Muscles in Motion

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INTRODUCTION

If you are reading this paper, you have probably just finished using a number of muscles in your body. From the lids of your eyes to the tips of your fingers, you have contracted and extended an assortment of muscles. Our bodies are made up of approximately 650 muscles. We use them daily to perform from the most simple to complex movements. They come in different shapes and sizes and ache in various degrees at different times. Some are pumped or hypertrophied while others are ill and atrophied. While some people work arduously to chisel their muscles away, others are content with solely calling upon them for their daily needs. The focus on muscles create job opportunities, such as physical therapist, occupational therapist, massage therapist, coaches, doctors, trainers and professional athletes to name a few. Yet they hinder and debilitate, leaving some with diseases such as Muscular Dystrophy and Lou Gehrig's disease.

Muscles make possible every move we make, from winking our eye to lifting a loaded barbell. However, many people tend to hide their muscles underneath a nice, thick blanket of adipose tissue, otherwise known as fat. Although our muscles continue to do their daily jobs, they will often suffer from work overload. Carrying around a body can become quite strenuous when you add several extra pounds of fat to it. As a physical education teacher I witness this stress often when my students are exercising. Their fitness test scores are a great indication of how much extra fat they actually carry around.

Many of our students' test scores also indicate poor muscle strength. The fitness test that we administer is called the Fitnessgram. The Fitnessgram is an assessment of health-related physical fitness and involves several components: aerobic capacity, body composition, muscular strength, endurance and flexibility. The test is given to help children achieve a level of activity and fitness associated with good health, growth, and function. We give this test twice during the school year; in October, and then again in February. Prior to the first test and throughout the school year, students engage in various exercise routines that are designed to help them pass all the fitness components on the test. They are encouraged to practice the skill at home as well. We encourage parents to call us if they need assistance in creating an exercise program that their child can follow at home.

After completion of the test, the students are given a computerized printout of their results. Their forms also contain healthy zone graphs so that they can see if they score within the healthy zones. In addition, they receive personalized suggestions to help them improve in the areas in which they score below the healthy zone. I randomly picked a sixth grade class of all females and analyzed their data. I discovered that 15 out of 24

students scored at the moderately-high to high range on their body fat composition. It is no wonder why many of them often complain of backaches and knee aches.

On the muscle strength test, 16 out of 24 did not even score at the low end of the healthy zone. At such a young age, this is rather disturbing.

Much of the literature and information that I have received during my five years as a physical education and health teacher suggests that our youth are more obese than in the past and suffer more from heart disease and diabetes now than ever before. According to information gathered from the Centers for Disease Control website, I discovered that over the past 20 years the obesity rate in the United States has dramatically increased. Three in five Americans are either overweight or obese. I am always concerned about my students that are only 12 years old and are already overweight or obese. Usually, overweight children grow up to be overweight adults. Consequently this predisposes them to other health problems and a poorer quality of life.

According to Research Highlights from the Centers for Disease Control, obesity affects more people than smoking, heavy drinking, and poverty. Obesity and overweight rates are used to be stable before 1980. However, since then the obese category alone grew by 60 percent between 1991 and 2000.

There are many reasons why our society is becoming more overweight, and various solutions to the problem. The reasons and outcomes would be a good source for yet another curriculum unit. In this unit, however, I would like my students to develop an understanding, interest and excitement in their muscles. I think that with a better awareness and understanding of their muscles and how they work, students will be more interested in taking care of them and exercising them. It is a known fact that a weight lifting program serves as a good tool for increasing muscle mass and thus increasing metabolism. This increase leads to more caloric expenditure.

I would also like this unit to spark an interest in enhancing the performance of my student athletes by educating them on all the fascinating roles of the muscles. I would like for the students who are not athletes to get a better appreciation for athletic performance. I will call upon the Physical Education Department and the science teacher in my learning academy to assist in reinforcing the curriculum unit. Also, I believe that all the students should obtain information regarding some of the debilitating diseases that can arise from muscle problems. As a result of this lesson, I hope that the students will have a better understanding of the logic and benefits of training. The students should also finish the unit with a good overview of the names of the larger muscles, as well as their functions and reactions during movement.

