

Chapter 2

Structure of Muscle Tissue and Muscle Contraction

Lecture Outline

- I. Types of Muscle Tissue and General Characteristics of Each
 1. Smooth Muscle
 2. Skeletal Muscle
 3. Cardiac Muscle
- II. Skeletal Muscle Structure
 1. Connective Tissue Layers
 - A. Epimysium
 - B. Perimysium
 - C. Endomysium
 2. Structure of the Muscle Fiber
- III. Muscle Fiber Types
 1. Classification Systems
 2. Three Fiber Types and Their Characteristics
 - A. Slow Oxidative
 - B. Fast Oxidative Glycolytic
 - C. Fast Glycolytic
 3. The Motor Unit
 4. Determinants of Fiber Type in an Individual
- IV. Structure of the Myofibril and the Contractile Mechanism
 1. The Structural Unit of the Myofibril: The Sarcomere
 2. Sliding Filament Model of Muscle Contraction
 - A. Steps involved
 - B. Role of ATP
- V. Summary

Student Assignments

1. In small groups, discuss how the structural components of the sarcomere are related to the way in which muscle tissue contracts.
2. *Develop reference skills.* Find an article on the subject of fiber typing in athletes and summarize the practical implications of the article for the class.
3. List three sports/events where you might expect athletes to have a high percentage of (A) FG, (B) FOG, and (C) SO type fibers. Explain why.
4. Draw a diagram outlining the series of events that occur during skeletal muscle contraction. Include all relevant structures and events.

Discussion/Essay Questions

1. Describe the composition and distribution of muscle fibers within a motor unit.
2. Describe the process of muscle contraction from depolarization of the motor neuron to the breakdown of ATP.
3. Describe and contrast the two theories of ATP use during muscle contraction.
4. Diagram a cross-sectional and a longitudinal view of skeletal muscle. Label all relevant structures, including connective tissue layers.
5. Discuss the different methods of classifying muscle fiber type. In what ways are the resulting categories related? How are they different?

Test Questions

1. Which of the following structures is the cell membrane of a muscle fiber?
 - A. epimysium
 - B. perimysium
 - C. endomysium
 - D. sarcolemma
2. The perimysium divides muscle into which of the following?
 - A. Filaments
 - B. Myofibrils
 - C. Fasciculi

- D. Fibers
3. What does a motor unit contain?
 - A. One fiber type
 - B. All fiber types in equal proportions
 - C. All fiber types in different proportions
 - D. Any of the above, depending on the muscle
 4. What happens with endurance training?
 - A. FG fibers improve their oxidative capacity.
 - B. FOG fibers become more glycolytic in nature.
 - C. SO fibers improve their anaerobic capacity.
 - D. Both A and B.
 5. Which of the following are most resistant to fatigue?
 - A. SO fibers
 - B. FOG fibers
 - C. FG fibers
 - D. Both B and C
 6. Which of the following is the neurotransmitter of the motor nerves?
 - A. Serotonin
 - B. Epinephrine
 - C. Acetylcholine
 - D. Norepinephrine
 7. Which of the following is the functional unit of the myofibril?
 - A. A band
 - B. I band

- C. C. sarcomere
 - D. Z line
8. What happens during muscle contraction?
- A. The A band shortens.
 - B. The H zone may disappear.
 - C. The I band stays the same length.
 - D. Z lines are stretched further apart.
9. Depolarization of the sarcolemma results in which of the following?
- A. Calcium release from the sarcoplasmic reticulum
 - B. Calcium uptake by the mitochondria
 - C. Calcium uptake by the t-tubules
 - D. Calcification of muscle tissue
10. What happens during relaxation?
- A. Calcium is removed from the sarcoplasmic reticulum.
 - B. Calcium is bound to troponin.
 - C. Actin-myosin interaction is inhibited.
 - D. None of the above.

Quiz Answers

- 1. D
- 2. C
- 3. A
- 4. A
- 5. A
- 6. C

7. C

8. B

9. A

10. C

Chapter 2 Lab

Isokinetic Assessments of Muscle Function.