ScienceCube

Stimulus and Response

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1. **Measure the response times of conditioned and unconditioned reflexes and compare the differences.**
2. **Understand the reflex pathways of conditioned and unconditioned reflexes and explain the reasons for the differences.**

Fundamental Concept

Reflex is an unconscious response that allows our body to escape from danger and maintain smooth physiological functions. There are two main types of reflexes: unconditioned reflexes, which are innate and do not involve the brain, and conditioned reflexes, which are acquired and involve the brain.

1) **Unconditioned Reflex**

i. Characteristics

A. Innate

B. Does not involve the brain

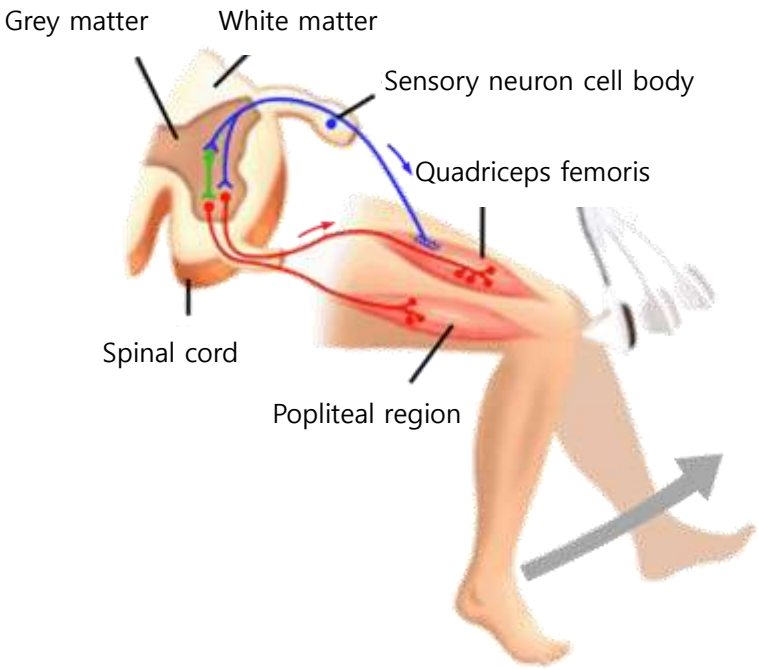
C. Central - Medulla, spinal cord, midbrain

