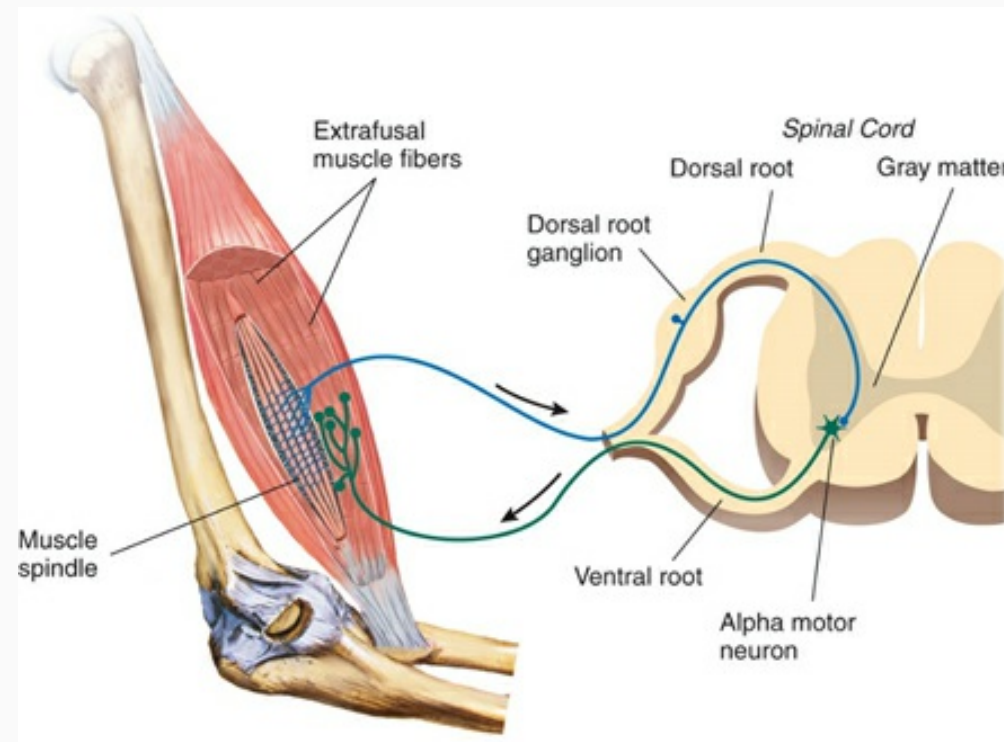
- intrafusal muscle fibers connected to spindle afferent neurons and h-motor neurons
- extrafusal muscle fibers innervated by f-motor neurons, contraction supplies muscle force
- h-motor neurons contract intrafusal fibers to regulate sensitivity of muscle spindles to contraction of surrounding extrafusal fibers



Proprioception and Reflexes

Muscle Spindles - The Monosynaptic Stretch Reflex.