I believe that many individuals venture into a gym looking for that quick fix workout that will leaving them looking like that illusion they saw on a “get buff quick” commercial. The reality is that most people in general do not understand the amount of

work involved in order to get that lean and muscular body. Some people may not even take into consideration the role that genetics plays on muscle structure. I hope to make my students understand that one cannot just remove fat from given areas at any given time. I want them to understand how to work each muscle to it's specific potential and how to work the opposing muscle to accomplish a symmetrical tone. We have all seen the typical pumped up torso with two dangling strings, otherwise known as legs. A classic case of asymmetrical lifting! I plan to work with the physical education teachers so that they will explain and demonstrate how to work each muscle group. There are several different philosophies or theories behind workout plans. In the Lesson Plans section, you will find the format I will give to the physical education teachers to use during their lesson. I will ask the PE teachers to incorporate an activity that will show the students daily activities that predominantly utilize certain muscle groups over others. For example, as I type this paper, I am using a number of muscles in my hand that I would not generally use if I were reading a book, let's say. I will also ask the teachers to demonstrate various exercises that are designed for specific muscle groups. In order to maintain consistency between all the physical education teachers, I will provide a brief in-service to explain and demonstrate what I would like the students to learn. For example, I would like my students to understand how to work not only the hamstring, but also the opposing muscles that form the quadriceps. Not only is it important to work opposing muscles to produce a balanced appearance, but it also serves as a means for injury prevention during exercise or while playing a sport. Many individuals do crunches to strengthen the abdominal muscles, but forget about the trapezius and obliques. In order to ensure an understanding of this concept, one of the projects the students will submit will be a workout log. This can also be found in the Lesson Plans section.

Another project will involve the students researching a particular muscle disorder or an issue related to the information learned during the lessons. Students will be given options such as researching the latest advances in technology directed toward genetic disorders involving the muscular system. Students can discuss the benefits and consequences that this type of research may lead to.

Next year, along with some of the changes, will be the addition of a research elective. In this research class, students will learn how to conduct research using library and electronic sources. Students will also learn the correct way to format a bibliography using MLA (Modern Language Association) or APA (American Psychological Association) style. I hope that if students are given the opportunity to conduct research in this area they may become more aware of the devastating consequences of a muscle disorder, and hopefully they will have a better appreciation for their own muscles.

I will try and make as many cross-curricular connections while teaching this unit. For example, the science teacher will teach a lesson on genetics and incorporate the information that the students discover in regards to advances in genetic treatments and the link between genetics and muscle diseases. I will also link with the math teacher during the lesson on muscle contraction. The math teacher will explain percentages using

maximum efforts during a one-time bench press or leg extension. This information will be explained in better detail in the lesson plan sections.

The small learning community concept should be conducive to making these cross-curricular connections, as I will be in close connection with all the teachers within the health and fitness community.

AUDIENCE/POPULATION

Next year the school I am working at will be restructuring and following the guidelines from a program called First Things First. Basically, this program suggests that students have a better opportunity for learning and success if they are placed in small learning communities in which they will stay for the duration of their schooling. The school I teach at is a middle school for sixth, seventh, and eighth graders. Therefore, students will begin and end in the same community. The same group of teachers will follow the group of students through their three years at the school.

The school I teach at is predominately Hispanic. The student population is about 1100 students. Students will be placed into eight different learning communities or academies. There will be eight teachers per academy. The restructuring of the school will alleviate the student/teacher ratio. Most of the class sizes will be no more than twenty students.

This particular curriculum unit will be an innovative lesson plan for an elective class. The elective class is a theme elective for a group of students within a small learning community. The students in this community have expressed some interest in health, fitness, or sports and elected to be a part of this community. The Sports and Fitness Community is one of eight new communities that will be introduced to our school next year. As a result of this restructuring, new elective classes will be offered to the students. Each community will have a theme elective that serves as a link between all the content areas. Therefore, the elective class in which this unit will be taught is part of a Sports and Fitness Community. Although all students will participate in the theme elective class, this particular unit will be for the eighth grade classes.

This unit will be one of several units taught on the anatomy and physiology of the human body. Most of the students in the community will be the athletes from the school. Consequently, many of the units will pertain to human performance, health issues, and sports.

Many of the students in the Sports and Fitness Community will participate in at least one school sport. The five sports that the school offers are volleyball, cross-country, basketball, swimming, and track. Some students will not be active participants in a sport, but will assist with managerial or trainer jobs. Others may have elected to be in the community because of a general interest in health or fitness.

