Practical 2
Neuromuscular physiology

The finger twitch
Motor unit.
Muscular fatigue.

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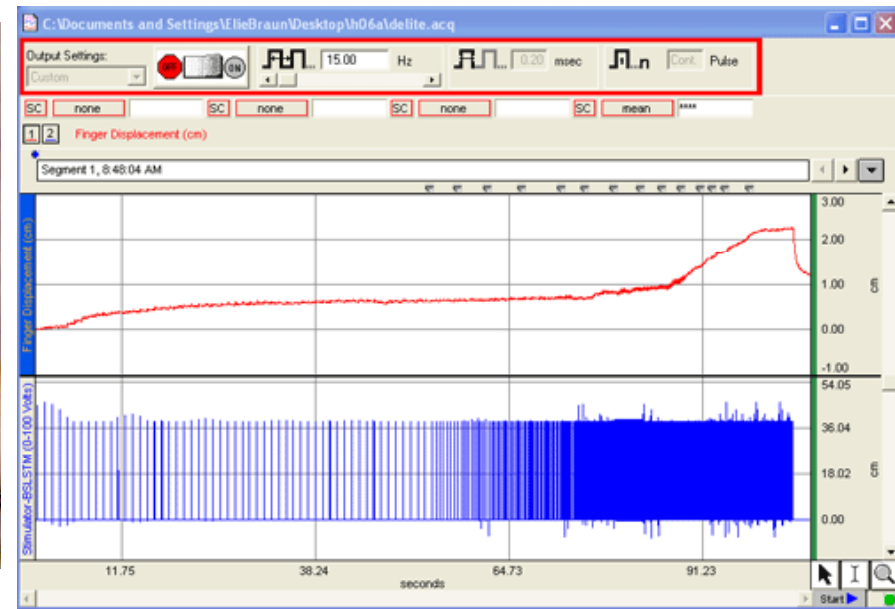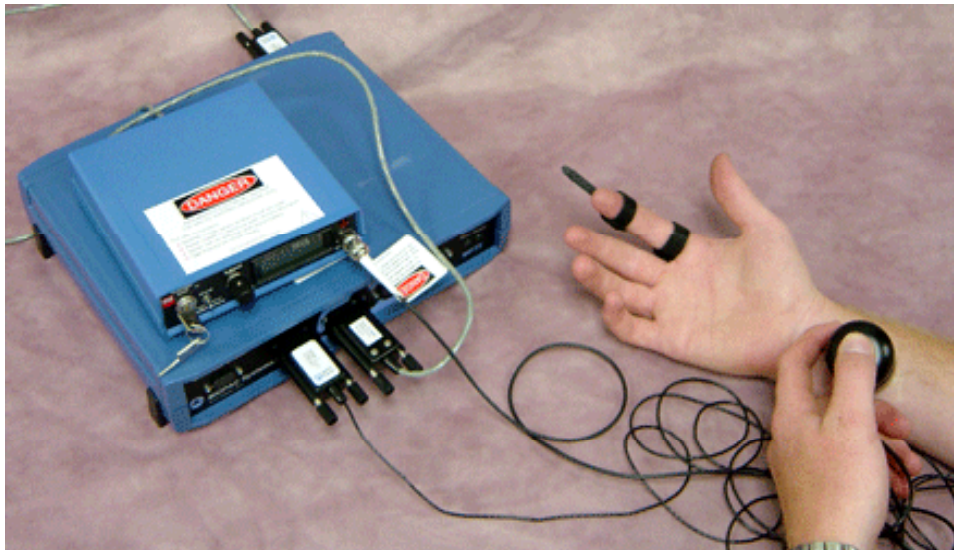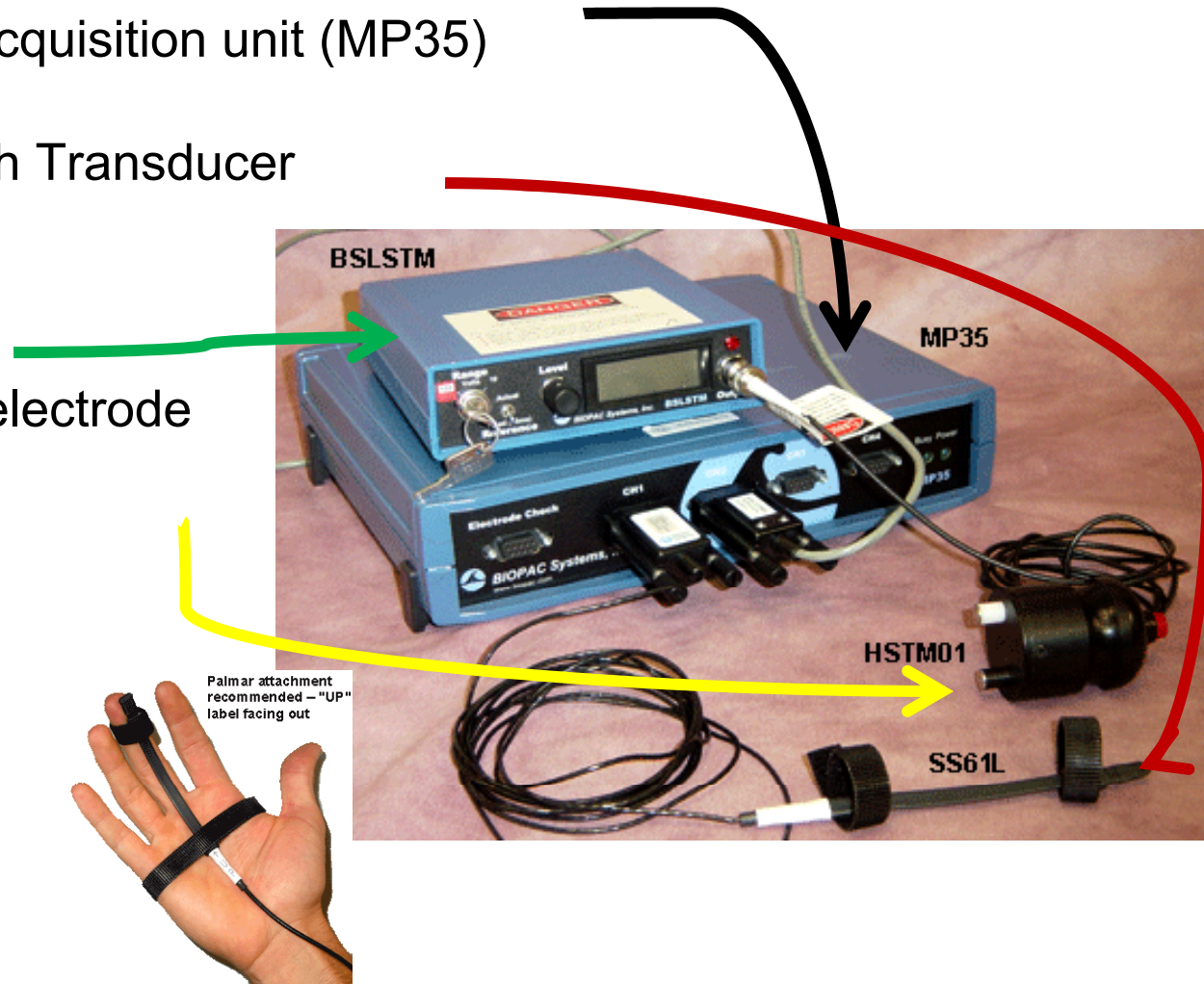
The finger twitch

