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| **Presentation Title:** | **Muscle Mechanics** |
| **Visual Description and Reference Images:** | |
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| **Script:** | |
| All cells of the body require ATP to carry out their specified functions. Skeletal muscle has adapted numerous ways to optimize ATP creation to meet the specific demands of an activity. In this unit, you will learn about the three main ways that ATP is made by all cells of the body using skeletal muscle as the context. This unit will also explore how ATP synthesis relates to muscle histology and the types of exercises we engage in. | |

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| **Slide #:** | 2 | **Slide Title:** | Learning Objectives (objectives slide) | |
| **Visual Description and Reference Images:** | | | | |
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| **Key Bullet Points: (Learning Objectives for this presentation)** | | | | **Script:** |
| In this unit you will learn about:   * Role of ATP * ATP synthesis * Creatine phosphate * Glycolysis * Aerobic respiration * Motor units * Type I fiber * Type II fiber * Exercise and muscle * FIT principle * Fitness | | | |  |

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| **Slide #:** | 3 | **Slide Title:** | Role of ATP | |
| **Visual Description and Reference Images:** | | | | |
| Macintosh HD:Users:phillipgreco:Desktop:stock-photo-slingshot-on-white-1530659.jpg | | | | |
| **Key Bullet Points:** | | | | **Script:** |
| * Energy can be transferred to put molecules in a state of high potential energy. * A trigger will release this potential energy and it will become kinetic energy. * The energy stored in the bonds of ATP can be transferred to other molecules. * This energy from ATP puts the molecule in a state of high potential energy. * Another molecular event will trigger the release of this energy. * ATP has three main roles in muscle contraction:  1. ATP breaks the cross bridge formed between myosin and actin 2. The energy in ATP is used to “re-cock” the myosin head. 3. ATP fuels the reuptake of calcium back into the sarcoplasmic reticulum. | | | | Recall that ATP is the universal energy currency. The energy in ATP is stored within phosphate bonds. When these bonds are broken, the energy released can be transferred to another molecule. In order to understand this concept, consider the following analogy:   * A slingshot has a low energy and high energy state relative to the rubber band. When the rubber band is pulled back, the sling shot is in a high energy state because the potential energy has been created. * This energy is released when the rubber band is let go because the potential energy transforms into kinetic energy. * ATP acts much like your arm pulling back the rubber band. Your arm is investing energy in the rubber band as it is pulled back. Energy has been transferred from the contraction of your muscles and invested in the band until it is released.   Similarly, ATP invests energy in proteins by placing them in a high-energy state. Another event will then cause the release of that energy. In muscle contraction, ATP “recocks” myosin heads. The formation of a cross bridge will act as the trigger to release this energy, causing the myosin head to perform a power stroke.  In muscle contraction, ATP has three main roles:   1. ATP breaks the cross bridge formed between myosin and actin. 2. The energy in ATP is then used to recock the myosin head so that another cross bridge and subsequent power stroke occur. 3. ATP fuels calcium pumps that push the ion back into the sarcoplasmic reticulum following a muscle twitch. |

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| **Slide #:** | 4 | **Slide Title:** | ATP Synthesis | |
| **Visual Description and Reference Images:** | | | | |
| I’d like something similar o what we did in Unit 1:slide 5 where the chemical equation is dynamically changing based on the audio. For this slide, however, it would be the following…  ATP 🡪 ADP + P + energy  ADP + P + energy 🡪 ATP | | | | |
| **Key Bullet Points:** | | | | **Script:** |
| * The energy stored in an ATP molecule is found in the bonds between phosphates. * The following equation describes ATP releasing energy to fuel a process:   ATP 🡪 ADP + P + energy   * Making ATP is described by reversing the equation:   ADP + P + energy 🡪 ATP   * Chemical reactions that make ATP differ in what is used as energy to fuel this process. | | | | The energy stored within in an ATP molecule is found in the bonds holding the phosphate together. Breaking one of the bonds results in the following chemical equation…  ATP 🡪 ADP + P + energy  ATP stands for adenosine trisphosphate (three phosphates). ADP is adenosine diphosphate (2 phosphates) and P is a single phosphate. The energy that is a product of this chemical reaction can be transferred to another molecule and helps drive numerous processes within a cell. All cells of the body require ATP. Therefore, these cells must have a way of making more ATP when necessary. In this case, we will look at the same chemical equation but reverse it…  ADP + P + energy 🡪 ATP  In order to make ATP, a cell must combine an ADP molecule, a free P, and some form of energy. Chemical reactions that enable a cell to make ATP all share this chemical equation in common. However, they differ in what is used as energy to combine the ADP and P. |