Within the community, we will have a small portion of Gifted and Talented students as well as Special Education students. In addition, there will be some Limited English Proficiency (LEP) students. I find that placing students into co-operative groups helps to even out the playing field, so to speak. Many of the activities that the students will complete will be accomplished in small co-operative groups. I will try to equally distribute the students based on academic and learning levels. Each member of the group will be responsible for specific projects or activities. Although all the members of the group will assist in completing the final assignments, each member will have a clear understanding of their individual responsibilities.

FACILITIES

I am fortunate to be in a learning community that has allowed me to utilize one of the bigger rooms that were offered to our community. This will allow me to utilize part of the room as a lab not only for this curriculum unit, but for other lessons as well. In addition, I will have access to a small weight room. The Physical Education Department will also be able to utilize the room to help reinforce the lesson. As an ex-physical education teacher, I will be able to call upon the teachers to help support the unit ideas.

The addition of a research assistant and research class will also be helpful during this curriculum unit, specifically during the research project assignment.

SUBJECT MATTER

Muscle Names

Before diving into the microscopic portions of a muscle, I will try and spark the interest of my students by first having them explore the following question: "What would happen if we did not have muscles?" I have asked this question before and always receive about the same responses, such as, we couldn't move, we would be floppy, fall down, and others similar to this.

Because many of the students in the community will be athletes, they will probably have an interest in knowing the names of the muscles. Many times during a physical education class, I will have a student ask the names of certain muscles. Sometimes they just want to know how to "get rid of" or make certain parts bigger. They seem to have a poor understanding of how to tone specific parts of the body. They don't seem to understand that most muscles have opposing muscles that should be exercised to maintain a healthy balance and to prevent injury of the skeletal joints. I plan on working with the Physical Education Department to get a cross-curriculum connection with them while I am teaching this lesson. Their physical education class will be a good place for them to demonstrate the use of major muscles. As they learn the names of the muscles, the physical education teacher can help them be aware of which muscles are at work during the warm-up and stretching phase of their class.

A variety of activities will be used to help students learn the names of the major muscles in the body. Many of the examples used to help students learn the names will help them to understand why they are required to perform various exercises in order to do well on their fitness test. In my opinion, I also think that with a better understanding of how each large muscle opposes another, the students will have more confidence when approaching a weight room or workout facility. A gym can be an intimidating place if one is not accustomed to using exercise equipment. Some of the students have parents that are members of fitness clubs. Students will be required to develop an exercise routine for themselves or their parents. I think it's important for students to take responsibility for their health at an early age.

Muscle Components

When exploring the muscles, we will move from a broad to a more specific view. Initially, I will point out the larger muscles in the body and help students understand which muscles are at work during activities that are familiar to them such as climbing stairs or throwing a ball. The list of muscles I will teach can be found in the Lesson Plans section.

After learning the names of some of the larger muscles, we will begin the task of looking at the smaller units that make up a muscle. In order to proceed to the intricacies involved with muscle contraction, the students must have a better understanding of how each particular piece of the muscle works collaboratively to perform the chemical processes involved with the contraction of the muscle.

The epimysium is the tissue that covers the entire muscle. Lying beneath the epimysium is another layer of tissue called the perimysium. This tissue in a sense compartmentalizes the muscle into bundles called myofibrils. Within the myofibrils is a network of tubules called the sarcoplasmic recticulum that runs throughout the fiber. Myofibrils run longitudinally through the muscle and are multinucleated. The myofibrils in turn are broken down into smaller units called myofilaments. Myofilaments are arranged in compartments called sarcomeres. Dense material, called Z lines, separates each sarcomere. Each sarcomere is divided into areas containing thin and thick filaments called actin and myosin. The dense area of the sarcomere is made up of thick filaments of myosin and is referred to as the A band. The light colored area is contains the thin or actin filaments. This area makes up the I band.

Most of the components that make up a muscle tissue will be new to the students so I will provide several activities to help them become more familiar with these terms. I will also have the students create a muscle using various fabrics and material so that they can get a better understanding of how the muscle is put together.

Chemical Reactions in Muscle Contraction

Muscles work by contracting. As a muscle shortens or contracts to move a bone upward, it must relax while the opposing muscle contracts in order to bring the bone down. Without an opposing force, an individual muscle would be of little use to the body. The muscles are in a constant state of contraction with antagonistic muscles working together to perform movement as well as to maintain muscle tone. Because skeletal muscles are so versatile, they allow us to perform movements that require great strength as well as delicate movements such as putting a contact lens in our eye. With the naked eye one can see a muscle as it contracts. However, it is impossible to see the chemical reactions that are necessary in order for the muscle to contract.

