Name_____ Class_____ Date _____

Observing Nervous Responses

Introduction

The nervous system is a series of conducting tissues that carries impulses to all parts of the body. Your nervous system initiates many types of reflex actions. When you touch a hot object, you immediately pull your hand away. You might be aware of this reflex action occurring, but you are unable to stop or control it.

How do reflex actions occur? When your hand touches a hot object, for example, heat receptors in the skin send an impulse to the muscles of the arm to contract. The impulse travels along the sensory neurons, to the spinal cord, across a synapse, and stimulates a motor neuron. The impulse leaves the spinal cord, passes back to the same nerve, and back to the arm muscles, causing them to contract and pull your hand away. This pathway is called the reflex arc. Because the reflex arc involves only the spinal cord and not the brain, a reflex action occurs in a matter of a fraction of a second. you are not able to control a reflex—it happens automatically.

In a nonreflex response, an impulse must travel to the brain. The brain interprets the stimulus and initiates an appropriate response. In this case, the time it takes to respond is measurably longer than the time required for a reflex arc. A person's reaction time can be measured by how quickly he or she can perceive a stimulus and then react to it. Driving a car and playing tennis are examples of activities in which reaction time is very important.

In this investigation, you will observe two reflex actions and measure your reaction time.

Problem

Can you control reflex actions? How can you measure reaction time?

Pre-Lab Discussion

Read the entire investigation. Then, work with a partner to answer the following questions.

1. What data will you record in Data Table 2?

_____

_____

2. What is another name for an involuntary or automatic response to a stimulus?

_____

3. What caution should you observe for shining the light?

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4. Why do you put your elbow on the table when you are catching the meter stick?

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5. In Part A, why do you use an eyepatch instead of just closing your eye?

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Materials *(per group)*

pen light
eye patch or eye cover
meter stick

Safety

This experiment involves physical contact. Avoid this experiment if a problem with the knee, eye, or hand exists. Note the safety alert symbol next to step 3 in the Procedure and review the meaning of the symbol by referring to Safety Symbols on page 8.

Procedure

Part A. Reflexes

1. Sit on a chair or stool.

2. Cross your left leg over your right.

3. Have a member of your group tap your knee firmly, slightly below the knee cap, with the side of his or her hand, as shown in Figure 1. **CAUTION:** *Be sure the knee is not hit hard. A firm, quick tap is sufficient. Avoid this experiment if a physical problem in the knee exists.* Record your observations.

Figure 1

4. Repeat steps 1 to 3. This time, try to stop your knee from jerking. Record your observations.
5. Reverse roles and repeat steps 1 to 4.
6. Sit on a chair or stool.
7. Close one eye and cover it with the eye patch. Keep the other eye open.
8. Have a group member shine the pen light close to the open eye for about 10 seconds. **CAUTION:** *Do not shine light directly into the eye.*
9. Quickly remove the patch from the other eye.
10. Have a group member observe what happens to the pupils of both the eye exposed to light and the eye that remained in darkness. Record the observations in Data Table 1.

Data Table 1

Stimulus	Observations
Light	
Dark	

11. Reversing your roles, repeat steps 6 to 10.

Part B. Reaction Time

1. Rest your elbow on a table and extend your arm over its side as shown in Figure 2.

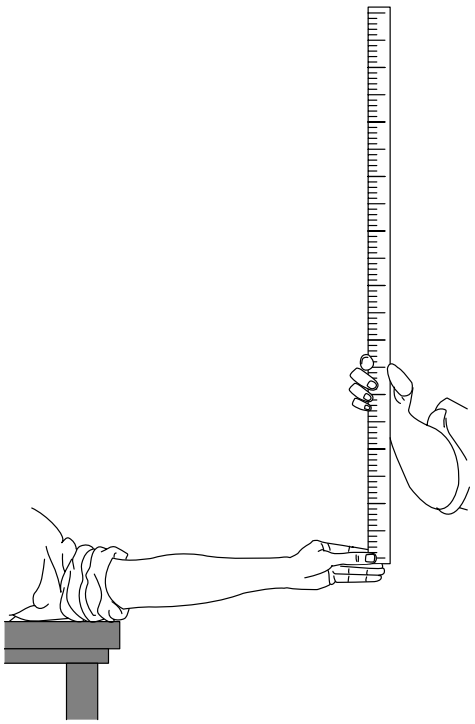

Figure 2

2. Have a group member hold a meter stick in the air, with the 0-cm line between the thumb and index finger of your extended hand.
3. Have the group member drop the meter stick without advance notice. Try to catch it between your thumb and index finger as quickly as possible.
4. In Data Table 2, record in centimeters the position of your thumb and index finger. This is the distance the meter stick fell before you caught it.
5. Repeat steps 2 to 4 three times.

Data Table 2

Trial	Distance (cm)
1	
2	
3	
4	

Analysis and Conclusions

1. **Observing** What happened to your knee when it was tapped?

2. **Inferring** Could you prevent the knee jerk or the pupil contraction? Explain your answer.

3. **Observing** What happened to the pupil of the eye that was close to the light?

4. **Inferring** How does the amount of light affect the pupils?

5. **Classifying** Is catching the meter stick a voluntary reaction or a reflex? Explain your answer.

6. **Calculating** What was the average distance the meter stick fell in your four trials?

7. **Comparing and Contrasting** In catching the meter stick, were your reactions faster or slower than those of your classmates? How do you know?

_____

_____

_____

8. **Classifying** From your observations, how would you classify the knee-jerk and the pupillary response? Explain your reason.

_____

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9. **Drawing Conclusions** Suggest some possible ways that reflex arcs could be advantageous to a species.

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Going Further

Do the senses of sight, smell, hearing, taste, and touch also affect our reflex actions? Why does your mouth water when you are hungry and see a picture of a delicious meal? Ivan Pavlov, a Russian biologist, carried out many experiments on conditioned reflexes. What are conditioned reflexes? How are stimulus and response related? Use resources in your school library or on the Internet to find out more about conditioned reflexes. Share your findings with the class.