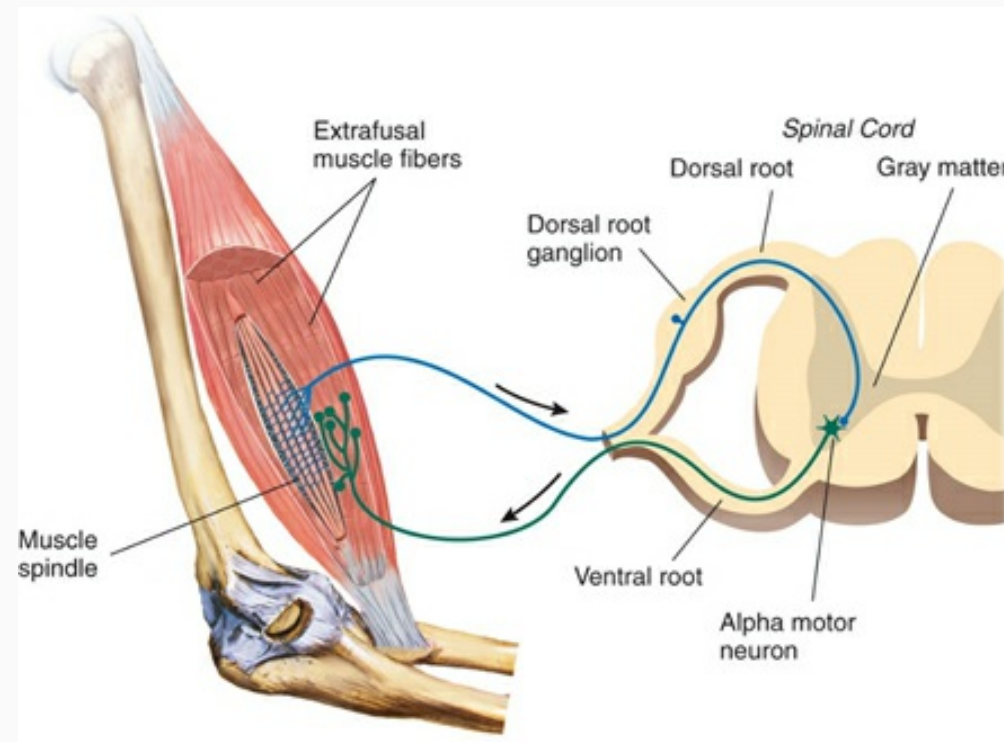
- muscle spindle stretched (lengthened)
- spindle afferent neurons provide monosynaptic input to f -motor neuron at spinal cord
- f -motor neuron elicits reflexive contraction



Proprioception and Reflexes

Muscle Spindles - The Monosynaptic Stretch Reflex.

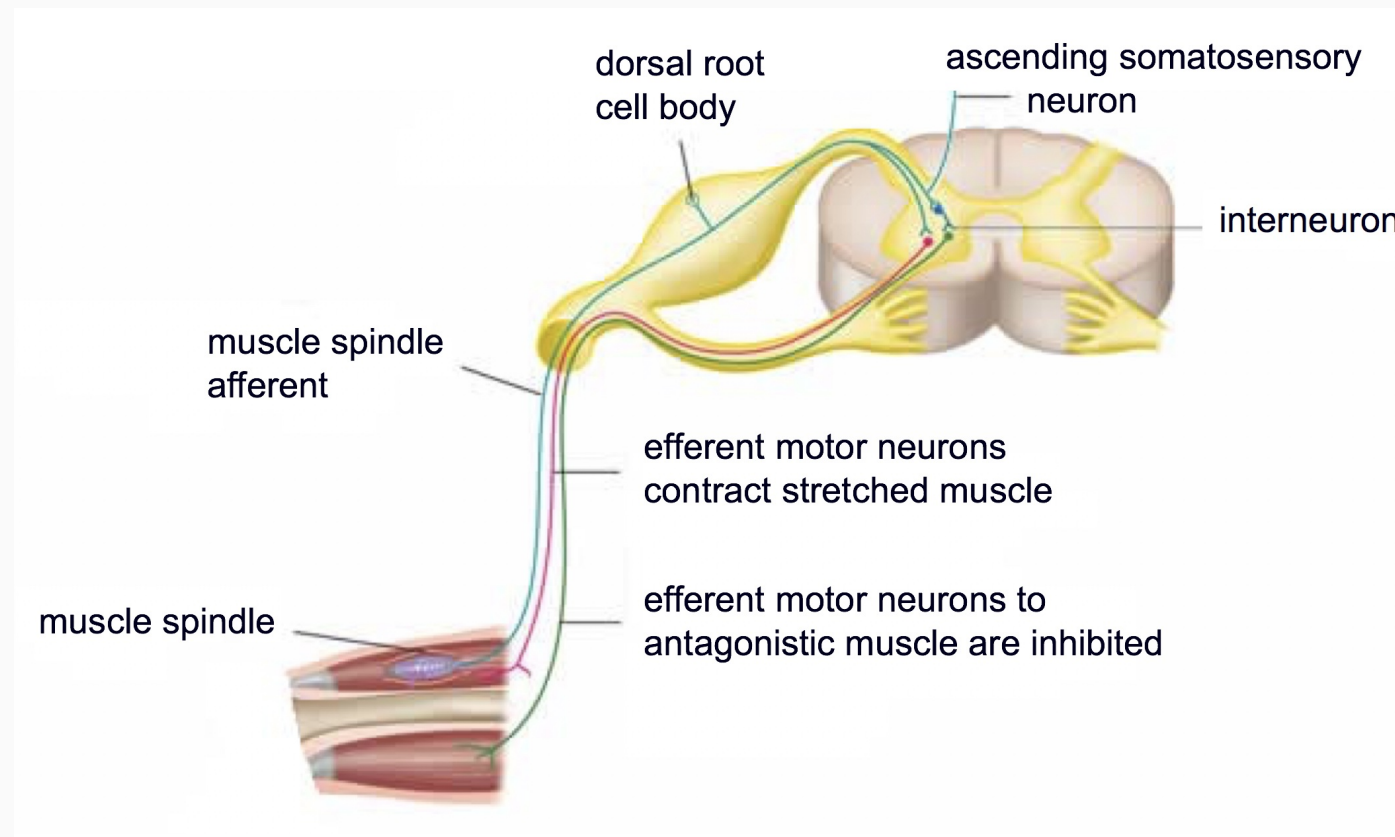
- only known monosynaptic reflex, very fast (≈ 50 msec)