Objectives

1. To record the response generated from the twitch of a finger.

2. To measure the stimulus frequency required to induce fatigue.

Equipment

- PC + BIOPAC Data acquisition unit (MP35)

- BIOPAC Finger Twitch Transducer

- BIOPAC Stimulator

- BIOPAC Stimulating electrode

- Electrode gel

- Adhesive tape

BSLSTM

MP35

HSTM01

SS61L

Palmar attachment
recommended – "UP"
label facing out

Setup
Hardware

- Plug the BSLSTM Trigger cable into the Analog Out port on the back of the MP35 unit.
- Plug the BSLSTM Reference Output connector into CH 2 of the MP35 unit.
- Plug the SS61L Finger Twitch transducer into CH 1 on the MP35 unit
- Plug the HSTM01 human-safe stimulating electrode into the Stimulus Output port on the front of the BSLSTM Stimulator.
- Be sure to position the small metal knob on the unit in the metal groove of the BNC connector and rotate clockwise to lock into place.
- Set the voltage Level and Range.
- On the BSLSTMB, turn the Level knob counterclockwise until it stops and turn the key to the left to set the Range at "100V."
- Set the Reference switch to Fixed (15ms).
- Turn the BSLSTM Stimulator on.
- Turn the MP3X data acquisition unit on.

Setup Software

- Turn the computer on.
- Launch the BSL PRO 3.7 software on the host computer.
- The program should create a new "Untitled1" window.
- Open the Finger Twitch template by choosing File > Open > choose Files of type: GraphTemplate (*GTL) > File Name: "h06a.gtl"
- A Stimulator window is automatically generated; do not close this window.

Subject Setup:

- Attach the SS61L Finger twitch transducer to the subject
- Palmar placement is recommended.

