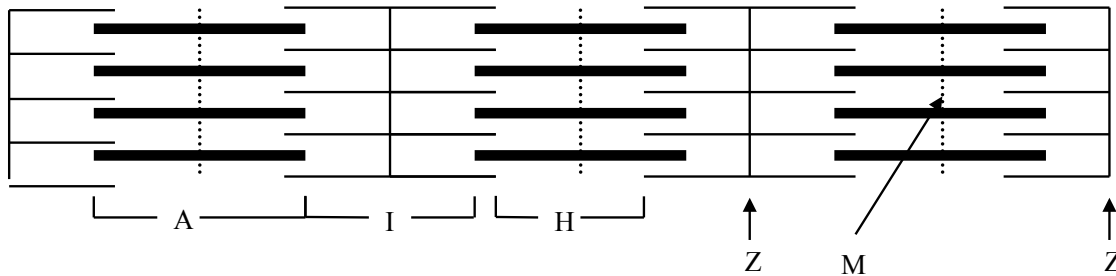


Muscle Contraction

Model 1: Anatomy of a Sarcomere

The sarcomere is the functional (contractile) unit of skeletal muscle. It is the region of a myofibril between two Z discs. Each sarcomere is approximately 2 mm long.



QUESTIONS:

1. Label the thick horizontal filament **THICK** filament.
2. Label the thin horizontal filament **THIN** filament.
3. How many sarcomeres are shown in the above model?
4. Based on your observations of the location of thick and thin filaments, describe each of the following:
 - a) A band
 - b) I band
 - c) H zone
 - d) Z disc
 - e) M line
5. Using complete grammatically correct sentences, describe how the H zone differs from the A band.
6. How many sarcomeres do you think are in a muscle cell found in your quadriceps?
7. Do you think you would have more or fewer sarcomeres in an eye muscle?

Model 2: Comparing Relaxed and Contracted Sarcomeres

Figure 1. Relaxed sarcomeres.

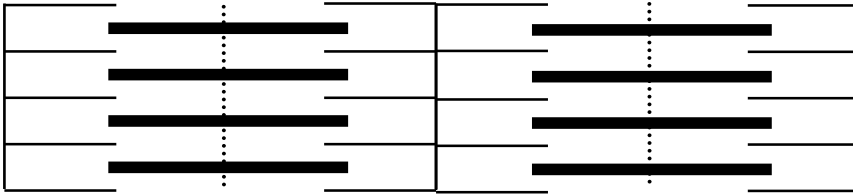
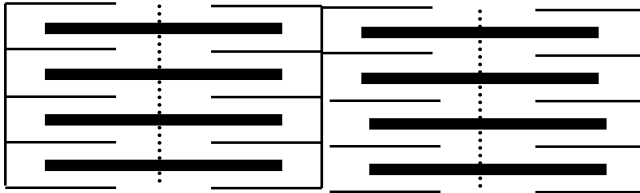


Figure 2. Contracted sarcomeres.



QUESTIONS:

8. In Figures 1 and 2 above, label the A-bands, I-bands, and H-zones. Measure and record the lengths (in mm) of these structures and the thick and thin filaments in the chart below:

Structure	Length in Relaxed Sarcomere (mm)	Length in Contracted Sarcomere (mm)	Did the length change between Figures 1 and 2? (Y/N)
Thick filament			
Thin filament			
A band			
I band			
H zone			
Sarcomere			

8. Discuss the data from the table in Question 8 with your group and describe what happens to thick and thin filaments when muscles contract:

9. As a group, examine the diagram in Model 2. Why is there a limit to the amount of shortening that can occur in a sarcomere during muscle contraction?

Model 3: Cross Sections Through a Sarcomere

Model 3 shows cross-sections of a sarcomere that show the filaments at various locations within a sarcomere.

