

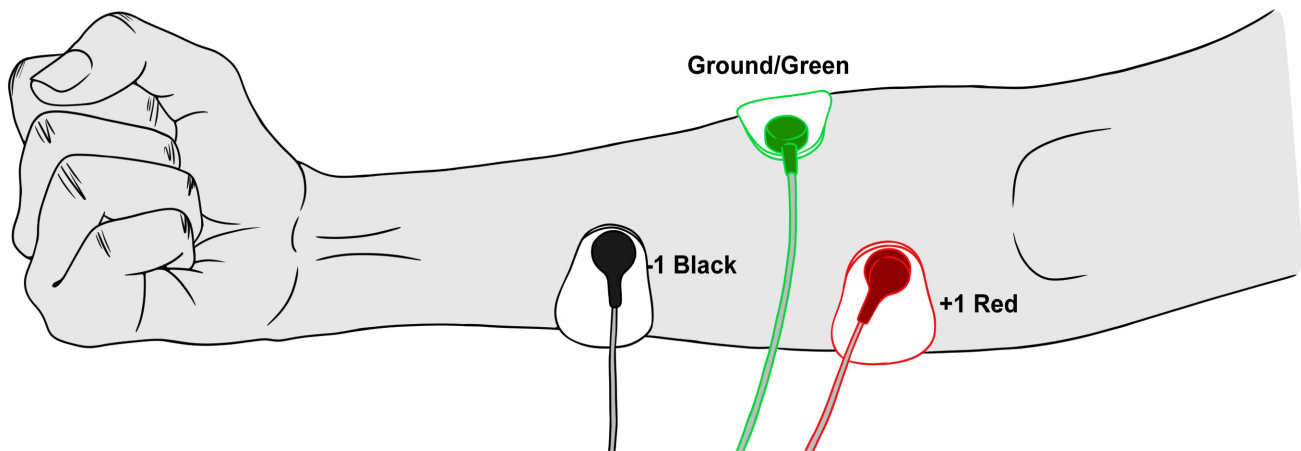
Foundations Lab 3: Muscle Activity and Grip Strength

EMG Cable and Grip Sensor Setup

Note - Connect the iWire-B3G to the IXTA prior to turning it on.

1. Plug the iWire into the IXTA.
2. Plug the red, black and green electrodes into the iWire.
3. Screw the Grip sensor and extension tubing into the IXTA.





4. Snap the lead wires onto the electrodes before putting them on the subject's dominant forearm:
 - the red lead is attached to the electrode closer to the elbow.
 - the green lead (the ground) is attached to the electrode in the middle of the forearm.
 - the black lead is attached to the electrode on the wrist.

Note – the Grip Sensor is pre-calibrated to PSI.

Exercise 1: Muscle Activity (EMG) and Grip Strength

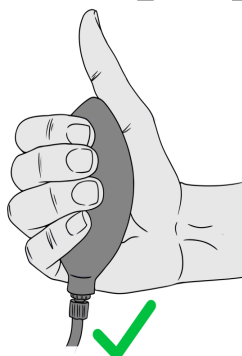
Aim: To determine the relationship between the EMG activity and the grip strength in the subject's dominant arm.

Procedure

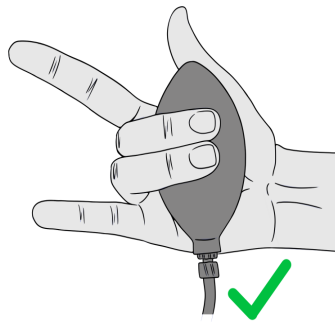
1. The subject should sit quietly with his or her dominant forearm resting on the table top.
2. The subject will squeeze the grip sensor five times, for two seconds each with a two second rest between squeezes. Use only the finger tips when squeezing, do **not** use the whole fist.
 - Each squeeze will be a little stronger than the previous one.