Palmar attachment recommended – "UP" label facing out

System calibration
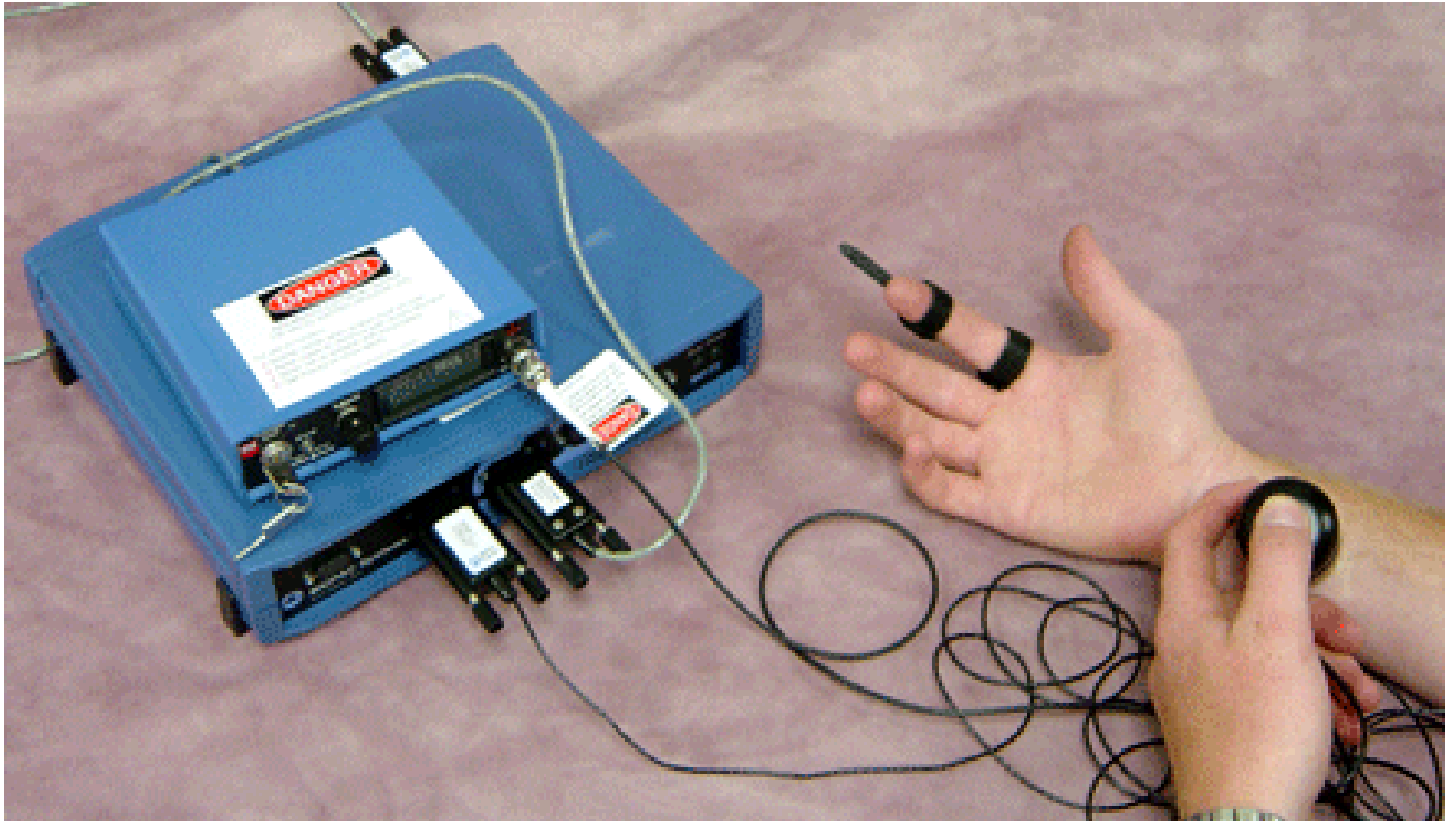
Calibration

- Select MP35 > Setup Channels then click the Channel 1 wrench icon and choose "Scaling."
- Make sure the finger is pointing straight (best against a table) and click 'Cal1'. This will be equivalent to 0 cm.
- Have the subject bend his or her finger 5cm from the table and click 'Cal2'. This will be equivalent to 5 cm.
- Click OK.
- Have the subject rest his or her arm, palm up, on a flat surface and smear some electrode gel on the lower forearm.
- Place the HSTM01 stimulating probe lengthwise along the wrist and have the Subject depress the red button to allow stimulation.
- Confirm that "Pulse Rate" is set to 1.00 Hz in the Stimulator window and then click on the "ON" switch.
- Slowly increase the Level setting on the BSLSTM Stimulator until an involuntary twitch is noted on one of the three middle fingers.
- A response usually occurs between 20 and 40 volts.
- If you do not see any twitching, set the Level on the stimulator at 40 volts and slowly move the stimulating probe around the forearm while maintaining a lengthwise orientation.
- After locating a point on the forearm that generates a distinct twitch from one of the three middle fingers, find a comfortable voltage setting for the subject.
- Click the "OFF" switch in the Stimulator window without adjusting the Level setting on the BSLSTM Stimulator.
- Attach the SS61L Finger Twitch Transducer to the index finger.

Running the Experiments

- 1. Keep the HSTM01 stimulating probe in the same place on the forearm where the twitch was detected.

- 2. Press the "Start" button on the data window.

- 3. Have the subject close his eyes and relax with his hand resting on a table or other surface.

- 4. Click the "ON" switch in the Stimulator window.

- 5. Have the subject depress the red button on the HSTM01 to allow stimulation.

- 6. Increase the stimulation frequency in the Stimulator window in 1 Hz increments until the Force data plateaus.

- 7. Click the "OFF" switch in the Stimulator window.

