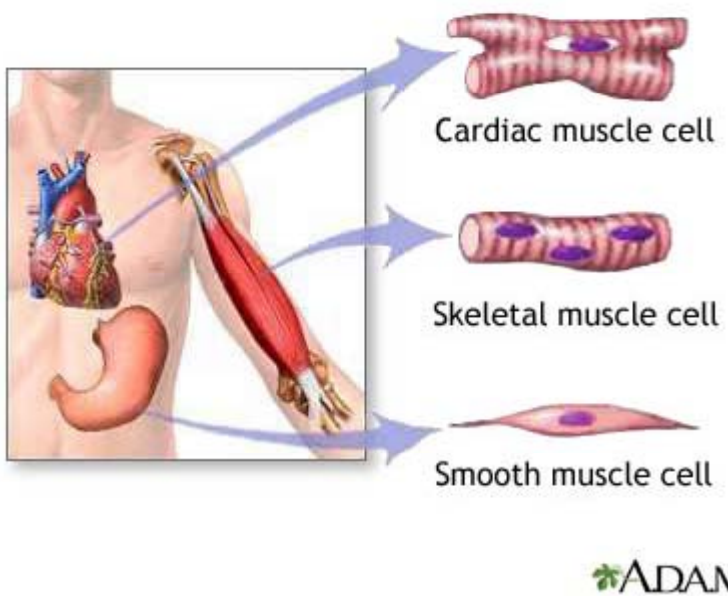
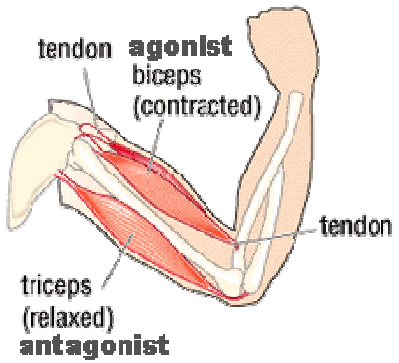
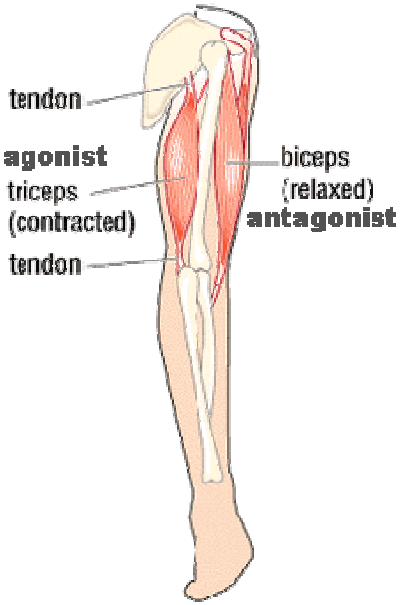
Chap 6. movement

