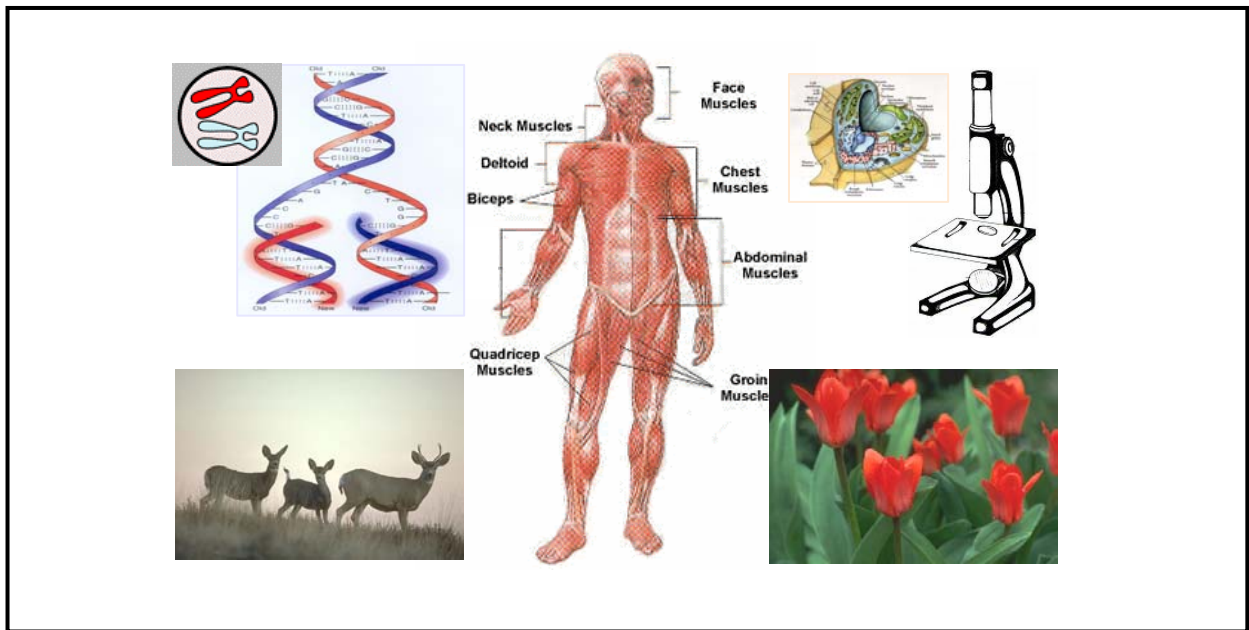


Project EASE

(Effective Alternative Secondary Education)

BIOLOGY



MODULE 10

Musculo - Skeletal System



BUREAU OF SECONDARY EDUCATION

Department of Education
DepED Complex, Meralco Avenue
Pasig City



Module 10

Musculo-Skeletal System



What this module is about

Are you amazed at the wonder of the work of the human machine? Get ready for another trip to a more complex part of the body, your musculo-skeletal system.

You often think of bones as those parts of the body that remain long after the softer organs of a dead body have decomposed. However a living bone is quite different from the remains of a dead body. It is a living organ, richly supplied with blood. It requires oxygen and nourishment and it responds to the care you give.

This module has 3 lessons, namely:

- **Lesson 1 – Skeletal System**
- **Lesson 2 – Muscular System**
- **Lesson 3 – Bones and Muscle Problems**



What you are expected to learn

After going through this module, you are expected to:

1. Discuss the purpose of the skeletal system.
2. Describe some important parts and explain their functions.
3. Tell how bones are connected to the muscles.
4. Distinguish the different types of joints.
5. Locate places where this type of joint is found.
6. State and explain the functions of the muscular system.
7. Classify muscles according to types and functions.
8. Discuss the causes of some of the more common problems of the bones and muscles.
9. Explain ways of preventing the problems of the bones and muscles.



How to learn from this module

1. Read and follow instructions carefully
2. Answer the pre-test before you start the lesson.
3. Take note and record points of clarification.
4. Try to achieve at least a 75% level of proficiency in the tests.
5. Work diligently and honestly.
6. Answer the posttest thoroughly.



