**Reflex and Reaction Lab**

**Introduction**Dust gets in your nose and you sneeze. You smell a cake baking and your mouth salivates. During a baseball game the ball flies towards your face and you jerk your head back and move out of the way. All of these are examples of a reflex.

A **reflex** is an automatic response to a stimulus that threatens the homeostatic state or survival of an organism. Your body reacts before you even have time to think about what is happening. The process in which this occurs is through a **reflex arc**.

Imagine touching a hot stove. In the **reflex arc**, your hand is the receptor, and detects the stimulus (in this case, the heat from the stove). A nerve impulse is sent down a sensory neuron toward the spinal cord in the CNS. The nerve impulse is carried through the dorsal root and dorsal horn of the gray matter of the spinal cord where it is processed by interneurons (in this case, “yikes, that’s too hot!”). A nerve impulse is then sent out through the ventral root and horn and down a motor neuron to the effector to carry out the response (bicep brachii contracts to move the hand away from the stove). Notice that the integrative function is completely carried out by the spinal cord and the brain is not involved.

A **reaction** on the other hand, does involve the brain. Think about waiting at a crosswalk. The light turns green telling you that it is safe to cross the street. First, your eyes must see the green light. This message must then be sent by the optic nerve to the brain where the thalamus processes the information and sends a message back to your leg muscles telling them it is okay to walk. Unlike a reflex, you could easily resist reacting to the stimulus of the green light. If you were to cross at the same intersection every day, you reaction time to the light changing would probably improve and you would react more quickly.

In the following activities you will observe and analyze different reflexes and tests of reaction time. Doctors often test patients’ reflexes because an abnormal reflex could be an indicator of nervous system malfunction or disease. For instance, lack of a pupillary reflex could indicate severe head trauma or damage to the brain stem.

|  |  |  |  |
| --- | --- | --- | --- |
| **Activity** | **Test** | **Normal Reaction** | **Abnormal Reaction** |
| 1 & 2 | Patellar Reflex | Extension of the lower leg  | No extension of the lower leg |
| 3 | Calcaneal Reflex | Plantarflexion of the foot  | No plantarflexion of the foot |
| 4 | Plantar Reflex | Curling of the toes | Flaring/Spreading of the toes |
| 5 | Pupillary Reflex | Constriction of the pupil | No constriction of the pupil |
| 6 | Ciliospinal Reflex | Constriction of the pupil | No constriction of the pupil |

**Activity 1 – Patellar Tendon Reflex**

1. Have the subject sit on the edge of the lab table with his/her legs dangling loosely over the edge.
2. Locate the patella on the subject’s right leg with your finger.
3. Slide your finger just inferior to the patella and locate the patellar tendon (rope-like structure between the patella and the tibial tuberosity).
4. Using the pointed end of the reflex hammer, tap gently on the subject’s patellar tendon (do not hurt your partner!)
5. The subject should record his/her OWN results on their data sheet.
6. Perform the same test on the left leg and record the observation.
7. Subject and Tester switch roles.

**Activity 2 – Patellar Tendon Reflex with Mental Distraction**

1. Have the subject sit on the edge of the lab table with his/her legs dangling loosely over the edge.
2. Locate the patella on the subject’s right leg with your finger.
3. Slide your finger just inferior to the patella and locate the patellar tendon (rope-like structure between the patella and the tibial tuberosity).
4. Have the subject recite the alphabet backwards.
5. While the subject is reciting the alphabet backwards, use the pointed end of the reflex hammer and tap gently on the subject’s patellar tendon (do not hurt your partner!)
6. The subject should record his/her OWN results on their data sheet.
7. Perform the same test on the left leg and record the observation.
8. Subject and Tester switch roles.

**Activity 3 – Calcaneal Tendon Reflex**

1. Have the subject kneel on the lab desk with his/her feet dangling off the edge.
2. Have the subject slightly dorsiflex their right ankle.
3. Locate the subject’s posterior calcaneus.
4. Slide your finger superior to the calcaneus and locate the calcaneal tendon.
5. Using the flat end of the reflex hammer, strike the subject’s right calcaneal tendon.
6. The subject should record his/her OWN results on their data sheet.
7. Perform the same test on the left leg and record the observation.
8. Subject and Tester switch roles.

**Activity 4 – Plantar Reflex/Babinski’s Sign**

1. Have the subject sit on the lab desk, with their knee extended and shoe and sock off.
2. Using the end of a pencil/ruler/reflex hammer, start on the lateral side of the calcaneus and bring the utensil up towards the pinky toe and then across the ball of the foot to the big toe.
3. The subject should record his/her OWN results on their data sheet.
4. Perform the same test on the left foot and record the observation.
5. Subject and Tester switch roles.



**Activity 5 – Cioliospinal Reflex**

1. The subject sits in a chair, facing the observer.
2. While observing the subject’s right pupil, the tester either lightly runs a finger down the right side of the back of the subject’s neck, or lightly pinches the right side of the subject’s neck. \**If this makes the subject uncomfortable, the subject can perform the action while looking at the tester.*
3. The tester watches the pupil of the right eye and describes what happened to the subject so the subject can record it on her/her OWN data sheet.
4. Subject and Tester switch roles.