Robot

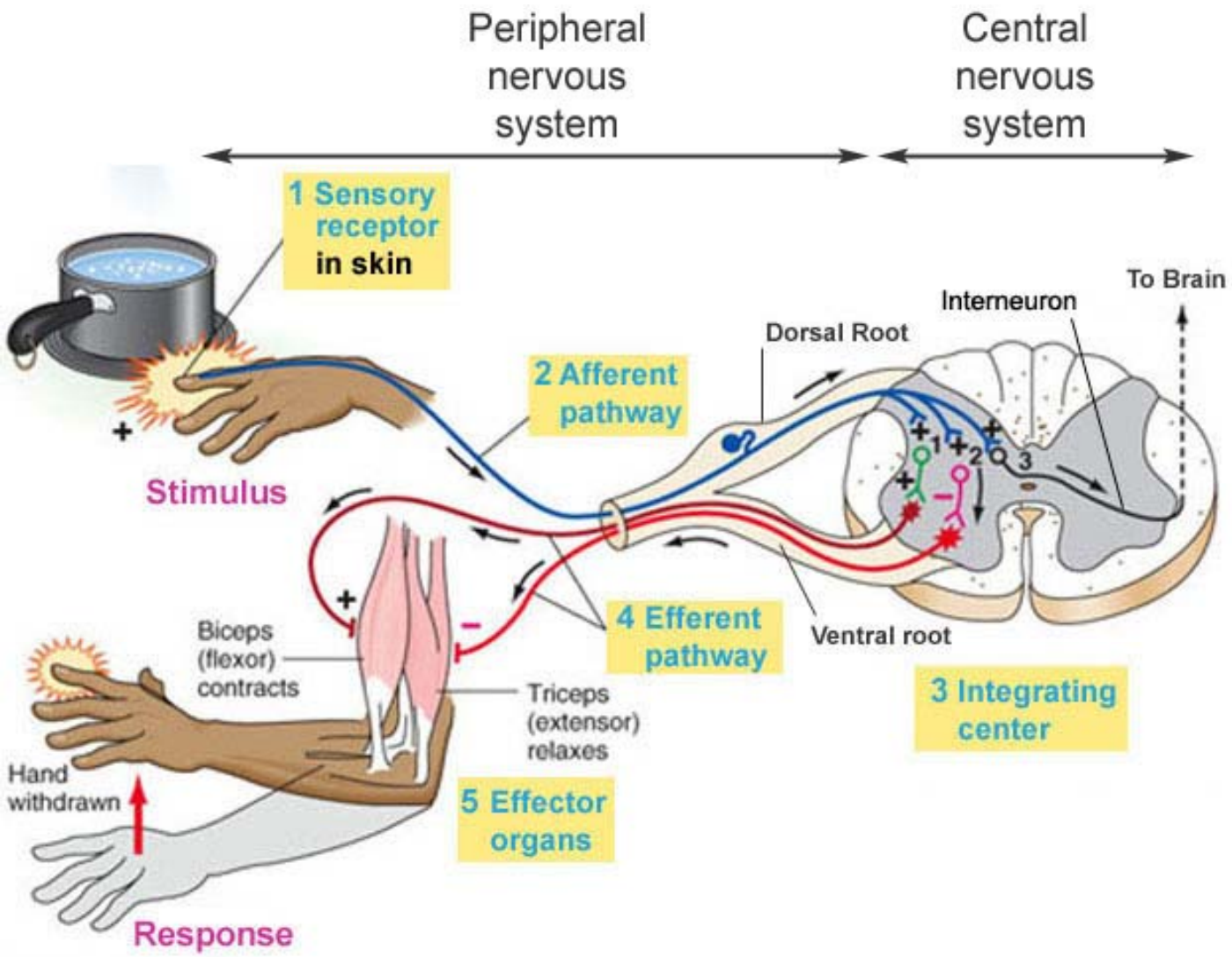


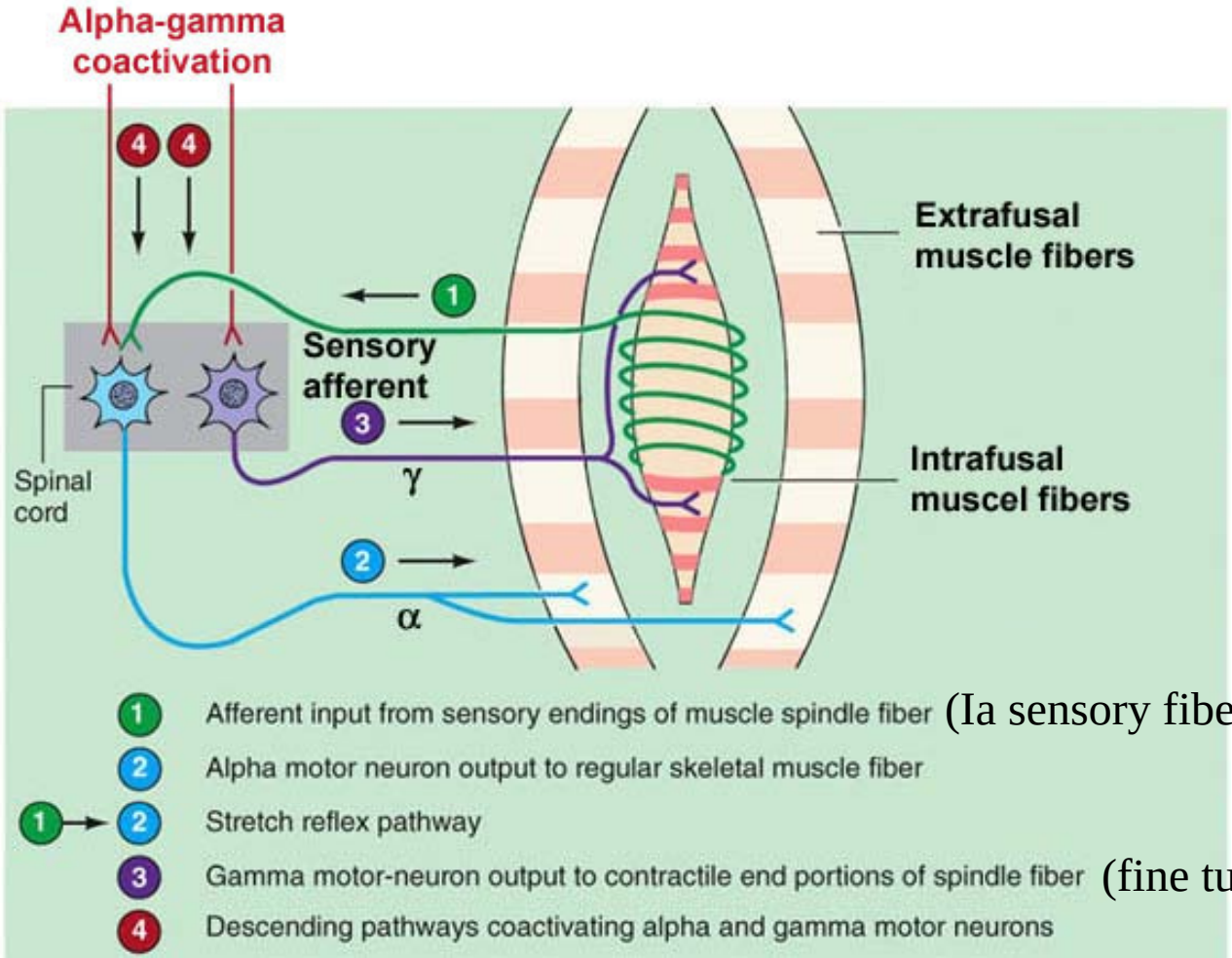




[Robot muscle]

[Muscle contraction]


