

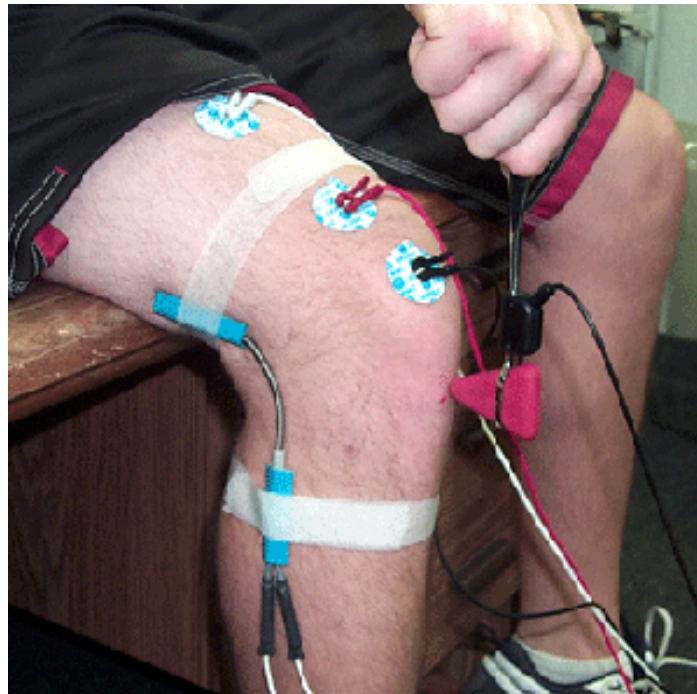
## **BSL PRO Lesson #H28**

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# Reflex Response

## (Patellar Tendon)

Using BIOPAC Reflex Hammer Transducer SS36L



This *PRO* Lesson describes basic reflex exercises and details hardware and software setup of the BSL Lessons System to record the reflex reaction. All data collection and analysis is done via the BIOPAC MP30 data acquisition unit and the Biopac Student Lab Lessons software.

### **Abstract: Reflex Response**

Spinal cord reflexes represent the most basic of motor responses. These reflexes are carried out entirely within the spinal cord and are modified by inputs from higher brain centers to generate complex movements.

The *myotatic*, or muscle stretch reflex, is an example of a *spinal reflex*. Muscle stretch activates receptors in the muscle which send nerve impulses to the spinal cord, stimulating the muscle's motor neurons and causing reflex contraction.

The *knee-jerk reflex* is a spinal reflex activated by tapping the **patellar tendon** below

the knee. This tendon then stretches the muscle spindles, generating sensory impulse to the spinal cord. Alpha motor neurons in the spinal cord cause a brief, rapid contraction of the **quadriceps femoris**, which causes the leg to extend.

Tapping the **Achilles tendon** behind the ankle and just above the heel activates *plantar flexion* of the foot. This reflex response is like walking tip-toed or standing on your toes.

These reflexes are very important when trying to diagnose damage to the nerves or spinal cord.

## Objective

1. To measure reflex time of different nerves in the body under different conditions using the reflex hammer.
2. To compare and correlate magnitude of hammer strike to magnitude of response (via EMG activity).
3. **Optional:** To measure response via angular movement (goniometer) under varying strike force.

## Equipment

- Computer: PC running Windows or Macintosh running OS 8.6 or greater
- BIOPAC [MP30](#) Data Acquisition Unit
- BIOPAC Software: [Biopac Student Lab PRO](#)
- BIOPAC reflex hammer ([SS36L](#))
- BIOPAC electrode lead set ([SS2L](#))
- BIOPAC Electrodes ([EL500](#)) -- 6 per subject
- Electrode gel and abrasive pad (BIOPAC [GEL1](#) and [ELPAD](#))
- **Optional:** BIOPAC twin axis goniometer ([SS20L](#))
  - If using goniometer: Tape ([TAPE1](#))
- Push-pin or thumb tack
- Chair
- Desk or Table
- [Lab Report](#) (Click to download PDF version)

## Setup

### Hardware





1. Plug the reflex hammer (SS36L) into "CH 1" on the front of the MP30 unit.
2. Plug the electrode lead set (SS2L) into "CH 2."
3. **Optional:** Plug the Y axis (marked blue) of the goniometer (SS20L) into "CH 3."
4. Turn the MP30 unit ON.

