Study Guide C11 (0723)
Muscle Tissue // Nerve Muscle Relationship - The Neural Muscular Junction // The Sliding Filament Theory - Contraction Cycle // Motor Units // Isotonic VS Isometric Contractions // Length Tension Relationship // Slow VS Fast Muscle Fibers // Muscle Conditioning // Muscle Energy Sources

Muscle Tissue (C11_1)

1 Why are skeletal muscle cells called muscle fibers? What common cell organelles are renamed in skeletal muscle fibers? What is the common prefix?

2 At one point in time, scientist thought muscle fibers contracted like an "accordion". In the 1950's, a new hypothesis was formulated. What was the name of the new hypothesis and how does it explain muscle contractions?

3 Study slide #7. You need to memorize the structure of a muscle fiber and be able to identify all the structures and their functions. Srcolemma, sarcoplasm, myobibils, multiple nuclei, mitochonria, sarcoplasmic reticulum, terminal cisternae, T tubles, the triad,

4 Are muscle fibers able to undergo mitosis? What state are muscle fibers in? What occurs when muscle fibers are damaged beyond repair?

5 What is the functional contractile unit of a skeletal fiber?

6 There are three classes of proteins in the sarcomere: contractile proteins, regulatory proteins, and structural proteins. What secondary proteins are associated with each group and what are their functions? (Note - for the structural proteins you only need to know titin and dystrophin)

7 Draw a sarcomere and include the following structures: Z discs, thick myofilaments (myosin), thin filament (actin), A band, I band, titin filament (see slide #30)

8 What molecule is used to construct a thick filament? How are these monomers arranged? How do we describe the head of these monomers arranged around the shaft of the thick filament?

9 What are the three components of a thin myofilament? How is the fibrous actin strand made and what does each subunit have? How is the tropomyosin molecule positioned on the fibrous actin? What does this molecule block? How is the troponin molecule positioned on the tropomyosin? What binds to troponin? (see slide 36)

10 What are the contractile proteins? What are the regulatory proteins? (see slide 38)

11 What is the function titin?

12 What is the function of linking proteins? What two structures are connected by linking proteins? What occurs if the dystrophin linking protein is missing? The name of the disease? Explain why this is a genetic disease?

Nerve Muscle Relationship & The Neural Muscular Junction (C11.2)

13 What must occur to start a voluntary skeletal muscle contraction? Where is it initiated? How is it transmitted to the skeletal muscle? What are the names of the structures used to connect the brain to the skeletal muscle? What happens if this path is broken? What condition occurs when the path is broken?

14 What is a synapse? What do we call a synapse between a nerve and a muscle fiber? What are the three components of a synapse? What is a synaptic knob and what is inside of this structure? What is acetylcholinesterase and where is it located within the neural muscular junction? Function?

15 In physiology, what does it me to be excitable? What two tissues have this capacity? What is the difference between voltage and current? What is the difference between a resting membrane potential and an action potential?

Sliding Filament Theory

16 What are the four phases of a skeletal muscle contraction cycle? What occurs during each step? (See Web site tutorial > **Sliding Filament Theory / Test Your Knowledge About the Skeletal Muscle's Structure & Function**

17 What is the "power stroke"? What is the role of calcium? What happens when new ATP molecule binds to myosin head? What would happen if no new ATP was available?

18 What is a motor unit? How do we use them? Give example. Where do we have small motor units? Where do we have large motor units? Why?

19 What is rigor mortis? (not on exam)

Isotonic VS Isometric (C11.3)

20 What type of skeletal muscle contraction generates force without the muscle shortening? What prevents the muscle from moving? Where is this type of contraction used in your physiology? If the force of the muscle exceeds the resistance, then what happens?

21 What type of skeletal muscle contraction just exceeds the resistance so the muscle shortens as the muscle's tension remains constant? What is the difference between concentric and eccentric contraction?

22 Go to an object and slowly start to pick up the object. Explain how the two different types of skeletal muscle contractions are used in your feat of strength.

23 You have been told a thousand times to lift with your legs and not with your back. So, there is a really heavy box and you need to lift it off the floor. If you bend over with your back and don't flex your legs, then what will happen to the sarcomeres in the longitudinal muscles in your back? Explain the length tension relationship using this example. (draw this illustration C11_3 #7)

24 Many children enjoy playing sports. Some children excel running 100 yard dashes while other children excel running long distance races. How may we explain this phenomena by measuring the enzyme concentration inside skeletal muscle cells? How does this help explain how we would use the gastrocnemius and soleus muscles?

25 How does the skeletal muscle change when you engage in either endurance training, resistance training, or disuse? (see C11_3 slide #17)

26 What is recruitment? What is another way to describe this phenomena?

Muscle Energy Sources (C11_4)

27 In skeletal muscle physiology, what must occur to heart and respiratory rates as you move from a resting state, to a walking state, and then to a running state? ATP provides the energy for muscle contractions. What are the sources of the ATP for the muscle fiber? (see C11_4 slide #2)

28 When thinking about ATP, why do we say use it or lose it?

29 What are the two metabolic pathways used to make ATP? Requirements? Limitations? How is the ability of the heart and respiratory systems to provide oxygen and glucose to the muscle fiber as your "ramp up" from a resting to a running state? Do you think there maybe a period of a deficient in oxygen and glucose?

30 At the start of a race, what little "free ATP" is available is used up in the first second. What is the next available source to re-energize ADP into ATP so you can run for another few seconds?

31 You need oxygen to make ATP with the Krebs Cycle, but as you start running the heart/respiratory dynamic can not deliver enough oxygen. Is there another immediate source of oxygen available to the muscle fiber? What is the source? How long may it keep you running?

32 You are still at the beginning of the race, about five seconds into the race and you have exhausted the cytoplasmic ATP, the myoglobin oxgyen to drive the Krebs Cycle, and the creatine phosphate sysemt as sources of ATP. The heart/respiratory is still "ramping up" and not enough oxygen and glucose is being delivered to the muscle fiber. What must the muscle fiber now resort to in order for you to keep running? As you continue to run and now you are 40 seconds into the race, how may your muscles start to feel? (This is sometimes called "hitting the wall".)

33 After 40 seconds, now the heart and respiratory systems are able to supply the skeletal muscle with all the oxygen and glucose needed so you can continue to run without the feeling of muscle fatigue. At this point, how is the muscle making ATP?

34 If you watch a basketball game, when the play is stopped, the players are often bent overall and breathing as fast or faster then when the game was in progress? Why? What is this condition called?