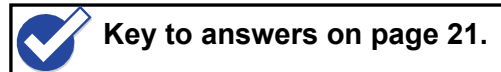
What to do before (Pretest)

Multiple Choice. Choose the letter of the best answer. Write the chosen letter on a separate sheet of paper.

1. The main support system of the body is/are the
 - a. blood
 - b. bones
 - c. muscles
 - d. skin
2. Which organs are protected by the rib cage?
 - a. heart and lungs
 - b. brain and spinal cord
 - c. ovaries and testes
 - d. small and large intestines
3. If there were no bones, the muscles would drop to the ground. Which function of the bone is shown here?
 - a. protects the heart and lungs
 - b. provides leverage for movement of muscles
 - c. forms a strong case for delicate organs
 - d. provides anchor to which muscles are attached
4. It is estimated that there are _____ bones in an adult.
 - a. 106
 - b. 206
 - c. 306
 - d. 406
5. What are bones made up of?
 - a. calcium
 - b. collagen
 - c. osteoblast
 - d. phosphorus
6. What bony cavity protects the brain?
 - a. cranium
 - b. pelvis
 - c. ribs
 - d. spinal column

7. What nutrients give bones their strength and shape?
- a. calcium and iron
 - b. calcium and phosphorus
 - c. iron and phosphorus
 - d. iodine and phosphorus
8. As bones grow older, they harden because of bone cells and minerals. What do you call this process?
- a. ossification
 - b. osteoarthritis
 - c. osteomalacia
 - d. osteoporosis
9. What do you call the point where two bones meet?
- a. joint
 - b. origin
 - c. marrow
 - d. insertion
10. A lubricating fluid that helps the bones move smoothly over one another is called
- a. cerebrospinal fluid
 - b. grease
 - c. oil
 - d. synovial fluid
11. There are about _____ muscles in the human body
- a. 300
 - b. 400
 - c. 500
 - d. 600
12. Muscle fibers have the power of shortening. This is also referred to as
- a. contraction
 - b. insertion
 - c. origin
 - d. relaxation
13. The connective cord which attaches a muscle to a bone is the
- a. cartilage
 - b. joint
 - c. ligament
 - d. tendon
14. The point of attachment of a muscle that remains fixed during muscular contraction is referred to as
- a. insertion
 - b. joint
 - c. origin
 - d. tendon
15. Muscles that move when we want them to move are called
- a. cardiac
 - b. involuntary
 - c. skeletal
 - d. smooth
16. The essential function of a muscle is for
- a. contraction
 - b. relaxation
 - c. pumping
 - d. pushing
17. Where can we find cardiac muscles in the body?
- a. chest
 - b. face
 - c. heart
 - d. pelvis

18. Which muscles are found in the walls of the hollow organs of the body like stomach, urinary bladder, etc?
- a. cardiac
 - b. involuntary
 - c. skeletal
 - d. voluntary
19. The movable bony attachment of muscles is the
- a. insertion
 - b. joint
 - c. origin
 - d. tendon
20. All of the statements below are true about muscles **EXCEPT** one. Which is it?
- a. Muscles can contract.
 - b. Muscles can pull.
 - c. Muscles can push.
 - d. Muscles have at least two attachments.



Lesson 1. The Skeletal System

Why do builders put up a wood/steel frame for a house? Why are there aluminum frames in an umbrella? The wood/steel frame supports the walls and roof of a house just as the aluminum frame supports the umbrella. These frames which provide support are also known as framework.

Animals have a framework similar to the framework of a home. The framework in animals is called the skeleton. In animals, the framework has muscles attached to it instead of walls or roof.

The skeleton has a number of jobs. These jobs are related to the protection, support, and movement of the body.

The skeletal system provides form and support to the body. Without a skeleton you would not be able to walk, talk, or lift objects. There would be little protection to your brain and internal organs. In fact, without bones you would be a formless being. Bones serve the following functions:

- Protect the vital organs inside the body.
- Provide anchor or support to the muscles.
- Produce blood cells.