Do Not Hold Bulb Like This



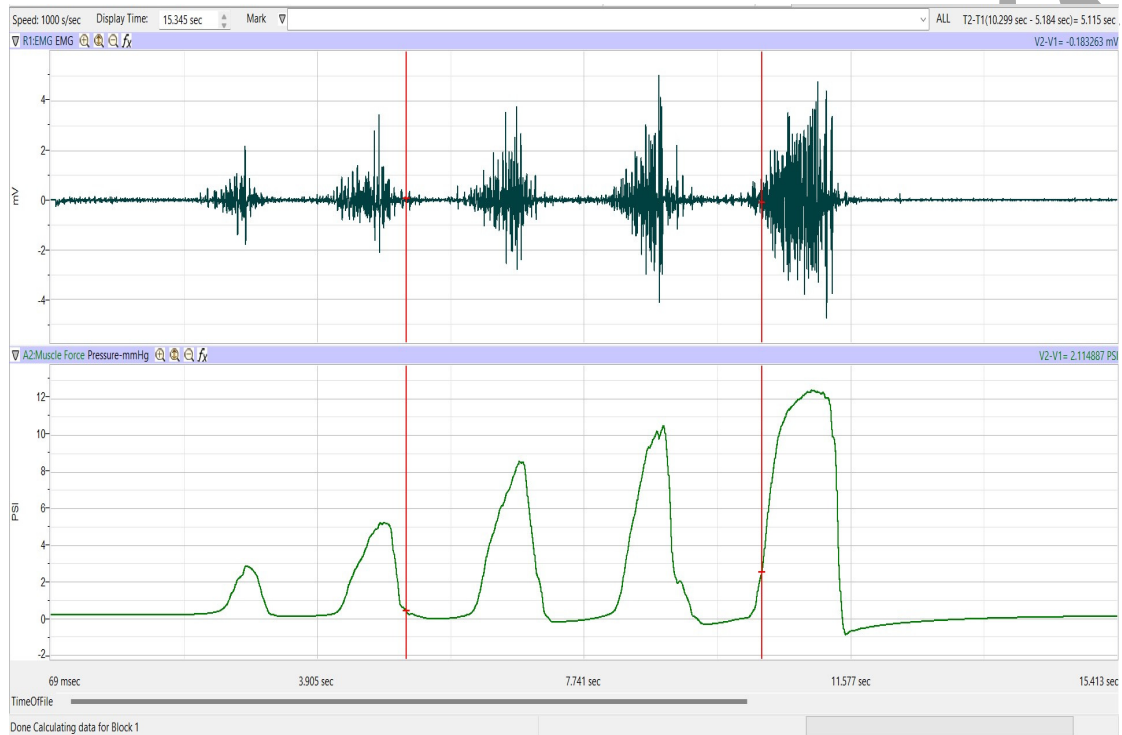
Make sure bulb is gripped by just finger tips and thumb is not on bulb



- Squeeze 1 – very light
- Squeeze 2 – a bit stronger
- By the time you get to Squeeze 5 – it should be a really strong squeeze.

NOTE - If you max out the pressure and the signal flat lines - squeeze the bulb using *ONLY* your middle and ring fingers.

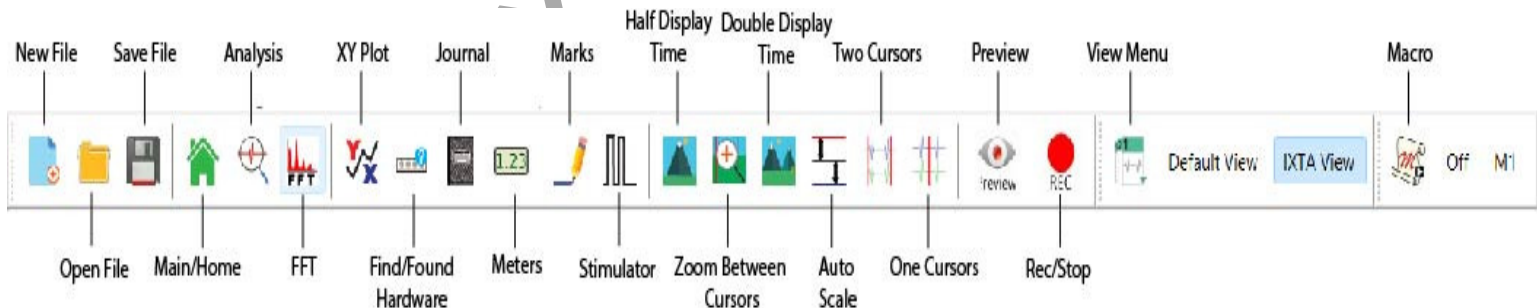
3. Click Record.
4. Have the subject squeeze five times as explained above. Click the AutoScale All button on the toolbar.
5. After the last squeeze, click Stop.
6. Click on File, Save As and name your data file. Click the Save button to save the data file.



