Sliding Filament Lab: Low-write

Name _____

Date _____

Period _____

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Do Now This is a real electron microscope picture of one muscle cell. The light and dark stripes repeat all along the cell. When the muscle contracts, the dark stripes move closer together. 2 minutes, before you open the lab

A. When the dark stripes move closer together, what do you think happens to the width of each dark stripe?

☐ It gets thinner ☐ It stays the same ☐ It gets wider

B. What could make the stripes move closer together?

_____

☐ I can name the bands of a sarcomere and say which filaments make each one.

☐ I can use a model to show the filaments slide and do not shrink: the sarcomere, I band and H zone shorten, the A band stays the same.

☐ I can explain how many tiny shortenings add up, and why a muscle pulls hardest at a middle length.

Part 1. Measure the bands (Tab 1)

SEP 2 Developing and Using Models · CCC Structure and Function

Pick Relaxed. Tap each band, read the ruler, subtract, and type the length. Then do the same for Contracted.

1. Copy your measurements from the lab. For "Change", write shorter or same.

Band	Relaxed (µm)	Contracted (µm)	Change: shorter, longer or same?
Sarcomere (Z disc to Z disc)			
A band			
I band			
H zone			

2. Which band stayed the same length? ☐ sarcomere ☐ A band ☐ I band ☐ H zone

3. The sarcomere got shorter by ☐ 0.4 µm ☐ 1.6 µm ☐ 2.1 µm Which bands got shorter by that same amount?

☐ A band ☐ I band ☐ H zone

4. Watch the thick (red) filaments when you switch to Contracted. Do they get shorter?

☐ Yes, they shrink ☐ No, they stay the same length and the thin ones slide in

READ FIRST. In the lab, find the green Learn It box and read it. Then answer 5 to 7.

5. Model check (SEP 2). What makes each band? Tick one in each row.

A band	☐ only thin filaments	☐ only thick filaments	☐ the whole thick filament
I band	☐ only thin filaments	☐ only thick filaments	☐ the whole thick filament
H zone	☐ only thin filaments	☐ only thick filaments	☐ the whole thick filament

6. Predict. A stretched sarcomere is 3.2 µm. Example, not yours: for a 2.8 sarcomere, I band = 2.8 – 1.6 = 1.2 and H zone = 2.8 – 2.0 = 0.8. Yours: A band = _____ I band = 3.2 – 1.6 = _____ H zone = 3.2 – 2.0 = _____

7. Finish the sentence. Use the word bank. The filaments do not get _____. They _____ past each other, so the _____ gets bigger and the A band stays the _____.

Word bank: slide · overlap · same · shorter

Part 2. Add them up (Tab 2)

SEP 5 Using Mathematics · CCC Scale, Proportion, and Quantity

Contract every sarcomere in all three fibers. Try "Only one sarcomere" once. Then do the math in Step 3.

8. Copy your records for the three fibers.

Fiber	Sarcomeres in a row	Contracted length (µm)	Shorter by (µm)
1 mm			
1 cm			
10 cm			

9. When only one sarcomere in the 1 cm fiber contracted, the fiber got shorter by ☐ 0.4 µm ☐ 1,600 µm ☐ 0 µm

10. Percent shorter. Example, not yours: 10 to 8 is 2 ÷ 10 = 0.20 = 20%. Yours: 2.5 to 2.1 is 0.4 ÷ 2.5 = _____ = _____%

READ FIRST. In the lab, find the green Learn It box and read it. Then answer 11 to 12.

11. A whole muscle shortens by centimeters because thousands of sarcomeres in a row each shorten ☐ a tiny bit, and it adds up ☐ by centimeters

12. Math. A fiber is 50,000 µm long. Sarcomeres: 50,000 ÷ 2.5 = _____. Shorter by: that number × 0.4 = _____ µm = ☐ 0.8 cm ☐ 8 cm ☐ 0.08 cm

Part 3. Length and force (Tab 3)

SEP 4 Analyzing and Interpreting Data · CCC Cause and Effect

Slide to each length in the table. Press Record each time. Count the green heads and read the force.

13. Fill in the table from your records.

Sarcomere length (µm)	Heads that reach actin (of 28)	Force (% of most)
1.8		
2.1		
2.5		
2.9		
3.6		

14. At which length was the force biggest? ☐ 1.8 ☐ 2.1 ☐ 2.5 ☐ 2.9 ☐ 3.6 As the sarcomere got longer than 2.2 µm, the number of heads that reach actin ☐ went down ☐ went up ☐ stayed the same

READ FIRST. In the lab, find the green Learn It box and read it. Then answer 15 to 16.

15. At 3.6 µm the force was 0 because the thin filaments ☐ do not overlap the thick filaments, so no heads reach actin ☐ got too short

16. Explain it (SEP 6). Finish each sentence. The therapist is ☐ right ☐ wrong. In the lab, the force was _____% at 2.1 µm and _____% at 3.6 µm. At a middle length the filaments _____ the most, so the most myosin heads can pull.