Data recording window
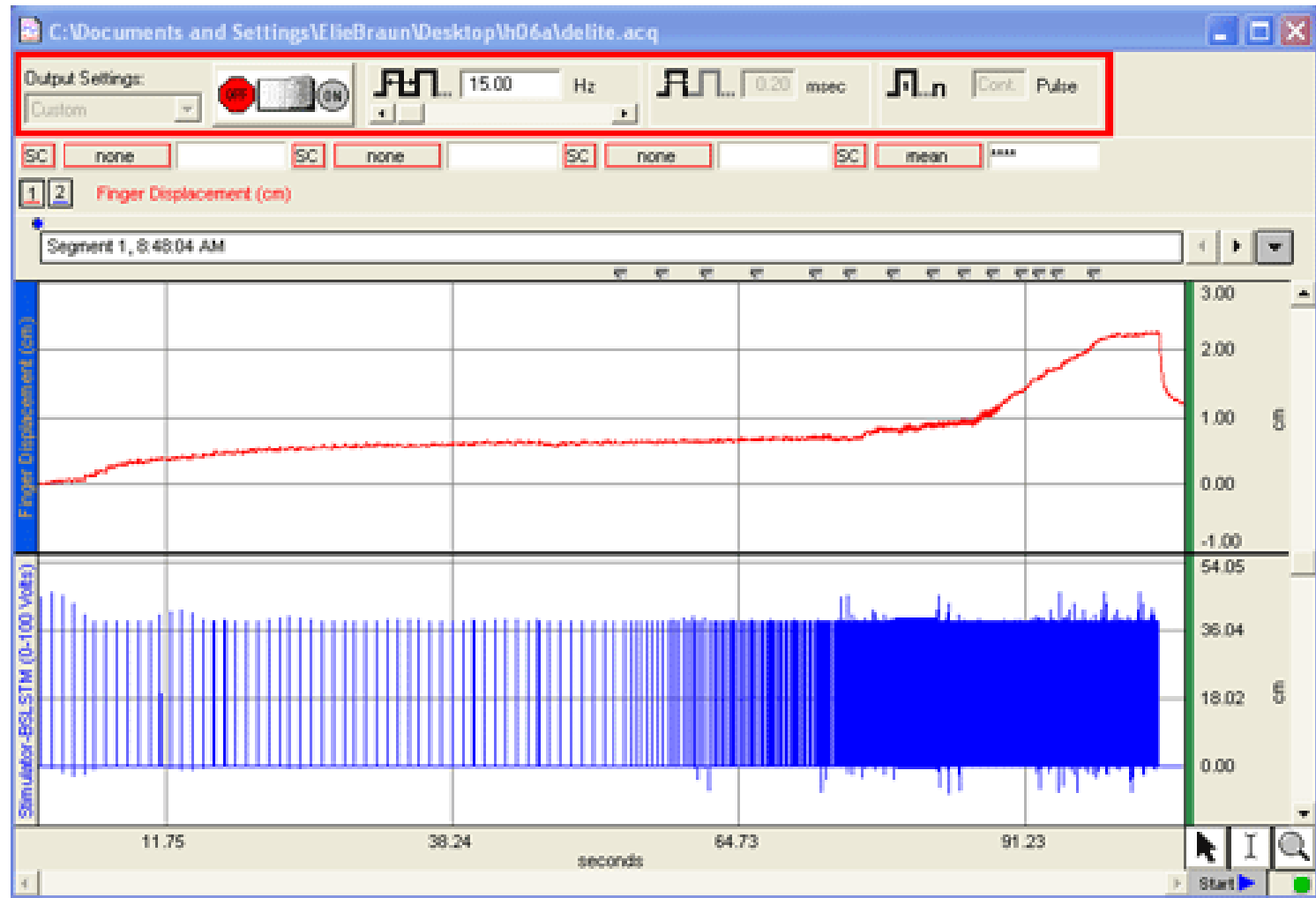
Motor unit.
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