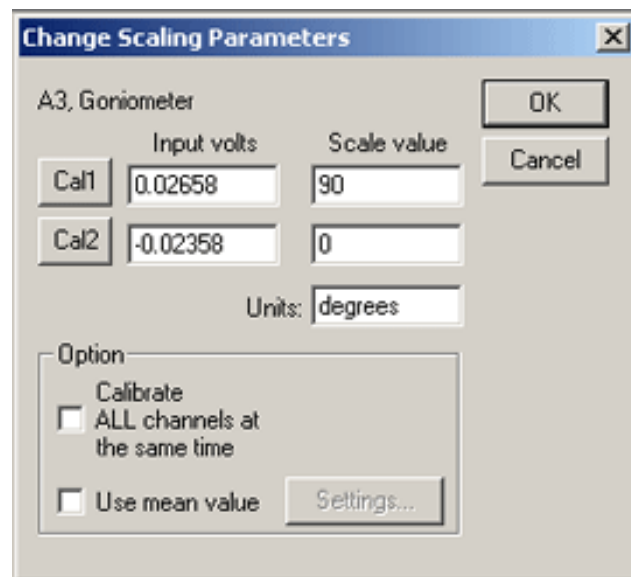
## Software

1. Turn the **computer on**.
2. Launch the **BSL PRO** software.
3. Open the *Reflex Hammer* template file by choosing **File menu > Open > choose Files of type: GraphTemplate (\*.GTL) > File Name: [h28.gtl](#)**.
  - The file can be downloaded from the BIOPAC web site [PRO Lessons](#) page.

## Calibration

- **Calibration is only necessary if using the SS20L twin axis goniometer**

1. In BSL software click: **MP30 > Setup Channels**.
2. Click **View/Change Parameters** (wrench) for CH3.
3. Click **Scaling...**
4. Place goniometer on desk at **90 degree angle** (L-shape).
5. Click **Cal 1**.
6. Under **Scale Value**, enter **90**.
7. Place goniometer on desk in a **straight line**.
8. Click **Cal 2**.
9. Under **Scale Value**, enter **0**.
10. Change Units to: **degrees**



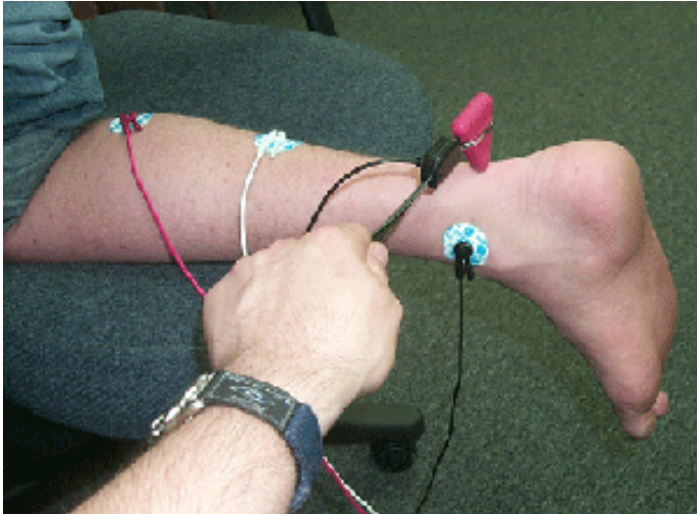
## Subject

1. Place electrodes for the ankle reflex.
  - a. Place two electrodes on the inside of the calf muscle, approximately 5 inches apart.
  - b. Place a ground electrode just inside of the ankle on the same leg.
2. Place electrodes for the knee reflex.
  - a. Place two electrodes on the quadriceps muscle on front of thigh, approximately 10 cm apart.
  - b. Place a ground electrode on the knee of the same leg.

3. **Optional:** Attach a goniometer (SS20L) to the outside of the knee.
  - a. This will measure angular movement of the leg which is proportionate to the force of the strike from the reflex hammer.