Peripheral nervous system
Central nervous system
1 Sensory receptor in skin
2 Afferent pathway
Stimulus
To Brain
Interneuron
Dorsal Root
4 Efferent pathway
Ventral root
3 Integrating center
Biceps (flexor) contracts
Triceps (extensor) relaxes
Hand withdrawn
5 Effector organs
Response



(Ia sensory fiber)

(fine tuning)

Muscle spindle (stretch receptor): detects muscle length
constitutes proprioception together with Ia sensory fiber

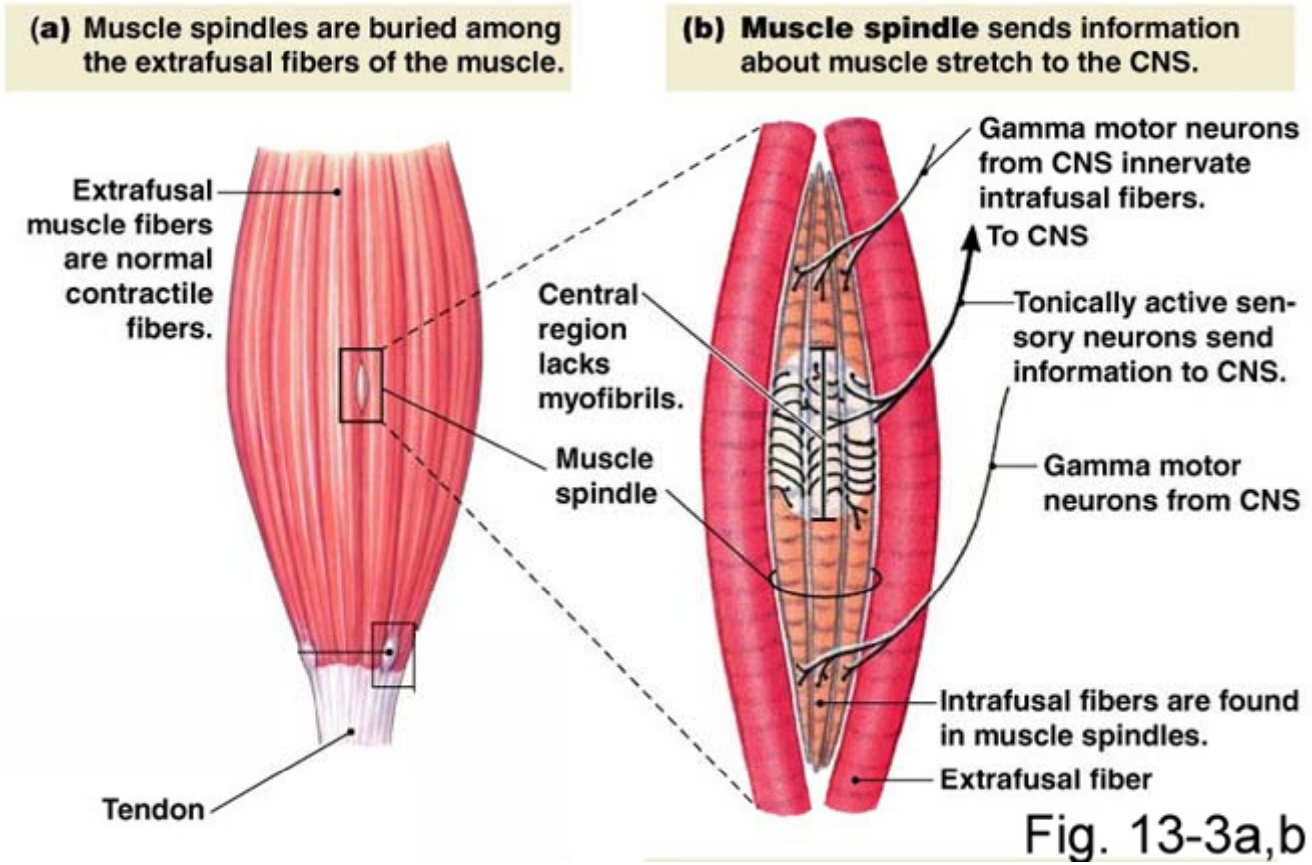


Fig. 13-3a,b

Golgi tendon organ: detects the force applied by a contracting muscle

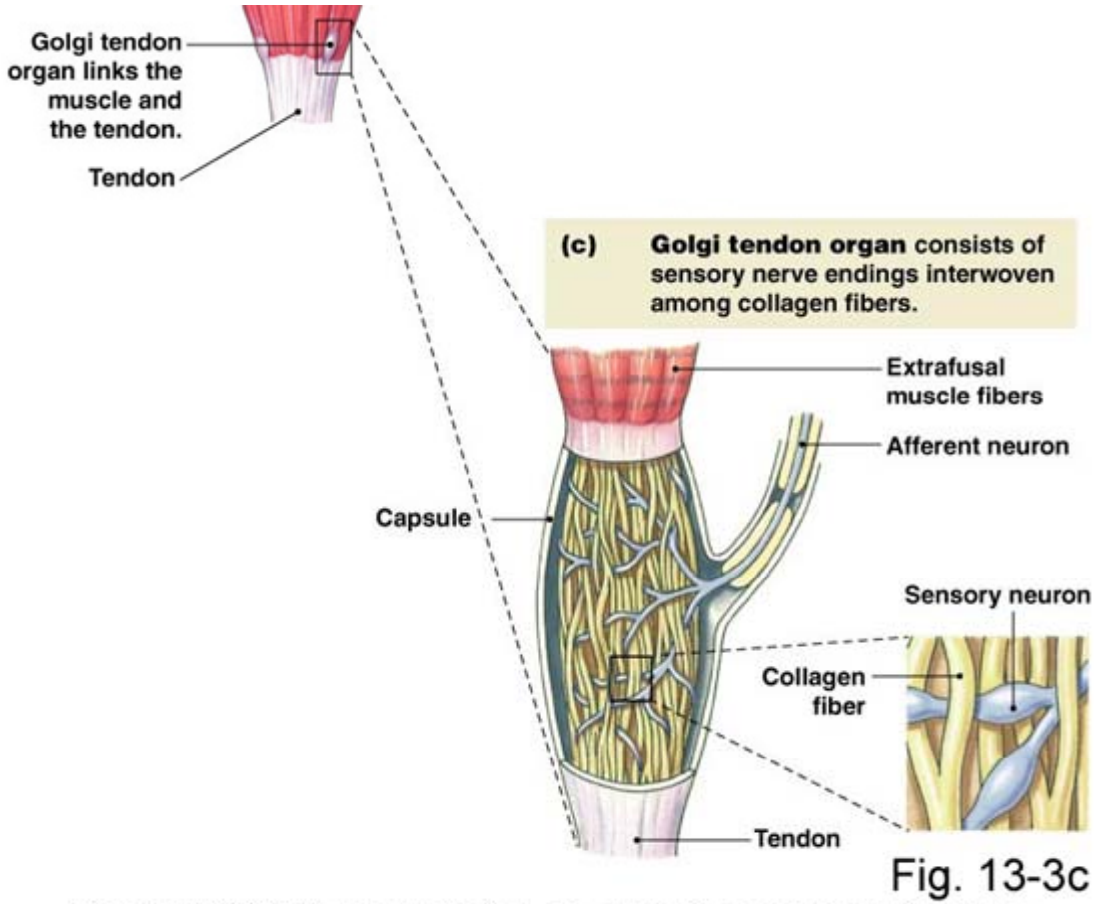


Fig. 13-3c

Muscle spindle reflex: the addition of a load stretches the muscle and the spindles, creating a reflex contraction.

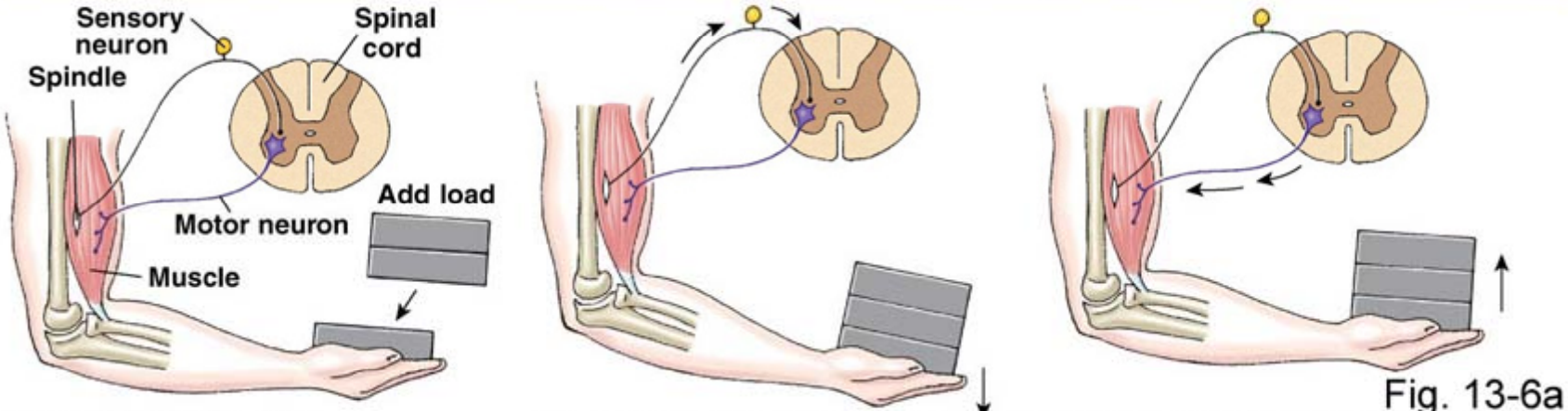


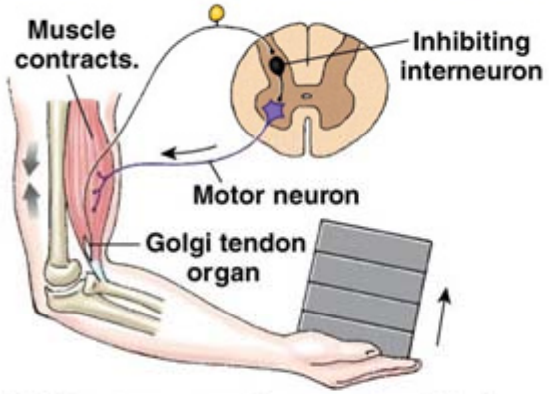
Fig. 13-6a

(a) Add load to muscle.

