

Physiology 121, Lecture 10
Reflexes (Dr. Donald B. Thomason)

Objectives:

The student should be able to:

1. Describe the role and innervation of:
 - a. excitatory interneurons;
 - b. inhibitory interneurons.
2. Define the neurotransmitters involved in:
 - a. excitation;
 - b. inhibition.
3. Identify which reflexes are monosynaptic and which are polysynaptic.
4. Define the classes of reflexes
5. State examples of reflexes of cutaneous and muscle origin.

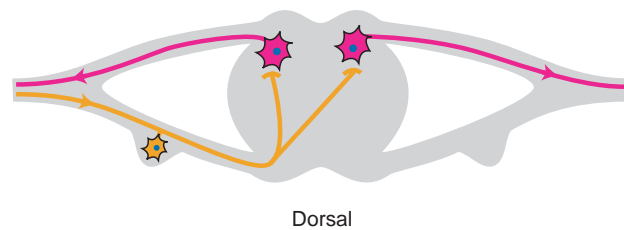
Outline:

I. Signals impinging upon the α -motorneurons

A. Dorsal root ganglion (DRG) afferents from sensory nerves

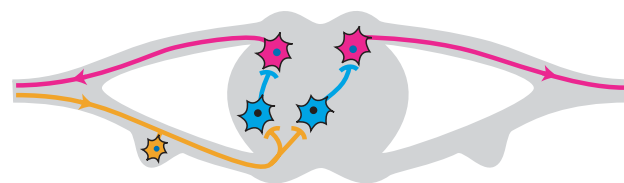
1. excitatory (monosynaptic, i.e.,
direct synaptic connection)

Excitatory Monosynaptic Feedback



2. inhibitory (polysynaptic,
involve interneurons)

Inhibitory Polysynaptic Feedback

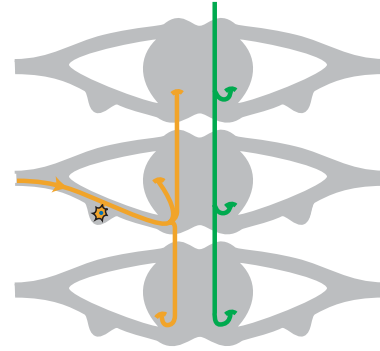


B. Higher motor centers

1. Classification

- a. intertract/intersegmental
(propriospinal)
- b. cerebellar

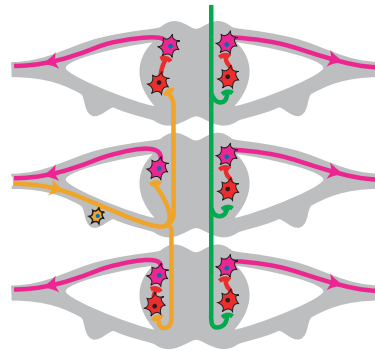
Intersegmental and Cerebellar Connections



2. Connections - all interneuron mediated

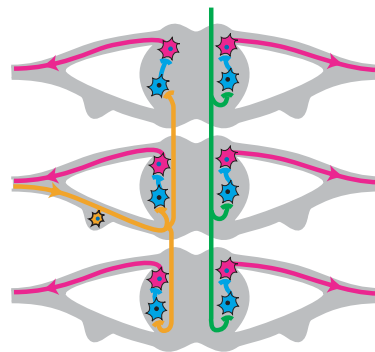
- a. excitatory

Excitatory Intersegmental and Cerebellar Connections



- b. inhibitory

Inhibitory Intersegmental and Cerebellar Connections



C. Renshaw cells - inhibitory

interneurons to “focus” a response

Renshaw Inhibition



II. DRG afferent nerve activity

A. Muscle spindle origin

1. Anatomy and origin

- a. nuclear chain fibers
- b. nuclear bag fibers

2. Type Ia afferent nerves

- a. chain and bag origin
- b. usually annulospiral endings (often called primary endings)
- c. responds to length and velocity

3. Type II afferent nerves

- a. chain, and sometimes bag origin
- b. annulospiral and “flower-spray” endings (often called secondary endings)
- c. responds to length