I will begin this lesson by looking at a muscle as it contracts and will explain the activities that occur at the microscopic level during contraction. I will assume that the eighth grade students will already have prior knowledge relating to the nervous system, as this is part of the science and health curriculum for middle school students. Because the contraction of a skeletal muscle begins with a signal from the brain, this prior knowledge will be helpful to the students.

Prior activities from this curriculum will give the students familiarity with the names of the larger muscles. The students will be given an opportunity to see the bicep as it contracts during a bicep curl using a dumbbell. I will ask the students to think about what processes must be in place to evoke the movement of a muscle.

After allowing for student exploration, I will introduce a milk carton and ask what it might have in common with muscle contraction. The point will be to get the students to focus on one of the main chemicals involved in the contraction or twitch of the muscle fiber, calcium. Along with calcium I will introduce the major proteins involved in contraction which are myosin, actin, and troponin.

The process of contraction begins with a neurological message from the brain. The role of calcium in contraction begins when the message reaches the sarcoplasm of the muscle fiber. In a relaxed state, calcium ions are stored in the sarcoplasmic recticulum. However, when the signal from the brain reaches the muscle fiber, it creates a release of calcium ions from storage. The calcium ions bind with troponin which causes the myosin binding sites on actin to be exposed. Formation of cross-linkages or cross bridges are created and the thin and thick filaments slide past each other to form the contraction. This sliding over of the think and thick filaments is referred to as the sliding filament theory.

Because the students will not have a chemistry prerequisite, I will try and explain the chemical activation in general terms. Also, I found an excellent Internet source that demonstrates and explains contraction. I will use the computer lab for this purpose. Students will go to the “how stuff works” website to understand the process of contraction. This website takes the reader through a step-by-step slide show

demonstrating contraction. This site also has a good diagram of the sliding filament theory, which basically looks the same in each resource I used. Students will be given a questionnaire to answer while they are on the computer. The questionnaire can be found in the Lesson Plans section.

Types of Contraction

When discussing contraction, there are several terms I would like the students to understand. There are three types of contractions I will discuss. The first is concentric contraction. This type of action causes the muscle to shorten. During eccentric contraction, the muscle lengthens. Isometric contraction causes neither a lengthening nor shortening of the muscle and causes no change in the skeletal joint angle (Jones, McCartney, McComas).

Muscle Maladies

All students will be required to turn in a short research paper on a muscular disorder or an issue pertaining to a muscular problem. Students will receive a list of topics that they may choose from. I am aware that not all students have access to the Internet at home. Therefore, students will be given a class period to do library research at the school. The school library has several computers with Internet access, so the students can use the Internet as well as books and encyclopedias to gather their information. The students will also be encouraged to use their community library, as this will be a homework assignment. I think that the knowledge that the students obtain through this research will help them to have more empathy toward the multiply impaired students at the school. Also, it will help them to understand the obstacles that are faced when a person suffers from a muscular disorder or ailment. In addition, students will understand the consequences of injury on a well-conditioned muscle. Unfortunately, involvement in sports can often put an individual at higher risk for muscle injury. I hope that students will get a general understanding of muscle atrophy and how to handle repair. Muscle atrophy is a condition that results from a lack of use of a particular muscle. There are several diseases and reasons that might cause a muscle to atrophy. When a muscle atrophies, it loses much of its strength and size. According to Harms-Ringdahl (1993), immobilization in a cast for 5 to 6 weeks can result in up to a 41% reduction in strength. It is estimated that strength decreases by 5% per day in the absence of muscle contraction. Unfortunately, the rate of recovery of strength is much slower than the rate of loss. Aside from being in a cast, a muscle can atrophy as a result of cancer treatment, diabetes, aging, or from a specific genetic disorder.

Muscular dystrophy is probably the disease that most people are familiar with. However, muscular dystrophy actually encompasses several forms of genetic diseases that cause progressive weakness to the degeneration of the skeletal muscles. Cardiac muscle can also be affected. Duchennes' muscular dystrophy is the most common form of muscular dystrophy affecting children. Because muscular dystrophy has a genetic link,

I will have to make sure that I teach this lesson after the science teacher in my learning academy teaches her lesson on genetics. During my lesson on muscles, the science teacher has already agreed to assist the students with their research papers in regards to information pertaining to genetics, treatments and any other issues. The language arts teachers will assist with the research papers as well. Their role will be to read and discuss a short story about Lou Gherig.