Proprioception and Reflexes

Muscle Spindles - The Monosynaptic Stretch Reflex.

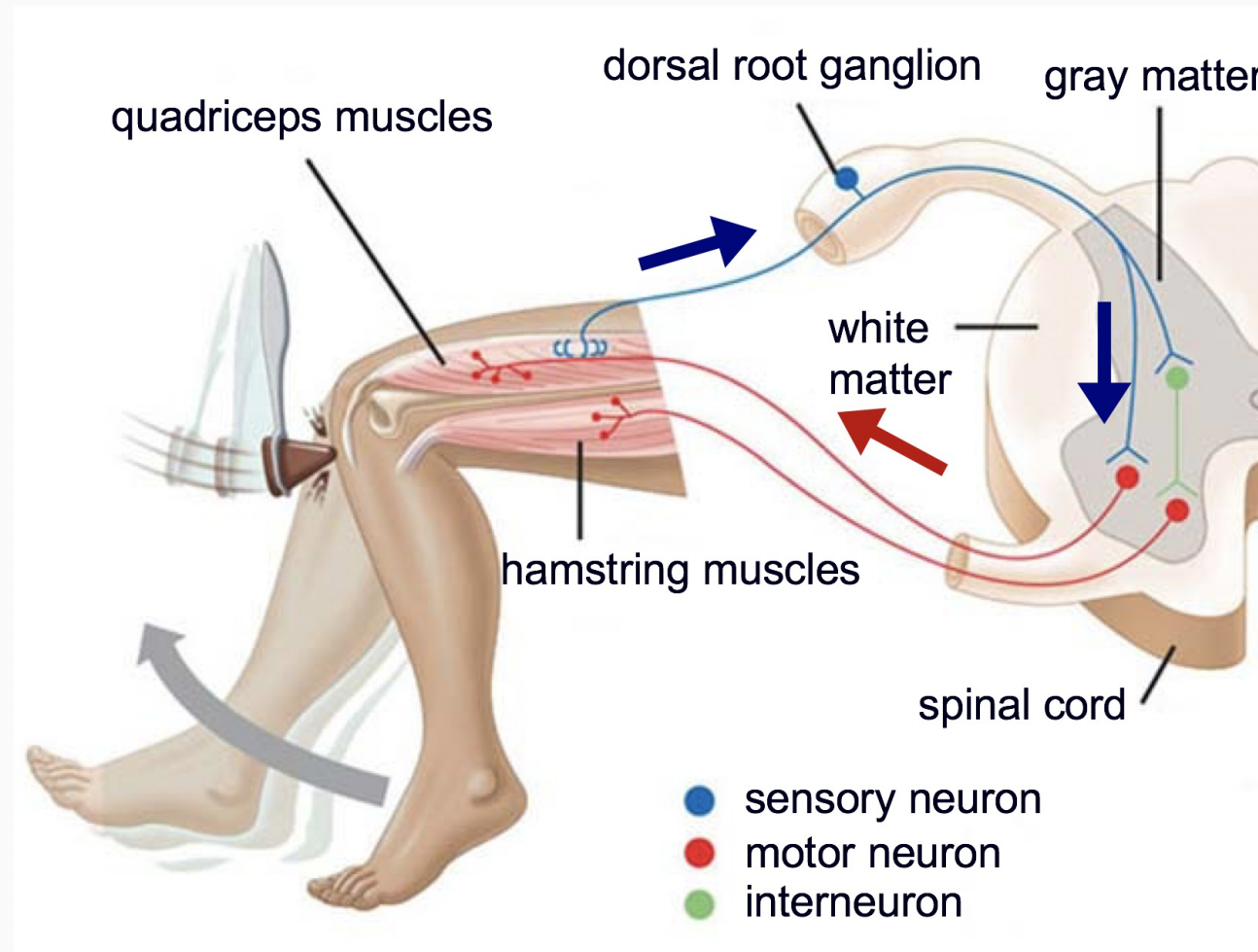
- spinal cord also sends message to inhibit f -motor neuron to antagonistic muscle and to higher CNS



