SECTION 1: REFLEXES AND REFLEX ARCS

Nerve impulses follow routes through the nervous system called nerve pathways. Some of the simplest nerve pathways consist of little more than two neurons that communicate across a single synapse. Reflexes are rapid, involuntary responses to stimuli, which are mediated over simple nerve pathways called reflex arcs. Involuntary reflexes are very fast, traveling in milliseconds. The fastest impulses can reach 320 miles per hour.

Reflex arcs have five essential components:
1. The receptor at the end of a sensory neuron reacts to a stimulus. For example, some receptors in the skin are sensitive to heat, others to pressure.
2. The sensory neuron conducts nerve impulses along an afferent pathway towards the CNS.
3. The integration center consists of one or more synapses in the CNS.
4. A motor neuron conducts a nerve impulse along an efferent pathway from the integration center to an effector.
5. An effector responds to the efferent impulses by contracting (if the effector is a muscle fiber) or secreting a product (if the effector is a gland).

Reflexes can be categorized as either autonomic or somatic. Autonomic reflexes are not subject to conscious control, are mediated by the autonomic division of the nervous system, and usually involve the activation of smooth muscle, cardiac muscle, and glands. Somatic reflexes involve stimulation of skeletal muscles by the somatic division of the nervous system.

Most reflexes are polysynaptic (involving more than two neurons) and involve the activity of interneurons in the integration center. Some reflexes, however, are monosynaptic ("one synapse") and only involve two neurons, one sensory and one motor. Since there is some delay in neural transmission at the synapses, the more synapses that are encountered in a reflex pathway, the more time that is required to effect the reflex.

SECTION 2: THE IMPORTANCE OF REFLEX TESTING

Reflex testing is an important diagnostic tool for assessing the condition of the nervous system. Distorted, exaggerated, or absent reflex responses may indicate degeneration or pathology of portions of the nervous system, often before other signs are apparent.

If the spinal cord is damaged, then reflex tests can help determine the area of injury. For example, motor nerves above an injured area may be unaffected, whereas motor nerves at or below the damaged area may be unable to perform the usual reflex activities.

Closed head injuries, such as bleeding in or around the brain, may be diagnosed by reflex testing. For example, remember that the oculomotor nerve stimulates the muscles in and around the eyes. If pressure increases in the cranium (such as from an increase in blood volume due to brain bleeding), then the pressure exerted on CN III may cause variations in the eye reflex responses.
SECTION 3: STRETCH REFLEXES

The primary tool that we will be using to test reflex activity is the Taylor Reflex Hammer. Care must be taken to use the proper hammer technique during our lab activities. Improper techniques will not elicit the desired reflexes. The tap stretches a muscle, which stimulates stretch receptors located in the muscle. In response to the increased stretch, which normally would only occur when the muscle load has suddenly increased, the muscle contracts. In this demonstration, such a reaction seems strange, but in normal circumstances the stretch reflex allows muscles to reflexively increase the strength of contraction in response to increased load.

1. The patellar reflex, or knee-jerk reflex, is centered in the spinal cord and is used to assess the nervous tissue between (and including) the L2 and L4 segments.

2. The Achilles reflex is a spinal reflex that results in plantar flexion of the foot. This reflex assesses the nervous tissue between (and including) the first two sacral segments.

SECTION 4: PLANTAR REFLEX (Babinski)

The plantar reflex is a superficial spinal reflex that depends both on functional upper-level motor pathways and on the cord-level reflex arc. In adults, stimulation of cutaneous receptors in the sole of the foot (as when testing the plantar reflex) usually causes the toes to flex and move together.

Damage to the corticospinal tract (or incomplete myelination of the nervous system, as is the case with infants) produces Babinski’s sign, an abnormal response in which the toes flare and the great toe moves in an upward direction.
A. Record the reactions for each of the reflex tests for both partners. Indicate if the response was normal or not. (6 pts.)

<table>
<thead>
<tr>
<th>Reflex</th>
<th>Result</th>
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<tbody>
<tr>
<td>Patellar</td>
<td></td>
</tr>
<tr>
<td>Achilles</td>
<td></td>
</tr>
<tr>
<td>Plantar (Babinski)</td>
<td></td>
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</tbody>
</table>

B. Answer the following questions from the lab. (3 pts.)

1. What is a normal reaction for the patellar reflex? ____________________________

2. What is a normal response for the achilles reflex? ____________________________

3. What is a normal response for the Babinski (plantar) reflex? _________________

C. Use your text to draw and label a typical reflex arc, labeling the 5 components: (5 pts.)
D. Summary: Fill-in each statement with the correct term from the lab. (8 pts.)

1. In infants, the ____ response is normal when testing the Babinski (plantar) reflex.

2. When testing the Babinski (plantar) reflex in an adult, extension of the toes may indicate damage to the ____.

3. In a ____ reflex, a muscle contracts when the load increases.

4. The center of the patellar reflex is in the ____.

5. The ________ conducts nerve impulses along an afferent pathway towards the CNS

6. A _____ conducts a nerve impulse along an efferent pathway from the integration center to an effector.

7. If the Achilles (calcaneal) tendon is tapped, one would expect the result to be____.

8. Damage to the ______ produces Babinski's sign

Short Answer Questions: (4 pts.)

1. What is an advantage of having reflex reactions? ________________________________

2. Why might newborn’s reflexes differ from those of an adult? ________________________________