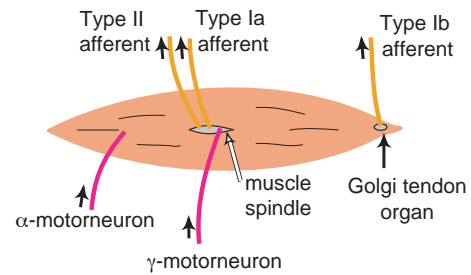
B. Golgi tendon organ origin

1. Anatomy

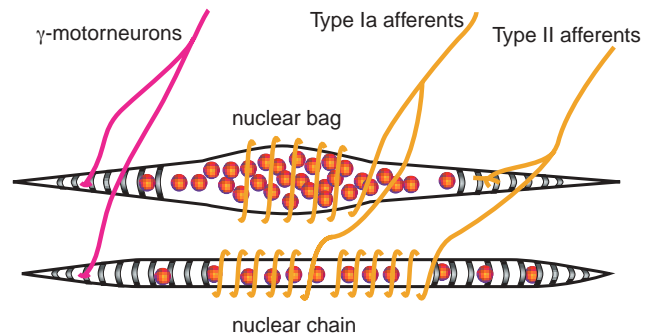
2. Type Ib afferent nerves

C. Other proprioceptors

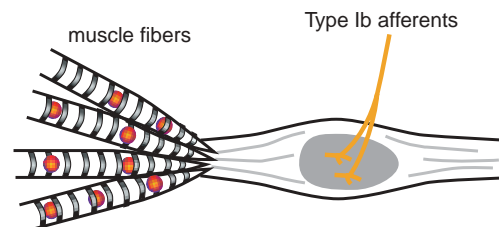
Anatomy of Muscle Sensory Organs



Anatomy of Muscle Spindles (Intrafusal Muscle Fibers)

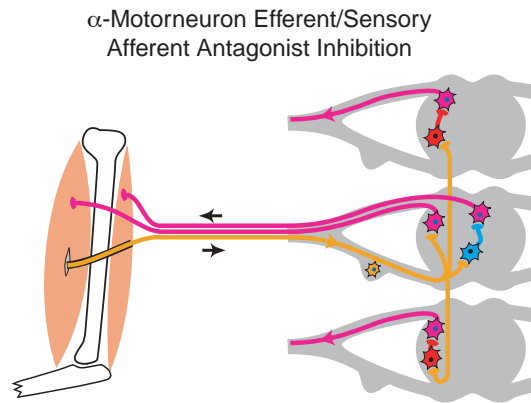
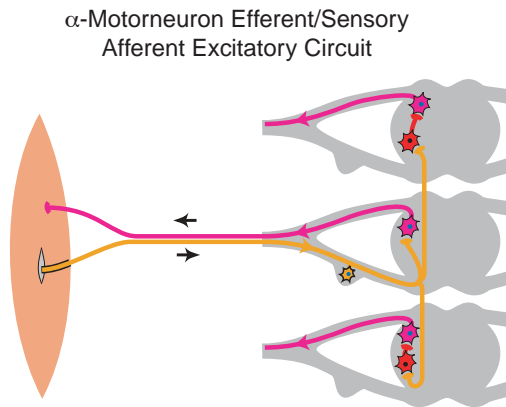


