

Reflexes and Reaction Rates

Knee-jerk

1. Have the subject sit on a chair with legs crossed. The upper leg should be relaxed.
2. Locate the position of the kneecap on the upper leg and feel the large tendon below the midline of the kneecap.
3. Using a reflex hammer, gently strike the tendon below the kneecap.
 - a) Describe the movement of the leg.
4. Ask the subject to clench a book with both hands, then strike the tendon again. Measure the distance of movement. Perform 10 trials.
5. Repeat the experiment for the other leg.
 - b) Compare the movement of the leg while the subject is relaxed with that when the subject is clenching the book.
 - c) Comment on any difference seen between the right and left legs.

Achilles Reflex

6. Remove the subject's shoe. Have the subject kneel on a chair so that the feet hang over the edge of the chair. Relax the foot and then lightly tap the Achilles tendon with the reflex hammer.
 - d) Describe the movement of the foot.

Pupillary Response

7. Have the subject close one eye for approximately one minute. Ask the subject to open the closed eye and compare the size of the pupils.
 - e) Which pupil is larger?
8. Ask the subject to close both eyes for one minute. Have the subject open both eyes. Shine a penlight in one of the eyes.
 - f) Describe the changes you see in the pupils.

Reaction Rate

9. Ask the subject to place the forearm flat on the surface of the desk. The subject's entire hand should extend over the edge of the desk.
10. Ask the subject to place the index finger and thumb approximately 2 cm apart. Place a 30 cm ruler between the thumb and forefinger of the subject. The lower end of the ruler should be even with the top of the thumb and forefinger.
11. Indicate when ready, then release the ruler within the next 30 s. Measure the distance the ruler falls before being caught between the subject's thumb and forefinger. Perform 5 trials and average the results.
12. Repeat the experiment for the other hand.
 - g) Calculate the average response time using the equation below:

$$t = \sqrt{\frac{2d}{a}}$$

where t = reaction time (s)
 d = distance the ruler falls (cm)
 a = acceleration due to gravity (980 cm/s²)

- h) Comment on any difference seen between the two hands.

Touch Sensitivity

13. Bend paper clips into a U shape. Using a ruler, adjust the ends of the clip so that the distance between the points is 1 mm, 2 mm, 4 mm, 8 mm, and 16 mm, respectively. After adjusting the distances, carefully wrap each one with tape so that the distances are fixed. Label each one.

14. Have the subject sit with eyes closed. Touch the tip of each tester to the subject's fingertips, palms, forearms, and nape of the neck in turn. Occasionally, touch only one point to the skin so the subject will not assume that there will always be two points.

15. The subject is to report the number of points that can be felt. If the subject detects two points, record a "+," otherwise, a "-." Do not record anything for the one-point trials. The data table could be as follows:

| | 1 mm | 2 mm | 4 mm | 8 mm | 16 mm |
|-----------|------|------|------|------|-------|
| Fingertip | | | | | |
| Palm | | | | | |
| Forearm | | | | | |
| Neck | | | | | |

- i) Which skin area was the most sensitive? Which was the least sensitive?
- j) Which skin areas have the highest density of receptors?
- k) What is the correlation between the density of the receptors and the function of each skin area?
- l) Would you predict the soles of the feet or the skin on the knees to have the higher density of receptors? Explain.

Questions

1. Freddy touches a hot stove, withdraws his hand, and then yells. Why does the yelling always occur after the hand is withdrawn? Does Freddy become aware of the pain before the hand is withdrawn? What would happen if the motor neuron associated with this reflex arc were severed?
2. A doctor observes that the pupils of a car accident victim are not responsive to light. What might be the cause? How would the doctor react?
3. While examining the same victim, the doctor pricks the leg with a needle. He begins near the ankle and proceeds toward the hip. What is the doctor checking for? Why begin at the ankle?
4. Make a sketch of a reflex arc, showing the pathway of the arc if a stimulus such as heat is applied to the finger tips.
5. How are the Achilles and knee jerk reactions important in walking?