## Reflex Exercises

1. **Ankle Jerk Reflex** - tests the **medial popliteal** nerve



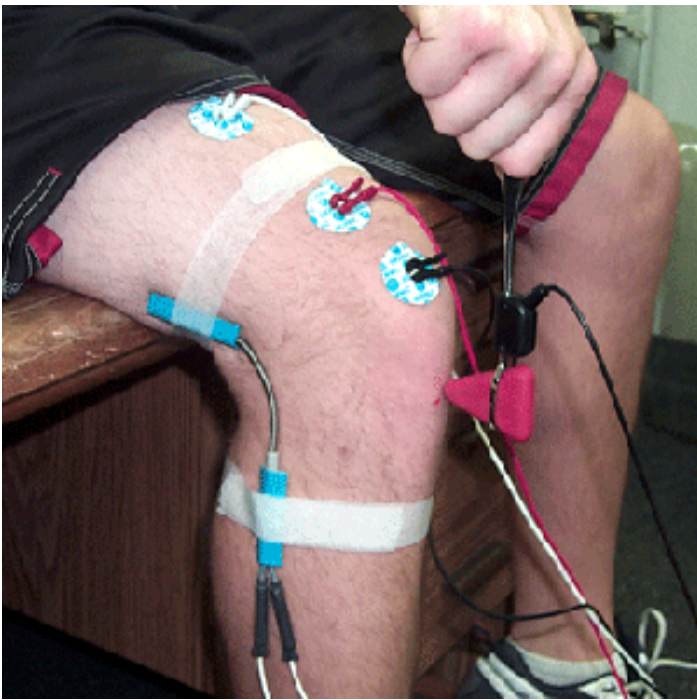
- a. Have the Subject stand on one leg alongside a chair, with the other leg bent at the knee and its shin resting on the seat of the chair. The foot should project over the edge of the chair.
- b. Connect the SS20L leads to the calf (as seen in the picture above).

Lead Color	Signal	Position
Red	(+)	closest to knee
White	(-)	middle of calf
Black	(ground)	inside of ankle

- c. Click on the "Start" button to begin recording.
- d. Strike the **Achilles tendon** behind the ankle just above the heel and observe the resulting muscle contraction.
- e. Repeat 10 times and note reaction times in lab report.
 

**Note:** Reaction time is measured from onset of hammer strike to onset of EMG activity.
- f. Click on the "Stop" button to suspend recording.

2. **Knee Jerk Reflex** - tests the **quadriceps femoris tendon**



- a. Move the SS2L leads to the knee reflex electrodes (as seen in picture above).

Lead Color	Signal	Position
Red	(+)	middle electrode
White	(-)	closest to waist
Black	(ground)	on the knee

- b. Have the Subject sit with his or her legs hanging freely over the edge of the chair.
- c. **Optional:** Attach a goniometer (SS20L) to the outside of the knee (as seen in picture above).
- This will measure angular movement of the leg which is proportionate to the force of the strike from the reflex hammer.
- d. Before you continue recording, find the optimal spot on the subject's knee that will cause a good reflex and mark the spot.
- e. Click on the "Start" button to resume recording.
- f. Strike the patellar ligament and observe the resulting reflex contraction.
- g. Repeat 10 times and note reaction times and amplitudes in lab report.
- Note:** In order to get an accurate goniometer reading, it is crucial that the leg come to a resting position between strikes.
- h. Click on the "Stop" button to suspend recording.

### 3. Knee Jerk Reflex - with Jendrassik Maneuver

- a. Have the Subject remain seated with his or her legs hanging freely over the edge of the chair and ask the subject to perform the "Jendrassik Maneuver."
- To perform the "Jendrassik Maneuver," the subject must grip both hands together across his/her chest and attempt to pull them apart with maximum force.
- b. Click on the "Start" button to resume recording.
- c. Strike the patellar ligament and observe the resulting muscle contraction.
- d. Repeat 10 times and note reaction times and amplitudes in lab report.

e. Click on the "Stop" button to suspend recording.

#### 4. **Knee Jerk Reflex - with mental distraction**

- a. Prepare ten addition problems consisting of three-digit numbers (i.e.,  $247+498$ ).
- b. Have the Subject remain seated with his or her legs hanging freely over the edge of the chair.
- c. Click on the "Start" button to resume recording.
- d. Ask the subject to solve the problems in the shortest amount of time possible without using a pen or calculator while you strike the patellar ligament and observe the resulting muscle contraction.
- e. Repeat 10 times and note reaction times and amplitudes in lab report.
- f. Click on the "Stop" button to suspend recording.

