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II. EXPERIMENTAL OBJECTIVES

1. To become familiar with anatomical and physiological elements of simple spinal reflexes.
2. To examine properties of some simple neuromuscular reflexes commonly tested in physical diagnosis.
3. To measure and compare latent periods and reaction times of extensor and flexor reflexes.
4. To elicit an extensor reflex and compare contractile force vs. stimulus strength.
5. To apply the Jendrassik maneuver and observe exaggeration of an extensor reflex.
6. To measure and compare reaction times of voluntary activation of skeletal muscle vs. involuntary (reflex) activation of skeletal muscle.

III. MATERIALS

- BIOPAC Reflex Hammer (SS36L)
- Response Setup –
  - Via electrodes:
    - BIOPAC Electrode Lead Set (SS2L)
    -BIOPAC Disposable Electrodes (EL503,) 3-6 electrodes per subject
    -BIOPAC Electrode gel (GEL1) and Abrasive Pad (ELPAD)

OR

  - Via goniometer:
    - BIOPAC Twin-axis Goniometer (SS20L or SS21L)
    -BIOPAC Single-sided Tape (TAPE1)
- Push-pin, thumb tack or alternate media for cutaneous stimulus
- Chair
- Biopac Student Lab System: BSL 4 software, MP36 or MP35 hardware
- Computer System (Windows 8, 7, Vista, XP, Mac OS X 10.5 – 10.8)

IV. EXPERIMENTAL METHODS

A. SETUP

FAST TRACK Set Up

1. Select a **Subject**, a **Director** and a **Recorder**.
2. Turn the computer **ON**.
3. Turn **OFF** the MP36/35 unit.
4. **Plug the equipment in** as follows:
   Reflex Hammer SS36L — CH 1
   AND
   Lead Set SS2L — CH 2

Setup continues…

Detailed Explanation of Set Up Steps

The **Subject** must be wearing shorts. The **Director** will control the reflex hammer and the **Recorder** will operate the computer.

Fig. 20.3 Hardware (*shown with SS2L Lead Set connected*)

OR :

Goniometer SS20L or SS21L — CH 2

- SS20L or SS21L-X output (Cable with green band on Goniometer side.)

5. Turn **ON** the MP36/35 unit.

6. Attach electrodes (EMG) or goniometer to **Subject**.

IF USING: SS2L AND ELECTRODES:

a) Attach three electrodes for knee reflex (Fig. 20.5).
   - Two electrodes over the quadriceps muscle on front of thigh, approximately 10 cm (4") apart.
   - One electrode (ground) on the interior thigh of the same leg.

b) If also recording ankle reflex, attach three additional electrodes (Fig. 20.6).
   - Two electrodes on the inside of the calf muscle, approximately 13 cm (5") apart, near the midline of the leg.
   - One electrode (as ground) just inside of the ankle on the same leg.

c) Clip the lead set (SS2L) to the knee reflex electrodes as shown (Fig. 20.5 and Table 20.1).

Setup continues…

Fig. 20.4 Hardware (*shown with SS21L Goniometer connected*)

Abrade skin around electrode sites. If the skin is oily, clean electrode sites with soap and water or alcohol before abrading.

If electrode is dry, apply a drop of gel.

Fig. 20.5 Knee Reflex

Knee Reflex Electrodes

- Lift leg and clench thigh to locate quadriceps muscle.

Fig. 20.6 Ankle Reflex

Ankle Reflex Electrodes

- Electrodes may be placed on the same or opposite leg; clinicians might use the same leg to test the ipsilateral reflex response.
- Flex foot to help locate calf muscle.

For optimal electrode contact, attach electrodes to **Subject** at least five minutes before recording.

Lead Color	Signal	Position
Red	(+)	middle electrode
White	(-)	closest to waist
Black	(ground)	interior thigh

Table 20.1 Electrode lead attachment for Knee Reflex

Position the electrode cables so they do not pull on the electrodes. Clip the electrode cable clip to a convenient location (such as Subject's clothes) to relieve cable strain.

The pinch connectors work like a small clothespin, but will only latch onto the nipple of the electrode from one side of the connector

IF USING: **SS20L or SS21L GONIOMETER:**

a) With Subject standing, attach Goniometer to outside of knee, taping fully around leg.

b) Attach with leg straight, with slight spring tension

c) Middle of spring aligns with middle of patella.

Fig. 20.7 Attach a goniometer (SS20L or SS21L) to the outside of the knee.

The Goniometer measures angular movement of the leg.

Place the Goniometer so that the cable is facing upwards.

***Note*:** The Goniometer is fragile and excessive spring tension can damage it.

7. Position the **Subject**.
   - **Subject** sits, legs hanging over the edge of chair or desk at 90 degrees.
   - Locate optimal reflex strike point, and mark it.

The leg must be able to swing freely and the foot cannot touch the floor or chair support.

To locate the optimal reflex strike point:

a) **Subject** relaxes leg.

b) Locate midline ridge on the knee cap.

c) Feel below the ridge, no more than an inch below the tip of the patella.

d) Using the reflex hammer, tap at areas around this location and locate the spot that gives the strongest response.

Mark the optimal spot with a water-soluble pen —if you prefer, use tape and a pen rather than marking the skin directly.

8. Start the Biopac Student Lab program.
9. Choose lesson "**L20 – Spinal Cord Reflexes"** and click **OK**.
10. **Type** in your filename and click **OK**.