CURRICULUM OBJECTIVES

Students will be able to:

1. Identify the major muscles of the human body.
2. Identify the principal components of skeletal muscle fiber.
3. Describe the process of muscle contraction.
4. Analyze the differences between fast and slow twitch muscle fiber.
5. Investigate a particular muscle disorder or an issue relating to muscle anatomy, physiology, or treatment.

PRELIMINARY ACTIVITY

The first day of the unit, I will place students into teams. After I examine the make-up of each group, I will choose team leaders based on academic performance and their conduct. I will also let students within the group sign up for jobs, such as timekeeper, materials, and clean up. Students will also be given specific responsibilities for each project or assignment. Each group will come up with a team name that is associated with muscles. For example, the M&Ms (muscles in motion), the Abdominators (abdominal muscles), or the Hams (hamstring muscle). After each team comes up with a name, they will turn in a sheet with their team name, team member names, and a list of duties with the name of the individual responsible for each.

LESSON ONE: NAME THAT MUSCLE

Materials

Computers, Dry Erase markers (two colors), blank body diagram, butcher paper, markers, tape, dumbbells, two mats, ankle weights, jump ropes, tennis balls, bench press bar, oval pieces of paper with name of muscle on each.

Concept Attainment Activity

For the initial activity of this lesson, I will use the Concept Attainment model. I often will start a lesson with this model as a means of discovery. To initiate this game, it is better to begin with a simple practice game. This activity is one of my student's favorite because it

is not threatening to those who are very unfamiliar with the subject and provides a fair opportunity for students to share what they know.

The rules of the game are simple; students are allowed to add to a list that begins with one or two words written on the board by the teacher. The words are actually examples of a specific, mystery topic. For example, if the topic were fruits, the teacher would write mango or kiwi on the "examples" side of the board. There is a side or column that says "examples" and "non examples." If a student says a word that does not belong to the list, the teacher writes it on the "non example" side. If a student knows or figures out the topic, he or she cannot say it, instead they can add another example to the list. The student might suggest "pear." After several students begin to add to the list, the teacher can ask all the students to give the answer in unison.

For this particular lesson, I will start by writing down a couple of muscle names that will probably be unfamiliar to the students, such as the stapedius or the sartorius. The students will probably guess some words that will be placed on the non-example side. Then I will start writing the more familiar muscles and see if the students can add to the list. After students guess the topic, it is important to add to the list any muscles that were not mentioned or any that will be used later on in the lesson.

The following muscles and their performance in contraction and flexion will be discussed and used during the concept attainment activity:

- Abdominal
- Biceps
- Deltoid
- Gastrocnemius
- Gluteus Maximus
- Hamstring
- Latissimus Dorsi
- Obliques
- Pectoralis Major
- Quadriceps
- Soleus
- Trapezius
- Triceps

After I get a general understanding of how much my students know the material, I can decide how thorough I will need to be when explaining the information. Because this will be a new elective for me as well as the school, I will have to be more thorough when assessing their knowledge of the various areas that will be covered in the theme elective class.

After introducing the muscle names, I will use dumbbells and ankle weights to show the muscle in motion as it works to lift the weight. This works really well to show the larger muscles such as the biceps, triceps and deltoids. I am familiar with exercises that expose a muscle group, but a visit to a fitness club would be helpful for someone not familiar with which exercises to use to show the particular muscle at work.

Use of Technology

After the students copy down the names of the muscles from the Concept Attainment activity, they will utilize the school computer lab. I will provide the students with two websites for this activity. They can be found in the Student Resources section. They will use these websites to label a diagram of the human body. I called upon the art teacher at my school to draw a simple diagram of the body. All the muscles from their original list must be labeled.

Group Activity One

Students will be divided into groups and each group will make an outline of a body on a piece of butcher paper. This activity should be well supervised and students in each group should be instructed that males will outline males and females will outline females. Each student in the group will be given two different muscle names typed on different shapes of paper. The students will then glue or tape their individual muscle cards on the appropriate area of the body. After all groups have successfully completed their human paper model, they will copy the information to their notebooks.

Group Activity Two

Each group will be given two to three pieces of equipment and three index cards, each with a name of a muscle group. Students will demonstrate the use of each muscle group utilizing the equipment given to them. Students may refer back to the original websites if they need assistance in coming up with exercises for each muscle group.