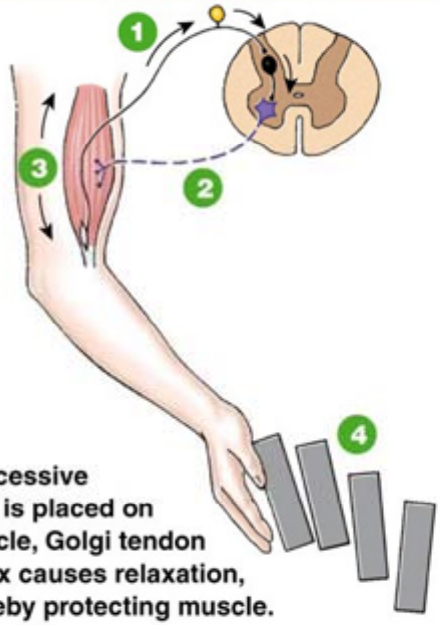
(b) Muscle and muscle spindle stretch as arm falls.

(c) Reflex contraction initiated by muscle spindle restores arm position.

Golgi tendon reflex protects the muscle from excessively heavy loads by causing the muscle to relax and drop the load.



(d) Muscle contraction stretches Golgi tendon organ.

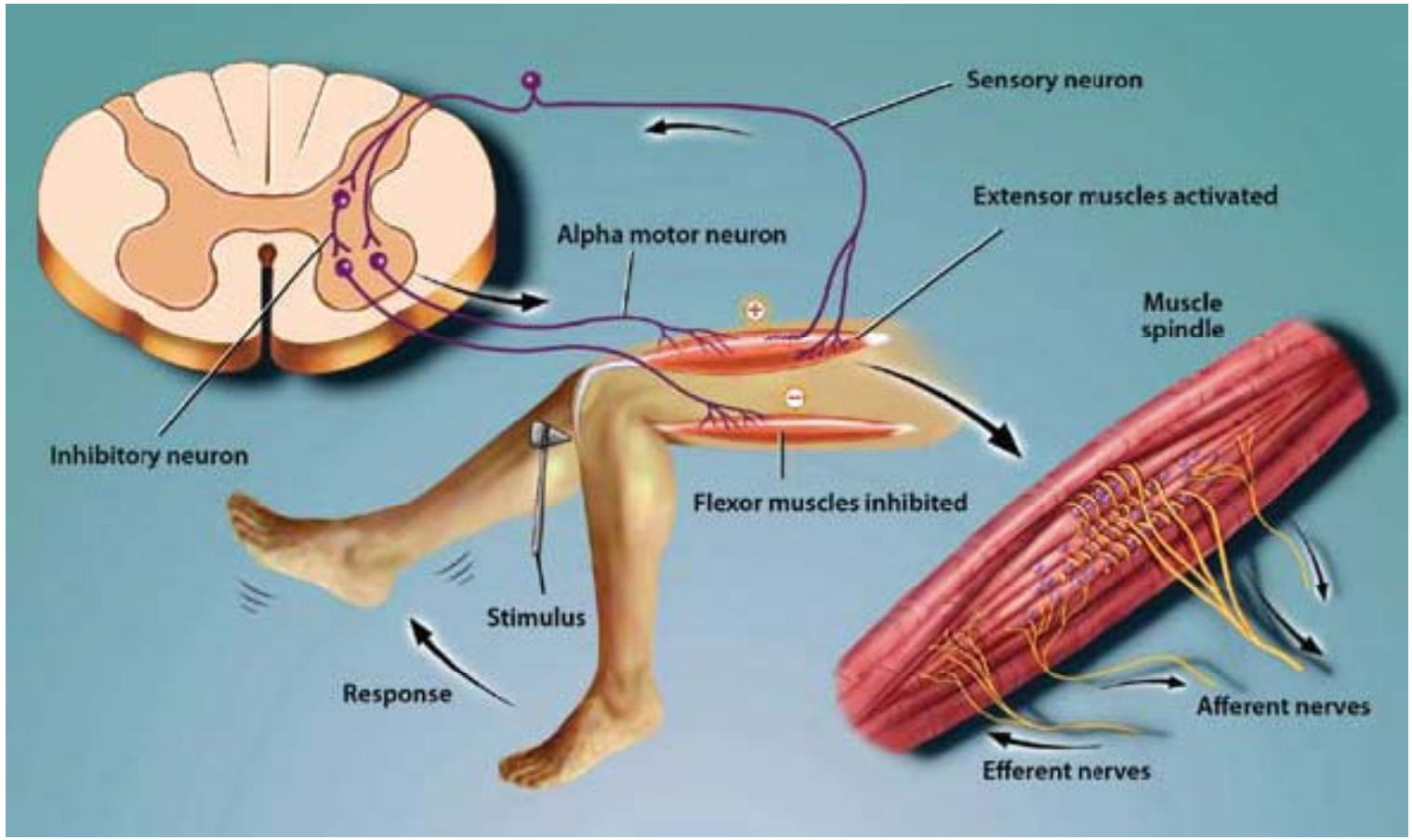


(e) If excessive load is placed on muscle, Golgi tendon reflex causes relaxation, thereby protecting muscle.