Start Biopac Student Lab by double-clicking the Desktop shortcut.

No two people can have the same filename, so use a unique identifier, such as **Subject's** nickname or student ID#.

A folder will be created using the filename. This same filename can be used in other lessons to place the **Subject's** data in a common folder.

11. ***Optional*** Set Preferences.
    - Choose File > **Lesson Preferences**.
    - Select an option.
    - Select the desired setting and click **OK**.

This lesson has optional Preferences for data and display while recording. Per your Lab Instructor's guidelines, you may set:

Grids: show or hide gridlines

Response Options: Selects transducer type for experiment

Lesson Recordings: Specific data recordings may be omitted based on instructor preferences.

END OF SETUP

B. CALIBRATION

Calibration establishes the hardware's internal parameters (such as gain, offset, and scaling) and is critical for optimum performance. **Pay close attention to Calibration**. (Click the **Calibration** tab to view example Calibration video.)

FAST TRACK Calibration

1. **Subject** sits, with legs hanging over edge at 90 degrees.
2. Click **Calibrate.**

*Additional steps **ONLY** if using Goniometer:*

a. At the prompt, **Subject** extends leg straight and holds the position. **Recorder** clicks **OK**.

b. At the next prompt, **Subject** relaxes leg. **Recorder** waits for leg to stop swinging then clicks **OK**.

3. **Subject** extends leg straight out and then returns to relaxed position.
4. **Director** lightly taps the Reflex Hammer twice on a table top.
5. Wait for Calibration to stop.
6. Verify recording resembles the example data.
   - If similar, click **Continue** and proceed to Data Recording.
   - If required, click **Redo Calibration**.

Calibration continues…

Detailed Explanation of Calibration Steps

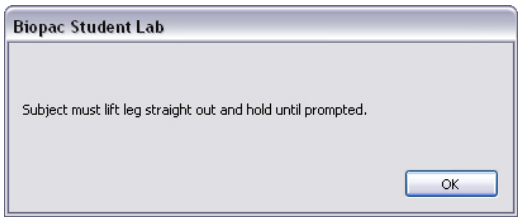


Fig. 20.8 Goniometer Calibration 1st prompt

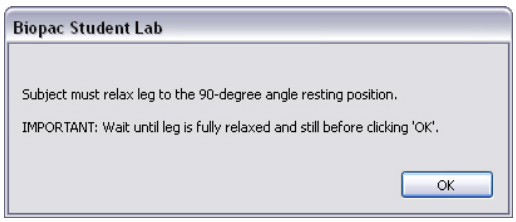


Fig. 20.9 Goniometer Calibration 2nd prompt

Calibration lasts 12 seconds.

The Response data should clearly show when the leg was raised and lowered. The Hammer Strike data should show two clear spikes when the reflex hammer was tapped.

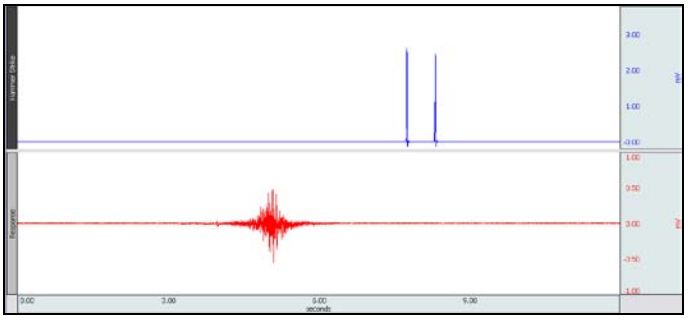


Fig. 20.10 – Example Calibration data using EMG Electrodes

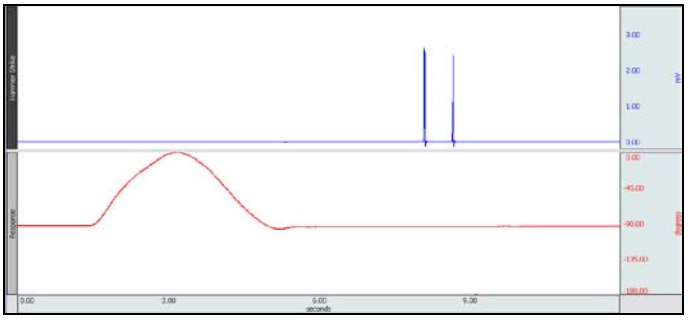


Fig. 20.11 – Example Calibration data using Goniometer

END OF CALIBRATION

If recording does not resemble the Example Calibration data:

- If the data is noisy or flat line, check all connections to the MP unit.
- If the Hammer Strike data shows no data "spikes," or very low amplitude spikes, try tapping harder.
- If there is little or no signal for the EMG Response, verify all electrodes are making good contact with the skin and that the leads are not pulling on the electrodes. Very low EMG amplitude may indicate that the electrodes are not optimally placed over the quadricep muscle; review Setup Step 6 and move electrodes if necessary.
- If baseline drift is present in Goniometer Response data, make sure Goniometer is positioned properly and firmly taped to the leg.

