Lab 9- Muscle Physiology

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Purpose:

Muscle cells are similar but differ in their degree of innervation, fatigue rate, and response to neurotransmitters. In this lab, we saw the electrical signal of a muscle contraction. The different experiments were used to investigate the different contraction characteristics of skeletal, cardia, and smooth muscle.

Procedure:

Skeletal Muscle Contraction

Procedure

1. Observe the laser disc presentation. Understand the terminology subliminal, liminal and maximal stimulus.
2. Sketch the changes in the waveforms that result from increased amplitude and frequency of stimulus.
3. Sketch the staircase phenomenon and complete tetanus followed by muscle fatigue.
4. Observe the effects of overloading a muscle.
5. Explain these observations in terms of the phases of a skeletal muscle twitch.

Cardiac muscle contraction

Procedure

1. Observe the laser disc presentation.
2. Understand the experimental setup
3. Observe the changes in heart rate after the application of the following substances:a. Acetylcholine. Epinephrine. Nicotine in Ringer's solution. Caffeine
4. Explain the results.

Smooth muscle contraction

Procedure

1. Obtain a baseline trace of the smooth muscle at rest.
2. Observe and note the effects on the chart recording of injection of these neurotransmitters:a. Acetylcholine. Norepinephrine
3. Diagram the typical smooth muscle contraction.
4. Summarize the effects of acetylcholine and norepinephrine on smooth muscle contraction.

Demonstration of the electromyography (EMG)

Procedure

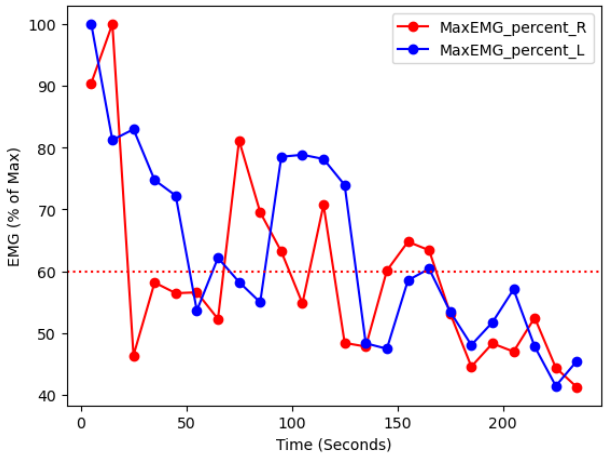
1.To get things started:Before you turn anything on, be sure the IWX/214 unit is plugged in, and that the IWX/214 unit is connected to the laptop by USB cable.Be sure that the C-AAMI-504 EEG cable is inserted into the isolated inputs of Channels 1 and 2 of the IWX/214. Be sure that

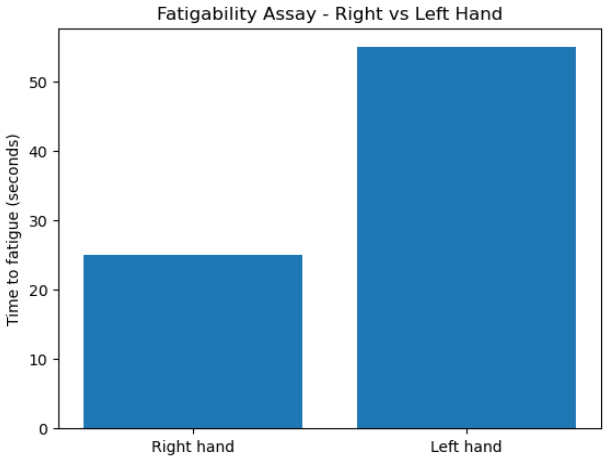
the color-coded lead wires are correctly inserted in the lead pedestal of the C-AAMI-504 EEG cable. Insert the connectors on the electrode lead wires into the color-coded matching sockets on the lead pedestal of the ECG cable.Once everything is connected, FIRST turn on the laptop and allow it to fully 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 Labscribe 3 Program by clicking on the Labscribe 3 Icon On the desktop. As soon as the program opens, you should see a window pop-up that says “Hardware found IWX 214:2008-1-24,” 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 “AntagonisticMuscle,” click on that tab and close the pdf file that appears, you don’t need it.
4. Instruct the subject to remove all jewelryfrom 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.
5. Place the electrodes from proximal to distal on the forearm in the following order: +2, -2on 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 activity. The recording for exercise “A”should look like Fig. 9-3.If you do not see anything, try clicking on the AutoScale tab and/or checking the electrode contacts.Repeat these procedures for each of the remaining activities.

The effect of oxygen supply on skeletal muscle activity
Procedure
1. Firmly squeeze a tennis ball as rapidly as possible with your non-dominant hand until you feel fatigued and can no longer squeeze it. Record the duration of this effort.
2. Have a partner attach a sphygmomanometer cuff to your dominant arm and inflate it to 150mmHg, or 10 mmHg above your normal systolic pressure, if you know your blood pressure values.

3. Repeat the squeezing exercise with your dominant arm. Record the time duration of this effort. (NOTE: it is important to stop at the same sensation of fatigue, or “burn,”as the non-dominant arm.)
4. Evaluate the differences between the two duration measurements obtained in terms of energy demands of skeletal muscle and fatigue

Results:





Discussion:

Cass and Jasmin were unfortunately not able to come to this lab. When we asked for a classmate's results, we were like what are these numbers and decided this lab was going to be last. But after looking and graphing the other labs it was manageable. It was interesting to see that we could graph it now. It was also interesting to see the results seeing that our classmate’s left hand had more endurance than his right. We didn’t ask if he was left-handed and doing this lab now seems like we should have. But the results show he is more likely left-handed.

Conclusion:

The purpose of this lab was to see the different fatigue rate of muscle. Compared to the left and right hand, it was clear that the left hand had more endurance. The left hand took longer than the right hand to feel fatigue showing that the left hand had less of a fatigue rate.