Data Analysis



1. Click the “two mountain” icon to double the display time to show the whole recording on the screen.

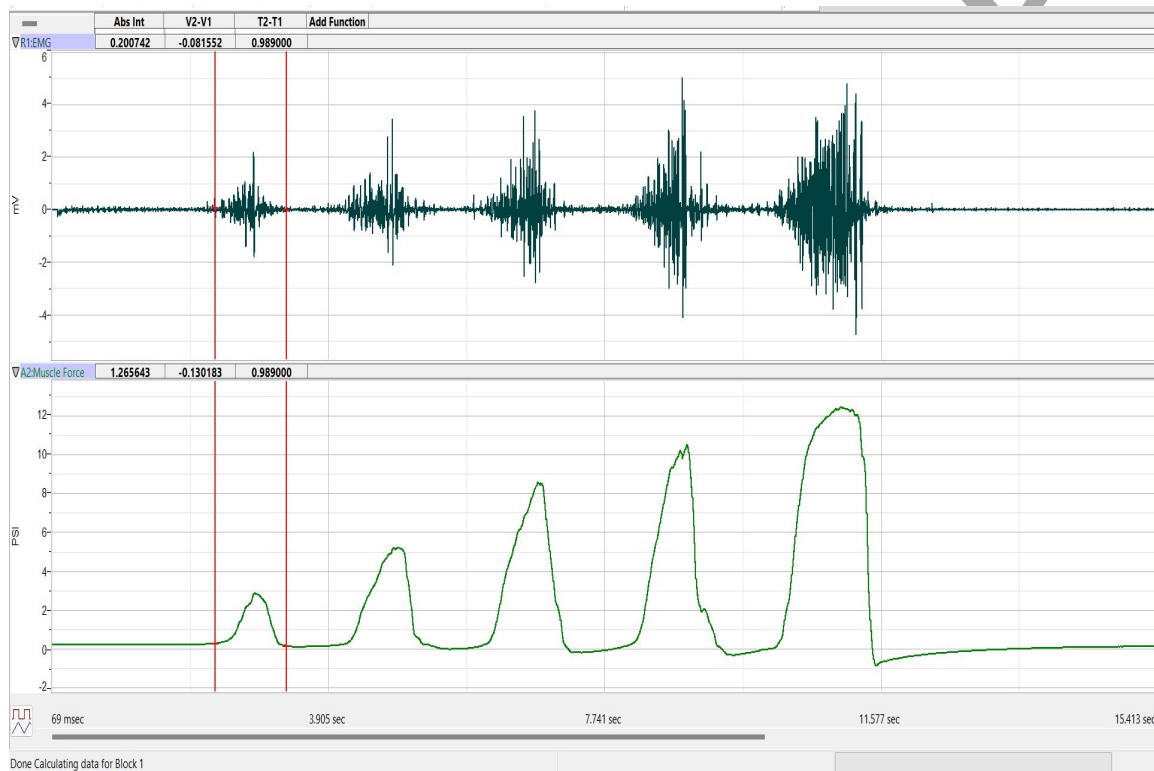


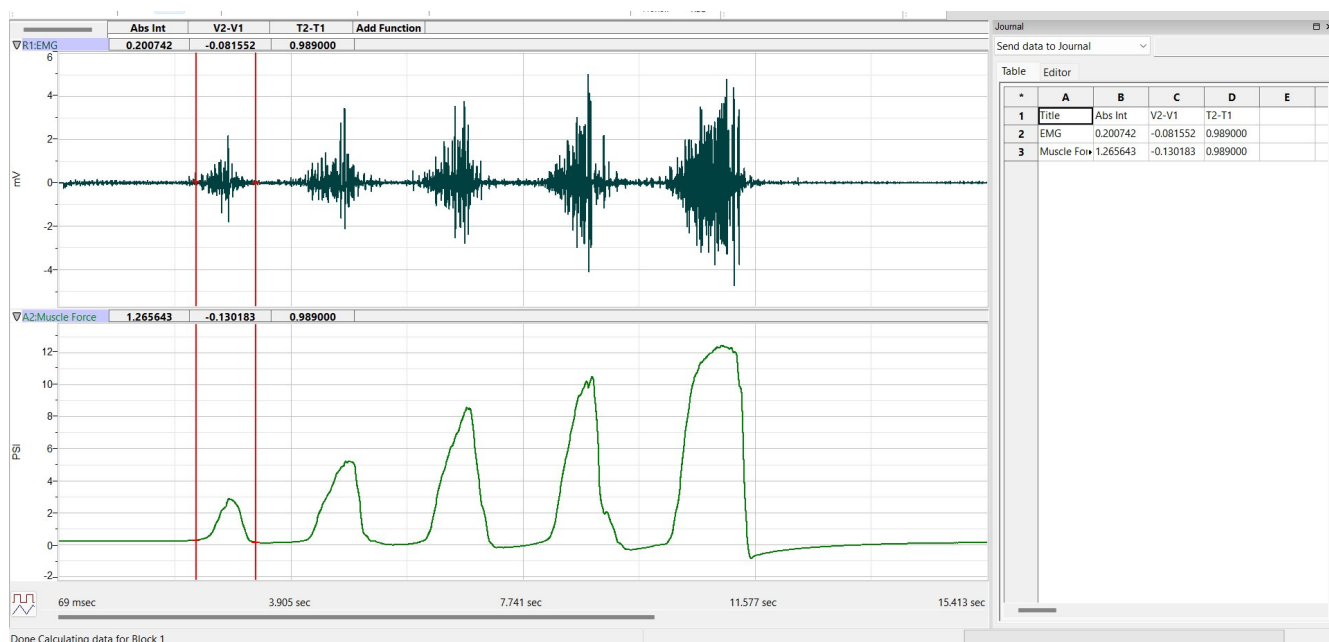


2. Click the Analysis icon on the toolbar.
3. Click and drag the cursors to either side of the first EMG (muscle activity) burst. Abs. Int is the relative amount of the electrical activity causing the muscle activity and grip strength. Record the values for these in the table below or directly into the Journal.



1. Click the Journal icon
2. Click Table
3. Click Tools – Add Title to Journal
4. Click Tools – Add All Data to Journal





4. Repeat Step 3 for the other four muscle contractions.
5. Select Save from the File menu.

Questions