Homework Assignment

Students will be given a word search developed using the Discovery Channel website for teachers. Refer to the References section for more information on this very teacher friendly website. Another worksheet will be a matching activity in which the students will need to match the muscle name with a specific area, such as arm, leg, and torso for example. Students are to complete the word search just as a means for assisting them in becoming familiar with some names that may be very new and different to them. The word search will also help with learning to spell the words.

LESSON TWO: MICROSCOPIC VIEW OF A MUSCLE

Materials

Diagram of muscle, vocabulary words, straws, red and green string, rectangular pieces of material (one per group), tape, pack of gum

The following parts of the muscle will be studied:

- Epimysium: A fibrous connective tissue that is the outermost wrapping of the muscle.
- Perimysium: The layer of tissue underneath the epimysium.
- Fasciculi: Bundles of fiber within the muscle that are inner extension of the epimysium.
- Endomysium: Inner extensions of the perimysium that penetrate into the inside part of each fascicle.
- Muscle fiber: Elongated muscle cells found parallel to each other and are separated within the fasciculi by the endomysium.
- Sarcolemma: The membrane that wraps around each muscle fiber.
- Sarcoplasm: The "cytoplasm" of the cell, containing the nuclei.
- Sarcoplasmic recticulum: Found within the sarcoplasm, a network of tubules.
- Myofibril: Very tiny structures found within muscle fibers; they are cylindrical in shape.
- Thick myofilament: Structures that are found within myofibrils that are about 16 nm in length.
- Thin myofilament: Structures found in myofibrils that are about 6 nm in length.
- Sarcomere: A compartment which holds the thick and thin myofilaments.
- Z line: Narrow zones of dense material that separate sarcomeres.
- A band: This is a dark area of the sarcomere that represents the thick myofilaments.
- I band (isotropic band): A light-colored or less dense area that represents the thin myofilaments.
- H zone: An area that contains only thick myofilaments.

Microscopic View of a Muscle

As a focus for learning the inner part of the muscle, I will use a pack of stick gum. I will begin by telling the students that we will be learning about the microscopic parts of all the muscles they learned in the previous lesson. I will show them the pack of gum and tell them that it will be used to demonstrate some of the parts within the muscle. They will be given a diagram of a muscle with all its inner components. Some of the books in the reference section contain illustrations of the muscle. Because this particular class does

not have a textbook, I will give each group a different book or printed version taken from one of the websites.

I will begin by comparing the outer wrap of the pack of gum to the epimysium. I will pull an individual stick halfway out to represent a fascicle; the outer wrapper will represent the perimysium and the inner wrapper will represent the endomysium. Although the actual architecture of a muscle is much more intricate, I want the students to understand the layering mechanism of a muscle and to get a general understanding that the muscle is broken down into smaller units. I will use this activity as a focus to get them to understand the actual diagram that they are given, along with the vocabulary words.

Group Activity

Each group will be given a set of straws, two different colors of yarn, and a piece of red material and some tape. Students will use the diagram of the muscle to make individual fascicle. The straws will represent a fascicle, the string will represent the thin and thick filaments within the muscle cells, and the material will be wrapped around each bundle to represent the perimysium. After all groups have a bundle, all the bundles will be enveloped by a larger piece of material to represent the epimysium of the entire muscle. Each group will also be responsible for turning in a muscle model created by the entire group.

Homework

Crossword puzzle using definitions of muscle components.

LESSON THREE: MUSCLE CONTRACTION

Materials

Computers with Internet access, questionnaire sheet, poster board, pipe cleaners, raw spaghetti, thin straws, markers, construction paper, tape, glue, library books, vocabulary words

The focus of this unit will be a hands-on activity. Students will use dumbbells to do bicep curls. They will watch as the bicep muscle contracts to bring the weight up, and will watch the muscle as it contracts eccentrically to bring the dumbbell down.

Students will need their list of vocabulary words from Lesson Two. In addition, students will be given a new list at the beginning of the class period. The list will include the following words:

- Isometric contraction: a contraction which creates no change in the length of the muscle.
- Concentric contraction: shortening of a muscle.
- Eccentric contraction: lengthening of a muscle.

A discussion will follow on the different isometric activities that one can perform as well as demonstrations of concentric and eccentric contraction. I will ask the Physical Education Department to reinforce these terms during their PE classes.

Chemical Processes in Contraction

As a focus for this lesson, I will bring in an empty milk carton to class. I will show the students the milk carton and ask them what it has in common with muscle contraction. I imagine I will receive an assortment of responses. Perhaps pertaining to milk and strong bones.