Proprioception and Reflexes

Muscle Spindles - The Monosynaptic Stretch Reflex.

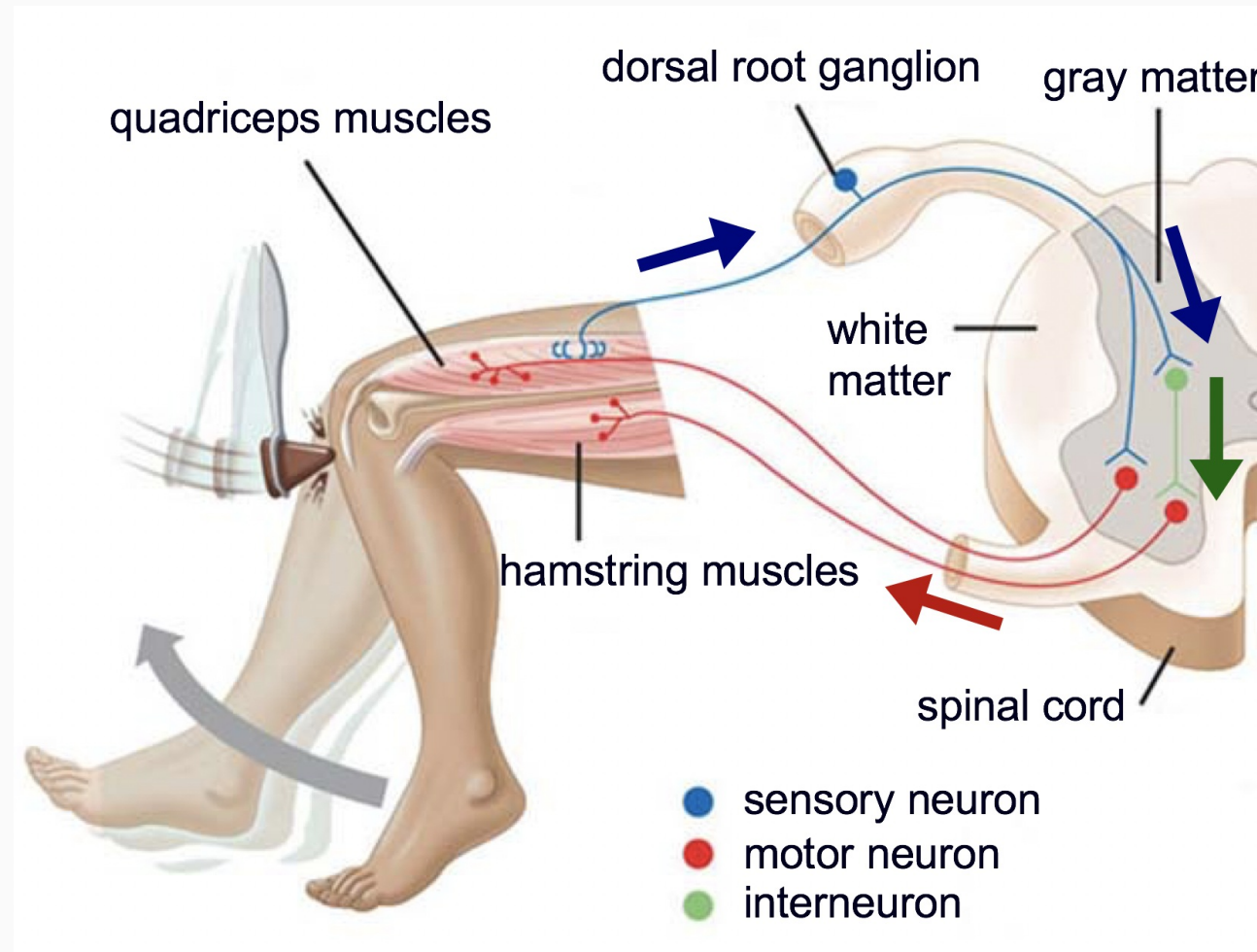
- the patellar reflex



Proprioception and Reflexes

Muscle Spindles - The Monosynaptic Stretch Reflex.

