JOHNSON COUNTY COMMUNITY COLLEGE
Human Physiology
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Reflexes
Laboratory Practical

General Objectives

In this session and the next we shall define and study several types of reflexes in the human body.

Specific Objectives:

In this exercise, you will develop an understanding of the most fundamental pathway in the nervous system, the REFLEX ARC. You will be introduced to the components of the GREY-H of the spinal cord. Finally, you will be able to observe specific types of reflexes on your associates.

Information:

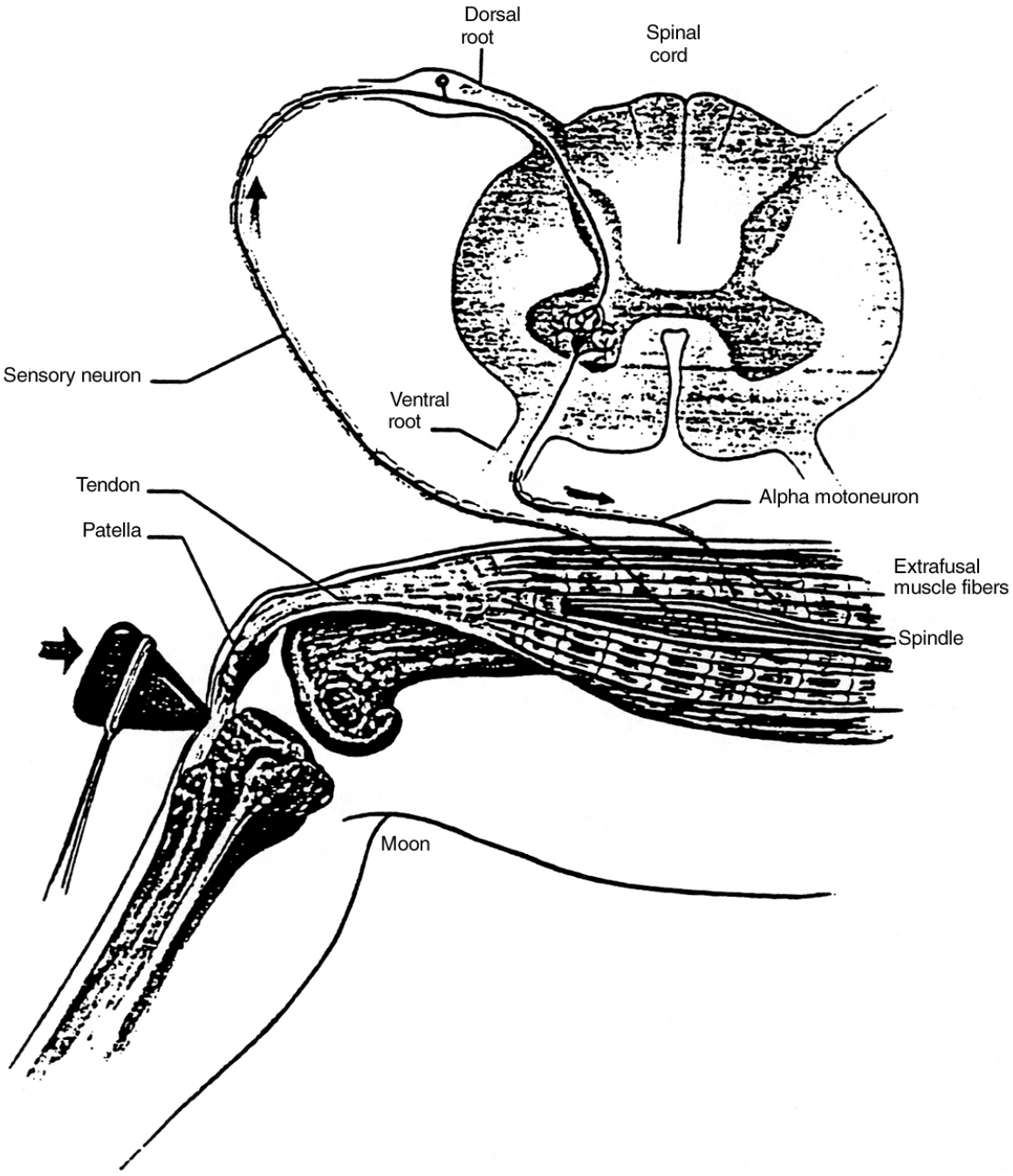
Some animal reflexes depend upon spinal nerve pathways while others involve cranial nerves. You will observe the stereotyped nature of reflex actions and attempt to determine how much or how little it is possible to control reflex behavior.

Reflexes are purposeful and may be categorized according to the functions they serve, such as postural reflexes, blood pressure-regulating reflexes, flexor and extensor reflexes, protective reflexes, etc. Reflexes may also be classified as visceral or somatic, depending upon the kind of organ that is stimulated. Visceral reflexes affect heartbeat, breathing and blood pressure. Somatic reflexes involve various skeletal muscles of the body. Finally, reflexes may be classified as to the location of the sensory receptors that initiate the reflex. In an exteroceptive reflex, the receptor is at or near the surface of the body. In a viscероceptive reflex, the sensory component is located within a visceral organ or blood vessel. In a proprioceptive reflex, the receptor is within a muscle or a tendon.