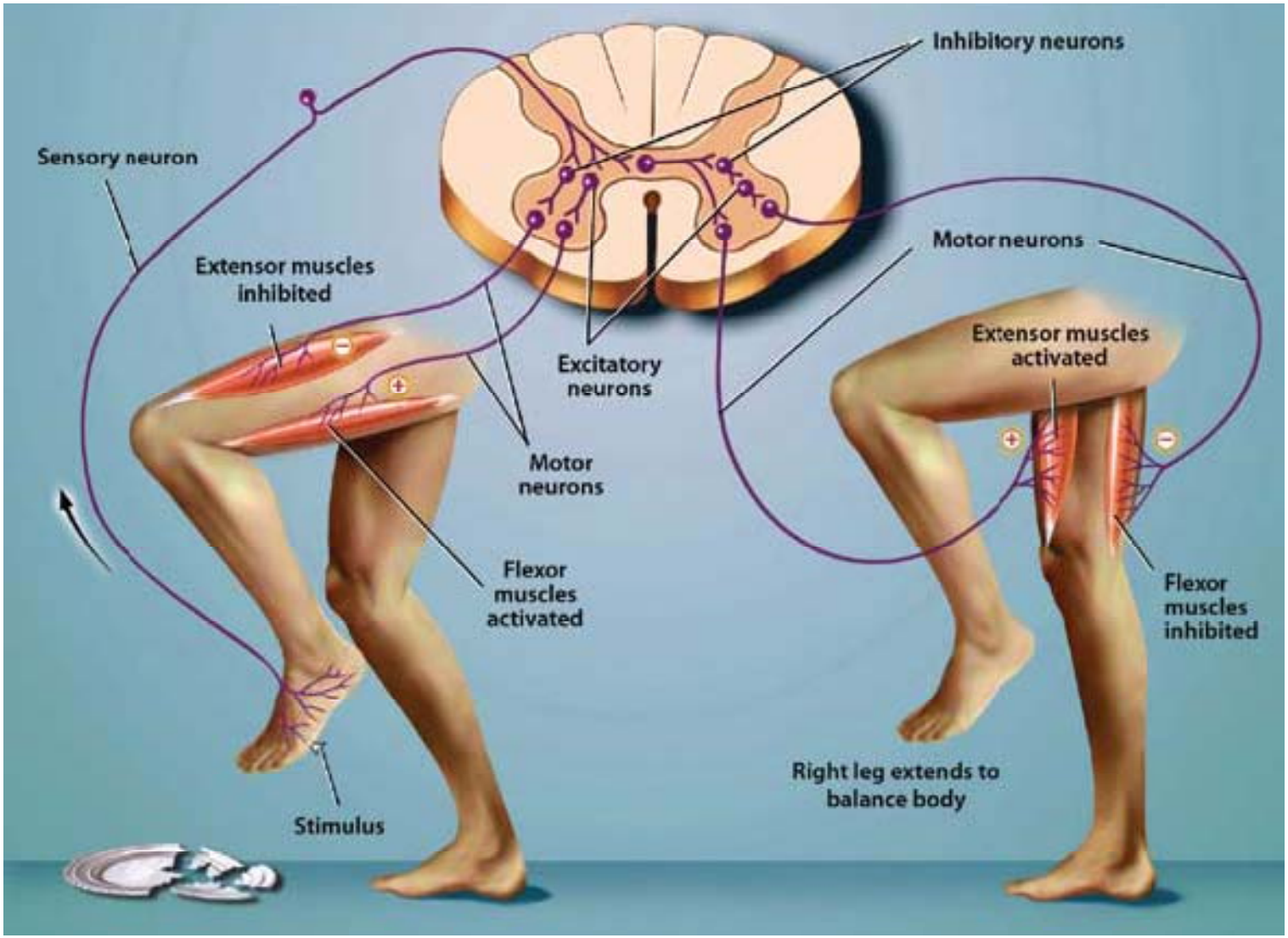
1. Neuron from Golgi tendon organ fires.
2. Motor neuron is inhibited.
3. Muscle relaxes.
4. Load is dropped.

Fig. 13-6b

reflexes


Sensory neuron
Extensor muscles activated
Alpha motor neuron
Muscle spindle
Inhibitory neuron
Flexor muscles inhibited
Stimulus
Response
Afferent nerves
Efferent nerves