Students will use the website How Stuff Works to learn about the chemical reactions involved in contraction. Students will be given the following instructions during their website investigation:

- Go to http//:www.howstuffworks.com.
- In the search window, type "muscles."
- Click on "How muscles work."
- Click on "Contracting a muscle."
- On the sliding filament diagram click on "contraction" and "relax" to witness how the myosin and actin filaments create the sliding motion.
  After students have had time to investigate the mechanism of contraction, they will answer the following questions.

1. What protein makes up the thin filaments?
2. What protein makes up the thick filaments?
3. Which protein controls the interaction between actin and myosin during contraction?
4. What is the role of calcium in muscle contraction?
5. What makes up a crossbridge?
6. What does myosin bind to that creates the power stroke?
7. Where does the energy come from to create and release the contraction?

Group Activity

Students will be given a poster board; each group will receive a book that has a picture of the sliding filament action. Using the information from the Internet as well as their book source that I will obtain from the library, students will make a model of the sliding filament in its relaxed state and its contracted state. Students can choose different materials provided to distinguish between the thin and thick filaments (actin and myosin), as well as the Z lines, I band, H zones, and A band. Students will glue and/or tape their final product to the poster board.

LESSON FOUR

Materials

Use of library and computers, rubric for research assignment

Research Assignment

Students will be allowed to choose a topic from a list provided. The list will be added to the end of this lesson. Students can research their own innovative topic with teacher approval. I will put a variety of topics on the list to encompass a broad range of interest. Not all the students in the community are athletes, and they will all have a variety of interests in the subject matter. Students may opt to create a project that includes written information, diagrams, and or illustrations with teacher approval. A standard research paper will also be accepted.

Research Topics

1. Muscular Dystrophy
   Information must include:
   - Reasons for choosing the topic
   - The name of the particular form chosen and a brief explanation
   - Who is affected
   - How a person acquires the disorder
   - Symptoms

2. Lou Gehrig's disease
   Information must include:
   - Reasons for choosing the topic
   - The scientific name of the disease and any other related forms
   - Who is affected
   - Transmission
   - Symptoms

3. Lou Gherig biography
   Information must include:
   - Reasons for choosing the topic
   - History of Lou Gherig and his accomplishments
   - Problems encountered by Lou Gherig

4. Muscle Injury
   Information must include:
   - Reasons for choosing the topic
   - A specific sports injury
   - Explanation of the length of recovery
   - Treatment
   - Prognosis for future participation in sport

5. Occupation
   Information must include:
   - Reasons for choosing the topic
   - Explanation of the job title of a physical therapist, athletic trainer, or occupational therapist
   - College requirements needed for the particular occupation
   - Explanation of why you might choose this career

6. New Treatment
   Information must include:
   - Reasons for choosing the topic
   - Research on any new treatment available for a muscular disorder or muscle atrophy.
   - How technology might assist an individual to make advances in the particular ailment
   - The pros and cons of new treatments

7. Innovative Ideas
   Information must include:
   - An original idea that relates to the information learned in class
   - A paper or project created and turn in for approval and assistance

PHYSICAL EDUCATION CONNECTION

Workout Log

Create a workout log for you or a family member. Use a graph or table to input all the data requirements. The following information must be included:

1. A description of a stretching and warm-up component lasting no less than ten minutes
2. A description of a stretching and cool down phase lasting no less than ten minutes
3. Two exercises that are designed to work the pectoralis major
4. One for the bicep and one for the tricep
5. One for the hams and one for the quads
6. Two for the abdominals and one for the obliques

The following is an example that I will give the Physical Education Department to use when assisting students with this project.

Muscle name to be exercised	*Description of Exercise*	*Frequency - Sets/Reps/Weight*
Pecs (Chest)		
Biceps		
Triceps		
Quadriceps		
Hamstring	.	
Obliques		
Abdominals		

Stretching and Warm – Up

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_____
_____

Cool Down

_____
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ANNOTATED BIBLIOGRAPHY

Teacher Resources

Anagnostakos, Nicholas and Gerald Tortora. *Principles of Anatomy and Physiology*. 5th ed. New York: Harper & Row, 1987. Chapter 10.
This is the textbook I used in an Anatomy and Physiology class at the University of Houston. This text has a thorough chapter on muscle tissue with great illustrations. I found it to be very useful in refreshing my memory on the subject matter.