ii. Examples of Reflexes

A. Spinal Reflex: Knee jerk, defecation and urination movements, escape from danger

B. Medullary Reflex: Tears when dust enters the eyes, sneezing, vomiting, blinking

Spinal Reflex



Knee Jerk Reflex

2) Conditioned Reflex

i. Characteristics

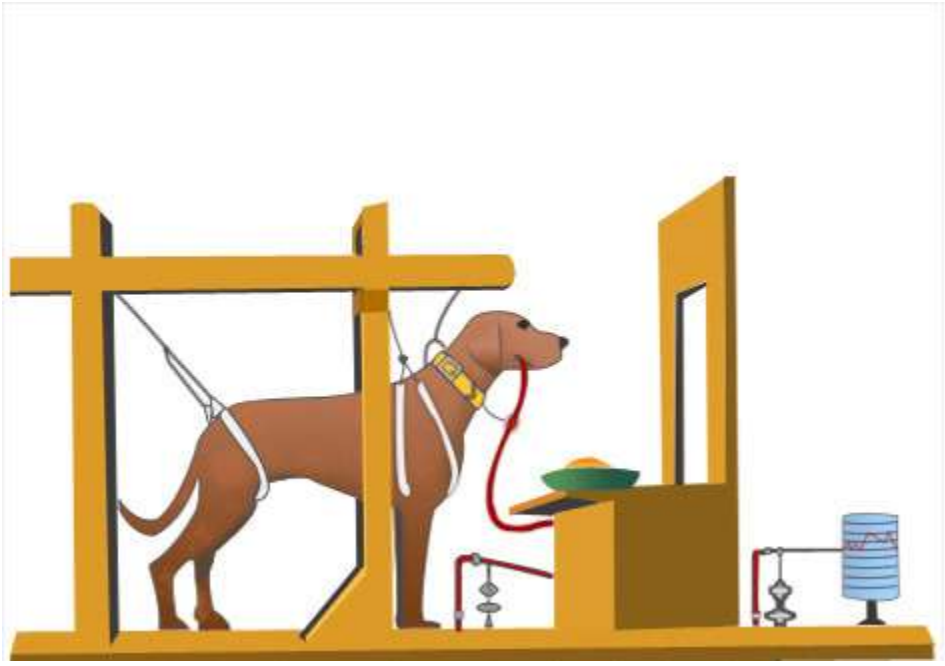
A. Acquired

B. Involves the brain

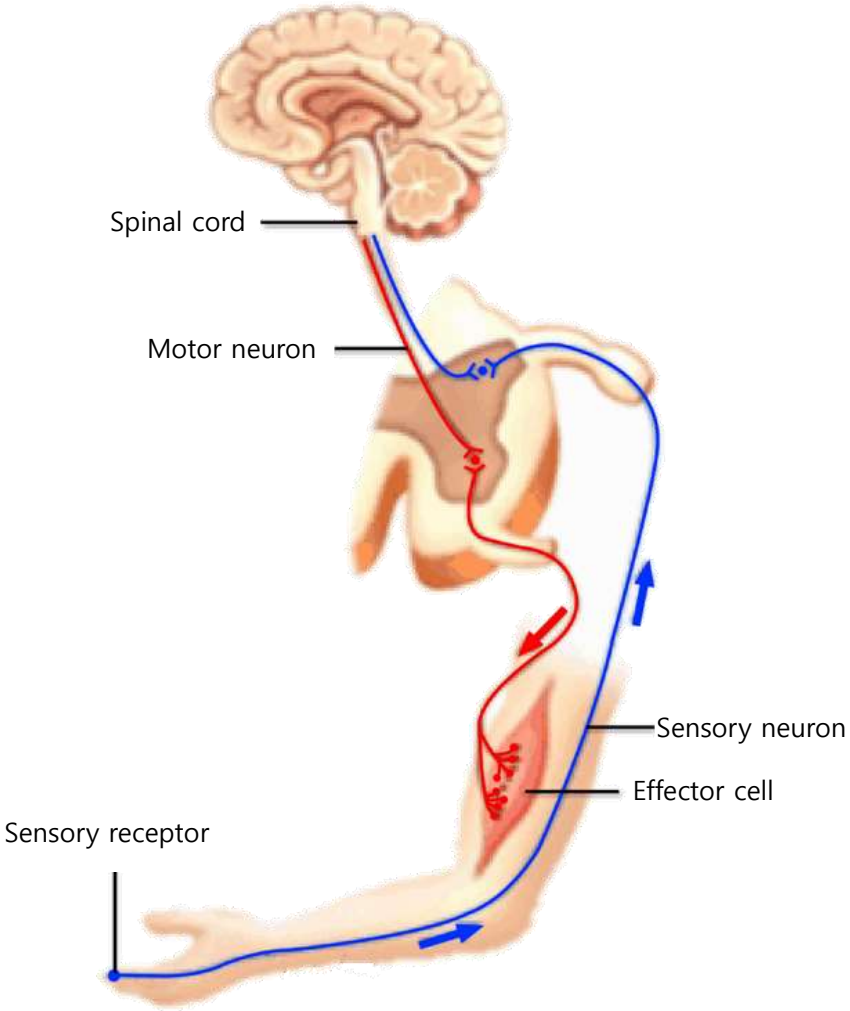
C. Central - Cerebrum

ii. Pavlov's Dog Experiment

When a dog is given food after hearing a bell, it starts to salivate at the sound of the bell alone. Here, the bell becomes a conditioned stimulus and salivation becomes a reflex action.