C. DATA RECORDING

FAST TRACK Recording

1. Recording overview.

Recording continues…

Detailed Explanation of Recording Steps

Six data recordings will be acquired:*

- Knee Jerk Reflex with increasing hammer strike force.
- Knee Jerk Reflex during Jendrassik maneuver
- Knee Jerk Reflex during mental distraction
- Flexor Withdrawal Reflex - tests delay in knee jerk when another reflex is stimulated
- Voluntary Knee Jerk Reflex - tests voluntary response to aural stimulus
- Ankle Jerk Reflex - tests the medial popliteal nerve

***IMPORTANT**
This procedure assumes that all lesson recordings are enabled in Lesson Preferences, which may not be the case for your lab. Always match the recording title to the recording reference in the journal and disregard any references to excluded recordings.

Hints for obtaining optimal data:

- Position **Subject** so Reflex Hammer can easily be held in the **Director's** dominant hand.
- Hold the electrical cable in the non-dominant hand so the hammer can move freely.
- Use at least a 5-sec interval between hammer strikes to allow the leg to return to rest and stop swinging.
- Practice striking the tendon a few times prior to starting the recording.
- Review all recording steps prior to clicking "**Record**."

Fig. 20.12 Positioning of Reflex Hammer

Knee Jerk Reflex ***Tests the femoral nerve***

2. **Subject** sits with eyes closed and legs at rest.
   - **Review** recording steps.
3. Click **Record.**
4. **Director** strikes the patellar tendon at least five times, waiting between strikes until **Subject's** leg stops swinging.
   - Begin by striking gently, then successively increase force on each remaining strike.
   - If a strike produces no response, repeat using the same force.
5. After five responses have been recorded, click **Suspend**.
6. Verify recording resembles the example data.
   - If similar, click **Continue** and proceed to next recording.
   - If necessary, click **Redo**.
   - If all required recordings have been completed, click **Done**.

Recording continues…

Because it is difficult to strike the optimal point every time, you may not record a response with every strike attempt. Repeat the hammer strikes until five clear responses are recorded.

Try to INCREASE strike force for next strike/response.

There should be five Hammer Strike pulses that produce a clear signal on the Response channel. Ideally all of these would be at different Hammer strike amplitudes, but this may be difficult to achieve.

Use the horizontal scroll bar to view the entire recording.

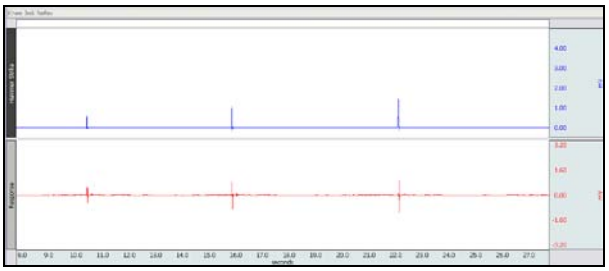


Fig. 20.13a Example EMG data

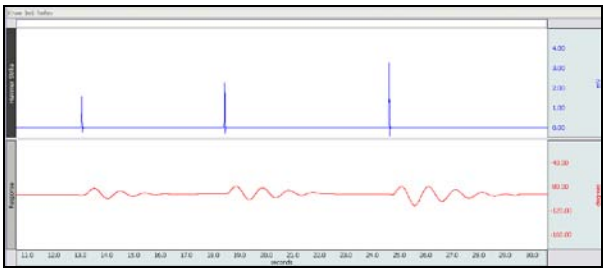


Fig. 20.13b Example Goniometer data

Click **Redo** and repeat Steps 3 – 6 if necessary. Note that when **Redo** is clicked, the most recent recording will be erased.

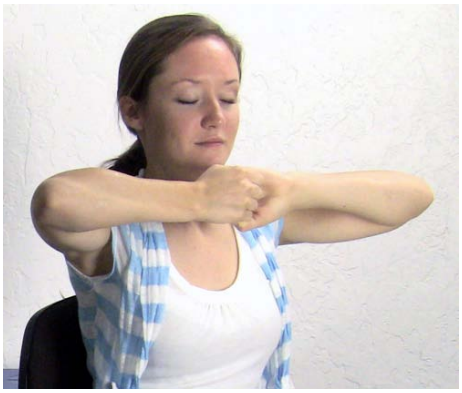
Jendrassik Maneuver

7. **Subject** sits with eyes closed and legs at rest.
   - **Subject** prepares to perform Jendrassik maneuver when Director says "pull."
   - **Review** recording steps.

8. Click **Record.**
9. When **Director** says "pull," **Subject** performs Jendrassik maneuver.
10. **Director** strikes the patellar tendon immediately after **Subject** begins pulling.
11. After hammer strike, **Subject** releases pull force.
12. After **Subject's** leg stops swinging, repeat Steps 9 – 12 four times using same hammer strike force, or until five reflex responses are recorded.
13. After five clear responses, click **Suspend**.
14. Verify recording resembles the example data.
    - If similar, click **Continue** and proceed to the next recording.
    - If necessary, click **Redo**.
    - If all required recordings have been completed, click **Done**.

Recording continues…

Knee Jerk Reflex with Jendrassik maneuver



To perform the Jendrassik maneuver, **Subject** interlocks hands at chest level. On cue from the **Director**, the **Subject** pulls hard and fast; trying to break the interlock. The emphasis should be on applying maximum force in a quick "burst."

Fig. 20.14 Subject in position for Jendrassik maneuver

- The patellar tendon is tapped immediately after the **Subject** applies the burst of force; trying to pull hands apart.
- After the hammer strike, **Subject** can release the pull force, then repeat on cue from the Director before each strike.

Try to apply the SAME FORCE for each strike.

