Biology 125- Human Physiology

Laboratory 9- Muscle Physiology

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I. Purpose

The purpose of this lab is to examine the various contraction properties of cardiac, smooth, and skeletal muscle using a variety of experimental techniques. We will look at how the neurotransmitters norepinephrine and acetylcholine affect the rates at which cardiac and smooth muscle contract. This specific exercise will demonstrate the concepts of agonist, antagonist, and synergist muscles.

II. Procedure

9-D: Demonstration of the electromyograph (EMG)

1. To get things started:
    - Before you turn anything on, be sure the IWX/214 unit is plugged in, and that the IWX/214 unit is connected to the laptop by USB cable.
    - Be sure that the C-AAMI-504 EEG cable is inserted into the isolated inputs of Channels 1 and 2 of the IWX/214. Be sure that the color-coded lead wires are correctly inserted in the lead pedestal of the C-AAMI-504 EEG cable. Insert the connectors on the electrode lead wires into the color-coded matching sockets on the lead pedestal of the ECG cable.
    - Once everything is connected, FIRST turn on the laptop and allow it to fully boot up before you turn on the IWX/214 unit. Once the Iworx unit is on, the red indicator light on the Iworx unit should light up and you may hear the USB chime from the laptop if the laptop does not default to mute (many are set to default to mute)
2. Open the Labscribe3 program by clicking on the Labscribe3 icon on the desktop. As soon as the program opens, you should see a window pop-up that says “Hardware foundIWX214:2008-1-24,” click “OK.
3. In the second from the top row (the row that says “File Edit View Tools Settings Advanced External Devices Help”), click on the “Settings” tab. About halfway down the drop-down window should be a tab called “Human Muscle.” Click on that tab and that should lead you to another drop-down list with the second tab from the top called “Antagonistic Muscle,” click on that tab and the close the pdf file that appears, you don’t need it.
4. Instruct the subject to remove all jewelry from his/her arm and wrist. Use an alcohol swab to clean the regions of skin on the forearm you are going to

use (Fig. 9-1.). Let the area dry. Remove a disposable electrode from its plastic shield and apply the electrode to the six locations. Have your partner repeat this experiment on your skin.6. Interpret the results you have obtained.

5. Place the electrodes from proximal to distal on the forearm in the following order: +2, -2 on the posterior and +1, -1 and ground on the anterior. (Fig.9-1.) Snap the lead wires onto the electrodes as follows:
    - The red "+1" lead is attached to the proximal electrode on the anterior surface.
    - The black "-1" lead is attached to the distal electrode on the anterior forearm.
    - The green "C" lead (the ground) is attached to the remaining electrode on the anterior surface.
    - The white "+2" lead is attached to the proximal electrode on the posterior forearm.
    - The brown "-2" lead is attached to the distal electrode on the posterior surface.
6. Record an EMG of the muscles of the forearm illustrating agonistic and antagonistic muscle activity for each of the exercises described below. Type the student's name and the appropriate letter for the activity (A, B, C, D–see below) in the Mark box to the right of the Mark button. Click the red "Rec" button to begin the recording; then, press the Enter key on the keyboard to mark the beginning of each the activity. The recording for exercise "A" should look like Fig. 9-3. If you do not see anything, try clicking on the Auto Scale tab and/or checking the electrode contacts. Repeat these procedures for each of the remaining activities.
    A. Gently flex the wrist with the palm open and hold for four seconds. Return the wrist to a neutral position. Extend the wrist, again with the palm open, and hold for four seconds. Repeat several times.
    B. Forcefully flex the wrist with the hand closed into a fist, hold for four seconds. Return to a neutral position. Extend the wrist maintaining the fist and hold for four seconds. Repeat several times.
    C. Attempt to flex the wrist against resistance applied by another student for 10seconds.
    D. Place the hand in mid-supination and make a fist. Attempt to move the hand upwards against resistance applied by another student. Hold for 10 seconds.
7. Evaluate the amplitude and frequency of the EMG recordings. Identify the agonists, antagonists, and synergists, if applicable, for each activity. For example, what muscles were the agonists during wrist flexion-anterior or posterior forearm muscles? How did the EMG change for the antagonists