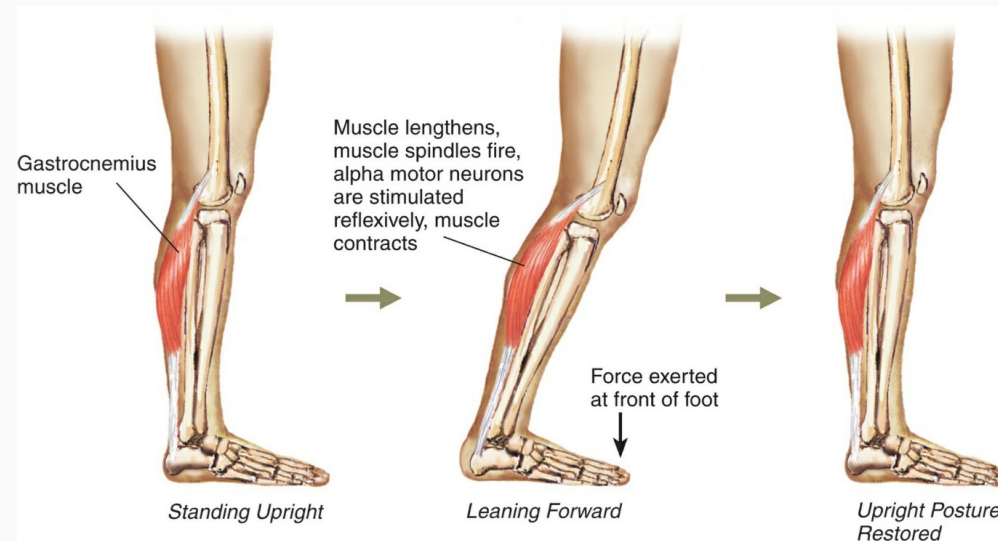
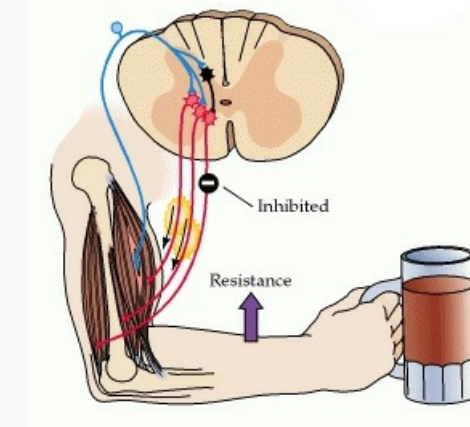
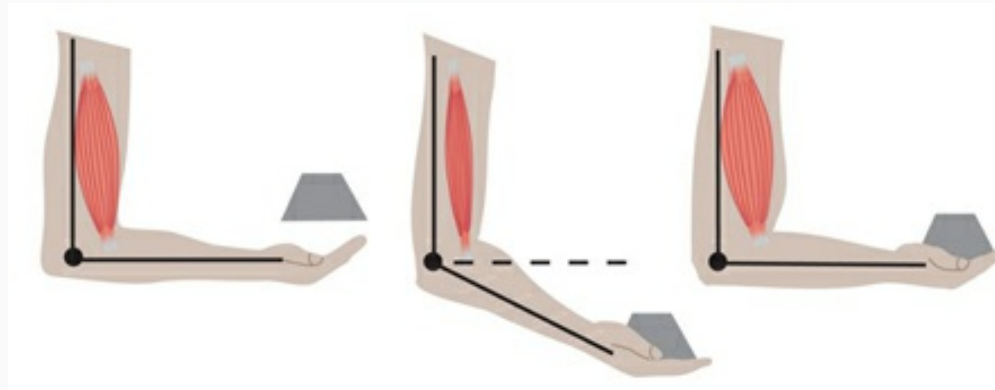
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Proprioception and Reflexes