Because it is difficult to strike the optimal point every time, you may not record a response with every strike attempt. In addition, if the hammer strike does not occur within an instant after the quick-pull burst, the desired reduced amplitude response may not be seen. Repeat the hammer strikes until five clear responses are recorded.

Verify that five Hammer Strike pulses producing a clear signal are present on the Response channel. Use the horizontal scroll bar to view the entire recording.

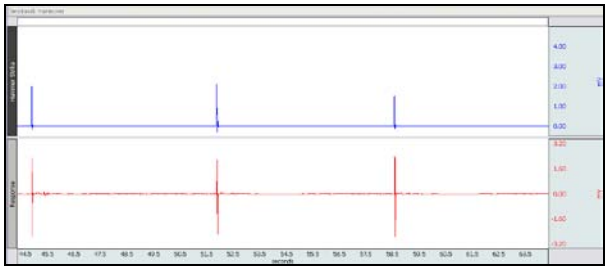


Fig. 20.15a Example EMG data

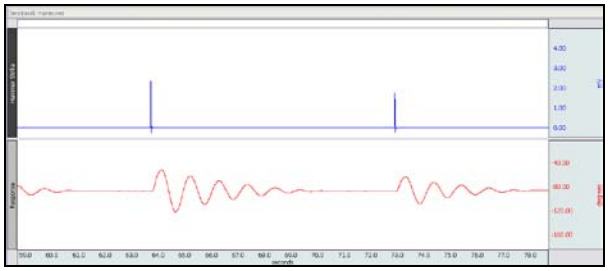


Fig. 20.15b Example Goniometer data

Click **Redo** and repeat Steps 8 – 14 if necessary. Note that when **Redo** is clicked, the most recent recording will be erased.

Mental Distraction

15. **Recorder** prepares five addition problems, each consisting of two three-digit numbers.
16. **Subject** sits with eyes closed and legs at rest.
    - **Review** recording steps.
17. Click **Record.**
18. **Recorder** poses addition problem.
19. **Subject** silently solves problem as quickly as possible and **Director** taps patellar tendon.
20. After **Subject's** leg stops swinging, repeat Steps 18 – 20 four times using same force, or until five reflex responses are recorded.
21. After five clear responses, click **Suspend**.
22. Verify recording resembles the example data.
    - If similar, click **Continue** and proceed to next recording.
    - If necessary, click **Redo**.
    - If all required recordings have been completed, click **Done**.

Flexor Withdrawal Reflex

23. **Director** prepares cutaneous stimulus (e.g. thumb tack).
24. **Subject** sits with eyes closed and legs at rest.
    - **Review** recording steps.
25. Click **Record.**
26. **Director** applies cutaneous stimulus to front of the thigh, while simultaneously striking patellar tendon.
27. After **Subject's** leg stops swinging, repeat Step 25 four times using same force, or until five reflex responses are recorded.
28. After five clear responses, click **Suspend**.

Recording continues…

Knee jerk reflex with mental distraction

Recorder prepares eight* addition problems consisting of two three-digit numbers (e.g., 247 + 498). Calculate the answers beforehand to verify if Subject tried to solve the problems.

The **Subject** should solve each problem mentally in the shortest amount of time possible.

The **Director** strikes the patellar tendon immediately after the problem is presented.

Try to apply the SAME FORCE for each strike.

Note*: Because it is difficult to strike the optimal point every time, you may not record a response with every strike attempt. Repeat the hammer strikes until five clear responses are recorded.

Verify that five Hammer Strike pulses producing a clear signal are present on the Response channel. Use the horizontal scroll bar to view the entire recording.

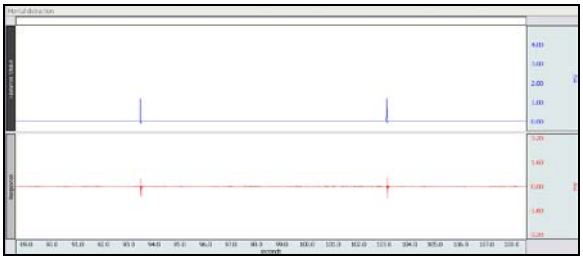


Fig. 20.16a Example EMG data

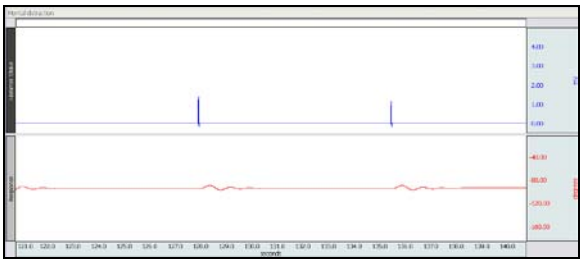


Fig. 20.16b Example Goniometer data

Click **Redo** and repeat Steps 17 – 21 if necessary. Note that when **Redo** is clicked, the most recent recording will be erased.

Knee jerk when another reflex is stimulated

Prepare a push-pin, thumb tack, or alternate media for cutaneous stimulus (prick the skin).

Important: File the tip so it is not sharp enough to pierce the skin.

Prick the skin on the front of the thigh and at the same instant, strike the patellar tendon. *It is optimal to introduce the cutaneous stimulus on the same path the neurons stimulated by the reflex hammer strike follow. In this case, the rectus femoris, which is part of the quadriceps femoris.*

The stimulus force must generate as response but not enough to puncture the skin.

