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?

*If done correctly, it should come out pretty close to linear; but see graph. A linear result should be expected, since more force requires greater 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)?

*Even when relaxed, a small proportion of the motor units are activated to produce muscle tone (tonus).*

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%.

*Depends on data [typical values seem to range between 2 and 10%]*

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

*Decline in cellular levels of ATP; accumulation of Lactic Acid (if anaerobic).*

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)?

*Depends on data. [Typically there is a decline in EMG, but not as large as decline in force]*

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

*If EMG remained high while force dropped; fatigue is likely to be physiological
If EMG and force both drop by similar proportion, then fatigue is likely to be psychological.
Typical results suggest a combination of both factors may be in effect*
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.

Anything reasonable.

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

Depends on data.

PART III — GENERAL REVIEW QUESTIONS

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

Action potentials along the muscle fibers.

14. What is electromyography?

Measurement of the electric potentials produced by muscles.

15. What is a motor unit?

A group of muscle fibers innervated by a single motor neuron.

16. What does the term “motor unit recruitment” mean?

The activation of increasing numbers of motor units in order to produce increasingly larger contractions.

17. What is meant by “tonus”?

The slight amount of muscle tension produced by a resting muscle; results from the cyclical activation of small numbers of motor units.

18. Define “fatigue.”

A reduced ability to do work.

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

Psychological fatigue results from reduced stimulation of the muscle by the nervous system. Physiological fatigue is the reduced performance due to depletion of ATP and/or accumulation of lactic acid.