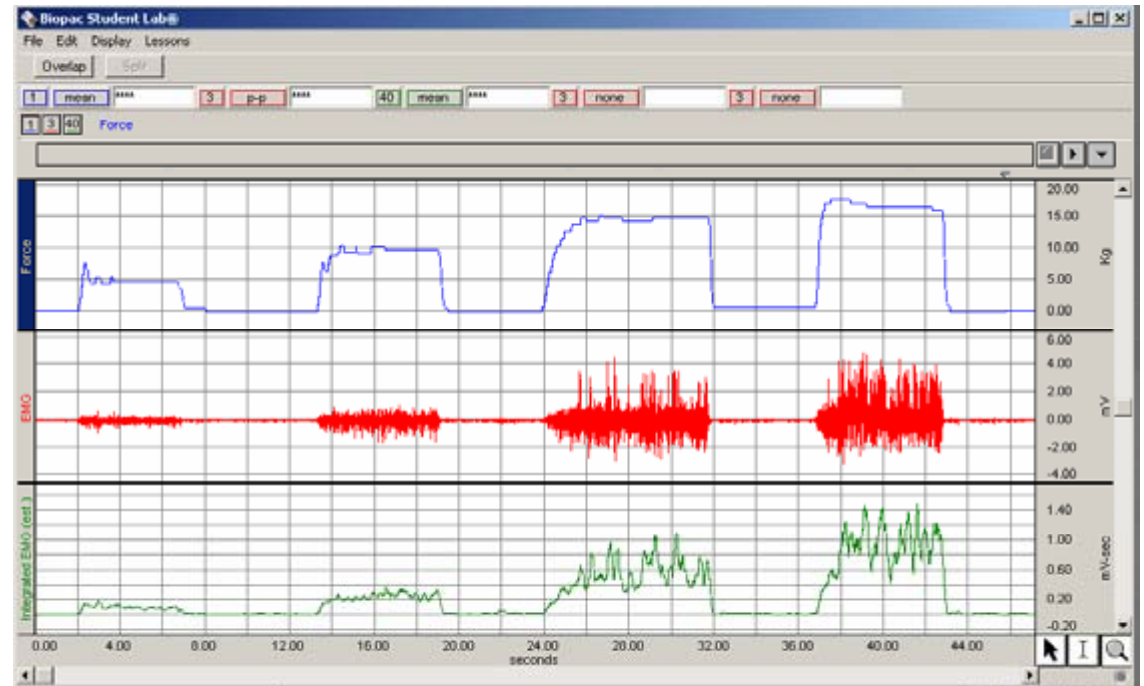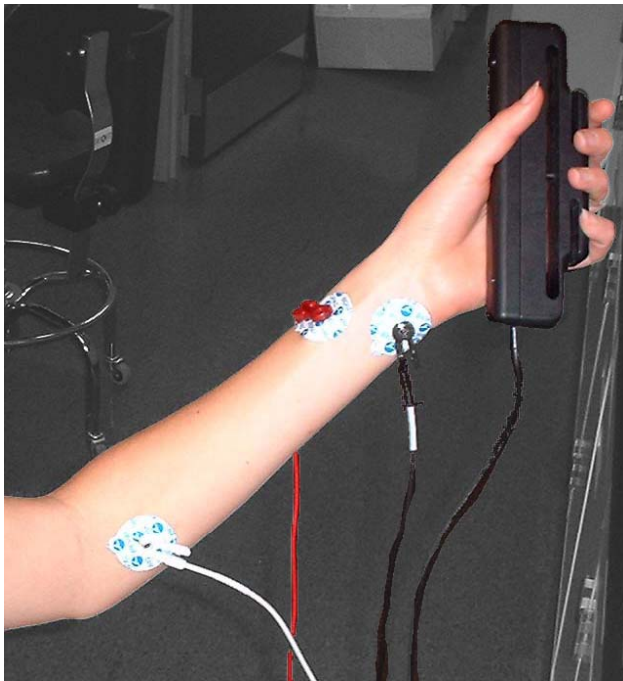
EXPERIMENTAL OBJECTIVES

