

THE BIG SQUEEZE

INTRODUCTION: *Aerobic respiration* is the breakdown of sugars in the presence of oxygen to produce ATP energy, CO₂ and H₂O. *Anaerobic respiration* is the breakdown of sugars in the absence of oxygen to produce ATP energy. There are two kinds of anaerobic respiration: **alcoholic fermentation** and **lactic acid fermentation**. In this lab, we will be examining the effects of prolonged exercise to mimic anaerobic respiration conditions. Partners (2) will have one clothes pin and take turns either squeezing or timing/recording.



OBJECTIVES: By the end of this activity, you will be able to...

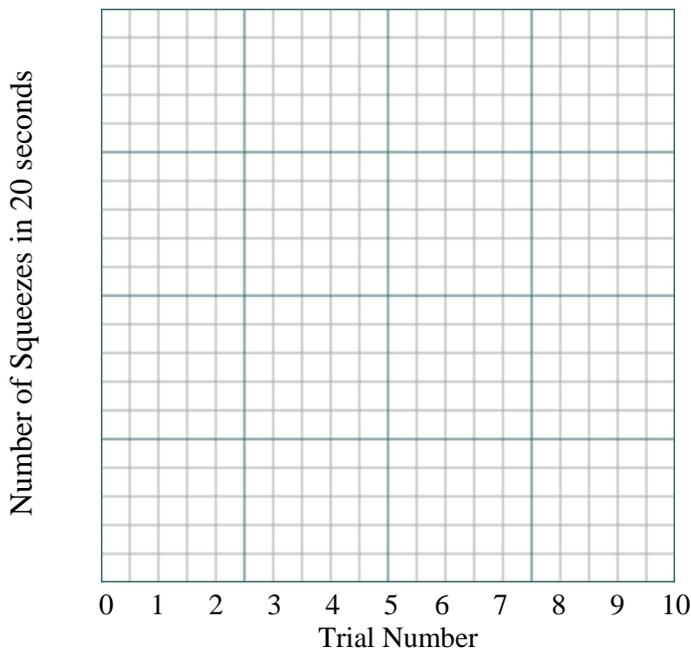
- Record and graph experimental data and manipulate an experiment with testable hypotheses.
- Determine when muscle cells convert from the aerobic respiration pathway to anaerobic respiration.
- Analyze the importance of the metabolic pathway of anaerobic respiration and its effect in muscle cells.

MATERIALS: 1 lab sheet per person, 1 clothes pin, 1 stopwatch

INSTRUCTIONS: PART ONE

1. The “squeezer” will count how many times they **FULLY SQUEEZE** a clothes pin for 20 seconds.
2. The “squeezer” will rest for 20 seconds between each of ten trials.
3. The “timer” will time each 20 second trial and each 20 second rest period.
4. After each trial the “timer” will jot down how many squeezes their partner did in the elapsed time in Data Table 1.
5. Graph your data in the space below. Include a title and an appropriate scale for the y-axis. Remember you are **COMPARING** the change across each trial.

Title: _____



DATA TABLE 1		
Trial #	Partner 1 # of squeezes in 20 seconds	Partner 2 # of squeezes in 20 seconds
1		
2		
3		
4		
5		
6		
7		
8		
9		
10		

