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1 st	1	2	3	4	5	
2 nd	1	2	3	4	5	

Name: _____

Muscle Physiology

LAB REPORT / QUESTIONS

Before you begin:

- 1) Prepare and attach a graph showing the relationship between stimulus voltage and twitch amplitude beginning from a subthreshold stimulus up to a supramaximal stimulus (from Exercises A & B).
- 2) Prepare and attach a graph of Muscle Length vs Tension for Exercise E.

Note: you can access the class data set for reference but should prepare your graphs from your own groups data. All graphs must be clearly titled and labeled.

Exercises A & B – Threshold, Submaximal & Maximal Stimuli

1. a. Which method, direct muscle stimulation or nerve stimulation requires the lowest threshold voltage? **Explain.**

b. Which produced the greatest maximal response (twitch amplitude)? **Explain.**
2. How is it possible to stimulate muscle contraction using external electrical stimuli, without involving the nerve?
3. How is it possible to produce muscle contractions of differing strengths when it is known that *muscle cells* contract completely when stimulated?

Exercises D – Summation, Tetanus & Fatigue

1. During summation, the muscle will experience incomplete and complete tetanus before fatigue sets in. Define and describe the differences between incomplete and complete tetanus.

2. Muscle contraction strength can be increased either by increasing the stimulus voltage (spatial summation = recruitment) or by increasing the stimulus frequency (temporal summation). Describe each.

Spatial summation = recruitment:

Temporal summation:

3. Explain how it is possible to lift light objects with an extended hand and hold your hand steady in an elevated position if the individual muscle cells that make up the muscle are only capable of producing twitches (quick contractions and relaxation). How is the whole muscle capable of this type of *sustained* contraction (without producing tetanus)?

4. List and describe the causes of muscle fatigue.

4. Rigor mortis is a transient stiffening of the muscles that occurs several hours after death. From your knowledge of muscle contraction physiology and fatigue, explain what causes rigor mortis?

Exercises E – Length-Tension Relationship

1. Explain how changing the length of a muscle cell (or all muscle cells within a muscle) can produce variable strength contractions.

2. What is the significance of the length-tension relationship to an athlete? Explain how stretching can increase muscle performance (keep your discussion limited to the effect on the length-tension relationship).

Clinical Correlation

The following questions are NOT intended as clinical training, thus clinical resolutions are typically not necessary. What is important is that you thoroughly explain the underlying physiological mechanism producing the problem and answer the question(s) asked. Realize that you may have to think for some time before being able to put all of the pieces together in order to answer the question(s). Some of the answers are not immediately obvious, but they are within your abilities.

Read through the provided information and all questions, looking up the definition of terms as necessary. Compare all values provided to the normal range in order to determine if they are greater or less than normal (as necessary). Review your notes and the text (you should be able to solve the problem using material that has been covered in class to date).

Background:

A mother, concerned about her 12 year old boy who has been complaining of fatigue and muscle pain since starting the seventh grade, brings him to the medical center for a check up. The family physician recalls that the boy has never been terribly athletic and that there is a family history of McArdle's disease. While speaking with the boy the doctor learns that, for the first time, he has had to do hard exercising in PE class is . He tells the doctor that he doesn't like PE class, that it hurts and makes him tired. Physical examination reveals that the boy is has a reduced range of flexibility due to mild muscle contracture. Given a family history of McArdle's Disease the doctor requests lab tests which reveal high levels of muscle glycogen and a deficiency in myophosphorylase B, characteristic of this mild inherited muscular disorder.

Myophosphorylase B is an enzyme involved in the breakdown of glycogen in the production of ATP in muscle cells.

1) Explain the role of ATP in a normal muscle contraction (note: there are at least 2 important roles that you should mention).

2) How will the ability to produce ATP be altered in a McArdle's Disease Patient? Explain. (note: it is not necessary to describe the role of myophosphorylase in cellular metabolism).

3) Explain how this change in ATP content in muscle cells leads to contracture.

Exercises A & B – Threshold, Submaximal & Maximal Stimuli

	Direct Muscle Stimulation		Nerve Stimulation	
	Stim (V)	Twitch (g)	Stim (V)	Twitch (g)
Threshold				
Submaximal				
Submaximal				
Submaximal				
Submaximal				
Submaximal				
Submaximal				
Submaximal				
Maximal				

Graph the relationship between stimulus voltage and twitch amplitude.



Exercises E – Length-Tension Relationship

Graph the relationship between muscle length and twitch amplitude.

