Biopac Electromyography Worksheet
Due at the start of next week's lab

PART I — DATA RECORDING
This portion of the worksheet is for recording the data you collected and must be done in lab.

Subject Profile:

Subject name: _____

Gender: _____   Age: _____   Height: _____

Other characteristics as suggested by your instructor: _____

1. Record the data from the EMG and dynamometer measurements for each clench in the following table (you may not need all rows). Limit the results to 3 significant digits. See instructions for rows "0" and "fatigue".

Clench #	Clench Force (kg) [Ch 1-mean]	Peak-to-peak (mV) [Ch 3-p-p]	Mean EMG (mV) [Ch 40-mean]
0	*0*		
1			
2			
3			
4			
5			
6			
7			
fatigue			

2. Use the sustained clenches to measure the time to fatigue, the onset of which will be operationally defined as when a subject no longer is able to produce at least half of the maximum amount of force. Record the results from the sustained contraction:

Maximum Force: (largest observed value of **Ch 1-value**)	
50% of Maximum Force: (*calculate by dividing above number by 2*)	
Time to fatigue: (**Ch 40-delta-T**)	

3. Record the indicated data from your own and other groups in the table below.

Subject Initials	Gender	Age	Height or Other	Clench Force for strongest clench	Mean EMG for strongest clench	Time to fatigue (Delta-T)

PART II — DATA INTERPRETATION
*This portion of the worksheet will give you an opportunity to further analyze
and interpret the data you collected. It may be done at home.*

4. As the forces of a muscle contraction increases, the muscle must recruit increasing numbers of motor units. The increased number of active motor units should be reflected in increased EMG activity. To visualize this, plot the **mean EMG** (question 1, right column) against **clench force** (left column) in the graph below. The scale on each axis should be such that most of the graph is used.

Mean EMG (mV) vs. Clench Force (kg)

5. Does the mean EMG increase linearly (in a more or less straight line) with the force being produced? Is this result what you would expect based on your knowledge of motor unit recruitment?

6. Why did the EMG not show zero activity when the subjects hand and forearm were completely relaxed (question 1, row 0)?

7. During **tonus**, muscles are activating only a small percentage of their motor units at any one time. To estimate the percentage of motor units active, divide the mean EMG value for tonus (question 1, row 0) by the mean EMG when all motor units are active (i.e., the maximum-strength clench; row with highest force). Express as a percentage by multiplying by 100%. Show your calculation.

8. As the subject squeezed the dynamometer at maximum strength, the force exerted decreased over time. What <u>physiological</u> mechanisms within the muscle fibers could explain this decline in strength?

9. Compare the mean force and mean EMG values for the first two and last two seconds of the sustained contraction (question 1, last numbered row and "fatigue" row). As force declined, did the EMG values remain constant (reflecting a constant level of stimulation from the nervous system) or did EMG values decline in proportional amounts (reflecting reduced stimulation of the muscles)?

10. Based on the results in question 9, was the decline in strength the result of psychological or physiological fatigue (or both)? Explain.

11. Would you expect the subject's sex, age, height or other characteristics suggested by your instructor to influence how quickly they fatigued? Explain your reasoning.

12. Are the results from the class data on time to fatigue (question 3) consistent with your predictions? Explain.

PART III — GENERAL REVIEW QUESTIONS

13. What is the source of the signals that were detected by the EMG electrodes?

14. What is electromyography?

15. What is a motor unit?

16. What does the term "motor unit recruitment" mean?

17. What is meant by "tonus"?

18. Define "fatigue."

19. What is the difference between psychological fatigue and physiological fatigue?