To help you better understand the function of bones, perform the activity on the next page.



What you will do

Activity 1.1 Knowing the Functions of the Bones

Prepare the following materials:

Paper doll
Piece of wire as tall as the paper doll
Masking or adhesive tape

Procedure:

1. Cut a paper doll and make it stand on the table.
2. Attach the paper doll to the wire using the adhesive tape.
3. Bend the wire in different directions and observe what happens to the paper doll.

Answer the following questions:

- a. Did the paper doll stand on its own?
- b. Did the paper doll stand when it was attached to the wire? Why or why not?
- c. What function did the wire play in relation to the paper doll?
- d. What happened when you bent the wire in different directions?
- e. What part of the body can be compared to the wire in this activity?
- f. What help does the backbone offer in bending?



Key to answers on page 21.

Did you enjoy the activity? I'm sure you did. Now proceed to the next interesting topic.

Bones

A bone is alive and is made of cells just like other organs and body parts. Because bone cells are living, they can reproduce resulting in the hardening of the bones called **ossification** and bone growth. You know that bones grow because you are taller now than when you were younger.

Not only does bone size change, their number also changes. As you grow the number of your bones increases although some bones fuse. This could not happen if bones were not alive.

Figure 1 shows the parts of the *skeletal system*. The skeletal system includes the **bones, cartilage, ligaments, and tendons**. These are tissues that make up the skeleton. A bone is a hard, living tissue and contains blood vessels, nerves and dividing cells. Most

bones are hollow, or at least spongy inside. The hollow center of the bone is the marrow. The marrow produces red and white blood cells and stores some of the body's excess fat.

Cartilage is a tough, flexible tissue. Cartilage is the one cushioning the ends of the long bones where they meet. You can feel the cartilage in your earlobes and the lower part of your nose. Cartilage is also found in the walls of the voice box and in the windpipe.

Ligaments attach one bone to another where two bones connect. Ligaments are tough strands of connective tissues. It is the ligaments that hurt when you sprain an ankle.

Tendons are tissues that connect the bone to a muscle. Have you ever seen the thin, pink, tough membrane covering the outside of the bone? This is the **periosteum**, a tough, living membrane that covers all the bone except the ends. This is richly supplied with blood vessels. The periosteum is necessary for nourishing the bone, for producing bone cell and for repairing injuries.

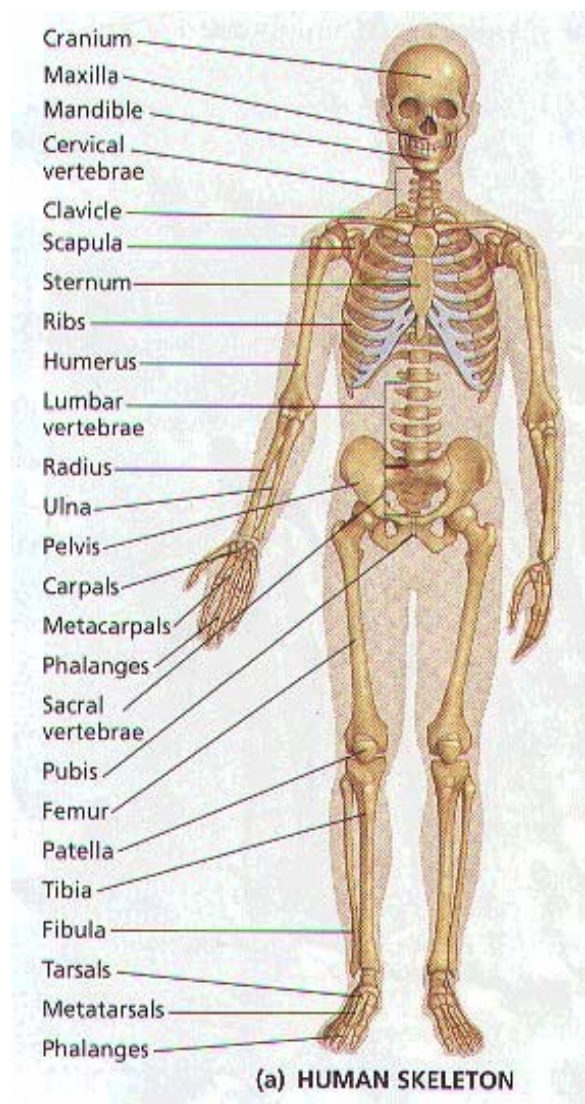


Figure 1
Parts of the Skeletal System
<http://www.sirinet.ml/~jgjohnso/biologyII.html>



