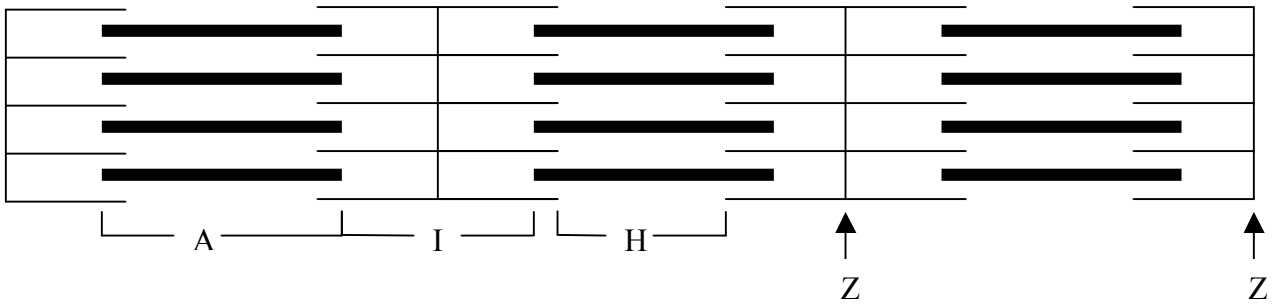
Muscle Contraction

Model 1 – Anatomy of a Sarcomere



Examine the above model, then answer the following 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. Discuss with your team, and based on your observations of the location of thick and thin filaments, describe each of the following:

- A band
- I band
- H zone
- Z disc

5. Describe how the H zone differs from the A band. (Use grammatically correct sentences)

6. How many sarcomeres do you think are in a muscle cell found in your quadriceps? Do you think you would have more or fewer sarcomeres in an eye muscle?

Model 2 – Comparing Relaxed and Contracted Sarcomeres

Relaxed

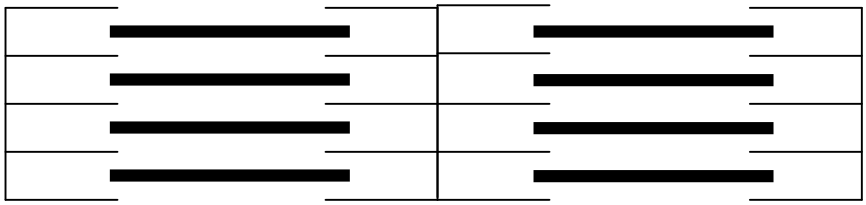


Figure 1. Relaxed sarcomeres.

Contracted

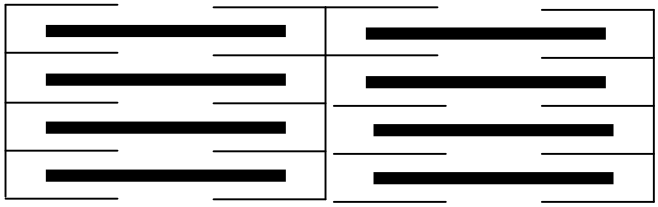


Figure 2. Contracted sarcomeres.

7. 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. Using the data from the above table, discuss with your group and describe what happens to thick and thin filaments when muscles contract.

9. As a group, observe the diagram in Model 2 and describe possible reasons why there is a limit to the amount of shortening that can occur in a sarcomere during muscle contraction.

Model 3 – Cross Sections Through a Sarcomere

The diagrams in Model 3 are cross sections of a sarcomere that show the filaments at various locations within a sarcomere.