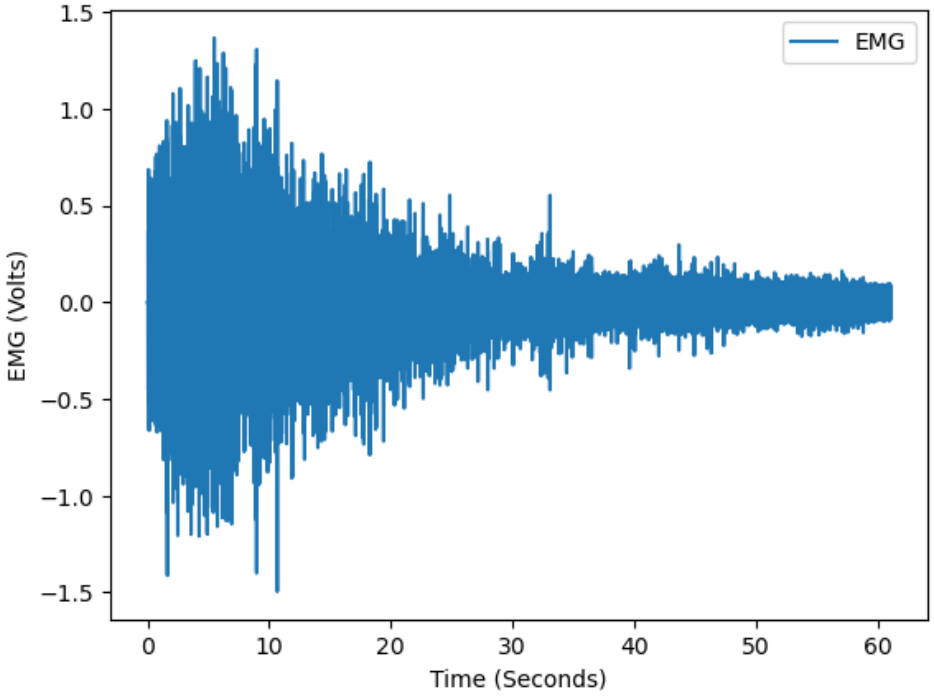
when the wrist was more forcefully moved? During which exercise(s) did synergistic muscle activity become apparent?

8. Print a sample of each activity. Before you print, find your highest amplitude waves (probably in activity C or D) and Auto Scale. Click on the Auto Scale tab at the upper margin of each of the EMG channels. Look for the row that says on the left "σA1: EMG Anterior (or Posterior) 3-10KHz," the Auto Scale tab is the second icon after "Hz," it looks like a magnifying glass with a2symbol on it. After you click this for the biggest waves, this is the scale you will print all four activities. To print a section of the recording, click on "File," select "Print View." Select "Landscape" for the page set-up. Be sure to select M-106 as the printer destination.

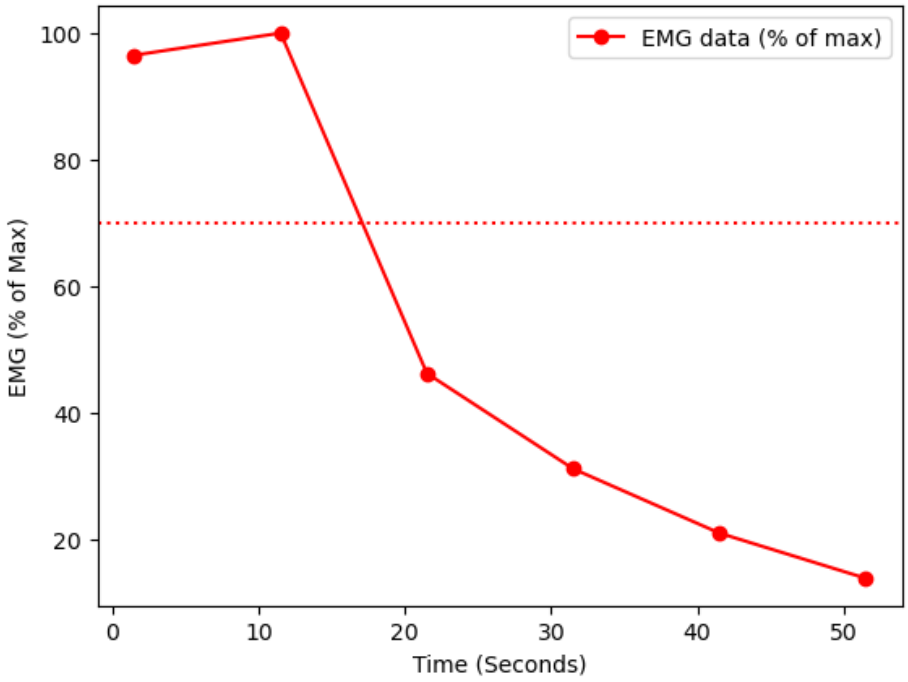
III. Result

9-D: Demonstration of the electromyograph (EMG)

	Time	EMG	Muscle Force
0	0.000	0.000000	0.221656
1	0.001	0.000000	0.221656
2	0.002	0.000000	0.221283
3	0.003	0.000000	0.221283
4	0.004	0.000000	0.221283
…	…	…	…
61019	61.019	-0.021938	0.221656
61020	61.020	-0.081695	0.221656
61021	61.021	-0.046602	0.221656
61022	61.022	0.030905	0.221656
61023	61.023	0.065759	0.221656



	Time	Max EMG	Max EMG Percent
0	1.4995	1.105490	96.509730
1	11.4995	1.145470	100.000000
2	21.4995	0.529550	46.229932
3	31.4995	0.356815	31.150096
4	41.4995	0.240445	20.990947
5	51.4995	0.158654	13.850559



IV. Discussion

Upon finishing this lab, it was found that the maximal strength is 96% at 0 seconds and 13% at 51 seconds for fatigue.

V. Conclusion

I came to the conclusion that strength is strong at the start of the recording, and exhaustion becomes noticeable after a while of tensely gripping the ball.