Muscle Spindles - The Monosynaptic Stretch Reflex.

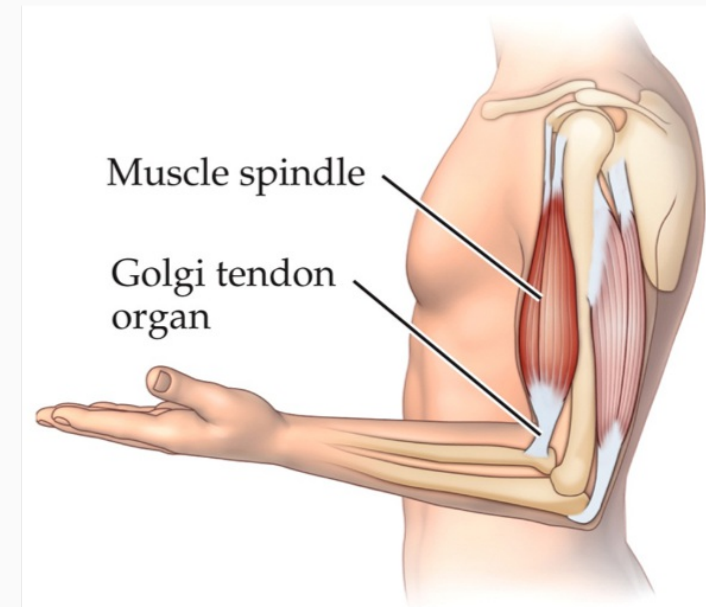
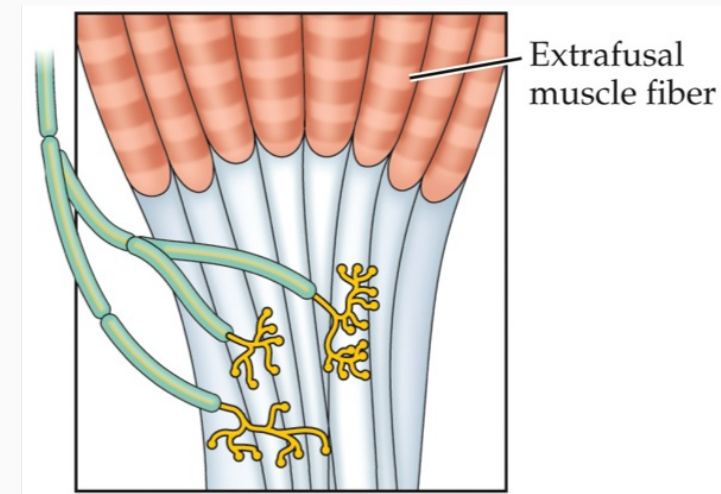
- important in regulation of variety of motor behaviors



Proprioception and Reflexes

Golgi Tendon Organs - A Polysynaptic Reflex.