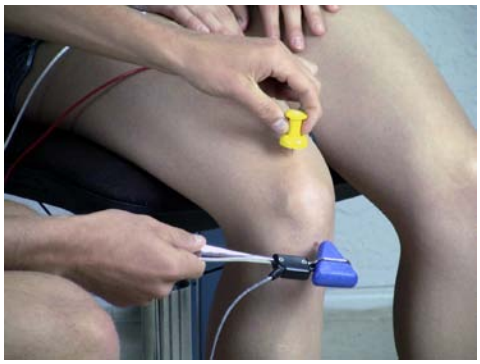


Fig. 20.17 Simultaneous stimulus and hammer strike

Try to apply the SAME FORCE for each strike.

Applying the stimulus and striking the hammer at the same instant is difficult to achieve and only one or two instances of the desired response may be recorded.

29. Verify recording resembles the example data.
    - If similar, click **Continue** and proceed to the next recording.
    - If necessary, click **Redo**.
    - If all required recordings have been completed, click **Done**.

Verify that five Hammer Strike pulses producing a clear signal are present on the Response channel. Use the horizontal scroll bar to view the entire recording.

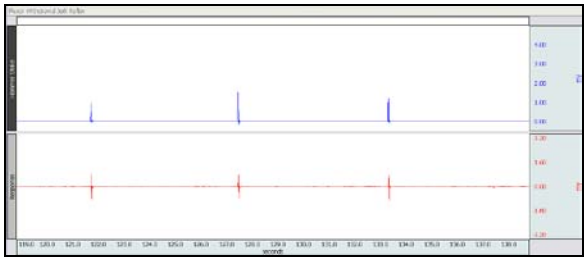


Fig. 20.18a Example EMG data

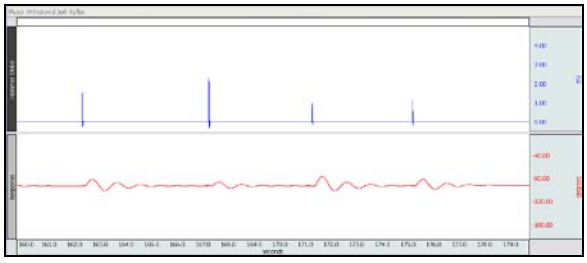


Fig. 20.18b Example Goniometer data

Click **Redo** and repeat Steps 25 – 28 if necessary. Note that when **Redo** is clicked, the most recent recording will be erased.

Voluntary Knee Jerk Reflex

Response to sound of strike

30. **Subject** sits with eyes closed and legs at rest.
    - **Review** recording steps.

Position the **Subject** so they can hear when the reflex hammer strikes the tabletop.

31. Click **Record.**

32. **Director** or **Recorder** strikes hammer on tabletop.

Strike the table with only enough force to be heard. Excessive strike force can damage the reflex hammer.

33. **Subject** – immediately upon hearing hammer strike – voluntarily lifts leg to simulate reflex response.

The Subject must try to lift leg as soon as possible after hearing the hammer strike

34. After **Subject's** leg stops swinging, repeat steps 31 – 32 four times or until five clear responses are recorded.

35. Click **Suspend**.

Recording continues…

Fig. 20.19 Subject responds to sound of hammer striking the table

36. Verify recording resembles the example data.
    - If similar, click **Continue** and proceed to next recording step.
    - If necessary, click **Redo.**
    - If all required recordings have been completed, click **Done**.

There should be five Hammer Strike pulses with corresponding signals on the Response channel.

Use the horizontal scroll bar to view the entire recording.

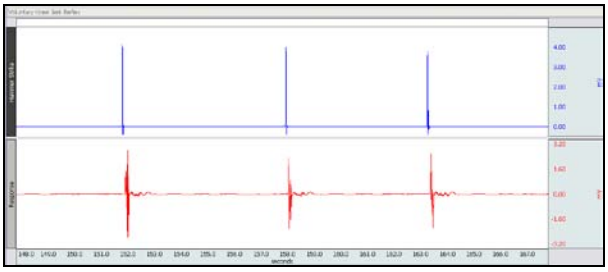


Fig. 20.20a Example EMG data

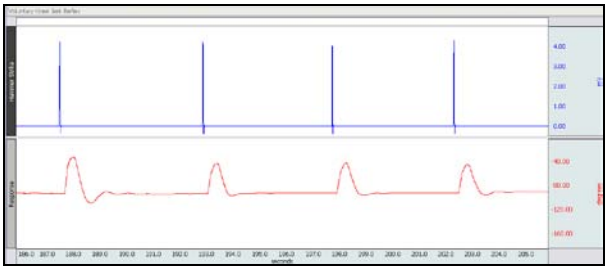


Fig. 20.20b Example Goniometer data

Click **Redo** and repeat Steps 31 – 35 if necessary. Note that when **Redo** is clicked, the most recent recording will be erased.

Recording continues…

Ankle Jerk Reflex

Tests the medial popliteal nerve

37. Unclip electrode leads or carefully untape goniometer from knee.
38. Position **Subject** (Fig. 20.21).
    - Bends leg at knee and rests knee and shin on chair.
    - Holds foot at right angle to leg, relaxing so foot is hanging freely.

If using SS2L and Electrodes:

39. Attach electrodes and clip leads for ankle response as designated in Table 20.2.

Clip leads to the electrodes on the calf and ankle following Table 20.2.

