

# Muscle Fatigue Lab

**Problem:** How does muscle fatigue affect the amount of work that muscles can do?

**Background:** As skeletal muscles contract and relax, they move bones in your body. This work requires energy. Muscles get energy from ATP molecules made through 3 processes of direct phosphorylation, aerobic respiration and anaerobic respiration. During continuous activity, the muscles begin to use up their energy supply and oxygen and start to accumulate waste products. As a result, the muscles become fatigued, losing their ability to contract. In this lab, you will observe how muscle fatigue affects the amount of work that muscles can do.

**Materials:** Stopwatch, Tennis Ball, Sneakers and your Body

**Procedure:** Work in pairs or trios, but everyone has to do each exercise. You and your partner(s) will take turns doing the following experiments.

## **Arm Flexors and Extensors**

1. Keeping the palm of your hand upward, stretch out your arm. Use your non-writing hand. Raise your hand by bending your arm at the elbow. Then lower your hand by straightening your arm. Try to keep your upper arm steady as you move your hand up and down.
2. Continue raising and lowering your hand for 1 minute. Move it as rapidly as you can without straining yourself or losing control of the motion. Have your partner count and record the number of times you can raise and lower your hand in 1 minute.
3. Repeat step 2 seven more times. **Do not stop between trials.**
4. Switch roles with your partner and repeat the exercise.

**NEVER STOP EXERCISING. REALLY PUSH IT. DO NOT STOP BETWEEN TRIALS.**

**Data:**

Name	1 <sup>st</sup> min	2 <sup>nd</sup> min	3 <sup>rd</sup> min	4 <sup>th</sup> min	5 <sup>th</sup> min	6 <sup>th</sup> min	7 <sup>th</sup> min	8 <sup>th</sup> min

## **Finger and Hand Flexors and Extensors**

1. Grasp the tennis ball in your **non-writing** hand. A legal squeeze causes a dent in the ball made by using the heel of the hand.
2. You are to record the number of squeezes in your Data Table every 10 seconds, but you are NOT TO STOP between trials.
3. You will be squeezing the tennis ball without stopping for 100 seconds.

**NEVER STOP SQUEEZING. REALLY SQUEEZE. DO NOT STOP BETWEEN TRIALS.**

**Data:**

Name	10 sec	20 sec	30 sec	40 sec	50 sec	60 sec	70 sec	80 sec	90 sec	100 sec

## **Foot Plantar Flexors and Dorsiflexors**

1. Stand with your legs shoulder width apart. You will raise your heels and stand up on your toes. And then relax your heels back to the ground. (A calf raise)
2. You are to record the number of calf raises in your Data Table every 10 seconds, but you are NOT TO STOP between trials.
3. You will be performing this exercise without stopping for 100 seconds.  
**NEVER STOP EXERCISING. REALLY PUSH IT. DO NOT STOP BETWEEN TRIALS.**

*Data:*

Name	10 sec	20 sec	30 sec	40 sec	50 sec	60 sec	70 sec	80 sec	90 sec	100 sec

*Conclusions:*

1. After how many minutes did your arm muscles become obviously fatigued? How does the data show this? Describe how your muscles felt.
2. How did your squeezing hand and arm feel towards the end of your squeezing time period?
3. By looking at your results of your calf raises, pinpoint when you first had a lot of lactic acid buildup. What about your data tells you there must have been lactic acid present? What does the presence of lactic acid tell you about the energy available to your cells?

4. How long did it take for the burning feeling to disappear?

	Arm	Hand	Lower Leg
How Long?			

5. Explain how resting for 10 minutes between trials would have affected your results. What would occur in the body? Explain your answer in terms of the 3 processes that recharge ADP back into ATP.