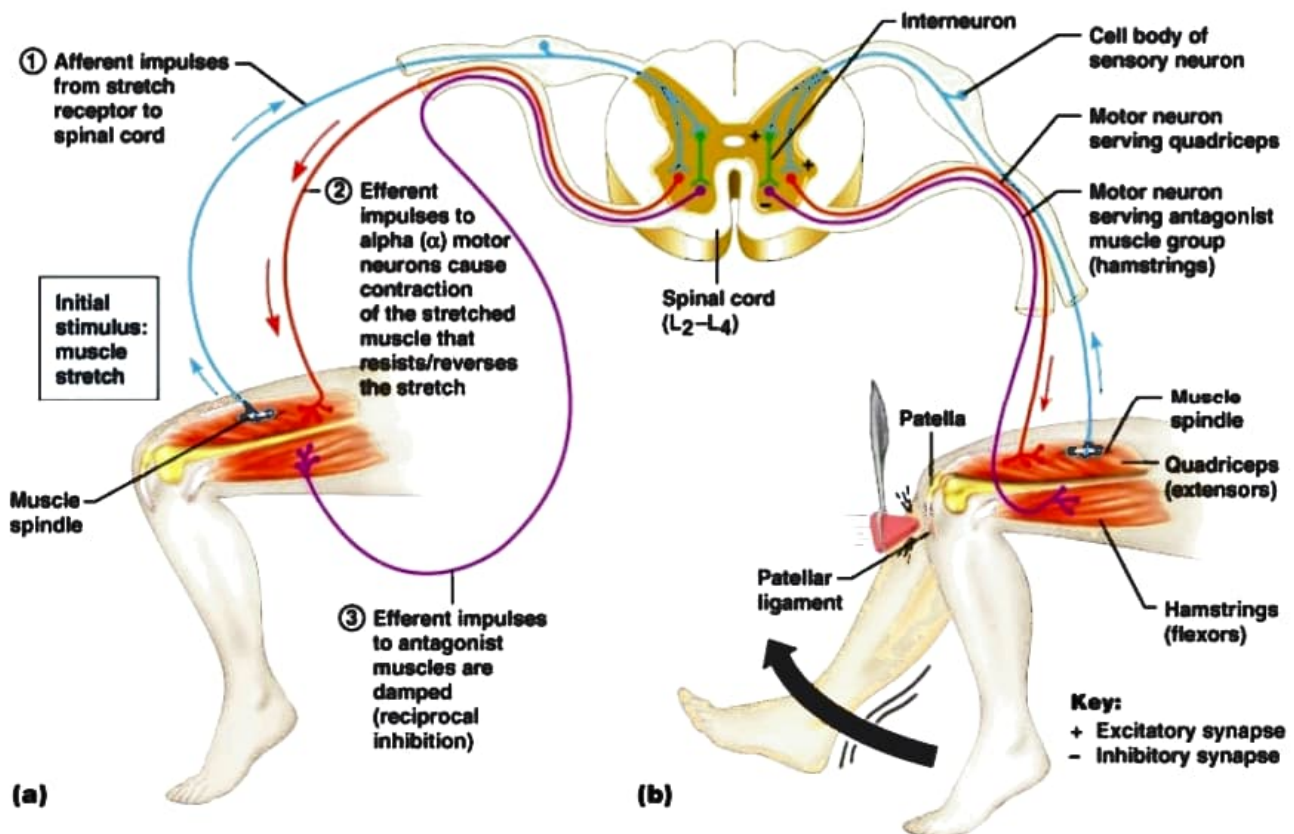


Stretch Reflex

- Stretching the muscle activates the muscle spindle
- Excited γ 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