- To observe and record skeletal muscle tonus as reflected by a basal level of electrical activity associated with the muscle in the resting state.

- To record the maximum grip clench for the right and the left hand.

- To compare the differences between the right and the left hand

- To observe, record and correlate motor unit recruitment with the increased power of skeletal muscle contraction.

Hardware

1. Computer + BIOPAC MP35 system

2. Hand dynamometer (SS25LA)

3. Leads, electrodes(SS2L)

4. Audio headphones (OUT1)

5. Conductive gel

6. Electrodes (3/subject)

Setup

1. Turn on computer with MP 35 still turned off
2. Connect:
   - Dynamometer (SS25LA) to CH1
   - Leads(SS2L) to CH2
   - Audio headphones (OUT1) to the back of MP35 unit.
3. Turn on the *MP35 system.*
4. Apply 3 electrodes on forearm.
5. Connect leads to electrodes
6. Launch Biopac Student Lab application .
7. Choose lesson "L02-EMG-2". Press OK.
8. Record the name of the subject.

red(+)   white (-)

black
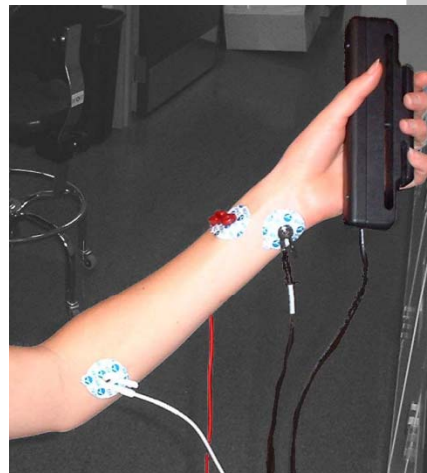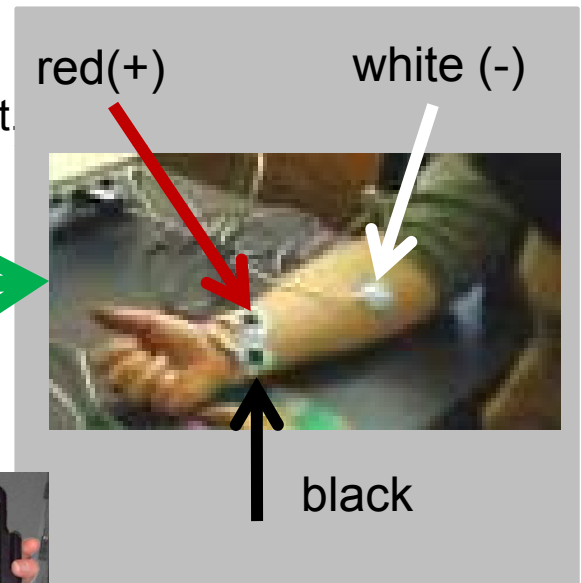
Protocol Setup

1. Press **Calibrate**.
2. With **Dynamometer** on the table. Press **OK**.
3. Take dynamometer in your hand
4. 2 seconds after calibration begins squeeze the dynamometer and then relax
5. Wait for calibration to end.
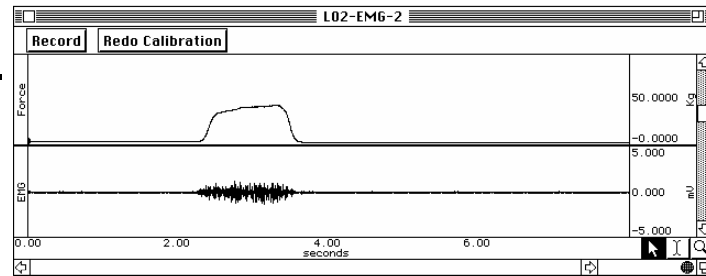
Performing the experiment

- Recruitment of motor units
  1. Press **Record**
  2. Squeeze/relax a few times enhancing the force progressively. Maintain for 2-3 seconds and wait 15 seconds for the next squeeze.
  3. Press **Suspend** at15 seconds from the last squeeze.
  4. If the recording is not correct press **Redo**.
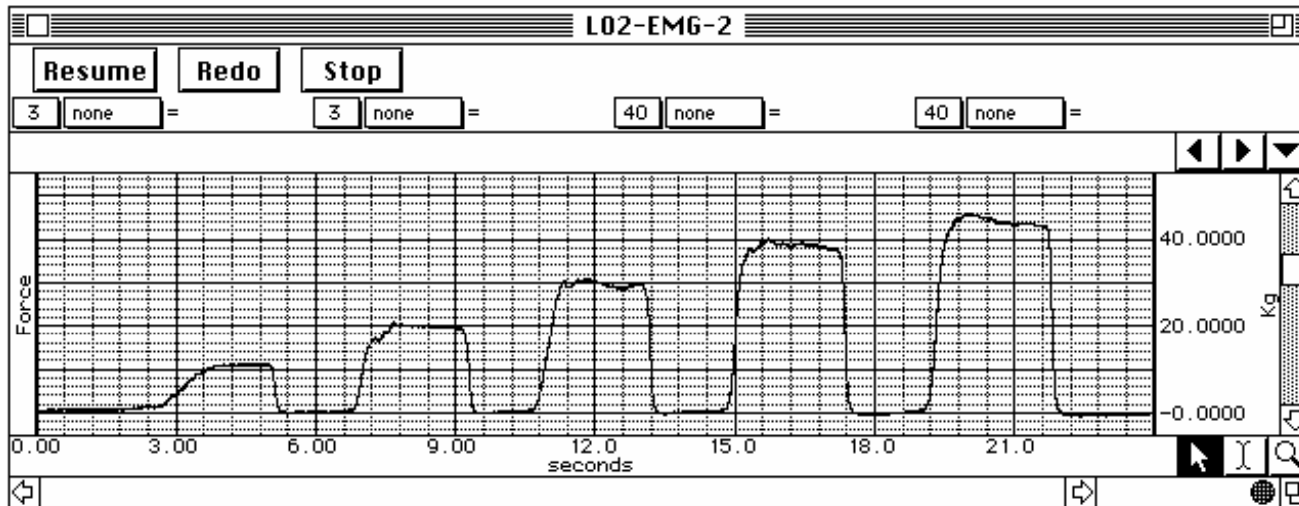
Performing the experiment