Fig. 20.21 Electrodes and Leads for recording Ankle Reflex

Lead Color	Signal	Position
Red	+	calf, close to knee
White	-	middle of calf
Black	ground	inside of ankle

Table 20.2 Electrode Lead Attachment for Ankle Reflex

Position the electrode cables so they do not pull on the electrodes. Clip the electrode cable clip to a convenient location (such as the chair) to relieve cable strain.

If Using the Goniometer: (SS20L or SS21L)

40. Secure Goniometer to foot using tape as shown. The cable should be going downwards.

With the foot roughly at a right angle to the leg, tape one end vertically along the line of the tibia and tape the other end horizontally along the lateral surface of the foot.

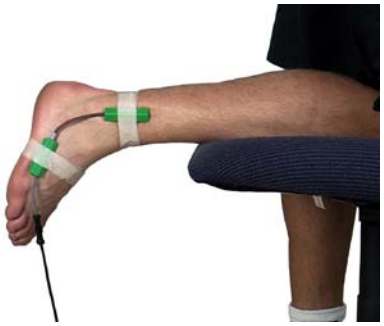


Fig. 20.22 Goniometer for recording Ankle Reflex

41. Locate optimal reflex strike point, and mark it.
    - **Review** recording steps.

To locate the optimal reflex spot:

a) Subject relaxes foot.

b) Locate Achilles tendon; behind the ankle, just above heel.

c) Using the reflex hammer, tap at areas around this location and locate the spot that gives the strongest response.

Mark the optimal spot with a water-soluble pen —if you prefer, use tape and a pen rather than marking the skin directly.

Recording continues…

Fig. 20.23 Positioning for Ankle Jerk Reflex

42. Click **Record**.
43. **Director** strikes the Achilles tendon.
44. Repeat previous step four times using same force, or until five reflex responses are recorded.
45. After five clear responses, click **Suspend**.
46. Verify recording resembles the example data.

- If similar, click **Continue** and proceed to the optional recording section, or click **Done** to finish.
- If necessary, click **Redo**.
- If all required recordings have been completed, proceed to Step 46.

Recording continues…

Try to apply the SAME FORCE for each strike.

Because it is difficult to strike the optimal point every time, you may not record a response with every strike attempt. Repeat the hammer strikes until five clear responses are recorded.

Verify that five Hammer Strike pulses producing a clear signal are present on the Response channel. Use the horizontal scroll bar to view the entire recording.

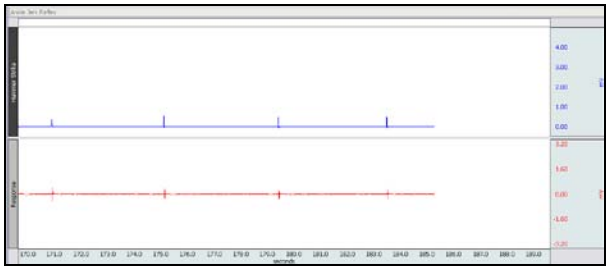


Fig. 20.24a Example EMG data

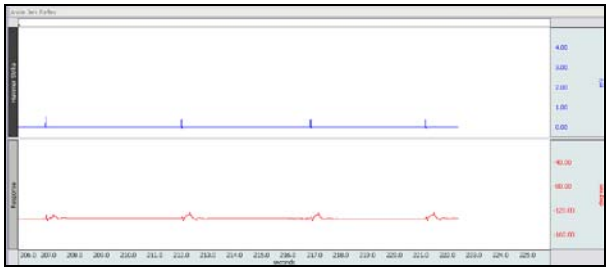


Fig. 20.24b Example Goniometer data

- If no signal is present for the EMG Response, verify all electrodes are making good contact with the skin.
- If the EMG signal is very low, select Display > Autoscale Waveforms. If the signal is still too low, the electrodes may not be optimally placed over the calf muscle; review Setup Step 6b and move electrodes if necessary.

Click **Redo** and repeat Steps 42 – 45 if necessary. Note that when **Redo** is clicked, the most recent recording will be erased.

OPTIONAL ACTIVE LEARNING PORTION

With this lesson you may record additional data by clicking **Continue** following the last recording. Design an experiment to test or verify a scientific principle(s) related to topics covered in this lesson. Although you are limited to this lesson's channel assignments, the electrodes or transducers may be moved to different locations on the subject.

Design Your Experiment

Use a separate sheet to detail your experiment design, and be sure to address these main points:

A. ***Hypothesis***

Describe the scientific principle to be tested or verified.

B. ***Materials***

List the materials you will use to complete your investigation.

C. ***Method***

Describe the experimental procedure—be sure to number each step to make it easy to follow during recording.

Run Your Experiment

D. ***Set Up***

Set up the equipment and prepare the subject for your experiment.

E. ***Record***

Use the **Continue**, **Record**, and **Suspend** buttons to record as much data as necessary for your experiment.

Click **Done** when you have completed all of the recordings required for your experiment.

Analyze Your Experiment

F. Set measurements relevant to your experiment and record the results in a Data Report.

47. After clicking **Done**, choose an option and click **OK**.

If choosing the **Record from another Subject** option: Repeat Setup Steps 6 – 7 then proceed to Calibration.

48. Remove the electrodes or the goniometer.

Remove the electrode cable pinch connectors and peel off all electrodes. Discard the electrodes. (BIOPAC electrodes are not reusable.) Wash the electrode gel residue from the skin, using soap and water. The electrodes may leave a slight ring on the skin for a few hours which is quite normal.