What you will do

Activity 1.2 Test for Calcium In Different Bones

Materials:

acid in dropping bottle
chalk
cow bone
wood

glass slide
pig's meat
chicken bone

Procedure:

1. Make a chart similar to the one shown on the next page to record your data.

- Place a piece of chalk on a glass slide.
- To see the effect of the acid on calcium, put a drop of acid on the chalk.

Reminder:

Do not spill acid on skin or clothes. If spillage occurs, rinse with water and call your teacher. The bubbles that form tell you that calcium is present.

- To see the effect of the acid when calcium is not present, put a drop of acid on the glass slide. No bubbles form. Calcium is not present.
- Record the results from steps 3 and 4 in your data chart.
- Test each of the skeleton parts listed in the materials list to see if calcium is present. Add only one or two drops of acid to each skeleton part. Make sure that each part to be tested is on the glass slide.
- Record your results in the chart.

Data and Observations:

Item Tested	Bubbles Form with acid? (Yes or No)	Is calcium present? (Yes or No)
Chalk		
Glass		
Cow bone		
Chicken bone		
Pigs meat		
Wood		

Answer the following:

- How can you tell if a skeleton part contains calcium?
- How can you tell if a skeleton part does not contain calcium?
- Which of the skeleton parts did have calcium?
- What is the job of calcium in a skeleton?
- Would you expect to find calcium in pig's meat? Why or why not?



Key to answers on page 22.

The ends of bones are covered with **articular cartilage**. This provides a smooth surface so that two bones can glide over each other.

The bone tissue near the joints is loose or spongy and has the ability to absorb mechanical shock. This is the **spongy layer**. It contains the bone marrow, which produces red blood cells and most of the white blood cells.

Between the joint ends the bone narrows into the slender area called the **shaft**. At the center of the shaft is the **medullary canal**, filled with yellow marrow. Most cells in this marrow are fat cells. (Figure 2)

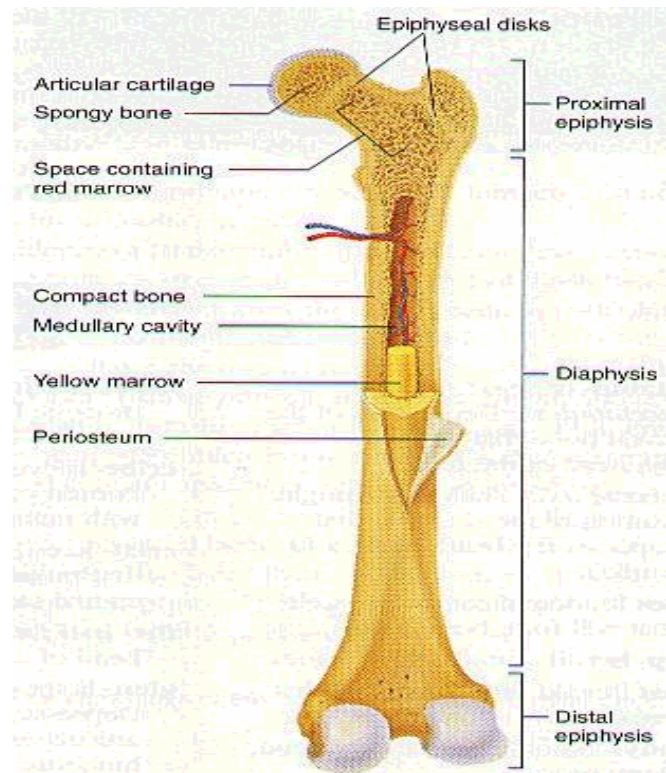


Figure 2. Parts of a Bone Shaft
<http://www4.tpgi.com.au/users/amegann/body/skeletal.html>

Beneath the **periosteum** is a hard bony layer. There is a network of canals running throughout the bony layer. These are called **haversian canals**, which contain blood vessels that supply nourishment to the bone cells.