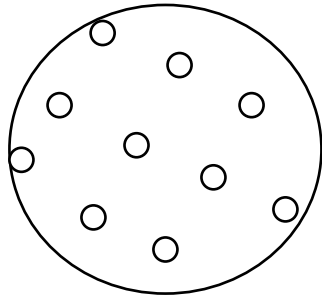


Fig. A

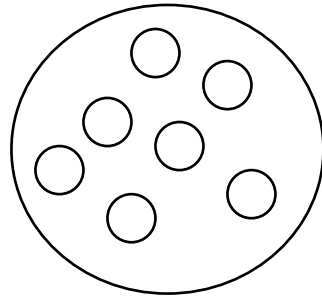


Fig. B

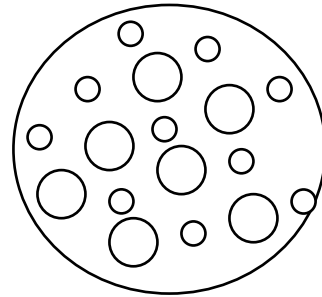
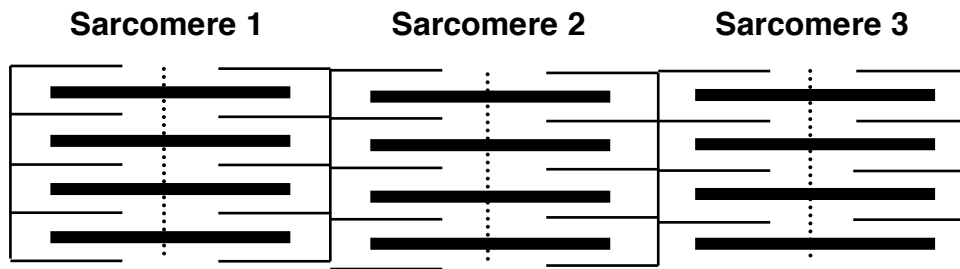


Fig. C

QUESTIONS:

10. Label the thick and thin filaments in Figs. A, B, and C above.
11. There are three sarcomeres shown in the diagram below.

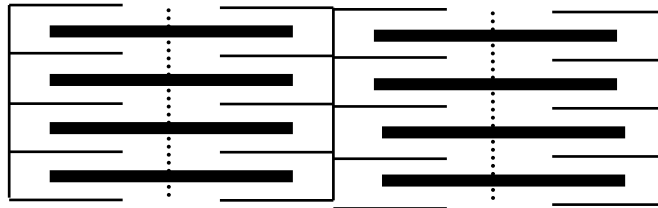


- a) In Sarcomere 1, identify the location within the sarcomere of the cross section indicated by Figure A in Model 3. Draw a vertical line and label it **A**.
 - b) In Sarcomere 2, identify the location within the sarcomere of the cross section indicated by Figure B in Model 3. Draw a vertical line and label it **B**.
 - c) In Sarcomere 3, identify the location within the sarcomere of the cross section indicated by Figure C in Model 3. Draw a vertical line and label it **C**.
12. Which of the figures (A, B, or C) represents a cross section in the H zone?

13. Which of the figures (A, B, or C) represents a cross section in the I band?

14. Which of the figures (A, B, or C) represents a cross section in the ends of the A band?

15. On the figure below, shade in the area of the A band. Then identify the location of the I band and label it.



16. When viewing skeletal muscle through a microscope, you can easily see the dark and light striations of the muscle fiber. Compare the shading in the diagram in Question 15 and in the photograph of muscle fiber as seen through a microscope below. What forms the dark and light bands?



Photo courtesy of LUMEN (Loyola University Medical Education Network)

17. On the photograph above, label the A band, I band, Z disc, and a sarcomere.

18. The *sliding filament* theory is used to explain the physiology of skeletal muscle contraction. On your own, using what you have learned from this activity, write your own description of what the sliding filament theory states.

19. Next, discuss your predictions with your group members and develop a definition of the sliding filament theory with regard to thick and thin filaments. (Use grammatically correct sentences).