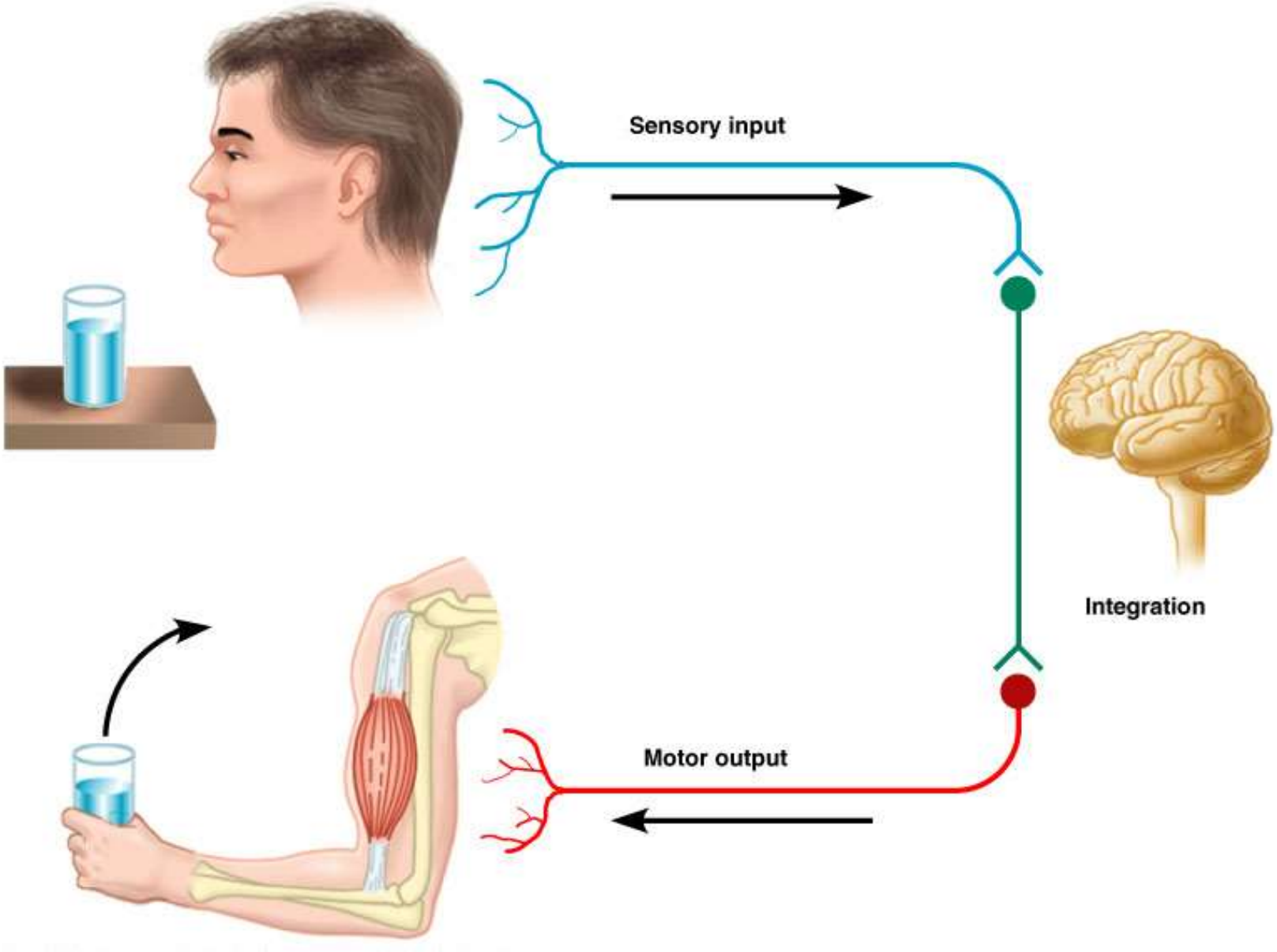
Demonstration of the unconditioned reflex action (Deep tendon reflex such as knee jerk reflex)