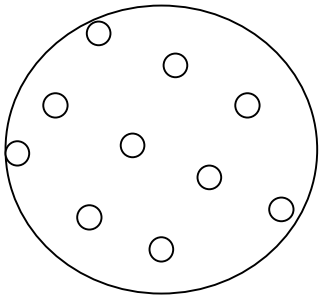


Fig. A

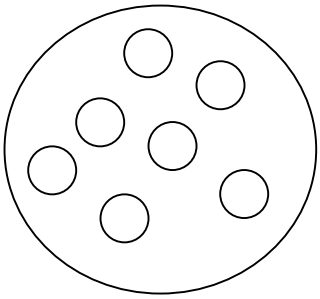


Fig. B

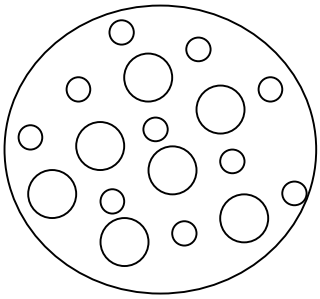
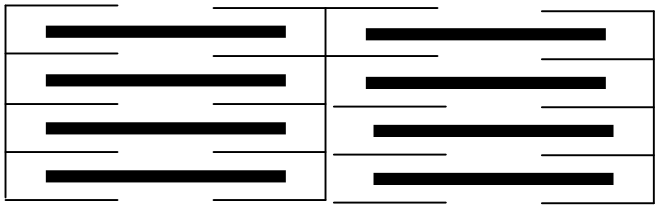


Fig. C

10. Label the **thick** and **thin** filaments in Figs. A, B, and C above.

11. In the diagram below, draw three vertical lines showing the locations within a sarcomere of the cross sections indicated by Figures A, B, and C. Label each of the lines.

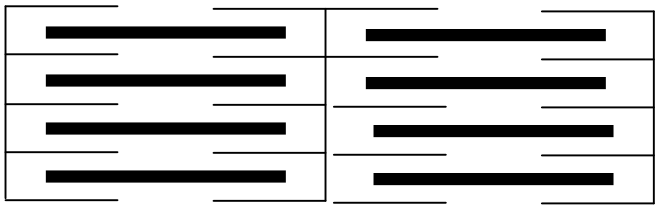


12. Which of the figures (A, B, or C) represents a cross section in the H zone?

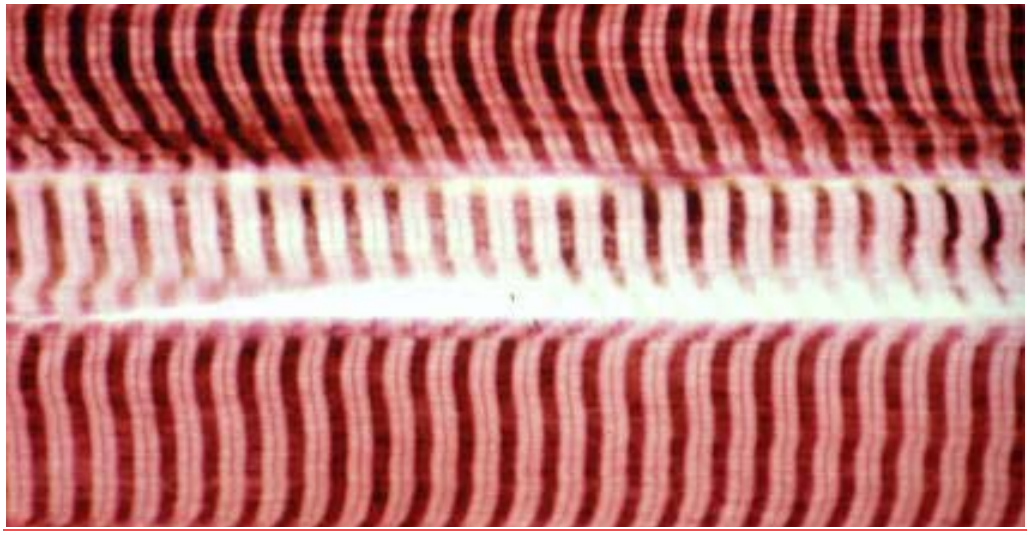
13. Which of the figures (A, B, or C) represents a cross section in the I band?

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. Identify the location of the I band.



16. When viewing skeletal muscle through a microscope, you can easily see the dark and light striations of the muscle fiber. Based on the shading in the figures above and below, hypothesize what forms the dark and light bands in the muscle fiber as seen through a microscope.



Source: LUMEN - Loyola University Medical Education Network

17. How many muscle cells are in the photomicrograph above?

18. On the figure above label the A band and I band. Label the Z disc.

19. 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, predict what the sliding filament theory states. 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)

20. How do you think muscles increase in size? Discuss this with your group and report all possibilities.