1. Using Excel or another graphing program, plot the absolute integral of muscle contraction as a function of the absolute integral of the EMG signals for each muscle clench. EMG will be the X-axis and Muscle Force will be the Y-axis.
2. Is there a linear relationship between the muscle activity (EMG) and the grip strength (force)?
3. Do muscle fibers have a refractory period like nerve fibers?

Table: The Effect of Muscle (EMG) Activity and Grip Strength

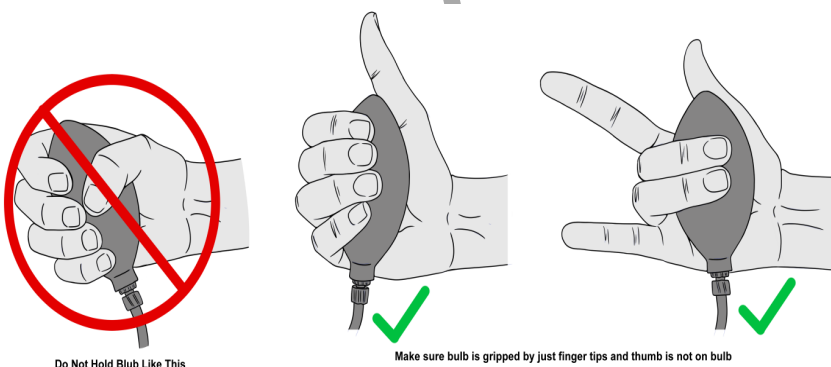
Relative Grip Strength	Absolute Int. of Muscle (EMG) Activity	Absolute Int. of Grip Strength (Force)
Lowest		
Higher 1		
Higher 2		
Higher 3		
Highest		

Exercise 2: Muscle Activity and Fatigue

Aim: To observe the relationship between the strength and length of contraction time of a muscle and EMG activity.