- located in tendons
- responds to increases in muscle tension, not stretch/length
- provides information to CNS regarding load on muscle, and acts as brake to prevent overly vigorous contraction
- prevents damage to muscles
- tendon is pulled by muscle contraction, activating GTO



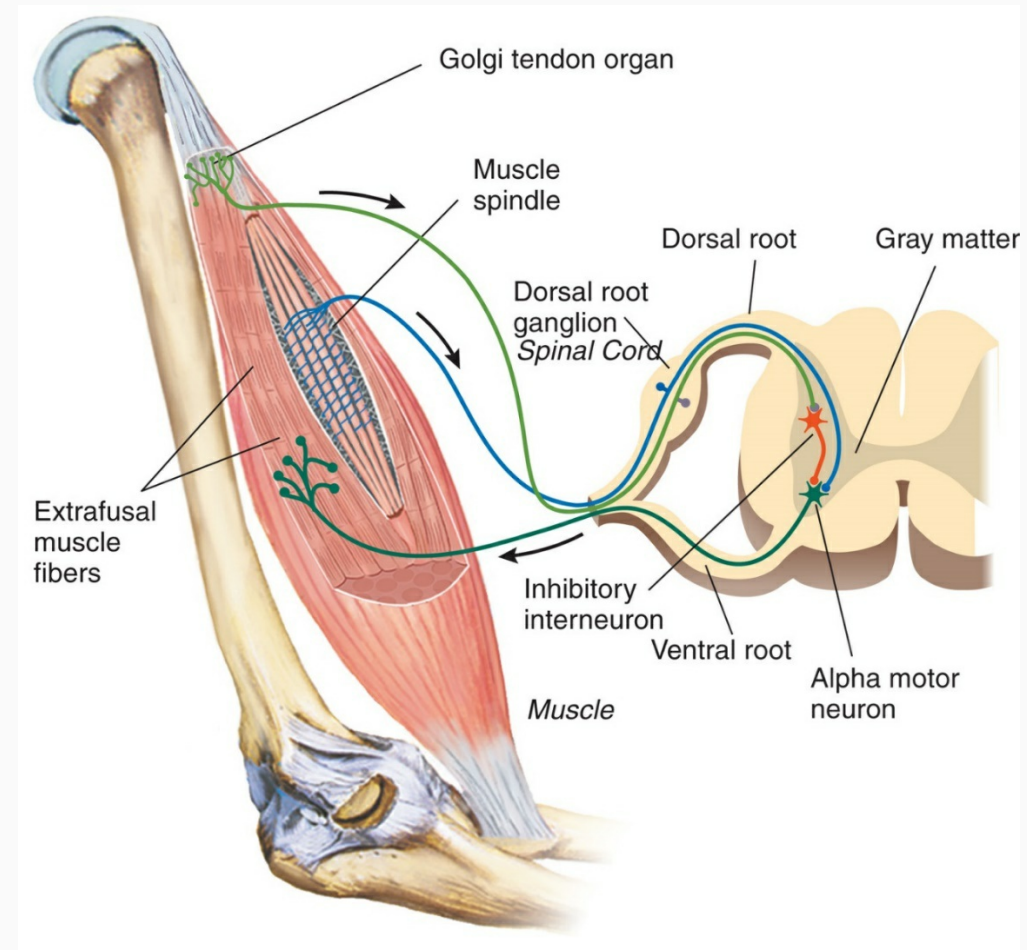
Proprioception and Reflexes

Golgi Tendon Organs - A Polysynaptic Reflex.

