

HUMAN REFLEXES

INTRODUCTION:

Neurons communicate in many ways, but much of what the body must do every day is programmed as reflexes. Reflexes are rapid, predictable, involuntary motor responses to stimuli and they occur over neural pathways called reflex arcs. Reflexes serve as immediate, protective responses to potentially harmful stimuli.

Reflexes can be classes as either autonomic or somatic reflexes. Autonomic reflexes (visceral) are not subject to conscious control. These reflexes activate smooth muscles, cardiac muscle, and the glands of the body and they regulate body functions such as digestion and blood pressure. Somatic reflexes include all reflexes that stimulate skeletal muscles. An example of such a reflex is the rapid withdrawal of your foot from a piece of glass you have just stepped on.

All reflex arcs have a minimum of five functional elements: 1. The receptor reacts to a stimulus. 2. The sensory neuron conducts the afferent impulses to the CNS. 3. The integration center consists of one or more synapses in the CNS. 4. The motor neuron conducts the efferent impulses from the integration center to an effector. 5. The effector, muscle fibers or glands, respond to the efferent impulses by contraction or secretion a product, respectively.

SOMATIC REFLEXES

SPINAL REFLEXES

STRETCH REFLEXES

Stretch reflexes are important postural reflexes that act to maintain posture, balance, and locomotion. Stretch reflexes are produced by tapping a tendon, which stretches the attached muscle. This stimulates muscle spindles (specialized sensory receptors in the muscle) and causes reflex contraction of the stretched muscle, which resists further stretching. Even as the primary stretch reflex is occurring, impulses are relayed to higher brain centers to advise of muscle length and speed of shortening- information needed to maintain muscle tone and posture.

PATELLAR REFLEX

The patellar, or knee-jerk, reflex assesses the L₂-L₄ region of the spinal cord. The reflex is processed at this level and does not progress to the brain. This reflex is a monosynaptic, two-neuron, reflex arc.

ACHILLES REFLEX

The Achilles, or ankle-jerk, reflex assesses the first two sacral segments of the spinal cord. The reflex is processed at this level and does not progress to the brain. This reflex is a monosynaptic, two-neuron, reflex arc.

BICEPS REFLEX

The biceps-jerk reflex is a more complex, three neuron reflex (polysynaptic). This reflex assesses C₅-C₈ and T₁.

SUPERFICIAL CORD REFLEXES

The superficial cord reflexes (abdominal and plantar reflexes) are initiated by stimulation of receptors in the skin and mucosa. The superficial cord reflexes depend both on brain participation and on the cord-level reflex arc.

PLANTAR REFLEX

The plantar reflex is elicited by stimulating the cutaneous receptors in the sole of the foot. In adults, stimulation of these receptors causes the toes to flex and move closer together. Damage to the corticospinal tract (the major voluntary motor tract, however, produces Babinski's sign, an abnormal response in which the toes flare and the great toe moves upward. In newborn infants, Babinski's sign is seen because the nervous system is still incompletely myelinated.

CRANIAL NERVE REFLEX TESTS

Two reflexes mediated by cranial nerves are the corneal reflex and gag reflex.

CORNEAL REFLEX

The corneal reflex is mediated through the trigeminal nerve (cranial nerve V). The absence of this reflex is an ominous sign because it often indicates damage to the brain stem. This reflex is tested by touching the cornea with a wisp of absorbent cotton. It causes pain and the eye to tear up. This reflex will not be tested in class.

GAG REFLEX

The gag reflex tests the motor responses of cranial nerves IX and X.

When the oral mucosa on the side of the uvula is stroked, each side of the mucosa should rise to some extent. We will not perform this experiment, as vomiting is a possibility for those with queasy stomachs!

AUTONOMIC REFLEXES

The autonomic reflexes include the pupillary reflexes as well as many others.