Anatomy of Golgi Tendon Organs

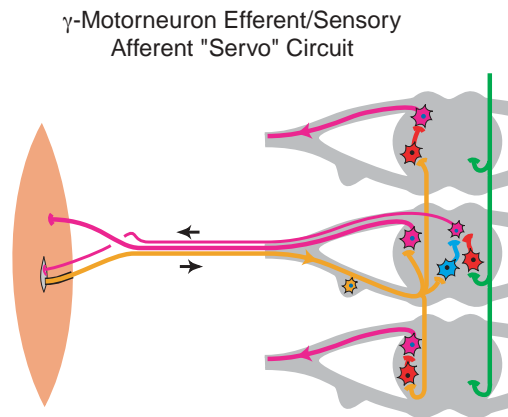


III. Circuits and connections

A. α -motorneuron efferent/sensory afferents

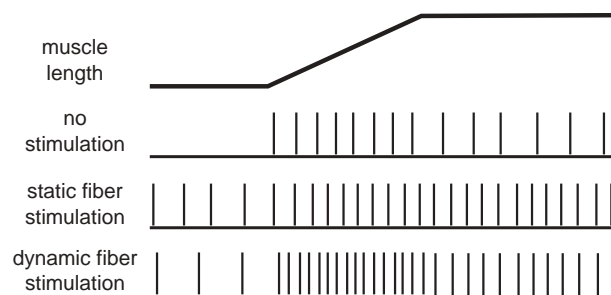


B. γ -motorneuron efferent/sensory afferents



1. Dynamic - nuclear bag fibers
2. Static - nuclear bag and chain fibers

Effect of Static and Dynamic γ -Motorneurons on Type Ia Afferent Nerve Activity



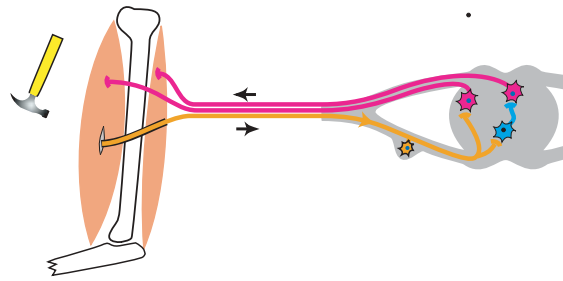
C. Propriospinal (intersegmental)

IV. Reflexes

A. Myotatic (stretch) reflex

1. Monosynaptic
2. Dynamic and static (for damping)
3. Reciprocal inhibition
4. Clinical implications
 - a. knee jerk
 - b. ankle clonus - requires brain activity

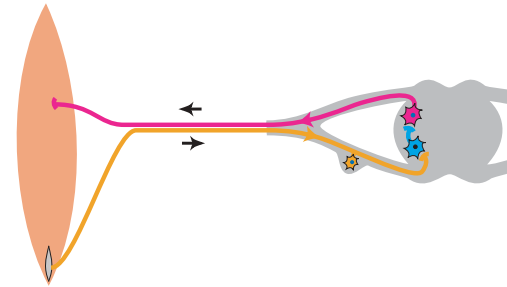
Myotatic (stretch) Reflex and Reciprocal Inhibition



B. Golgi tendon reflex

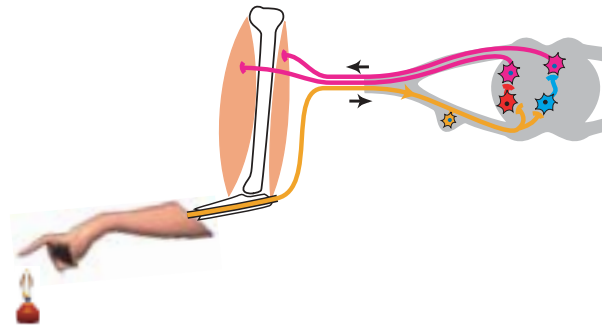
1. Inhibitory function
2. Balances load
3. Safety mechanism

Golgi Tendon Reflex



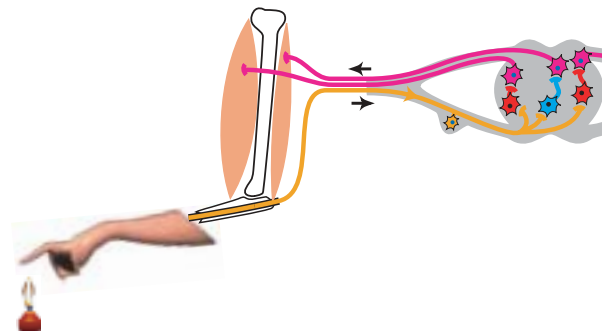
C. Flexor reflex

Flexor Reflex and Reciprocal Inhibition



D. Crossed extensor reflex

Crossed Extensor Reflex



E. Other (stepping, gallop, scratch)