Pavlov's Dog Experiment



Experiment

Materials Needed

Interface, Science# program, ECG sensor, Force sensor, ECG patches, Cellophane tape, Rubber hammer (force sensor accessory), Chopsticks

Experimental Setup

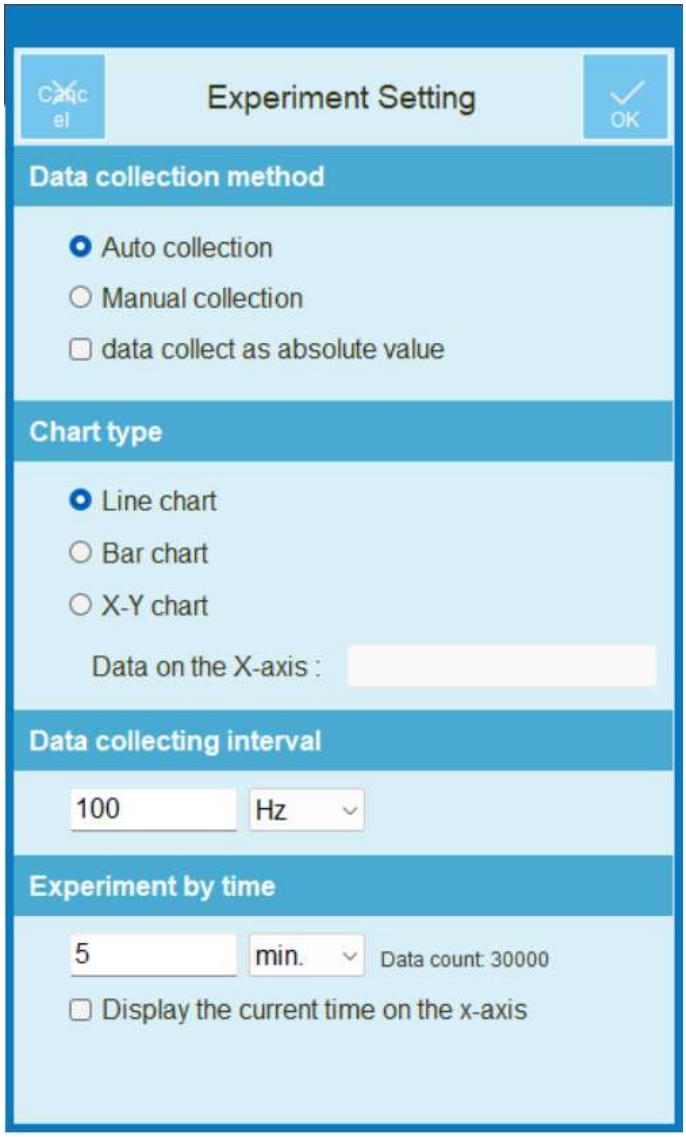
1. Remove the ring from the force sensor and attach the rubber hammer.
2. Loosen the screw on the handle part of the force sensor and insert the chopsticks to create a handle.

Rubber hammer Force sensor Wooden chopsticks

3. Sit on a table with your knee bent at a right angle and your leg freely swinging.
4. Attach one ECG patch above the knee and two below the knee, securing them with cellophane tape. The ECG patches should be attached in the order of red, blue, and white from top to bottom.

Interface Setup

1. Run the Science# program.
2. Connect the ECG sensor and the force sensor to the interface.
3. Press to set up the experimental environment as shown below or press for automatic setup.