- sensory nerve excites spinal inhibitory interneuron
- interneuron inhibits α -motor neuron to diminish contractile force

2 synapses

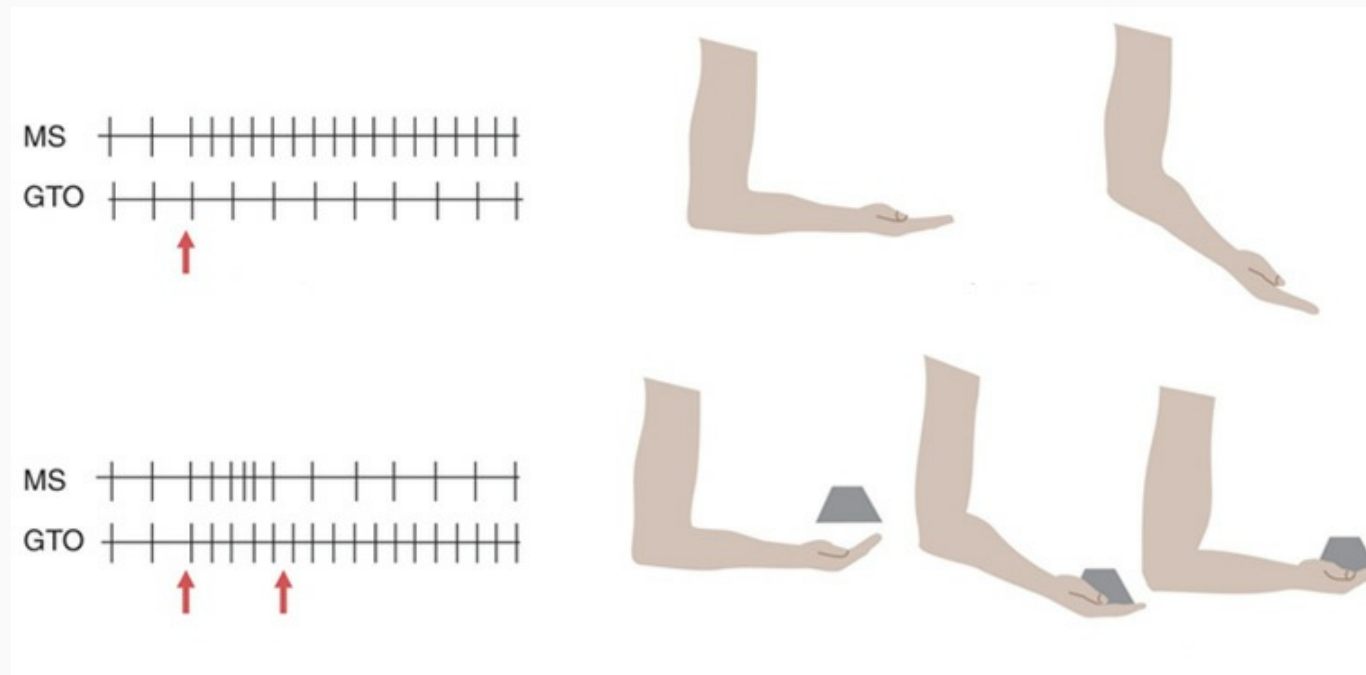
- not as fast as monosynaptic reflex
- spinal cord also sends message to higher levels of CNS



Proprioception and Reflexes

Muscle Spindles and Golgi Tendon Organs.

- coordinated function of MSs and GTOs



Proprioception and Reflexes

Tests of Proprioception.

- field sobriety test



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- slide 7: http://www.edoctoronline.com/media/19/photos_6d35d6f0-4ead-46bb-a161-e961a93ab28b.jpg
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- slide 9-10: Carlson, N.R. (2012). Physiology of Behavior, 11th ed. Pearson Publishing
- slide 10: Carlson, N.R. (2012). Physiology of Behavior, 11th ed. Pearson Publishing <http://www.realmagick.com/muscle-spindle-stretch-reflex/>
- slide 12-13: Breedlove, S.M., Watson, N.V. (2013). Biological Psychology: An Introduction to Behavioral, Cognitive, and Clinical Neuroscience, 7th ed. Sinauer Associates, Inc.
- slide 14: Carlson, N.R. (2012). Physiology of Behavior, 11th ed. Pearson Publishing