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| **Slide #:** | 5 | **Slide Title:** | Creatine Phosphate | |
| **Visual Description and Reference Images:** | | | | |
| Macintosh HD:Users:phillipgreco:Desktop:cp.JPGThis is what I would draw in class. If we could have something like this animated, that would be great. | | | | |
| **Key Bullet Points:** | | | | **Script:** |
| * Creatine phosphate (CP) binds an ADP and a P molecule. * After creatine has donated its phosphate, it is in a low energy state. Creatine kinase enzymes bind a phosphate after use. * CP is used to produce ATP at the onset of an activity. * Short high intensity exercises may exclusively use CP to make ATP. * CP is made at rest. * More ATP is required to make CP than it will produce during activity. * Used by muscle cells and neurons. | | | | * Creatine phosphate (CP) is a molecule that has the ability to quickly bind ADP and P. In this instance, the energy donation comes from the creatine molecule itself as it forces the ADP and P to bind. * Energy is neither created nor destroyed. In this instance, the energy from the CP molecule is donated to the ATP molecule. When the CP molecule has donated its phosphate to ADP, it is now in a low energy state. Enzymes known as creatine kinases will bind a P onto the creatine molecule so that it can be used again to make ATP. This process occurs at rest. * CP is used at the onset of all activities. This is because other energy systems (glycolysis and aerobic respiration) require time to start producing ATP. CP acts as a quick way to make ATP until the other systems are running. * Some activities occur so quickly that they rely solely on CP. Intense burst like activities such as a 50 yard dash, shot put, or discus would primarily utilize this system. * CP is made at rest in a muscle cell. The manner in which this is done is not very efficient. Several ATP molecules are required to make a CP molecule. However, the CP molecule only makes one ATP. This represents a trade off; energy is invested in CP at rest so that it will immediately be available when an activity begins. * Muscle cells and neurons are the few cell types capable of using the CP system. |

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| **Slide #:** | 6 | **Slide Title:** | Glycolysis | |
| **Visual Description and Reference Images:** | | | | |
| Macintosh HD:Users:phillipgreco:Desktop:glycolysis.JPGThis is what I would draw on the board for this lesson. The chemical reactions are drawn as a box so that the focus is placed on reactants and products. I will make it a point in the audio to discuss that glycolysis is a series of reactions occurring in the cytoplasm of the cell. | | | | |
| **Key Bullet Points:** | | | | **Script:** |
| * Glycolysis is an anaerobic method of producing ATP. * Glucose is used to fuel the process of ATP production. * The reactants of this process are:   + ADP   + P   + Glucose   + NAD. * The products are:   + ATP   + Pyruvate   + NADH * If oxygen is not present, pyruvate will be converted into lactic acid. * Lactic acid build up can eventually inhibit chemical reactions in the cell. * Glycolysis occurs faster than aerobic respiration, but not as fast as CP. | | | | * Glycolysis is another fast method of producing ATP. Like the CP system, oxygen is not used in this process so it is anaerobic. * Glycolysis is a series of chemical reactions that occur in the cytoplasm of the cell. Numerous enzymes are required for this process to occur. * Glycolysis uses the metabolism of glucose as energy to fuel the production of ATP. * A molecule called NAD is also required to accept a hydrogen in the process. * The product of glycolysis will be ATP, NADH, and pyruvate. * If oxygen is not present, the pyruvate will be converted into lactic acid. Lactic acid build up inside the cell may eventually inhibit protein function. This lactic acid build up is the burning sensation often associated with intense exercise. * Glycolysis occurs relatively fast compared to aerobic respiration, but not as quickly as CP. * Like CP, glycolysis is used at the onset of activities until aerobic respiration can be used to create ATP. When activities are too intense or oxygen is not readily available, glycolysis is used to create ATP. |