Ballard, Carol. *The Skeleton and Muscular System*. Austin, Tex.: Raintree Steck-Vaughn, 1998.
This is one of the books I checked out from my school library. A classroom set of this book would be very handy for this curriculum unit. It has excellent illustrations and is written for a middle school level student.

DiCarlo, Stephen E., E. Sipe, J. Eilynn, J.P. Layshock, and Sandhia Varyani. "Experiment Demonstrating Skeletal Muscle Biomechanics." In *Advances in Physiology* 20 (1998): 59-71.
This selection is a description of an experiment that was conducted by students to understand muscle biomechanics. Using dumbbells the students measured how much weight could be lifted and held at different angles. I passed this article on to the Physical Education Department leader to use as a resource when connecting with the lesson. The article also contains good illustrations of muscle contraction and the sliding filament theory. It can be used as a guide for the student projects.

Harms-Ringdahl, Karin, ed. *Muscle Strength*. London: Churchill Livingston, 1993.
Chapter two of this book had extensive information on muscle contraction, very useful for getting base knowledge to use for discussion and for student assistance.

Jones, Norman L., Neil McCartney and Alan J. McComas, eds. *Muscle Strength*. Champaign, Ill.: Human Kinetics Publishers, 1986.

Ruegg, J.C., et al., eds. "Calcium in Muscle Activation." In *Zoophysiology* 19 (1986).
I made a few index cards from this book to use as a teaching tool during the lesson on muscle contraction. It is a good supplemental source to use with the Internet website on muscle contraction. It also contains good diagrams.

Internet Resources

http://www.hopkinsmedicine.org/als.html
ALS (Lou Gehrig's Disease)
This article provides general information about Lou Gehrig's disease. It will be provided to any student wishing to do research in this particular area.

http://www.ultranet.com/~jkimball/BiologyPages/M/Muscles.html
Anatomy of Skeletal Muscle

This article had great illustrations of the sliding filament theory as well as good definitions for the muscle components.

http://www.muscular–dystrophy.org/information/Research/carrier.html
Muscular Dystrophy Campaign

This website will be provided to any student wishing to do research on muscular dystrophy.

http://www.neuromus.ucsd.edu?MusIntro/fiber.shtml
Muscle Physiology

This article had good information on muscle contraction to use as information gathering for teaching the muscle contraction lesson.

http://www.e-muscles.net
Muscles

This article has a good explanation of the three types of contraction, hypertrophy, and the sliding filament theory.

http://www.cdc.gov/nchs/products/pubs/pubd/hestats/over99fig1.htm
Prevalence of Overweight Among Children and Adolescents: United States, 1999

This is the Centers for Disease control website. The article provides statistics regarding overweight and obese children in the United States. This is also a good site to refer to students to gather a variety of information for their research project.

http://www.rand.org/congress/health/0602/obesity/rb4549/index.html
The Health Risks of Obesity

This article provided statistical data on teen obesity and consequences associated with obesity.

http://users.rcn.com/jkimball.ma.ultranet/BiologyPages/S/Sliding_Filament_Model.html
The Sliding Filament Model

This is a great article for explaining and demonstrating the sliding filament theory.

http://www.healthcentral.com
Health Central

This website has good information on muscle disorders and disease along with an assortment of other health related issues.

http://school.discovery.com
The Discovery School

Free registration! Log on and register to use the worksheet and puzzle maker. This is a great source for making a variety of puzzles, quizzes and worksheets. Just plug the information in, and create fun worksheets for class. I made several crosswords and word search puzzles using the different muscle names and components. It is also good for designing quizzes and worksheets.

Student Resources

http://www.innerbody.com
Inner Learning Online

This site will be used by students when learning the names of the muscles. This site has an active diagram of the body, students can click on various areas and learn the names of the muscles and related information.

http://www.exrx.net/Lists/Directory.html
ExRx Exercise and Muscle Directory

This site is also useful in learning not only muscle names, but if you click on a specific muscle, it gives you various exercises to do that will work the specific muscle.

http://www.howstuffworks.com
How Stuff Works

Students will use this site during their computer assignment on learning the steps in contraction and the sliding filament theory. This site has a colorful slide show that demonstrates each phase of contraction. Students can replay it many times over to understand the concept.

http://www.kidshealth.org
KidsHealth

This site will be given to students to use as a source for their research project. It has an assortment of information on muscle disorders and health issues. It is a fun page for kids to learn about different fitness and health issues.

http://www.teenweb.org/teens
Teenweb

This site will also be given to students to use in for their research purposes. It contains easy to understand information on fitness and health issues.