**Activity 6 – Pupillary Reflex**

1. The subject sits in a chair, facing the observer.
2. Using the penlight, the tester should bring the light in from the right side of the subject’s face and end so that the light is shining on the subject’s right pupil.
3. The tester describes what happened to the subject so the subject can record it on his/her OWN data sheet.
4. Perform the same test on the left eye and record the observation.
5. Perform the test again, starting with the penlight on the right side. This time the tester should observe the **left** pupil and note any observations.
6. Subject and Tester switch roles.

**Activity 7 – Reaction Time Ruler**

1. The subject sits in a chair, facing the observer.
2. The tester holds the reaction time ruler between the thumb and first finger, by the end marked “release.”
3. The tester positions the reaction time ruler at the subject’s eye level or higher.
4. The subject places his or her thumb and first finger over the “thumb line,” leaving about 1 inch between the thumb and first finger. The subject **should not be touching the ruler**.
5. When the subject is ready, the tester releases the ruler.
6. As quickly as possible, the subject tries to catch the ruler between the thumb and first finger.
7. The line under the subject’s thumb is the reaction time in milliseconds. Each line on the ruler represents 10 milliseconds. Estimate the reaction time to the nearest whole number.
8. The subject notes the result on his/her data sheet.
9. Perform this test 10 times.
10. Subject and Tester switch roles.

**Activity 8 – Card Reaction Time**

This activity consists of two trials.

1. For Trial 1, the subject holds a deck of shuffled cards face down.
2. The tester starts the timer and tells the subject to begin.
3. The subject turns over the cards, one at a time, and places them in either a “red” pile or a “black” pile, depending on the color of the card. The subject continues until all cards have been placed.
4. The tester stops the timer and the subject records the time in his/her data sheet.
5. Shuffle the cards and reset the timer.
6. For Trial 2, the subject again holds the deck of cards face down.
7. The tester starts the timer and tells the subject to begin.
8. The subject turns over the playing cards, one at a time, and separates them into four piles, according to suits: hearts, diamonds, clubs, and spades. The subject continues until all cards have been placed.
9. The tester stops the timer and the subject records the time in his/her data sheet.
10. Shuffle the cards and reset the timer.

Name: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

**Reflex and Reaction Lab Data Sheet**

**Pre-Lab Questions**

1. What is a reflex?
2. What part of the nervous system processes a reflex?
3. What is a reaction?
4. What part of the nervous system processes a reaction?
5. What are the parts of a reflex arc, in order?
6. Why is it important for doctors to test patients’ reflexes regularly?

**Data and Observations**

**Activity 1 – Patellar Tendon Reflex**

*Record the results of Activity 1 in the table below.*

|  |  |
| --- | --- |
| **Leg** | **Describe Results** |
| **Right** |  |
| **Left** |  |

1. How did the reflexes of your right and left leg compare?

 **Activity 2 – Patellar Tendon Reflex with Mental Distraction**

*Record the results of Activity 2 in the table below.*

|  |  |
| --- | --- |
| **Leg** | **Describe Results** |
| **Right** |  |
| **Left** |  |

1. How did your results from Activity 1 compare to your results from Activity 2?

**Activity 3 – Calcaneal Tendon Reflex**

*Record the results of Activity 3 in the table below.*

|  |  |
| --- | --- |
| **Foot** | **Describe Results** |
| **Right** |  |
| **Left** |  |

**Activity 4 – Plantar Reflex/Babinski’s Sign**

*Record the results of Activity 4 in the table below.*

|  |  |
| --- | --- |
| **Foot** | **Describe Results** |
| **Right** |  |
| **Left** |  |

 **Activity 5 – Ciliospinal Reflex**

What happened when the right side of your neck was stroked/pinched?

**Activity 6 – Pupillary Reflex**

*Record the results of Activity 5 in the table below.*

|  |  |
| --- | --- |
| **Eye** | **Describe Results** |
| **Right** |  |
| **Left** |  |

1. What happened to the pupil of your left eye when the light was shined into the right eye?
2. Why does the pupil size change?
3. A quarterback is hit hard on a sack during a football game. He briefly loses consciousness and is taken to the athletic trainer. The athletic trainer performs the pupillary reflex immediately. Why is this test important?

**Activity 7 – Reaction Time Ruler**

|  |  |
| --- | --- |
| **Trial** | **Time (milliseconds)** |
| **1** |  |
| **2** |  |
| **3** |  |
| **4** |  |
| **5** |  |
| **6** |  |
| **7** |  |
| **8** |  |
| **9** |  |
| **10** |  |
| **Ave.** |  |

 *Fill in the chart with your trial times from Activity 7.*

1. Did your reaction times differ as you performed more trials? If so, how?

**Activity 8 – Reaction Time Cards**

*Fill in the chart with the card reaction times from Activity 8.*

|  |  |
| --- | --- |
| **Trial** | **Reaction Time (seconds)** |
| **1** **(two piles)** |  |
| **2** **(four piles)** |  |

1. What could you do to make your reaction time faster?
2. What could you do to make your reaction time slower?