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| **Slide #:** | 7 | **Slide Title:** | Aerobic Respiration | |
| **Visual Description and Reference Images:** | | | | |
| Macintosh HD:Users:phillipgreco:Desktop:aerobic.JPG | | | | |
| **Key Bullet Points:** | | | | **Script:** |
| * Aerobic respiration is the manner in which all cells make ATP. * This is the reason we breath oxygen and exhale carbon dioxide. * Reactants are:   + ADP   + P   + Acetyl CoA   + Oxygen   + NADH * Products are:   + ATP   + Water   + Carbon dioxide   + NAD * This process occurs in the mitochondria and takes more time than the other pathways. | | | | * Aerobic respiration is the manner in which all cells of the body create ATP. It is the reason we breath oxygen and deliver it to all tissues. * If oxygen is present, the events of glycolysis can be though of as ‘aerobic respiration part 1’. This is because the pyruvate that was made will be a key reactant to produce more ATP. * Aerobic respiration occurs in mitochondria. The reactant that fuels the process is known as Acetly CoA. This molecule can come from three different sources:   + Pyruvate from glycolysis is normally converted into acetyl CoA. This account for 50% of the Acetly CoA normally.   + Fatty acids can be converted into Acetyl CoA. This account for the other 50%.   + If necessary, amino acids can be converted to Acetly CoA. This is necessary during emergency situations when glucose and fatty acids are not available. The amino acids used come from breaking down components of the cell and produce waste products that can be harmful to the body. * The reactants for aerobic respiration are ADP, P, Acetyl CoA, NADH, and oxygen. * These reactants enter the mitochondria and undergo numerous chemical reactions. These reactions are the Kreb’s cycle and electron transport chain but will not be covered in depth in this unit. * The products of aerobic respiration are ATP, water, carbon dioxide, and NAD. * Aerobic respiration produces 19 times more ATP than glycolysis can from one glucose. The limitation, however, is the presence of oxygen and the time allowed to form the numerous chemical reactions. |

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| **Slide #:** | 8 | **Slide Title:** | Pathway Comparisons | |
| **Visual Description and Reference Images:** | | | | |
| Rather than bullet points, I’d like it if we could have a chart appear that coincides with the audio. Note that I am only listing net ATP produced—gross ATP produced would require an explanation of specific chemical reactions.   |  |  |  |  | | --- | --- | --- | --- | |  | **CP** | **Glycolysis** | **Aerobic respiration** | | **Speed of reaction** | Very fast | fast | slow | | **Purpose** | Fuels first few seconds of an activity | Fuels first few minutes of an activity or if oxygen is not present | Fuels almost all activities in the body as long as oxygen is present | | **Location** | Cytoplasm | Cytoplasm | Mitochondria | | **Oxygen requirement** | Anaerobic | Anaerobic | Aerobic | | **Limitation** | CP molecules expended | Lactic acid build up | Presence of oxygen | | **Economics** | Inefficient: 1 ATP produced but several ATP needed to make CP. | Somewhat efficient: 2 ATP produced for one glucose | Very Efficient: 36 ATP produced for one glucose | | **Primary activities** | Intense, burst –like (high jump, discus) | Strenuous, lasting minutes and ending in burning sensation (quarter mile run, resistance training) | Sustained, low intensity (one hour walk, watching an interactive A&P lesson) | | | | | |
| **Key Bullet Points:** | | | | **Script:** |
|  | | | | * Chart should be added to the notes. |

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| **Slide #:** | 9 | **Slide Title:** | Motor Units | |
| **Visual Description and Reference Images:** | | | | |
| Macintosh HD:Users:phillipgreco:Desktop:c49x38motor-unit.jpg  Unfortunately, I couldn’t find anything on shutterstock or wikicommons like this. We would want something like this diagram. Ideally, action potentials would travel down the green and then blue fibers and the muscle fibers they are attached to would twitch. | | | | |
| **Key Bullet Points:** | | | | **Script:** |
| * Large motor units control a region of muscle with a small number of neurons.   + Used for gross motor movements.   + Found in areas that require more force than refinements. * Small motor units control a region of muscle with a large number of neurons.   + Used for delicate movements.   + Found in areas that require more refinement than force. * Muscles always maintain a slight contraction called muscle tone. * Motor units specify what type of muscle will be rectuited for an activity. These types of fibers include:   + Type I   + Type IIa   + Type IIb | | | | A motor unit is a neuron and all of the muscle cells that it innervates.   * Large motor units are comprised of a relatively small number of neurons used to control a region of muscle fiber. When these motor units are stimulated, gross movements occur that require little refinement. For example, when the hamstrings contract, the knee is flexed. This requires little fine-tuning, thus large motor units are used to control the movement. * Small motor units are comprised of a relatively high number of neurons used to control a region of muscle fiber. When these motor units are stimulated, refined movements that require more control and refinement can occur. For example, the complex manner in which the tongue and lips are controlled to form speech requires small motor units. * Muscles are not simply stimulated to cause movement. In order to maintain posture and keep joints tight, muscles are always in a slight state of contraction. This is called muscle tone. Motor units are constantly stimulated. The rate at which they are stimulated, however, alters so that a more forceful contraction can be achieved by the muscle belly. * Aside from being large and small, motor units will also specify a type of muscle fiber to recruit for a particular activity. These types of muscle fiber are types I, IIa, and IIb and will be explored next. |