- Recording muscle fatigue
  1. Press ***Resume***
  2. Squeeze dynamometer with maximum force and try to maintain it
  3. When force is under 50% of initial value press ***Suspend***.
  4. Check data on the screen. If incorrect press ***Redo***.
  5. Press ***Stop***.
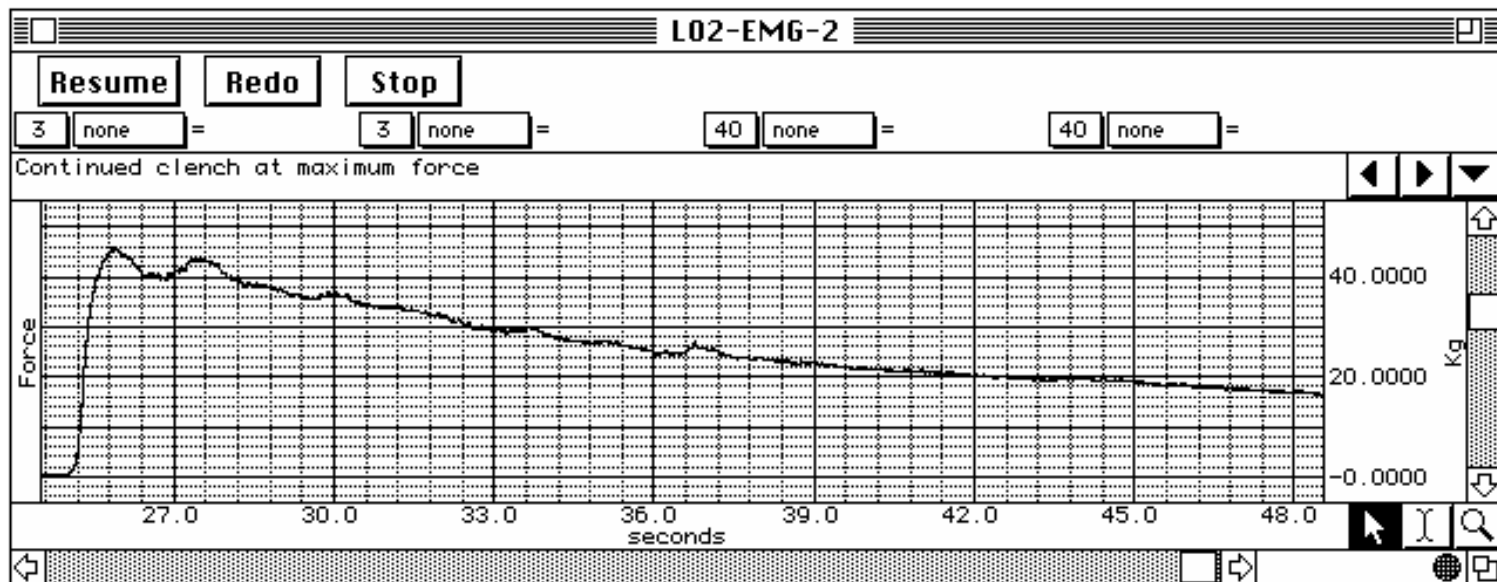
Performing the experiment

Data analysis
- – Use **Review Saved Data** *option to measure and review the recorded parameters.*