**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