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| **Slide #:** | 10 | **Slide Title:** | Slow Twitch Oxidative Muscle Fiber | |
| **Visual Description and Reference Images:** | | | | |
| Macintosh HD:Users:phillipgreco:Desktop:stock-photo-bike-racer-motion-blur-68747086.jpg  Slides 9 and 10 are closely related so this might be a good slide to have buttons on the left. An intro slide could contain the following:  “All muscles of the body contain a mixture of Types I, IIa, and IIb muscle fibers. The concentration of these fibers depends on the environment in which the body is placed.” | | | | |
| **Key Bullet Points:** | | | | **Script:** |
| * Slow twitch oxidative fiber also known as:   + Type I fiber   + Dark meat * Characterized by:   + High mitochondrial count   + Myoglobin   + Small diameter   + Slow rate of twitch   + Resistance to fatigue * Found at highest concentrations in muscles used daily for extend periods of time. | | | | Muscle fibers come in two basic forms. One is specialized to perform aerobic respiration while the other is specialized to perform anaerobic methods of ATP production.   * Slow twitch oxidative fiber is also known as Type I fiber or “dark meat”. * These muscle fibers are morphologically distinct and are characterized by the following:   + High mitochondrial count.   + Presence of myoglobin (similar to hemoglobin but found inside the cell). Give the fiber a darker appearance.   + Comparatively smaller diameter compared to fast twitch.   + Slower rate of twitch.   + Resistant to fatigue.   + High perfusion by local capillaries. * Slow twitch fibers are found at highest concentration in muscles that are used every day for extended periods of time. For example, in humans the quadriceps must be used every day to maintain posture and mobility. |

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| **Slide #:** | 11 | **Slide Title:** | Fast twitch glycolytic fibers | |
| **Visual Description and Reference Images:** | | | | |
| Macintosh HD:Users:phillipgreco:Desktop:stock-photo-a-female-fitness-instructor-demonstrates-the-finishing-position-of-the-fitball-crunch-483959-1.jpg | | | | |
| **Key Bullet Points:** | | | | **Script:** |
| * Fast twitch glycolytic fiber also known as:   + Type II fiber   + White meat * Characterized by:   + Low mitochondrial count   + No or low myoglobin concentration   + Large diameter   + Fast rate of twitch   + Low resistance to fatigue * Found at highest concentrations in muscles used daily for explosive and high intensity activities. * Further categorized into:   + Type IIa- somewhat resistant to fatigue. Suited to prolonged intense activities.   + Type IIb- not resistant to fatigue. Suited for explosive intense activities. * All muscles of the body contain a mixture of Types I, IIa, and IIb. The concentration of these fibers depends on the environment in which the body is placed. | | | | * Fast twitch glycolytic fibers are also called Type II fibers or “white meat”. * These fibers are morphologically distinct and characterized by the following:   + Low mitochondrial count.   + Lack of myoglobin. This gives the fiber a lighter appearance.   + Comparatively larger diameter compared to fast twitch. This is why resistance training tends to increase the size of muscles compared to aerobic training.   + Faster rate of twitch.   + Not as resistant to fatigue. Heavily rely on CP and glycolysis. * Slow twitch glycolytic fibers are further broken down into the following subtypes:   + Type IIa- somewhat more resistant to fatigue. A kind ‘inbetween’ fiber that has elements of fast twitch and slow twitch. Used for activities that have both elements of anaerobic training and resistance training.   + Type IIb- not resistant to fatigue. Used for brief explosive movements. Heavily rely on CP for ATP synthesis. * Note that all muscles have a mixture of Type I, IIa, and IIb. The manner in which these muscles are used on a daily basis, including the athletic endeavors an individual undertakes, will determine the concentration of each fiber type in a particular muscle belly. This ability to adapt to the environment represents the dynamic potential our bodies possess and is used in both exercise and rehabilitation. |

