**Muscle Microanatomy and Physiology Review Questions**

**Mutiple Choice**

1. Skeletal muscle is attached to bone by strong connective tissue structures called
   1. ligaments
   2. tendons
   3. myofibrils
   4. fascicles
2. A bundle of muscle fibers wrapped together is called a
   1. sarcolemma
   2. fascicle
   3. z-disc
   4. myofibril
3. Structures that bring nutrients and oxygen to your muscles and carry waste products like carbon dioxide and lactic acid away are
   1. fascicles
   2. myofibrils
   3. mitochondria
   4. blood vessels
4. Which one of the following is composed of myosin protein?
   1. thick filaments
   2. thin filaments
   3. z lines
   4. sarcolemma
5. A sarcomere is
   1. a skeletal muscle cell’s nucleus.
   2. the skeletal muscle cell’s membrane.
   3. the contractile unit between two Z lines.
   4. the organelle that produces ATP for the muscle cell.
6. Which one of the following groups of skeletal muscle terms is placed in order from largest to smallest?
   1. muscle fiber, myofibril, thin actin filament, fascicle
   2. fascicle, muscle fiber, thin actin filament, myofibril
   3. thin actin filament, myofibril, muscle fiber, fascicle
   4. muscle fiber, myofibril, fascicle, thin actin filament
   5. fascicle, muscle fiber, myofibril, thin actin filament
7. Thick filaments use this molecule for energy to pull thin filaments together.
   1. Calcium
   2. ATP
   3. Oxygen
   4. Lactic acid
8. The mechanical force of contraction is generated by
   1. the rapid removal of contractile proteins from the muscle cell.
   2. the shortening of thick filaments.
   3. the pulling of thin filaments past thick filaments, which brings the z-lines closer together.
   4. the shortening of thin filaments.
9. This type of energy production requires oxygen
   1. Anaerobic glycolysis
   2. Aerobic respiration
   3. Lactic acidosis
   4. Pyruvate production
10. Which type of energy production produces much more ATP per glucose molecule?
    1. Aerobic glycolysis
    2. Anaerobic glycolysis
11. Cell organelle where aerobic respiration takes place.
    1. sarcolemma
    2. nucleus
    3. mitochondria
    4. sarcoplasmic reticulum
12. Acidic byproduct of anaerobic energy production.
    1. pyruvic acid
    2. lactic acid
    3. phosphoric acid
    4. hydrochloric acid
13. During an asthma attack, the person’s airway closes and they are unable to breathe normally. Not enough oxygen gets in the person’s bloodstream. As a result, the person’s muscles are forced to use the \_\_\_\_\_\_\_\_\_ energy pathway.
    1. aerobic
    2. anaerobic
    3. mitochondrial
    4. deoxyribonucleic acid
14. Billy is training hard for his upcoming Ultimate Fighting Championship match. He does lots of sprints and weight lifting. All of the following are body changes that will improve the anaerobic activity in his muscles EXCEPT:
    1. increased amount of the oxygen-binding protein myoglobin
    2. increased amount of contractile muscle proteins
    3. increased glucose stores in his muscles
    4. increased blood supply to more efficiently remove lactic acid
15. Another name given to a single muscle cell:
    1. myofibril
    2. muscle fiber
    3. thick myosin filament
    4. sarcolemma
16. This organ increases in strength to better deliver oxygen and nutrients to working muscles:
    1. Brain
    2. Heart
    3. Spleen
    4. Lungs

**True or False**

1. True or False. Aerobic exercise leads to an increase in the number of mitochondria found within muscle cells.
2. True or False. Aerobic exercise leads to a decrease in the number of blood vessels found in muscles so that not as much lactic acid will be produced.
3. True or False. Skeletal muscles need nerve stimulation for contraction to occur.
4. True or False. Muscle cells will use anaerobic energy production when the intensity of the muscle activity is high and/or oxygen delivery to the muscle is insufficient.

**Short Answer**

1. A couple months ago, Dr. Kelly decided to get into shape for the Fairfield Turkey Trot 10 mile run. He ran laps around the school every morning for two months. As a result of his training, Dr. Kelly felt in great shape for the race. Describe 3 body changes that occurred in Dr. Kelly as a result of his aerobic training. (3 points)

Grow more blood vessels to his muscles and lungs, more mitochondria in his muscle cells, increased heart strength, more myoglobin protein to bind oxygen in his muscles, more glucose stored in his muscles and liver for fuel.