Nervous System

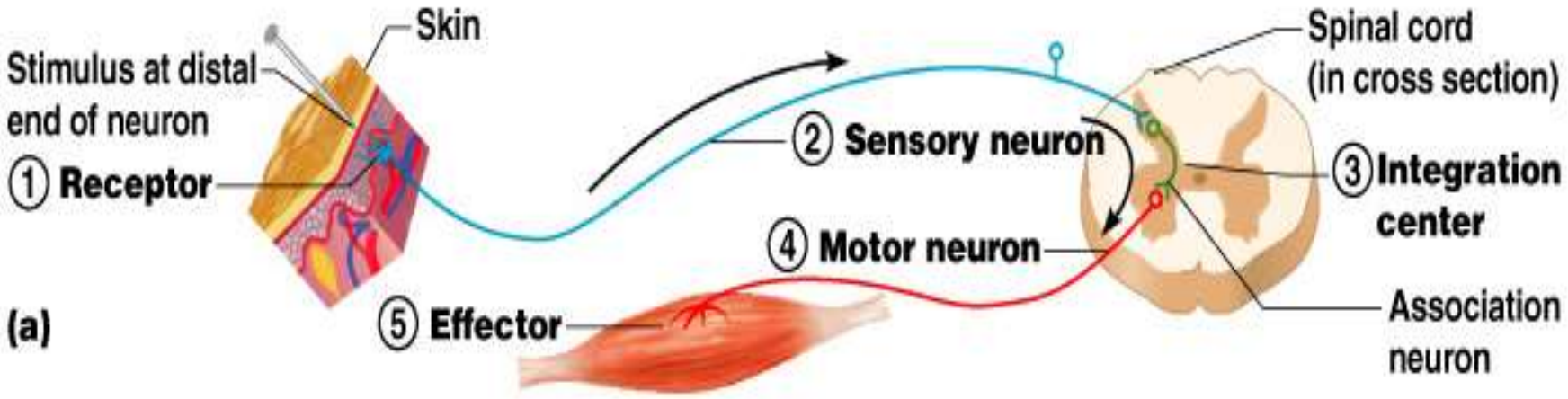


Reflexes

- **Reflexes** are rapid, predictable involuntary responses to stimuli.
- The pathway along which the electrical signals travel is called a reflex arc
- **Reflex arc:** a pathway in which signals travel over many synapses on their way back to the muscle .

There are five parts to a reflex arc:

1. The receptor detects a stimulus.
2. The sensory (afferent) neuron sends an electrical signal to the CNS.
3. The integration center consists of one or more synapses in the CNS, and processes the information.
4. The motor (efferent) neuron sends an electrical signal from the CNS to the effector.
5. The effector, which may be muscle tissue or a gland, responds appropriately.



Reflex Arc

There are two types of reflex arc:

1. autonomic reflex arc (affecting inner organs).
2. somatic reflex arc (affecting muscles).

Autonomic Reflexes:

- Autonomic reflexes control and regulate smooth muscle cells, cardiac muscle cells and glands. In general these reflexes contain the same basic components as somatic reflexes but a key difference is that autonomic reflexes have the ability to both stimulate or inhibit the smooth muscle/gland.
- Examples of Autonomic Reflexes:

1. Pupillary-pupil constricts on both sides when shine a light into the eye
2. Accomodation-focus on distant object then near object-pupil constricts on both sides.

Somatic Reflexes

- Somatic reflexes an unlearned skeletal muscle reflex mediated by the brainstem and spinal cord result in an involuntary contraction of a muscle are involved in the reflex control of skeletal muscles and as such there are many different types of somatic reflexes including scratching reflexes, withdrawal reflexes and stretch reflexes and tendon reflexes. A few of these will be covered in the section below.
- Examples of Somatic reflexes :