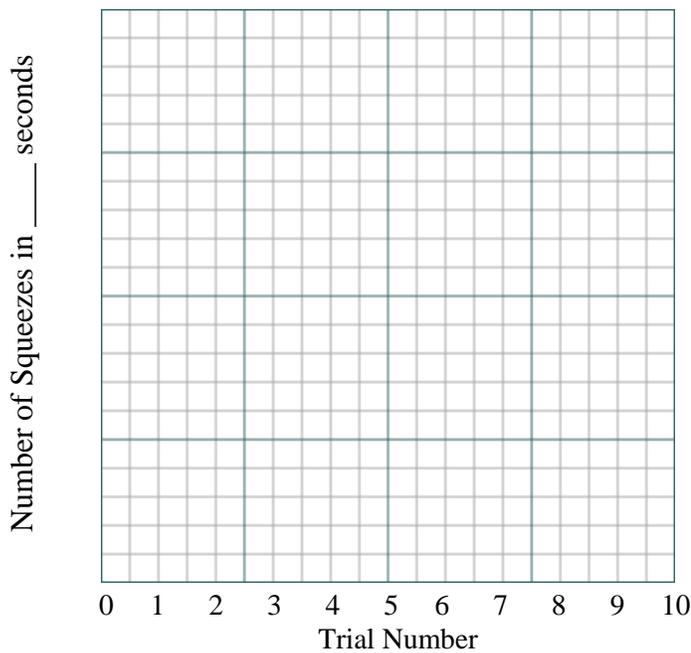
INSTRUCTIONS: PART TWO

1. Decide with your partner on a variable to change (i.e. squeeze time, rest time, or some other variable such as switching to the less dominant hand).
2. Describe in detail the variable you will change:

3. **HYPOTHESIS:** (How do you think the changed variable will affect your results?)

4. Repeat the experiment as described in part 1 with the changed variable.
5. Graph your data in the space below. Include a title and an appropriate scale for the y-axis.

Title: _____



DATA TABLE 2		
Trial #	Partner 1 # of squeezes in ___ seconds	Partner 2 # of squeezes in ___ seconds
1		
2		
3		
4		
5		
6		
7		
8		
9		
10		

DATA ANALYSIS & RESULTS: Answer the following questions.

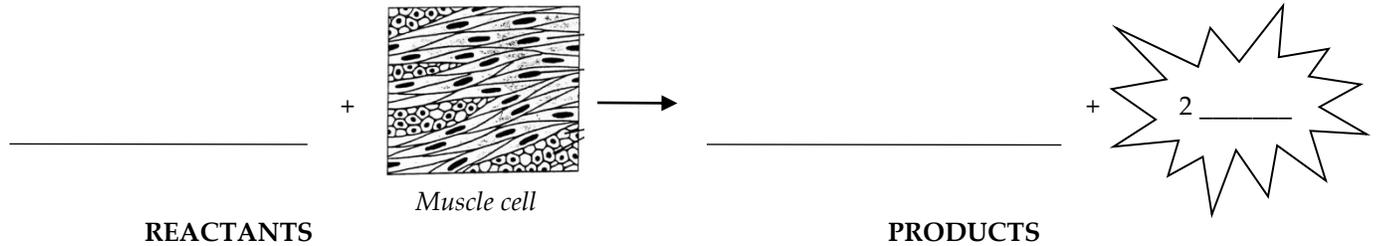
1. What does "aerobic" and "anaerobic" mean?
2. What produces more ATP energy, aerobic or anaerobic respiration? _____
3. Did squeezing the clothes pin get easier or harder to do over the ten trials?
4. What type of cellular respiration were your hand muscles using **before squeezing the clothes pin** and what type of cellular respiration were your hand muscles using **once you started to get sore**?

Before: _____ After: _____

5. At what point in experiment 1 do you think that your muscle cells converted from aerobic respiration to lactic acid fermentation? (Refer to your graph # 1.) _____
6. At what point in experiment 2 do you think that your muscle cells converted from aerobic respiration to lactic acid fermentation? (Refer to your graph # 2.) _____

CONCLUSION QUESTIONS: Using your data and analysis, answer the following questions.

7. Fill in the following blanks of the **LACTIC ACID FERMENTATION** Pathway.



8. Muscle soreness after strenuous exercise is a common occurrence. The reason for the soreness, once thought to be due to the production of lactic acid, is now being questioned by scientists. Although there is no definitive answer to muscle soreness, scientists believe that it is due to a combination of molecules (or metabolites) produced during anaerobic respiration OR due to injury of the muscle cell (and subsequent release of products that trigger an inflammatory response). Make a hypothesis about what you think may be causing your muscle soreness after squeezing the clothes pin for 10 trials and propose a way to test your hypothesis.
9. What were the differences between your two experiments? How did changing a variable (i.e. squeeze time, rest time or some other variable that you chose) lead to different results? Discuss your findings here.
10. Think about what might happen if you did not stop squeezing the clothes pin.
- a. What do you think would happen to your muscle cells and body?
 - b. Could you survive off lactic acid fermentation alone? Why or why not?
11. Where does Aerobic Respiration occur in the cell? _____
- Where does Anaerobic Respiration occur in the cell? _____