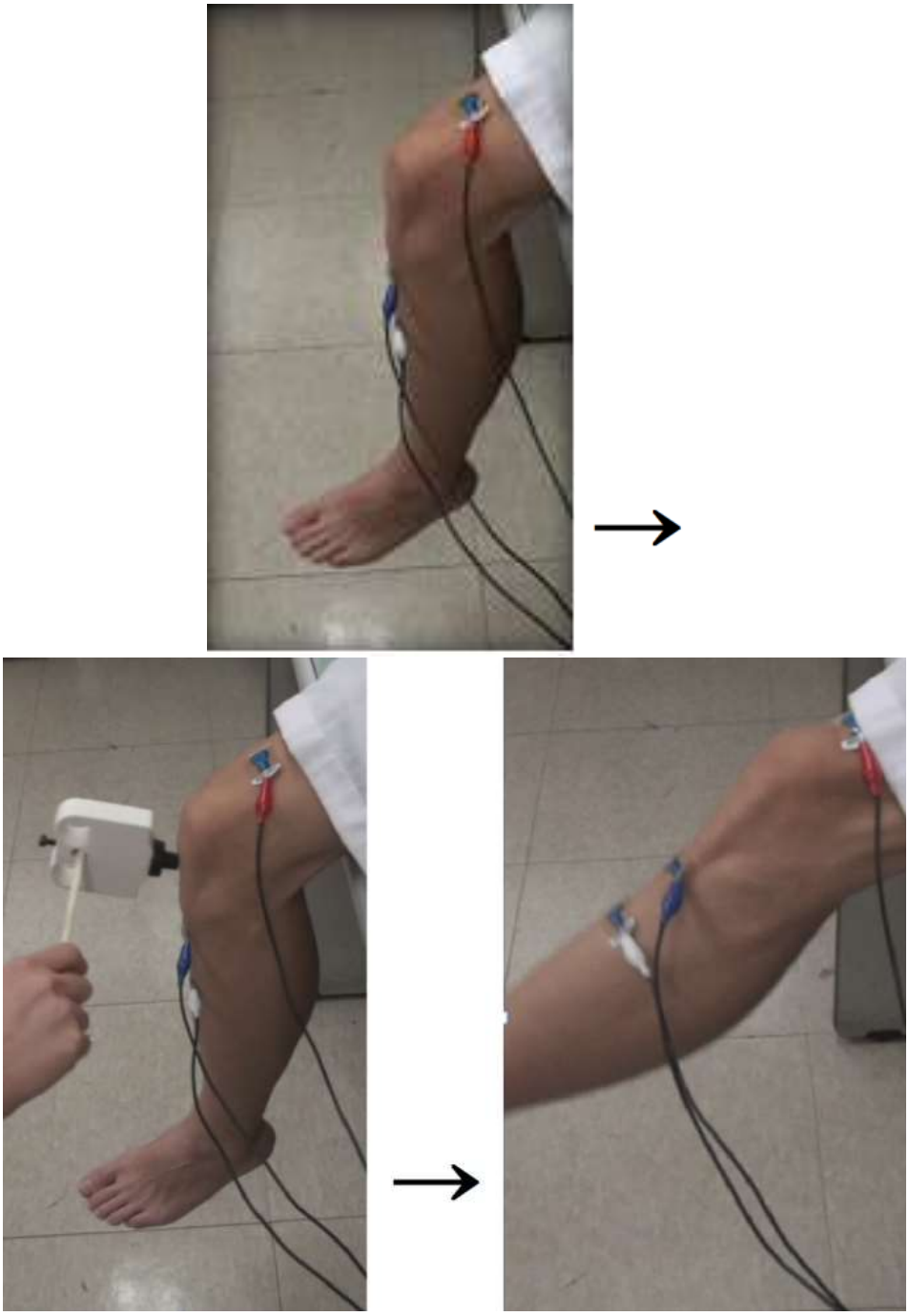
 Automatic setup

Data Collection

1. Press  to start data collection..

[Knee Jerk Reflex]

2. Tap the lower edge of the kneecap (patella) with the force sensor hammer to trigger a reflex action that makes the leg jerk forward.



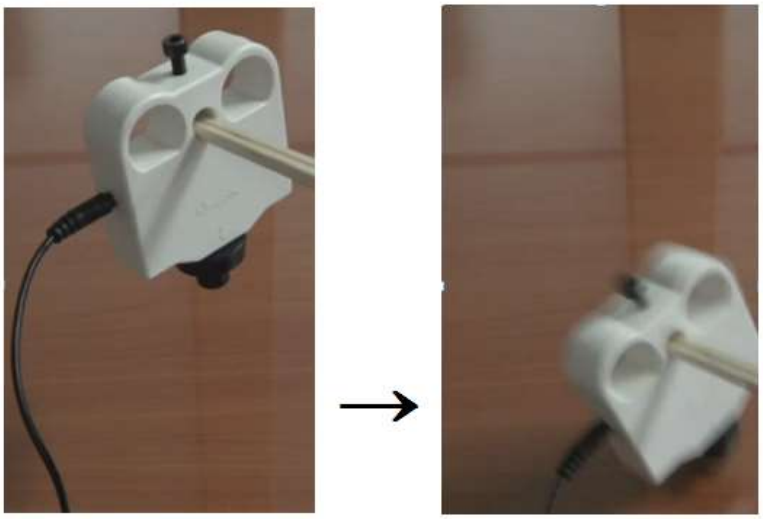
[Knee Relaxed] [Hammer Tap]