The human skeleton has 206 bones. There are five main parts of the skeleton - the **skull**, **rib cage**, **back bone** or **spinal cord**, **front appendages** which includes the hands, arms, shoulders and collar bone and the **back appendages** composed of the feet, legs, knees and hip bone.

The main part of the human skeleton is the **backbone**. The backbone is not a single bone. It is made up of thirty-three small bones called vertebrae. About one fourth of the bones, more than fifty, are located in a person's two hands. Six of the bones are the tiny, bony parts of the inner ear.

Exercise, correct posture and eating foods rich in calcium and phosphorous are good for the bones.



What you will do **Self-Test 1.1**

1. What are the four main parts of the skeletal system?
2. What is a bone?

3. What is a cartilage?
4. What are tendons?
5. What are ligaments?
6. What are the five main parts of the human skeleton?



Key to answers on page 22.



What you will do

Activity 1.3 Palpation (Touching)

Now, you are ready to perform a very interesting activity. Explore some parts of your body by observing and palpating or touching them as you work through this exercise.

1. Run your finger over the surface of your head. Notice that the underlying skull or cranium lies very near the surface. The skull protects the brain.
2. Spread your fingers on the skin of your face and feel it bunch and stretch as you smile, frown and make “faces”. You are now monitoring the action of the muscles of your face.
3. Run your fingers along the middle of your back and feel the spine or the vertebrae. The spine protects your spinal cord.
4. Touch your collar bone along its entire length from the breastbone to the shoulder.
5. From the breastbone, feel the ribs, the bones that protect the heart, lung, liver and other delicate organs.
6. Now, work your elbow – flexing and extending it – feel the ulna moving in and out on the backside of the upper arm.
7. Clench your fist and find the joint protrusions beyond the wrist.
8. Rest your hands on your hips. Feel the pelvic bones. These protect your reproductive organ and other parts.
9. Touch your ankle. Now feel the whole part of the ankle.
10. Move your fingers toward the heel bone.

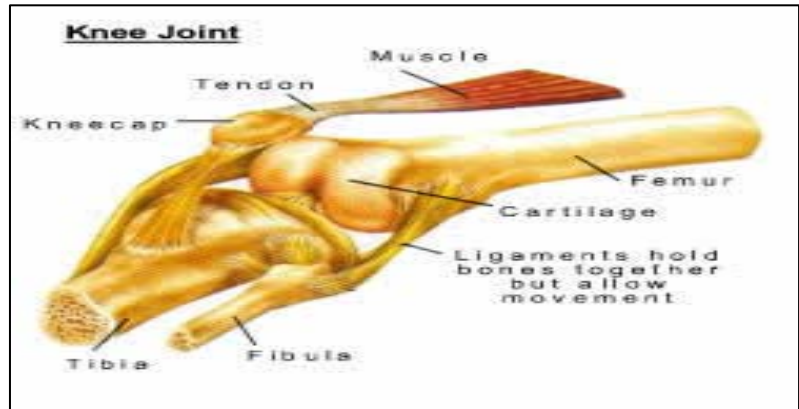
Did you enjoy the activity? How did you feel while touching some of the bones and muscles of your body? Were you amazed at the various parts that you have touched? Palpation or touching can also help locate broken bones and inflamed muscles in your body.

Do you know why you can move your knee, elbow, arm, or bend your body? This is because the skeletal system has joints.

The Joints that Connect Bones

A joint is a place where two bones meet. Most joints are movable. There may be some cartilage and fluids at the ends of the bones. This permits the joints to move smoothly without damaging the bones. There are five kinds of joints. Look at Figure 4 to know the location of the different kinds of joints.

- **Hinge Joints** - like the door hinge, a hinge joint can only move in one direction – up or down. Your knee and elbow are hinge joints. Study carefully the illustration of a hinge joint at the right. Notice the tendon, ligament and cartilage.