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| **Slide #:** | 12 | **Slide Title:** | Exercise Physiology | |
| **Visual Description and Reference Images:** | | | | |
| Macintosh HD:Users:phillipgreco:Desktop:stock-photo-young-african-american-couple-jogging-outdoor-at-park-under-summer-sky-35848000.jpgThe first picture is from shutterstock. The second is one I made. | | | | |
| **Key Bullet Points:** | | | | **Script:** |
| * Oxygen debt   + Amount of O2 required following an activity.   + Needed for muscle recuperation.   + Can be used to asses an individuals health. * VO2 max   + The maximum speed with which oxygen is delivered to a working muscle.   + The point at which a muscle must transition from aerobic to anaerobic mechanisms.   + VO2 max is also used to asses fitness. | | | | Most activities are not so clearly delineated between anaerobic and aerobic. The methods with which ATP is produced can occur simultaneously depending on the availability of oxygen, substrates, and time. In order to understand how muscles transition between these systems, we will look at the concepts of oxygen debt and VO2 max.   * Oxygen Debt   + Also called “afterburn”.   + The amount of oxygen required following an activity.   + The oxygen needed after exercise is used in the process of restoring CP, breaking down lactic acid, restoring myoglobin, and delivering glucose to muscles that may have had glycogen depleted.   + Oxygen debt can be used to assess an individual’s fitness level:     - Individuals who are not conditioned well tend to breath harder after exercises. This is because their muscles are not efficient at using oxygen and require more time to restore the muscle back to its pre-exercise state.     - Individuals who are aerobically conditioned require less time to recuperate from an activity. * VO2 Max * The maximum velocity with which oxygen is supplied to working muscle. * This measurement is a reflection of an individual’s aerobic fitness. * In the graph, notice that as physical exertion increases, ATP production must increase. * The VO2 max is the threshold when an activity becomes so strenuous oxygen cannot be delivered to the muscle fast enough for aerobic ATP production. * Because the oxygen is not available, the muscles cells fall back on anaerobic mechanisms. * Think of VO2 max as the point at which an exercise becomes so difficult your muscles start to burn. The burning sensation is being caused by lactic acid build up from anaerobic ATP production. * Aerobic fitness raises VO2 max. In other words, the more physically fit you are, the faster you can deliver oxygen to working muscles. |

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| **Slide #:** | 13 | **Slide Title:** | The FIT Principle | |
| **Visual Description and Reference Images:** | | | | |
| Any of the exercise stock imagery from shutterstock would be adequate here. Rather than bullet points, I would like this to be another area with a chart that coincides with the audio. In the audio, I will go through the aerobic column first, then resistance training.   |  |  | | --- | --- | | **Aerobic Training** | **Resistance Training** | | *Frequency*: At least three times per week | *Frequency*: Dependent on the type of exercise. For a full body workout, at least two times per week | | *Intensity*: Target heart zone: 60 to 80% of (220-age) | *Intensity*: Targeted muscle groups must experience muscle fatigue (failure) at least once. | | *Time*: At least 30 minutes in the target heart zone | *Time*: Dependent on the type of exercise. For a full body workout, no more than 45 minutes. Longer workouts are usually due to taking breaks that are too long. | | Stimuli for change:   * Recruitment of Type I fibers * Ischemia | Stimuli for change:   * Recruitment of Type II fibers * Lactic acid * Damage to myosin heads | | Adaptation:   * Increased VO2 max * Decreased oxygen debt * Increased Type I fiber * Increased angiogenesis * Increased resistance to fatigue * Decreased stress on the heart | Adaptation:   * Increased strength * Increased overall muscle size * Increased Type II fiber * Some resistance to fatigue depending on the nature of the exercise | | | | | |
| **Key Bullet Points:** | | | | **Script:** |
| Chart | | | | The FIT principle (frequency, intensity, time) is the minimum amount of activity needed in order to change the body. This is based on Wolff’s Law, which states that the human body will adapt to the environment in which it is placed. These principles are used in general health and rehabilitation. The FIT principle is not mere suggestion, it is based on scientific research used to asses the manner in which the body changes with exercise and rehabilitation. The components of this graph represent the minimum required activities to induce change in the musculoskeletal system. |