flexion withdrawal: crossed extension reflex in the opposite leg



Integration of voluntary movements

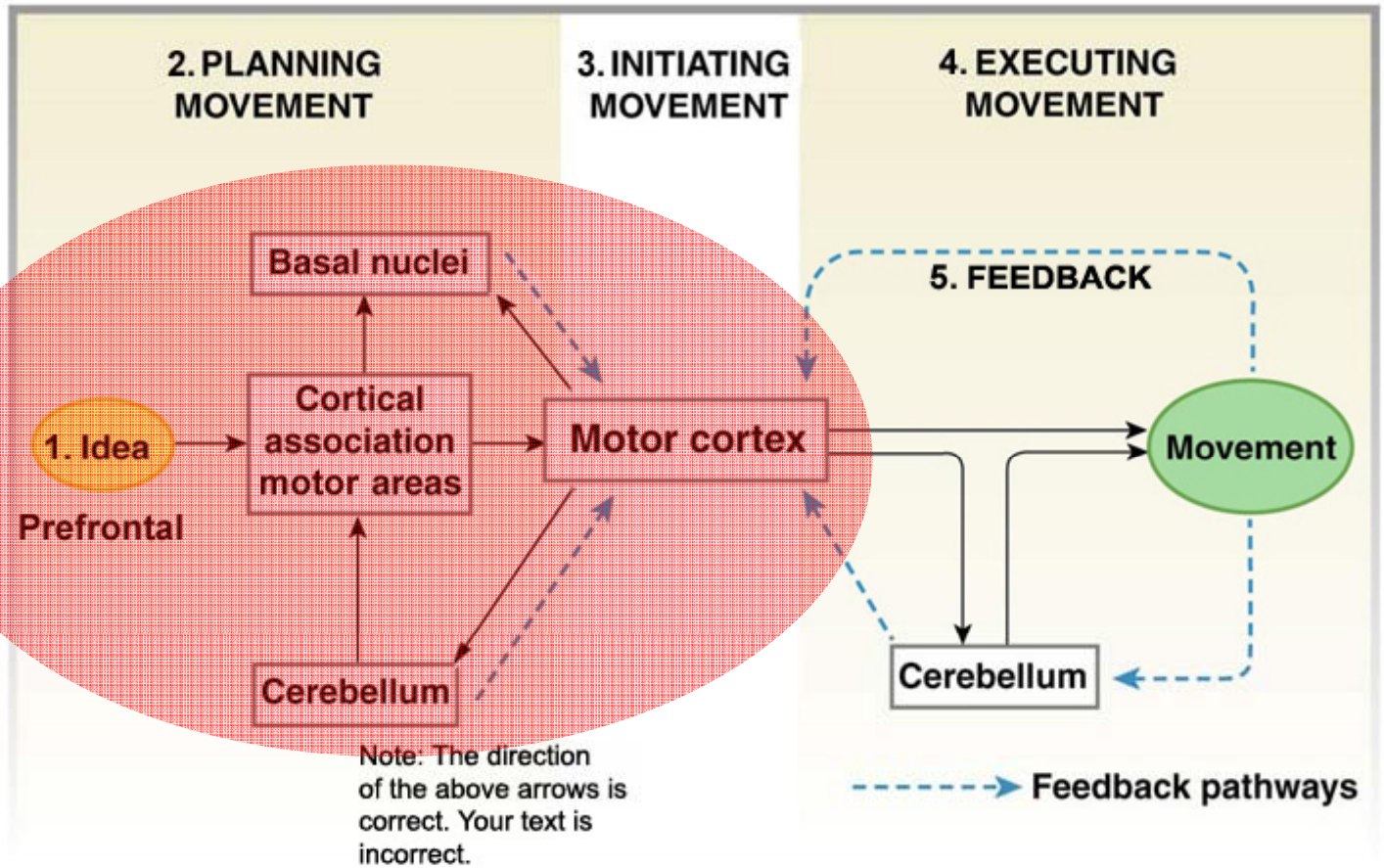
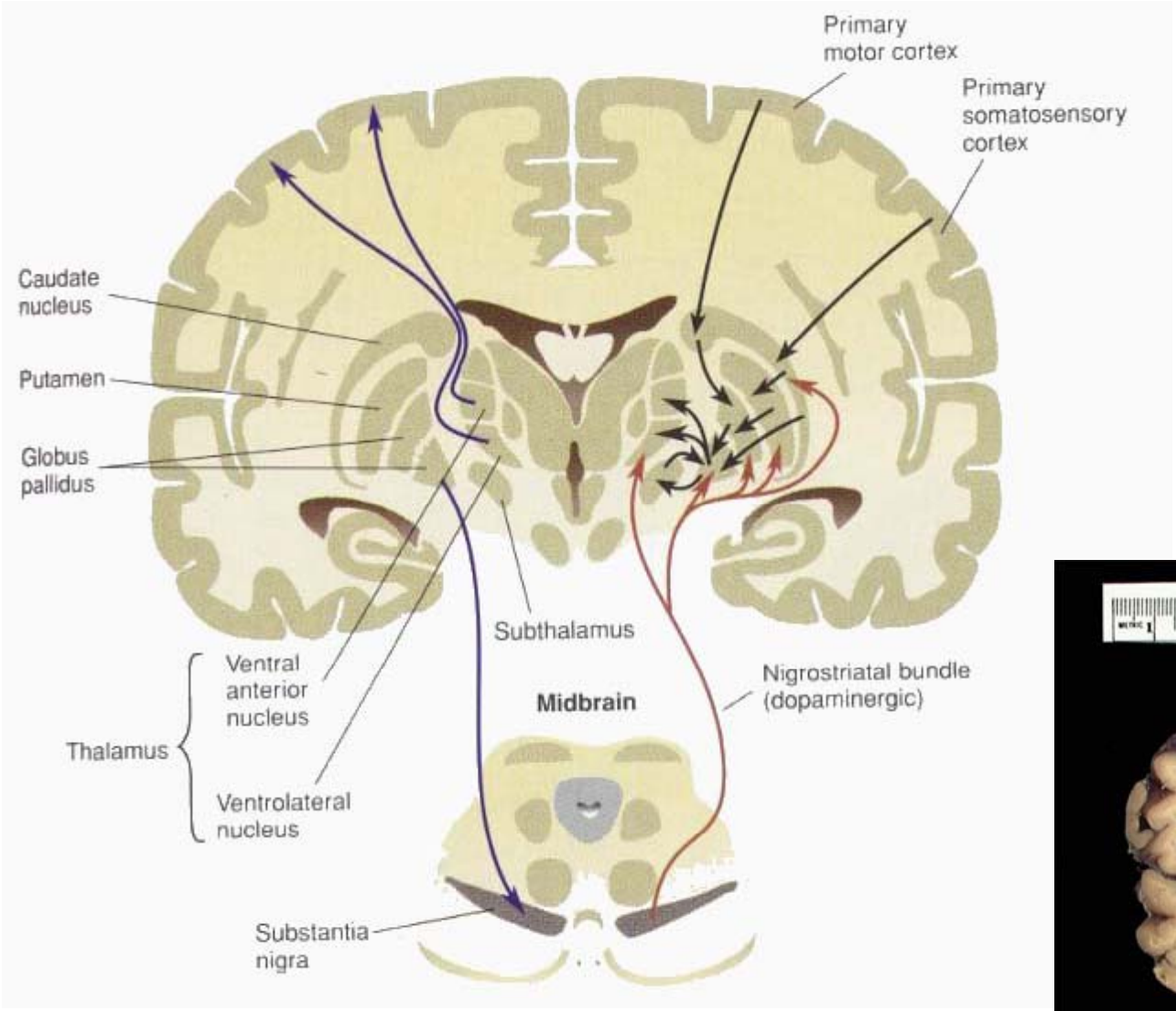
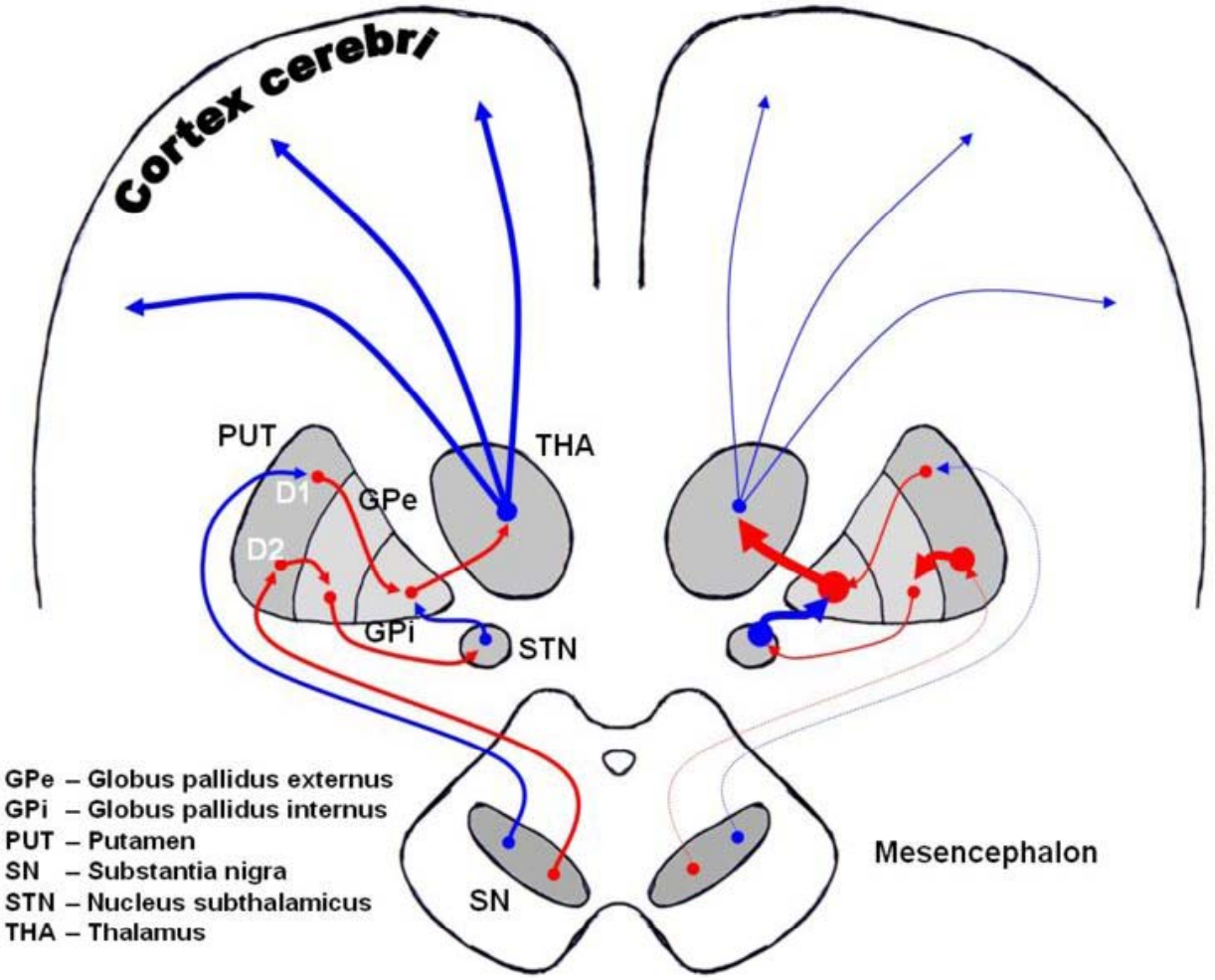


Fig. 13-10


Primary
motor cortex
Primary
somatosensory
cortex
Caudate
nucleus
Putamen
Globus
pallidus
Subthalamus
Ventral
anterior
nucleus
Thalamus
Ventrolateral
nucleus
Midbrain
Nigrostriatal bundle
(dopaminergic)
Substantia
nigra



The image shows dopaminergic pathways of the human brain in normal condition (left) and Parkinsons Disease (right). Red Arrows indicate suppression of the target, blue arrows indicate stimulation of target structure