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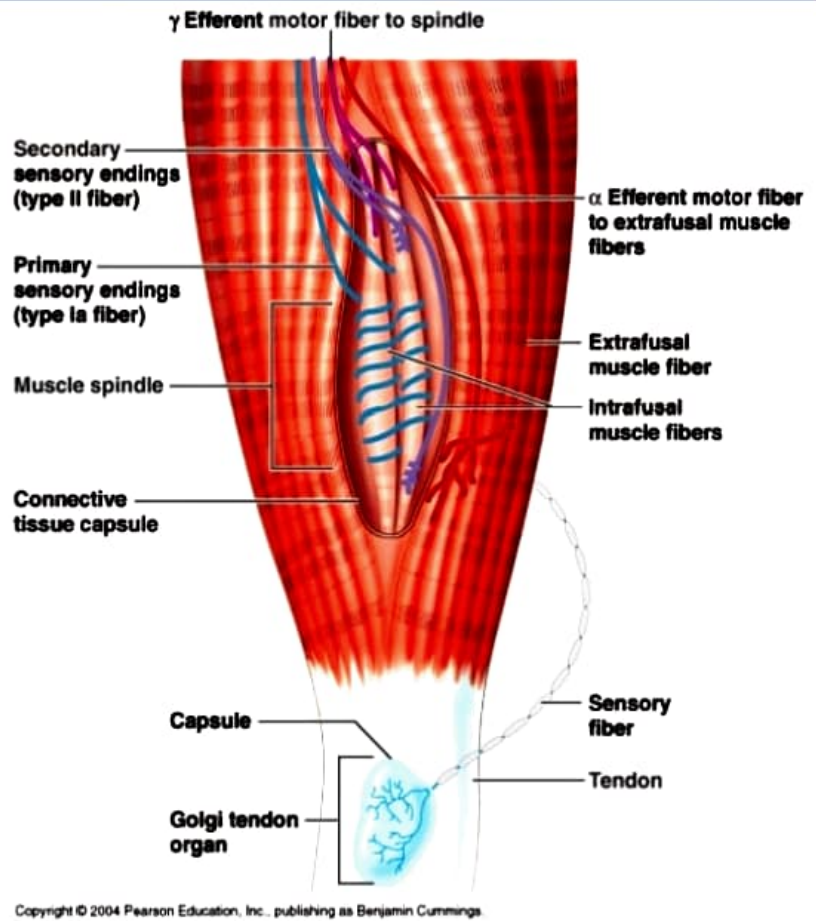
Stretch Reflex



Monosynaptic Stretch Reflex

- Simplest reflex because it has only one synapse in the path of its arc.
- Muscle spindles contain the sensory receptors for the stretch reflex.
- Each spindle contains modified muscle fibers called spindle or intrafusal fibers (inside spindle), innervated by gamma efferent fibers.