OR

Gently remove the tape from the Goniometer. Note that the Goniometer is fragile and should be handled carefully.

END OF RECORDING

V. DATA ANALYSIS

FAST TRACK Data Analysis

1. Enter the **Review Saved Data** mode.

2. Note Channel Number (CH) designations:

Channel	*Displays*
CH 1	Reflex Hammer Strike
CH 2	Response

3. Set up the measurement boxes as follows:

Channel	*Measurement*
CH 1	Delta T
CH 1	Max
CH 2	Max

4. Set up the display for optimal viewing of first "**Knee Jerk Reflex**" recording.

Data Analysis continues….

Detailed Explanation of Data Analysis Steps

If entering **Review Saved Data** mode from the Startup dialog or Lessons menu, make sure to choose the correct file.

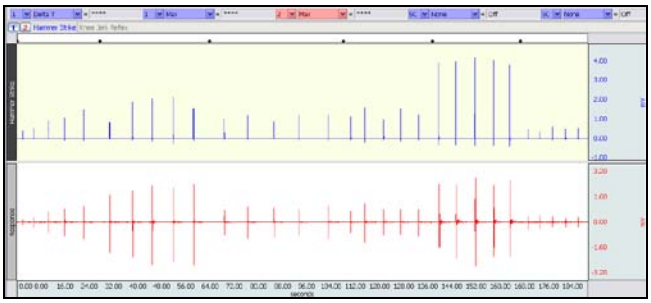


Fig. 20.25a Example EMG data

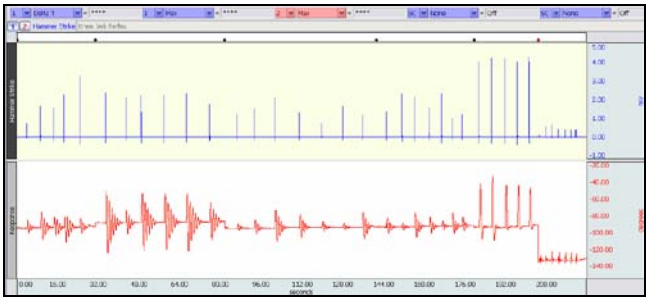


Fig. 20.25b Example Goniometer data

The measurement boxes are above the marker region in the data window. Each measurement has three sections: channel number, measurement type, and result. The first two sections are pull-down menus that are activated when you click them.

Brief definition of measurements:

Delta T: measures the difference in time between the end and beginning of the selected area.

Max: measures the maximum amplitude in the selected area.

The "selected area" is the area selected by the I-Beam tool (including endpoints)

***Note*:** The append event markers ◆ mark the beginning of each recording. Click the event marker to display its label.

Useful tools for changing view:

Display menu: Autoscale Horizontal, Autoscale Waveforms, Zoom Back, Zoom Forward

Scroll Bars: Time (Horizontal); Amplitude (Vertical)

Cursor Tools: Zoom Tool

Buttons: Overlap, Split, Show Grid, Hide Grid, -, +

Hide/Show Channel: "Alt + click" (Windows) or "Option + click" (Mac) the channel number box to toggle channel display.

To measure reaction times, select the area from the onset of the hammer strike in CH 1 to the onset of EMG activity in CH2.

5. Zoom in on the first Hammer Strike and Response in the "Knee Jerk Reflex" recording and take measurements:
   a) To measure reaction times, select the area from the onset of the hammer strike (CH 1) to the onset of Response (CH 2) and note the Delta T measurement (Fig 20.26).

      A

   b) To measure amplitudes, select an area that encompasses the Hammer Strike pulse and the maximum amplitude of the Response and note the Max measurements for each channel (Fig. 20.27).

      B

6. Use the Horizontal Scroll Bar to scroll to each successive hammer strike and response within the "Knee Jerk Reflex" recording and note all reaction time and amplitude measurements.

   A, B

7. Repeat Steps 5 and 6 for all recordings.
   Note:
   - Each recording begins with an append event marker. Click on the marker to display the label.
   - Scroll through using the Horizontal Scroll Bar, or zoom out (Display > Autoscale Horizontal followed by Display > Autoscale Waveforms) and then zoom in on the desired data.

     A, B

8. **Save** or **Print** the data file.
9. **Quit** the program.

END OF DATA ANALYSIS

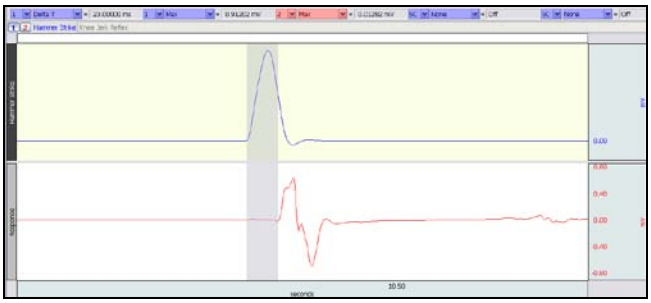


Fig. 20.26a Reaction Time measurement (EMG data)