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| **Slide #:** | 14 | **Slide Title:** | Fitness | |
| **Visual Description and Reference Images:** | | | | |
| Any exercise stock imagery is fine in this area. The overall slide should probably be broken up with buttons to the left.  *I will try to avoid ‘soap-boxing’ in the audio, but this is an area I feel very passionately about. Smoking, bad diets, lack of activity, and overall bad health seem rampant in the nursing world (I have worked with and taught nurses for 13 years now). This is ironic given that they directly see the impact this has on health. I have always made it a point in my courses to stress the importance of a healthy active lifestyle in the context of A&P lessons.* | | | | |
| **Key Bullet Points:** | | | | **Script:** |
| Intro slide:   * Modern convenience can have a negative impact on the body. * Many health related diseases are due to decreased activity level.   Benefits of exercise:   * Decreased risk of chronic disease. * Weight management. * Mood enhancement. * Increased energy. * Better sleep. * Decreased illness. * Fun.   Exercise Myths:   * “I don’t have the energy.” * “I don’t have the time.” * “I don’t know how to do it correctly.” * Spot reduction. * No pain no gain. | | | | In modern culture, we are very fortunate to have so many item of convenience. Information, entertainment, food, transportation, and many other requirements of our bodies are instantly accessible with a minimum amount of work. All of these conveniences change the manner in which our bodies interact with the environment such that the process of living is not as strenuous as it was at one time. With food readily available and little need to use the energy it contains, it is little wonder that health related diseases continue to rise. Fortunately, as time has passed and we have seen the impact of convenience on our collective health, more and more information has shown us the necessity of regular exercise. An active healthy lifestyle benefits the body in the following ways:   * Decreased risk of chronic diseases- exercise decreases the risk of cardiovascular disease, cancer, and many other disorders. * Weight management- the more activity the body engages in, the more calories it will utilize. * Mood enhancement- recent studies indicate that exercise is as effective as antidepressants. The combination of activity, goal accomplishment, endorphin release, stress relief, and neural stimulation all benefit the brain. * Increased energy- regular exercise enhances the energy you have throughout the day. * Better sleep- effective sleep has numerous benefits on mental ability. Exercise has been shown to help individuals fall asleep and maintain a deeper level of sleep. * Decreased illness- an overall healthy lifestyle certainly benefits health. But increasing evidence tells us that the exercise increases the use of the lymphatic system and may accelerate the effectiveness of the immune system. * Exercise is fun- Exercise does not have to be drudgery. Engaging in activities that you enjoy can be their own benefit and be a social and creative outlet.   The benefits of exercise exceed the list above. But there are numerous reasons individuals cite for not exercising or exercising incorrectly. Below are some common exercise myths:   * *I don’t have the energy*- one of the reasons you might feel so lethargic at the end of the day is because your body has adapted to the environment you have created. Thus, you feel spent at the end of the day because that is the normal limitation you create. Exercise is an investment; though at first it is tiring the increased energy will follow. * *I don’t have the time*- a good workout can be as short as 30 minutes a day. More often this statement is related to the *I don’t have the energy* excuse. * *I don’t know how to do it correctly*- if you have completed this lesson then you know more about exercise than most! * *Spot reduction*- an individual cannot tone a “problem area” alone. Fat loss and muscle adaptation occur over the whole body. Unfortunately, this myth is exploited by companies selling devices and supplements. * *No pain no gain*- as stated in describing the FIT principle: Proper aerobic training occurs in the target heart zone. Proper resistance training takes a muscle group to fatigue, but does not run the risk of damage. Exceeding recommended intensity runs the risk of injury. |