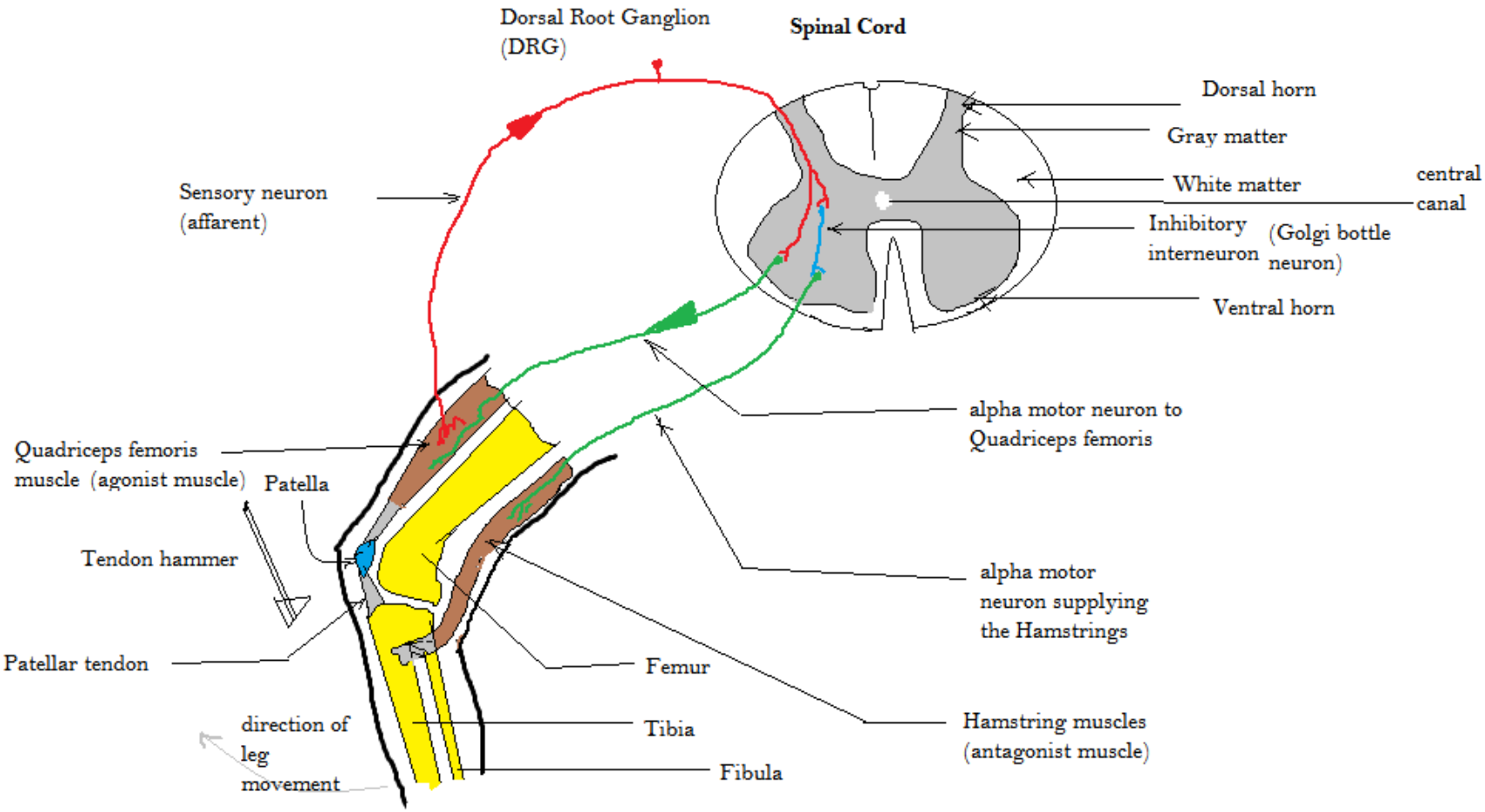
1. Corneal- blink reflex (respond to stimulus)
2. Pateller: knee jerk (tap patellar ligament-stretches quads)

Purpose of the Reflexes tests:

- Reflex testing is an important diagnostic tool for assessing the general health of the nervous system. Distorted, exaggerated or absent reflexes may indicate pathology. If the spinal cord is damaged, reflex tests can help pinpoint the level of damage

Somatic Reflex :The Patellar Reflex

- The patellar (or knee-jerk) reflex is called a stretch reflex because it is initiated by tapping a tendon, which stretches the muscle, stimulating the muscle spindle (the proprioceptor inside the muscle) and causing reflex contraction of the quadriceps muscles. Stretch reflexes generally act to maintain posture, balance and locomotion.



Mechanism:

The patellar (or knee-jerk) reflex is called a stretch reflex because it is initiated by tapping a tendon, which stretches the muscle, This produces a signal which travels back to the spinal cord and . From there, an alpha-motor neuron conducts an efferent impulse back to the quadriceps femoris muscle, triggering contraction. This contraction, coordinated with the relaxation of the antagonistic flexor hamstring muscle causes the leg to kick .

