**Anatomy and Physiology**

**Miss Ulmer**

**Notes over Muscles, ATP, Muscle Fatigue, Isotonic, and Isometric Contractions**

*There is a powerpoint that goes along with this.*

* Energy for muscle contractions
  + ATP is the molecule that is used as the “energy currency” of all cells
  + ATP is made during cellular respiration in the mitochondria of the cell
  + It is composed of one adenine molecule with three phosphate groups bonded to it--the three phosphate bond contains a lot of energy
  + When ATP is used up, it is converted into ADP--this can be converted back to ATP and used as energy again
  + Sources of ATP for muscles
    - Direct phosphorylation of ADP by creatine phosphate (CP)
      * When ATP is used up, CP will react with the ADP that is present as a byproduct of ATP
      * CP donates a phosphate to ADP, converting back to ATP to be used for more energy by the muscle
      * The CP reserves only last about 15 seconds
      * Most immediate method for getting ATP
    - Aerobic respiration
      * 95% of all ATP comes from aerobic respiration
      * Here, glucose is broken down to produce 32 ATP and CO2 but requires sufficient O2 supplies--so if there is not enough oxygen this cannot take place
      * Utilized during prolonged exercise
    - Anaerobic glycolysis and lactic acid formation
      * Used only when not enough O2is present in the cell
      * Only yields 2 ATP
      * Lactic acid is produced--why your muscles are sore the next day after exercise; helps to break down old muscle to build up more muscle fibers
* Muscle fatigue and oxygen deficit
  + When the muscles are used too much, they become tired and won’t contract unless they are rested
  + This can occur after an extremely difficult or long workout
  + The exact reason for muscle fatigue is unknown
  + Oxygen deficit is a huge contributor to muscle function
    - This occurs when a person physically cannot breathe in enough oxygen to supply to their muscles
    - Thus, oxygen deficit leads to lactic acid formation in the muscles
    - Red muscle fibers = slow-twitch muscle fibers that are effective for long term exercise like running cross country; not easily tired; have high blood and oxygen supply which is why they are red in color
    - White muscle fibers = fast twitch muscle fibers that are for quick bursts of energy that are effective for sprinters; tire quickly; these do not have high blood and oxygen supply which is why they are white in color
* Types of contractions and muscle tone
  + Isotonic contractions
    - Contractions when the muscle fibers successfully shorten and movement is produced
    - Like picking up a pencil
  + Isometric contractions
    - Contractions when the muscle fibers do NOT successfully shorten; the contraction is attempted but there is no movement that is produced
    - Like pushing a wall and trying to make it move--you would be able to make the wall move
  + Muscle tone
    - When muscles are in a constant partial muscle contraction
    - These contractions are from different motor units than the normal one to produce gross movements
    - It is scattered throughout the muscle