Lab 9- Muscle physiology

Purpose:

The purpose of this lab is to test the performance of our skeletal, cardiac, and smooth muscle. Even though they are similar, they are unique in their abilities to contract, degree of innervation, rate and duration of contraction, fatigue rate, and response to neurotransmitters.

Procedure:

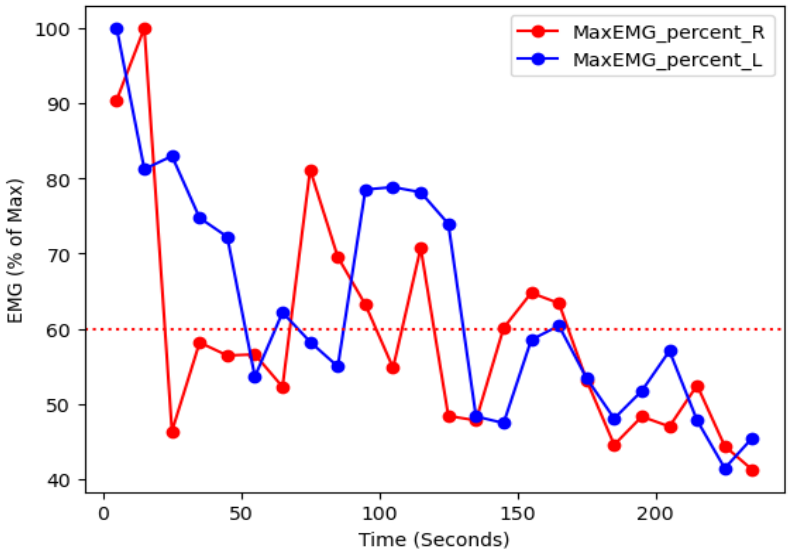
9-D: Demonstration of the electromyograph (EMG)This exercise will demonstrate the concepts of agonist, antagonist and synergist muscles. An agonist, or prime mover, is the muscle primarily responsible for a given movement. An antagonist muscle will work in opposition to the agonist. A synergist will aid the agonist and help refine a given movement. NOTE: You will need to arrange yourselves in groups to be able to obtain a copy of EMG recordings from the laptop computer running the I Worx program. Procedure1.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 I Worx unit is on, the red indicator light on the I Worx 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 Labscribe3program by clicking on the Labscribe3iconon the desktop. As soon as the program opens, you should see a window pop-up that says “Hardware found IWX214:2008-1-24,” 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 then 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.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. The experimental

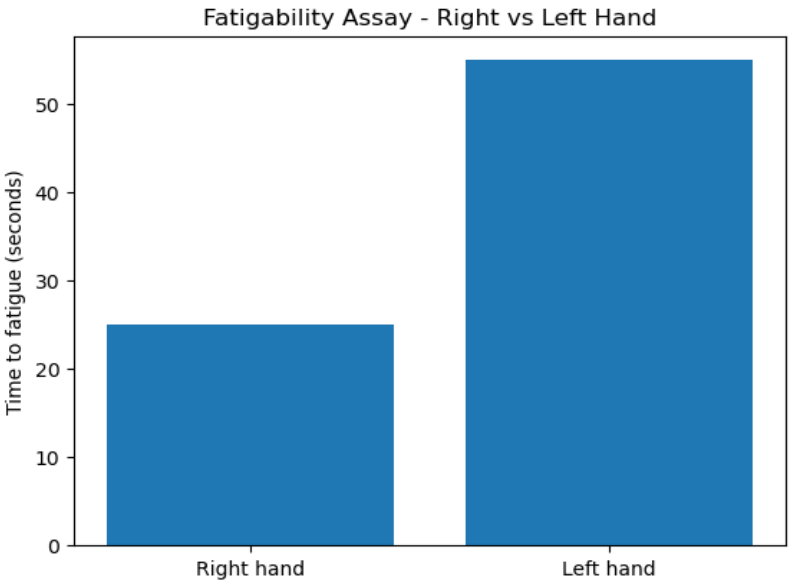
et-up should look like the illustration. 9-2: Experimental set-up Record an EMG of the muscles of the forearm illustrating agonistic and antagonistic muscle activity for each of the exercises described below. Type the student's name and the appropriate letter for the activity(A, B, C, D– see below)in 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 a 2symbol 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.

9-E: The effect of oxygen supply on skeletal muscle activity

Procedure1. 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: I enjoyed participating in this lab because I liked getting the electrodes placed on my arms. I felt like an experiment. It was also interesting to see how the fatigability differed in the right and left arm.

Conclusion: In conclusion, although skeletal muscle, cardiac muscle, and smooth muscle are similar, they differ in their rate of duration, rate of contraction, and the rate of fatigue. Skeletal muscle proved to exert rapid contractions of faster duration and early fatigue. The EMG also showed how oxygen plays an important role and how it effects on skeletal muscle.