Purpose of testing:

- After the tap of a hammer, the leg is normally extended once and comes to rest.
- The absence or decrease of this reflex is problematic, and known as Westphal's sign. This reflex may be diminished or absent in lower motor neuron lesions and during sleep.
- On the other hand, multiple oscillation of the leg (pendular reflex) following the tap may be a sign of a cerebellar disease. Exaggerated (brisk) deep tendon reflexes such as this can be found in upper motor neuron lesions, hyperthyroidism, anxiety or nervousness. The test itself assesses the nervous tissue between and including the L2 and L4 segments of the spinal cord.

DEEP (OR TENDON) REFLEXES-

- A tendon reflex is the involuntary contraction of a muscle in response to stretch.
- It is mediated by a reflex arc consisting of an afferent (sensory) and an efferent (motor) neuron with one synapse between: that is, a monosynaptic reflex.
- Muscle stretch activates the muscle spindles, which send a burst of afferent signals that in turn lead to direct efferent impulses, causing muscle contraction.
- These stretch reflex arcs are served by a particular spinal cord segment which is modified by the influence of descending upper motor neurons.

1- KNEE JERK (OR PATELLAR) OR QUDERICEPS FEMORIS JERK

Procedure-

In supine position – the examiner's hand is passed under the knee to be tested and placed on the opposite knee or the test knee rests on the dorsum of the examiners wrist. Strike the patellar tendon midway between its origin and insertion.

In sitting position- Alternately, it can be also more easily elicited with the subjects sitting up , the leg hanging freely or crossed legs on the edge of bed.

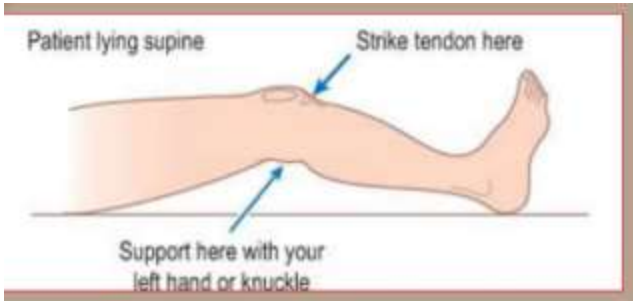


Fig: supine position

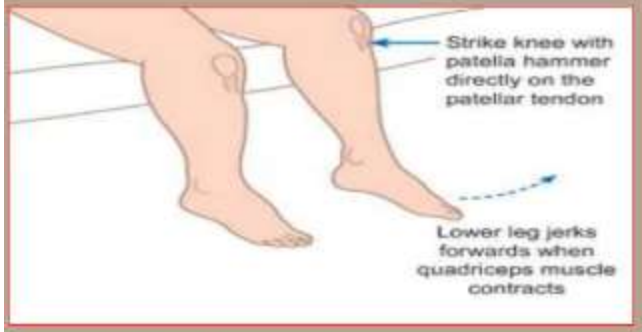
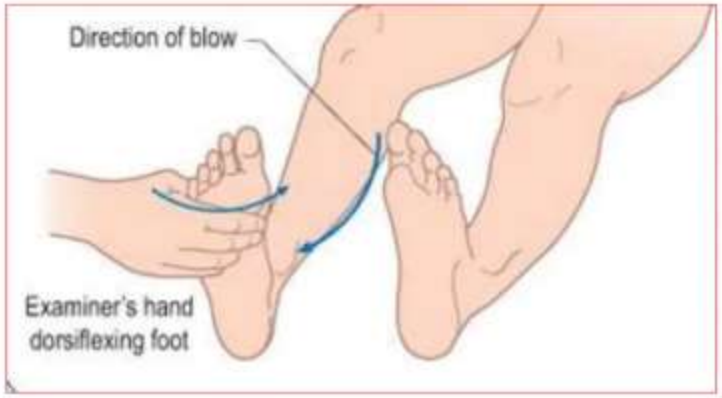


Fig: sitting position

Response- A brief contraction of the quadriceps femoris muscle results in extension of the knee.

Afferent and efferent paths are femoral nerve, level of spinal cord involves –L 2,3,4

Clinical significance- pendullar in acute cerebellar disease and present on the side of lesion. In hypothyroid they are week while in hyper the jerks are brisk.


Direction of blow
Examiner's hand
dorsiflexing foot