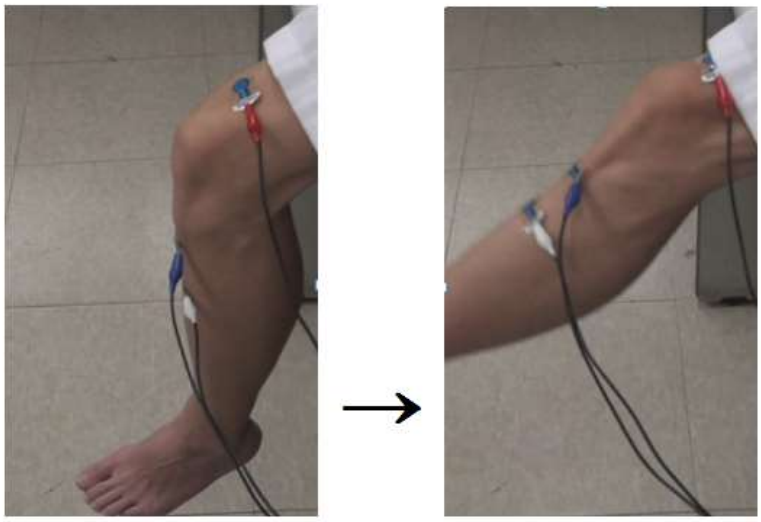
[Reflex Action]

3. Repeat the experiment several times to clearly capture the force and ECG graphs.

[Auditory Response]

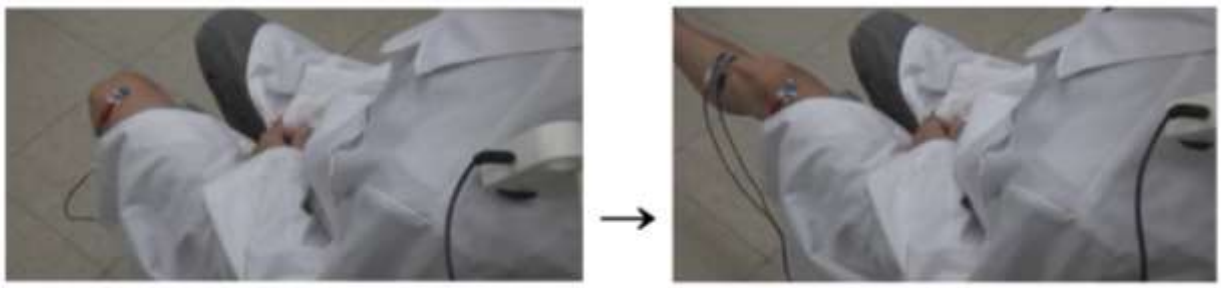
4. Another person taps the table with the force sensor, and the subject raises their leg upon hearing the sound of the force sensor hitting the table..





[Tactile Response]

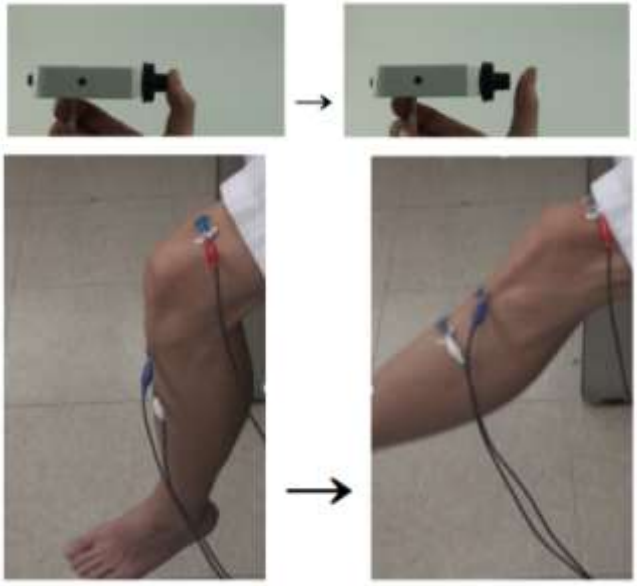
5. Another person taps the subject's shoulder with the force sensor, and the subject raises their leg upon feeling the force sensor on their shoulder..