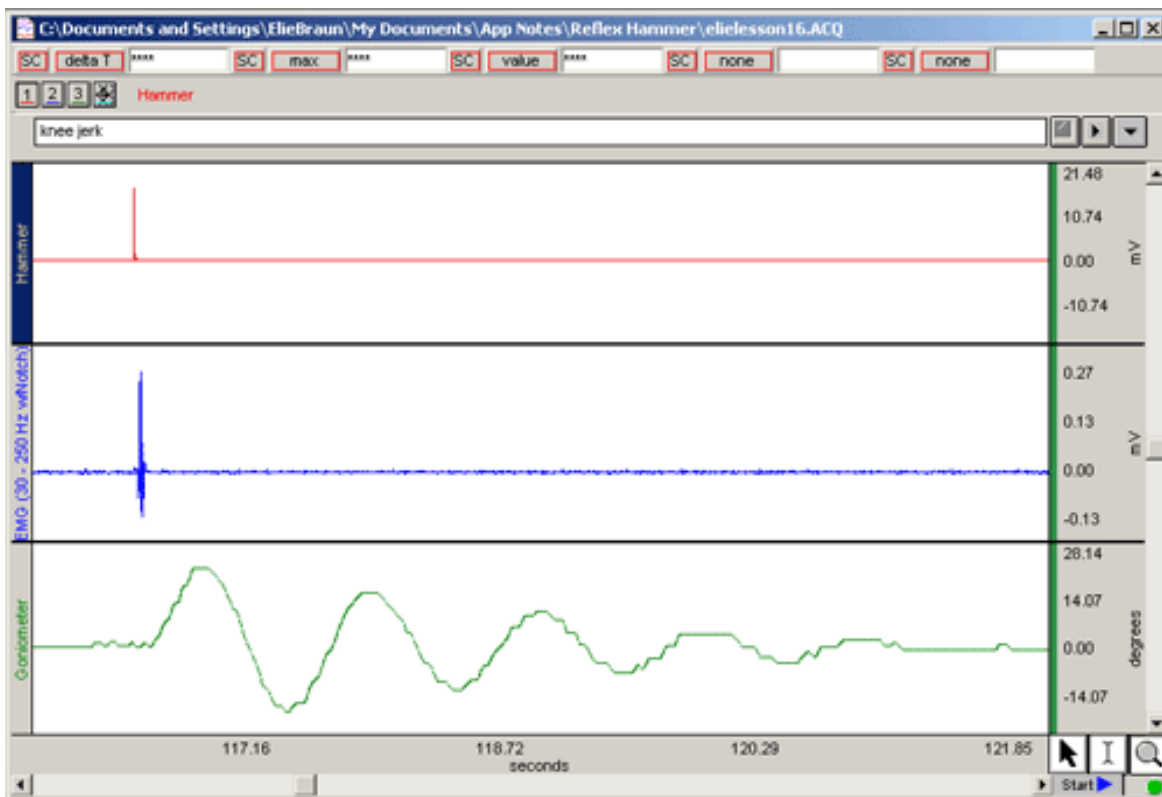
#### 5. **Flexor Withdrawal Reflex - tests delay in knee jerk when another reflex is stimulated**

- a. Have the Subject remain seated with his or her legs hanging freely over the edge of the chair.
- b. Click on the "Start" button to resume recording.
- c. Apply a cutaneous stimulus (such as a pin-prick to the skin) on the side of the leg, below the knee and simultaneously perform a knee jerk reflex.
- d. Repeat 10 times and note reaction times and amplitudes in lab report.
- e. Click on the "Stop" button to suspend recording.

#### 6. **Voluntary Knee Jerk Reflex**

- a. Have the Subject remain seated with his or her legs hanging freely over the edge of the chair or desk.
- b. Click on the "Start" button to resume recording.
- c. Strike the table next to the subject with the hammer and ask the Subject to voluntarily jerk his/her knee upon hearing the hammer strike.
- d. Repeat 10 times and note reaction times and amplitudes in lab report.
- e. Click on the "Stop" button to stop recording.

## **Data Analysis**



Data from the BIOPAC SS36L Reflex Hammer Transducer and SS20L Goniometer

#### Measurements:

Measure	Channel	Result
Delta T	EMG	Select the area from the onset of the hammer strike to the onset of EMG
Max	Goniometer	Determines maximum angular displacement of the knee
Max	Hammer	Use the result to calculate the relationship between strike force and EMG amplitude

#### Report Questions:

- Click here to download a PDF of the [Report Questions](#) and a data report table for 10 segments of each reflex test.

Reflex Test	Report Questions
Ankle Jerk	Which muscles contract? What causes these muscles to contract? What action occurs at the ankle joint?
Knee Jerk	Which muscles contract? What causes these muscles to contract? What action occurs at the knee joint?
Jendrassik Maneuver	Compare the size of the responses between the two conditions. What effect would a spinal-cord lesion have on the gain?
Mental distraction	Compare the size of the responses to the previous knee jerk test(s).
Voluntary	Compare to involuntary knee jerk reaction times.
Flexor Withdrawal	Compare reaction time with reaction time of normal knee jerk test.

## APPENDIX

### GRAPH TEMPLATE SETTINGS

Click here to open a [PDF of the graph template file](#) settings. The BSL *PRO* Graph Template file automatically establishes the settings shown in the table.

[Back to \*PRO\* Lessons](#)