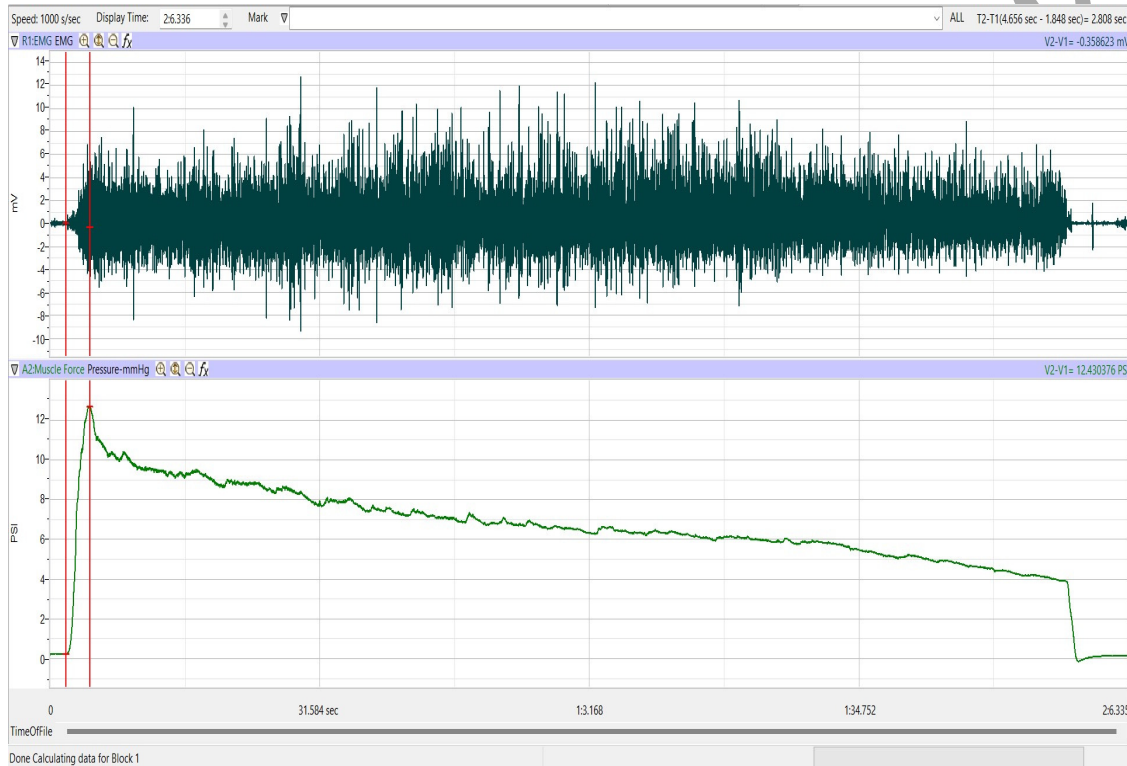
Procedure

1. Click Record.
2. Have the subject squeeze the bulb and hard as they can. Use only the finger tips when squeezing, do **not** use the whole fist.



REMINDER - If you max out the pressure and the signal flat lines - squeeze the bulb using **ONLY** your middle and ring fingers.

3. Have the subject hold the squeeze for as long as they can. They should try to hold for at least 1 minute, but no longer than 2 minutes. Click Stop only after the subject has released the bulb AND the subject's grip strength has dropped by at least 50% of the maximum squeeze at the beginning.
4. Click the AutoScale button while recording.
5. Click Save from the File menu.



Data Analysis

1. Click the “two mountains” icon to get the whole recording of the Fatigue section on screen. You may have to click a few times.
2. On the Muscle Force channel, drag one cursor to the flat line right before the big squeeze. Drag the other cursor to the peak of the big squeeze. Note the V2-V1 value on the Force channel. Write this in the data table below. Or enter the data into the Journal following the same directions from Exercise 1.
3. Keep the one cursor on the peak of the muscle force and move the cursor from the baseline to a point on the force channel where the value of V2-V1 is 50% of the full grip strength. Note – this number will be negative. Record the value.
4. Look at T2-T1, this is the time it took for the muscle to get to 50% of it's original, full strength. Record the value.

Table: Half-Max Fatigue Time

Full Strength	Half Strength (calculate from Full strength)	Time (sec)