[Visual Response]

6. Another person presses and releases the force sensor with their thumb. The subject raises

their leg upon seeing the thumb release from the stopper..



Data Analysis

Recording Data

1. The peak of the force sensor graph indicates the time when the stimulus occurred, and the peak of the ECG sensor graph indicates the time when the response occurred. Let's record the measurement times for each reflex..

Type of Response	Knee Jerk	Auditory Response	Tactile Response	Visual Response
Peak Time of Force Graph (s)				
Peak Time of ECG Graph (s)				
Time Interval (s)				

2. Indicate the type of reflex for each response..

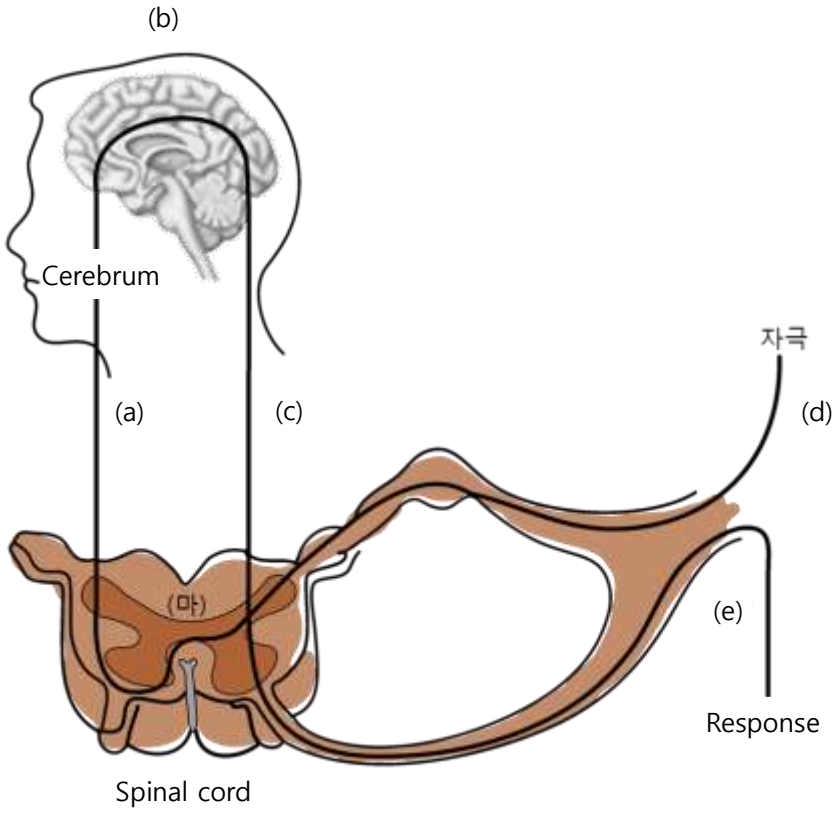
A. Conditioned Reflex	B. Unconditioned Reflex

Knee Jerk ( ), Auditory Response ( ), Tactile Response ( ), Visual Response ( )

3. List the types of responses in order from the fastest to the slowest response time..

Data Application and Extension Activities

1. The following is a diagram showing the stimulus transmission pathway. Refer to the diagram to answer the following questions.



(1) Describe the pathways for conditioned and unconditioned reflexes..

Conditioned Reflex:

Unconditioned Reflex:

(2) Explain why there is a difference in response times between conditioned and unconditioned reflexes.

2. The following is an experiment conducted by Pavlov on a dog..

- The dog salivates when given food.
- The experiment was repeated several times where a bell was rung before giving food.
- Eventually, the dog started salivating just at the sound of the bell without being given food.

What is the behavior of the dog salivating at the sound of the bell called and where is its central location?