A typical reflex arc establishes connection between a receptor and effector. In most cases, the receptor is the distal end of the sensory neuron. The sensory element (afferent limb) responds to stimulation by generating an action potential that is passed along to the spinal cord (reflex center) where the information is processed. Then the sensory neuron synapses with a motor neuron (efferent limb) and impulse passes along the motor pathway to an effector, such as a muscle or a gland. This type of reflex arc, known as two-neuron-monosynaptic arc, is exemplified by the deep tendon reflexes (patellar tendon and biceps tendon reflex). Most reflexes are more complex and involve at least three neurons. In this case, the sensory neuron synapses with associative neuron(s) that transmit the impulse to the motor elements.

Examination of reflex status is an important diagnostic tool for health care professionals. In clinical terms, reflexes are categorized as deep or superficial. Deep reflexes are all stretch (mytactic) reflexes such as those elicited by a sharp tap in the appropriate tendon or muscle to induce stretching of the muscle that results in a reflexive shortening of the same muscle. Superficial reflexes are withdrawal reflexes induced by noxious or tactile stimuli. Neural disorders may affect reflex activity in any one of the following ways:

1. The reflexes may be diminished or absent altogether (hyporeflexia)
2. The reflexes may be hyperactive (hyperreflexia)
3. The pattern of reflex activity may be altered in such a way that a new pathological reflex is present



Procedure

Work with your assigned team to complete the following procedures.

1. Tendon Reflexes (stretch reflexes, myotactic reflexes)

Stimulating tendon stretch receptors elicit a reflex contraction in the corresponding muscle. These reflexes are mediated by mono-synaptic reflex arcs.

A. Patellar Tendon Reflex

Seat the subject on a high stool or the edge of a table, so the legs hang freely. Instruct the subject to keep his/her eyes closed. Using a percussion hammer or the edge of your hand, tap the subject's patellar tendon just below the kneecap. Test this reflex in both legs under the following conditions:

1. Control conditions (normal). Are the responses equal in magnitude?

2. Have the subject contract the flexor muscles of the left thigh only. How do the reflex responses compare (a) to each other and (b) to the control condition?

3. Have the subject count backwards from 100 by 7s. What effect does conscious mental activity have on the magnitude of the reflex response?

4. Allow the subject to watch the test being done. Is there a change in the magnitude of the response?

B. Achilles Tendon Reflex

Have the subject kneel on a chair or table with the feet hanging over the edge. Tap the Achilles tendon with a percussion hammer or the edge or your hand. Describe the response that occurs and name the muscle whose contraction produces it.

C. Jaw Jerk Reflex

Sudden closure of the jaw occurs when the middle of the chin is struck while the mouth is slightly open, or when a pencil placed on the lower teeth is tapped.

D. Biceps Reflex

This reflex is obtained by striking the thumb placed upon the relaxed biceps tendon when the forearm is flexed at 90 degrees. The biceps muscle will contract and further flex the forearm.

2. Plantar Reflex (Babinski Sign)

This reflex occurs in response to cutaneous stimulation. The pathway is multisynaptic. A positive Babinski sign, extension of the big toe and spreading of the other toes fan-wise, is seen in adults (it is normal in babies under 18 months of age, especially during sleep) if the corticospinal motor pathways (pyramidal tracts) have been damaged. Flexion of all the toes is negative Babinski sign. To test this reflex, stroke the sole of the foot firmly, from the heel to the transverse arch. Use the handle of a percussion hammer or the blunt edge of a pen. What are your observations?

3. Eye Reflexes

A. Corneal Reflex (Eye Blink)

Gently touch the outer surface of the cornea.

1. What response do you observe?
2. Does only the stimulated eye respond?

B. Pupillary Reflexes (Light Reflex)

In response to light falling in the retina, the iris muscles will contract or relax to change pupil diameter. Have the subject cover both eyes with his/her hands, wait a few minutes, then focus a reasonably bright light into his/her face.

1. What response do you observe when you remove the light?
2. What do you observe when you present the light to the dark-adapted eye?

C. Consensual Light Reflex

Repeat the above procedure, shining light into the right eye only. To do this, have the subject hold a piece of paper (or his/her hand) vertically between the eyes. Check both eyes for pupil diameter changes. What do you observe?

D. Accommodation Reflex

Have the subject look at a distant object in ordinary light. Observe pupil size. Without changing the light intensity, have the subject look at another object 6 to 12 inches away from his/her eyes. Observe any changes in pupil diameter.

E. Convergence Reflex

Note the position of the eyeballs relative to an imaginary vertical line passing through the center of the pupil when the patient is looking at a distant object. Then have the patient focus on an object 6 to 12 inches away from his/her eyes.

1. What happens to the position of the eyeballs relative to the line?
2. Have the subject describe the sensations associated with focusing on a near object. Record your observation.