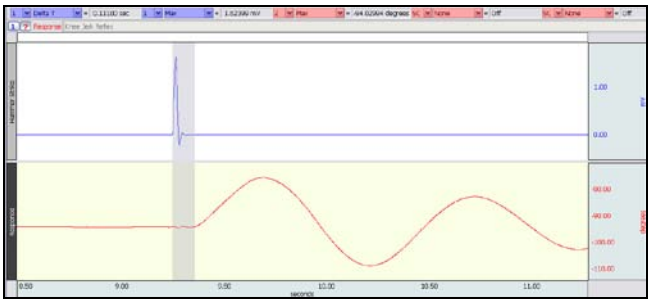


Fig. 20.26b Reaction Time measurement (Goniometer data)

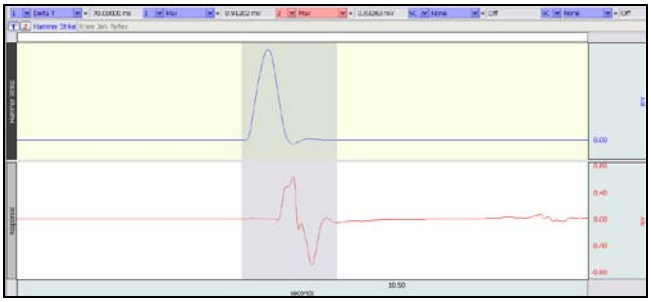


Fig. 20.27a Amplitude measurement (EMG data)

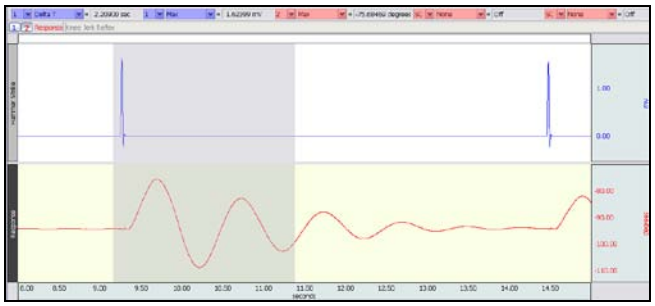


Fig. 20.27b Amplitude measurement (Goniometer data)

An electronically editable Data Report is located in the journal (following the lesson summary,) or immediately following this Data Analysis section. Your instructor will recommend the preferred format for your lab.

END OF LESSON 20

Complete the Lesson 20 Data Report that follows.

SPINAL CORD REFLEXES

DATA REPORT

Student's Name: _____
Lab Section: _____
Date: _____

Subject Profile

Subject's Name: _____

Gender: Male / Female Age: _____ Height: _____ Weight: _____

I. Data Tables—Spinal Cord Reflex measurements

A. **Complete Table 20.3 with reaction time (latent period) data** for each recording and complete the required calculations. Reaction time is measured from onset of hammer strike to onset of EMG activity.

Table 20.3

Trial #	1 Delta T					
	Knee Jerk	Jendrassik maneuver	Mental Math Distraction	Flexor Withdrawal	Voluntary Knee Jerk	Ankle Jerk
1	msec	msec	msec	msec	msec	msec
2	msec	msec	msec	msec	msec	msec
3	msec	msec	msec	msec	msec	msec
4	msec	msec	msec	msec	msec	msec
5	msec	msec	msec	msec	msec	msec
Average	msec	msec	msec	msec	msec	msec

B. **Complete Table 20.4 with Strike Force and Response Amplitude data** for each recording and complete the required calculations. Use the result to calculate the relationship between strike force and EMG amplitude.

Table 20.4

Measure	Trial #	Knee Jerk	Jendrassik maneuver	Mental Math Distraction	Flexor Withdrawal	Voluntary Knee Jerk	Ankle Jerk
1 Max	1	Volts	Volts	Volts	Volts	Volts	Volts
	2	Volts	Volts	Volts	Volts	Volts	Volts
	3	Volts	Volts	Volts	Volts	Volts	Volts
	4	Volts	Volts	Volts	Volts	Volts	Volts
	5	Volts	Volts	Volts	Volts	Volts	Volts
Calculated Average							
2 Max	1	Deg.	Deg.	Deg.	Deg.	Deg.	Deg.
	2	Deg.	Deg.	Deg.	Deg.	Deg.	Deg.
	3	Deg.	Deg.	Deg.	Deg.	Deg.	Deg.
	4	Deg.	Deg.	Deg.	Deg.	Deg.	Deg.
	5	Deg.	Deg.	Deg.	Deg.	Deg.	Deg.
Calculated Average							

II. Questions

1. What is the physiological meaning of the term “reflex”?

2. List the anatomical components of a reflex pathway in correct sequence from beginning to end.

3. What is the difference between an ipsilateral reflex and a contralateral reflex?

4. Define “reciprocal inhibition” and explain its importance.

5. The stronger the percussion hammer taps on the patellar tendon, the greater the reflex contraction of the quadriceps femoris. Explain.

6. The Jendrassik maneuver may exaggerate spinal reflexes such as the patellar reflex. Explain.

7. When a physician elicits the patellar reflex, what physiological activities are being examined? List four. (Hint: think of the function of each component of the reflex pathway).

8. Briefly explain the function of the supraspinal descending inhibitory motor pathways.

9. There are two pathways by which the Jendrassik maneuver facilitates alpha motor neuron output. Describe one.

III. OPTIONAL Active Learning Portion

A. ***Hypothesis***

B. ***Materials***

C. ***Method***

D. ***Set Up***

E. ***Experimental Results***

End of Lesson 20 Data Report