PUPILLARY REFLEXES

There are several types of pupillary reflexes- the pupillary light reflex and the consensual reflex. In both of these reflexes, the retina of the eye is the receptor, the optic nerve (cranial nerve II) contains the afferent fibers, some of which synapse at the optic chiasma in the midbrain with other optic nerve fibers from the opposite eye. As a result, the neurons in the midbrain process the signal on both sides of the brain. The oculomotor nerve (cranial nerve III) is responsible for conducting efferent impulses back to the eye, and the smooth muscle of the iris is the effector. Many CNS centers are involved in the integration of these responses. Absence of the normal pupillary reflexes is generally a late indication of severe trauma or deterioration of the vital brain stem tissue. The consensual response, or any reflex observed on one side of the body when the other side has been stimulated, is called a contralateral response. Any reflex occurring on the same side stimulated is referred to as an ipsilateral response.

PROCEDURE:

1. Test the patellar reflex by striking the ligament below the patella with a reflex hammer. Write the results in the chart provided.
Jog in position for several minutes until your legs become truly fatigued. Test the reflex again and write the results in the chart provided.
2. Test the Achilles reflex by pointing the toes upwards and striking the tendon above the heel with a reflex hammer. Write the results in the chart provided.
3. Test the biceps-jerk reflex by placing your bare arm, bent at the elbow, on the table. Have your partner press his/her index finger on the inside of the elbow over the tendon of the biceps brachii and gently strike his/her finger with the reflex hammer. Write the results in the chart provided.
4. Test the plantar reflex by removing the sock and dragging the metal end of the reflex hammer from the heel up the lateral side of the sole and around to the big toe. Write the results in the chart provided.
5. Test the pupillary light reflex by shining a light into each eye and measuring the size of the pupil (central, black region of the eye.) Write the results in the chart provided. Separate your eyes using your hand (completely block the area between the two.) Shine the flashlight into one eye, observe its response and that of the other eye.

DATA

REFLEX	RESPONSE
PATELLAR-NORMAL	
PATELLAR-AFTER FATIGUE	
ACHILLES	
BICEPS	
PLANTAR	
PUPILLARY-RESPONSE TO LIGHT	<u>Before:</u> <u>After:</u> <u>Difference:</u> Right eye ____mm Right eye ____mm Right eye ____mm Left eye ____mm Left eye ____mm Left eye ____mm
PUPILLARY-CONSENSUAL RESPONSE	

QUESTIONS

1. ____ Reflex arcs _____ are routes followed by nerve impulses as they pass through the nervous system.
2. A(n) ____ neuron _____ is the functional unit of the nervous system.
3. A(n) ____ reflex _____ is the simplest behavioral act.
4. The knee-jerk reflex employs only _2 (sensory and motor) _____ neurons.
5. What are the five functional elements of a reflex arc? Explain each briefly.
 1. The receptor reacts to a stimulus.
 2. The sensory neuron conducts the afferent impulses to the CNS.
 3. The integration center consists of one or more synapses in the CNS.
 4. The motor neuron conducts the efferent impulses from the integration center to an effector.
 5. The effector, muscle fibers or glands, respond to the efferent impulses by contraction or secretion a product, respectively.
6. What is a somatic reflex? Give an example.
Goes to voluntary muscles. Knee-jerk, biceps, Achilles, patellar reflexes.
7. What is an autonomic reflex? Give an example.
Goes to involuntary effectors. Pupillary responses.

8. Was nervous system activity or muscle function responsible for changes after the muscle fatigued?
Explain.
Muscular system- the nervous system does not fatigue. There is only a short refractory period during which the neuron cannot fire after repolarization.
9. What is the practical function of the corneal reflex?
Protection of the eye- it waters to remove harmful particles. It is a test for cranial nerve function.
10. What is the function of the normal pupillary response to light?
Protection of the eye- it constricts the pupil to decrease the amount of light entering the eye so as not to damage the retina. It is a test for cranial nerve function.
11. What is the function of the consensual response of the pupil to light?
Both eyes work together, so the pupils do also. There are fibers that cross between both eyes and the brain to coordinate activities. It is a test for cranial nerve function.
11. What functions do reflex responses serve?
Protection of the body by allowing rapid, pre-programmed responses to stimuli

Label the diagram below of the reflex arc.

