Muscle Metabolism

To complete this worksheet, select:

Module: Support and Movement  
Activity: Animations  
Title: Muscle Metabolism

Introduction

1. How do muscle cells use ATP? ________________________________
   ___________________________________________________________________

2. Describe ATP hydrolysis and explain its significance to muscle cells. ______________________
   ___________________________________________________________________

3. How is ATP regenerated? ________________________________
   ___________________________________________________________________

4. Summarize the role of ATP with regard to the following myosin head activities.
   a. energizing ________________________________
   b. detaching ________________________________

Energy Sources

5. How long can stored ATP in a muscle cell fuel muscular activity? ______________________
   ___________________________________________________________________

6. Muscle cells must be able to generate additional molecules of ATP to continue contracting. Name three processes that achieve ATP regeneration.
   ________________________________
   ________________________________
   ________________________________

*Creatine phosphate is used for short bursts of energy. Research the following.*

7. Describe the role of creatine phosphate (phosphagen system) with regard to ATP regeneration.
   ________________________________
8. When is creatine phosphate regenerated?

When muscular activity extends beyond 15 seconds, creatine phosphate reserves are depleted and muscle cells need another ATP source. Research the following information regarding anaerobic respiration.

9. Glucose fuels anaerobic respiration. Identify two sources of blood glucose.

10. a. What by-product is initially formed by the anaerobic breakdown of glucose?

b. How much ATP is USED to start this reaction?

c. How much ATP is PRODUCED from this reaction? What is the net gain of ATP by anaerobic respiration?

d. What “normally” happens to the pyruvic acid molecules produced by anaerobic respiration?

e. What happens to the pyruvic acid molecules if there is an insufficient oxygen supply?

11. How long can anaerobic respiration sustain maximum muscle activity?

When muscle activity is needed for several minutes, or even hours, aerobic respiration is the essential ATP source. Research the following regarding aerobic respiration.

12. What molecules “fuel” aerobic respiration?

13. a. How much ATP is generated by the aerobic breakdown of one glucose molecule?

b. How long can aerobic respiration fuel muscle activity?

15. Briefly describe how each of the following can result in muscle fatigue.
   a. calcium ion supply
   b. energy resource supply
   c. oxygen supply
   d. lactic acid and other metabolic wastes

16. a. What causes lactic acid levels to increase?
   b. After exercising, how does the cardiovascular re-establish homeostatic oxygen levels?

17. What occurs during recovery?