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| **Slide #:** | 15 | **Slide Title:** | Check Your Understanding (2nd to last slide) |
| **Visual Description and Reference Images:** | | | |
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| **Questions/Answers:** | | | |
| 1. (Click all that apply) What role does ATP play in muscle contraction?    1. **Recocks the myosin head**    2. **Active transport of calcium into the sarcoplasmic reticulum**    3. **Breaks the myosin and actin cross bridge**    4. Fuels the release of calcium from the sarcoplasmic reticulum    5. Causes a power-stroke to occur 2. You are carrying groceries from your car all in one hand while fumbling with your keys to open the door. Shortly, your shoulders begin to burn from the exertion. What energy system was primarily used to fuel this activity?    1. Creatine Phosphate    2. **Glycolysis (Correct! The burning sensation tells us that lactic acid was accumulating. Therefore, the primary energy system must have been glycolysis.)**    3. Aerobic Respiration 3. (Drop down menu choices) As you are taking this quiz, the muscles of your legs are relaxed and rely on (CP, glycolysis, **aerobic respiration**) for ATP. If you had to stand up quickly and run from your computer, the first part of the activity would be fueled by (**CP**, glycolysis, aerobic respiration) followed by (CP, **glycolysis**, aerobic respiration). If adequate oxygen is supplied to the muscles by the cardiovascular system, your muscles would eventually use (CP, glycolysis, **aerobic respiration**) for ATP production. **(Correct! All activities being with CP followed by glycolysis. Aerobic respiration only occurs if oxygen can be delivered to meet the demand of the working muscle.)** 4. Glycolysis can be thought of as ‘aerobic respiration part one’, depending on the presence of oxygen. This is because a product of glycolysis is used as a reactant in aerobic respiration. The molecule that links the two systems is    1. Fatty acids    2. Amino acids    3. **Pyruvate (Correct! Pyruvate is converted into Acetly CoA and then shuttled into the mitochondria for further processing).**    4. Lactic acid    5. Carbon dioxide 5. The track & field activity of shot put is performed by hurling a large metal ball as far as possible in one explosive movement. The ATP needed for this activity would primarily come from    1. **CP**    2. Glycolysis    3. Aerobic respiration 6. The muscles of the eye would have (large, **small**) motor units because they must perform delicate adjustments of eye movement. 7. Chickens do not fly, but flap their wings in short bursts as part of social behaviors and protection. The breast of a chicken, therefore, contains more (Type I, **Type II**) fiber. By comparison, ducks use their wings to fly for extended periods of time. The breast of a duck would contain more (**Type I**, Type II) fiber. 8. Consider a 35 year old nursing student. Which of the following represents an aerobic workout routine that meets the requirements outlined by the FIT principle?    1. **40 minute walks, 4 times per week, maintaining a heart rate of 111-148 beats per minute (Correct! This workout has the proper frequency, intensity, and time).**    2. 30 minute walks, 3 times per week, maintaining a heart rate of 100-132 beats per minute (Incorrect. This workout does not have the correct *intensity*).    3. 30 minute walks, 2 times per week, maintaining a heart rate of 111-148 beats per minute. (Incorrect. This workout does not have the correct *frequency*).    4. 50 minute jogs, 5 times per week, maintaining a heart rate of 140-180 beats per minute (Incorrect. This workout does not have the correct *intensity.* Maintaining a heart rate this high would likely use glycolysis more than aerobic respiration). 9. Which of the following will act to stimulate change of the body in resistance training?    1. **Damage to myosin proteins**    2. Recruitment of Type I motor units    3. **Recruitment of Type II motor units**    4. **Lactic acid**    5. Recruitment of lymphatic vessels 10. All of the following statements represent exercise myths. Which statement below illustrates the myth of “spot reduction”.     1. **“If I do 500 sit ups every day, I will get six pack abs.” (Correct! One exercise alone will not tone the abdominal muscles. A combination of diet, aerobic exercise, and core strength training are required for tone and noticeable abdominal muscles).**     2. “I can’t exercise as much as I’d like. So, when I do, I push myself to the limit.” (Incorrect. This statement is more closely associated with the ‘no pain no gain’ myth).     3. “I don’t have time to exercise because this A&P class takes all of my time.” (Incorrect. This statement is more closely related to the ‘I don’t have the time’ excuse. Consider listening to the MP4 audios or mobile versions of this lesson while you exercise. You’ll relieve stress, maintain health, and learn at the same time.)     4. “At the end of a long shift, I’m too exhausted to think about exercise.” (Incorrect. This statement is more closely related to the ‘I don’t have the energy’ excuse. Remember that exercise is an investment. You get tired at th end of the day because, without exercise, it has only adapted to the situations you’ve presented it. Exercising before a shift is logical way to counter exhaustion and add energy throughout the shift.) | | | |

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| **Slide #:** | 16 | **Slide Title:** | Summary (last slide, review of learning objectives) | |
| **Visual Description and Reference Images:** | | | | |
|  | | | | |
| **Key Bullet Points:** | | | | **Script:** |
| In this unit you learned about:   * Role of ATP * ATP synthesis * Creatine phosphate * Glycolysis * Aerobic respiration * Motor units * Type I fiber * Type II fiber * Exercise and muscle * FIT principle * Fitness | | | |  |