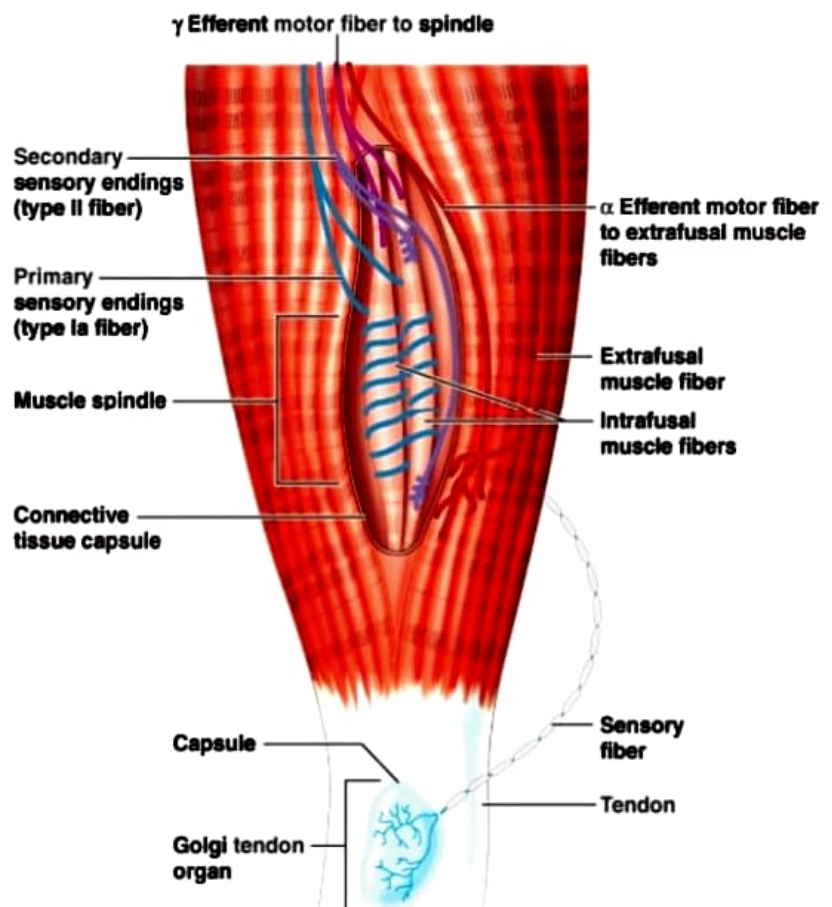
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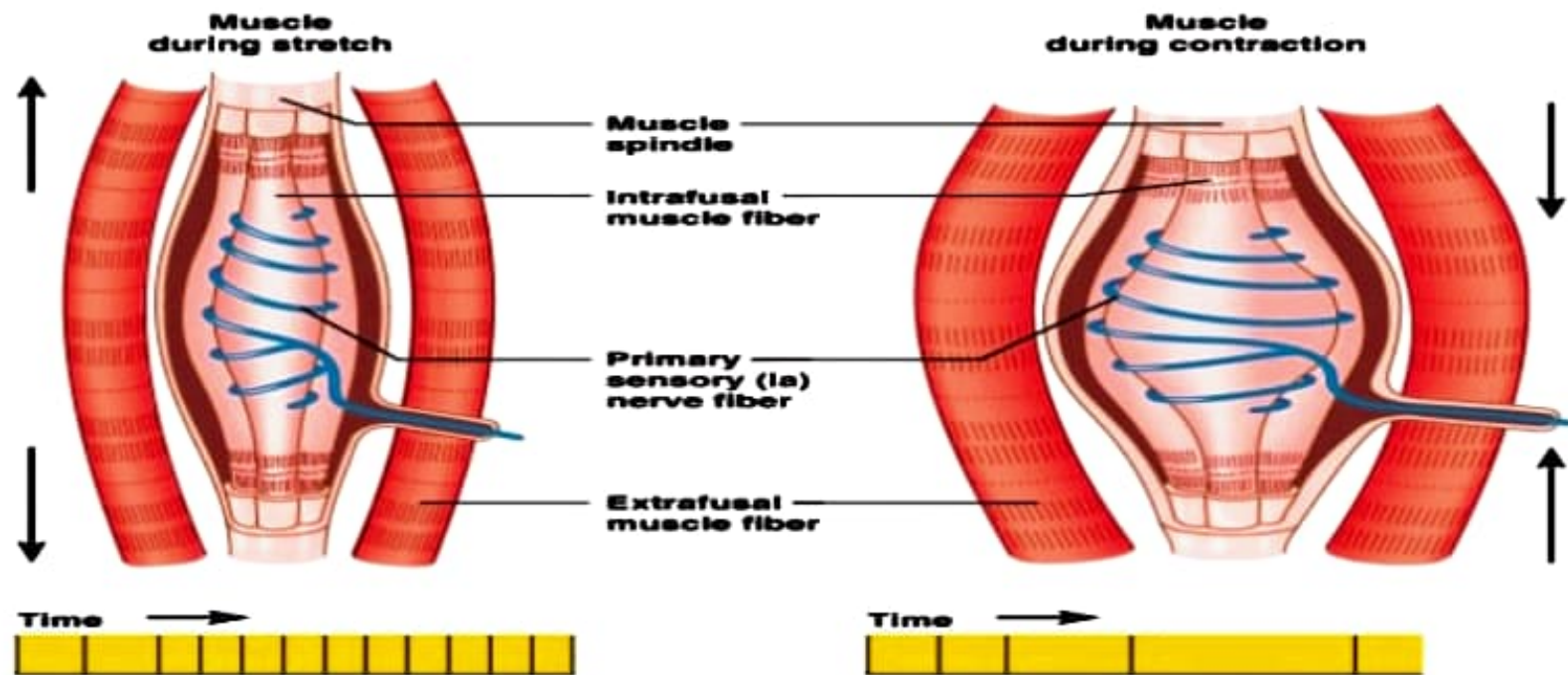
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- The middle segment of each spindle fiber acts as a mechanical stretch receptor that is connected to a sensory afferent nerve to the spinal cord.
- Stretching of the muscle stretches the spindle fibers activating the muscle spindle stretch receptors and the associated sensory fibers.

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- The terminals of the spindle sensory fibers make direct excitatory synaptic contact with alpha motor neurons serving the ordinary muscle fiber (extrafusal fibers).
- Contraction of these fibers shorten the muscle and relaxes the spindle fibers terminating the stretch reflex and muscle contraction.



(a) Action potential frequency increases during stretch

(b) Action potential frequency declines during contraction

Events in monosynaptic stretch reflex - Summary

- 1. Passive stretch of a muscle (produced by tapping its tendon) stretches the spindle (intrafusal) fibers.
- 2. Stretching of a spindle distorts its central (chain) region, which stimulates dendritic endings of sensory nerves.
- 3. Action potentials are conducted by afferent (sensory) fibers into the spinal cord on the dorsal roots of spinal nerves.
- 4. Axons of sensory neurons synapse with dendrites and cell bodies of somatic motor neurons located in the ventral horn gray matter of the spinal cord.
- 5. Efferent impulses in the axons of somatic motor neurons (which form the ventral roots of the spinal nerves) are conducted to the ordinary (extrafusal) muscle fibers. These neurons are (alpha) motor neurons.

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- 6. Release of Ach from the endings of alpha motor neuron stimulates the contraction of extrafusal fibers, and thus the whole muscle.
 - 7. Contraction of the muscle relieves the stretch of its spindles, thus decreasing electrical activity in the afferent nerve fibers, and relaxes the spindle fiber and terminates the stretch reflex and muscle contraction.

Note: By sending command to the motor neurons, the brain set a muscle's length. The stretch reflex makes sure the muscle stay at that length. The stretch reflex is therefore important for maintaining muscle tone and upright posture.