- **Pivot Joints** - the pivot joint allows rotation. Your wrist and where your head is attached to the spinal chord are pivot joints. This is why you can turn a doorknob with your hand and turn your head.

- **Ball-and-Socket Joints** - ball-and-socket joints allow you to turn your arms and legs in a complete circle. There is a ball or knob at the end of one bone. At the end of another is a hole or socket. A joint is formed where the ball fits into the socket. Shoulder joints and hip joints are ball-and-socket joints.

- **Gliding Joints** – a gliding joint allows two bones to move one over another. These are only found between the vertebrae in the backbone. The amount of movement is small.

- **Fixed joints** - joints where the bones are tightly joined together and cannot move. The skull bones are fixed joints.

Figure 3. Hinge Joint

<http://www4.tpgi.com.au/users/amegann/body/skeletal.html>

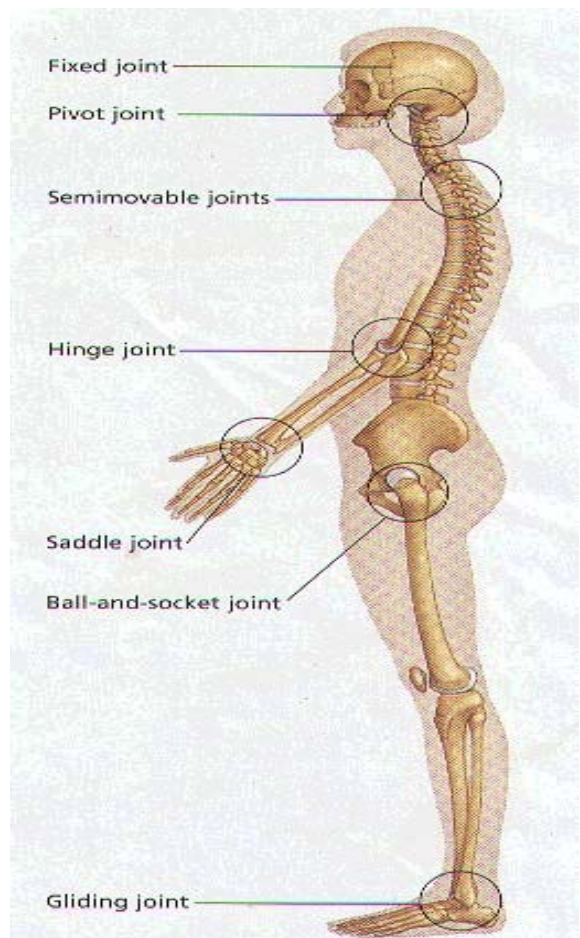


Figure 4. Joints of the Human Body

<http://www4.tpgi.com.au/users/amegann/body/skeletal.html>



What you will do

Activity 1.4 Examining a chicken bone

1. Carefully cut and peel away the skin and meat of a chicken thigh.
2. Remove the thin sheet of outer tissue covering the bone.
3. Observe the exposed layer. This is the periosteum.
4. Feel and observe the substance where bones come together. This is the joint.
5. Look for a white substance covering the ends of the bones. This is the cartilage.
6. Pick away the meat at the small end of the drumstick. Locate the round, tough piece of tissue. This is the tendon.
7. Carefully bend back two bones and crack a joint. Do not tear the bones apart. Find the tissue that is tough and crunchy which help hold the bones. This is the ligament.
8. Slice open lengthwise the leg bone. Observe carefully the inside parts. Locate the solid bone, marrow and spongy bone.

Lesson 2. The Muscles

A cat strikes out at a rat to capture it. With a quick turn, the rat moves away to escape. Both animals use their muscles for movements.

Muscle is a special kind of tissue that brings about movement. The kind of movement that muscles carry out depends on where the muscles are located. Without muscles your bones and joints will be useless. Bones cannot move by themselves. Moving, breathing and swallowing would be impossible without muscles.

Muscles, the organs of the muscular system (*Figure 5*), consist largely of muscle cells that are specialized to undergo contraction. During this contraction, some of the chemical energy of nutrients is converted to mechanical energy or movement. The front view of the muscular system is shown below.

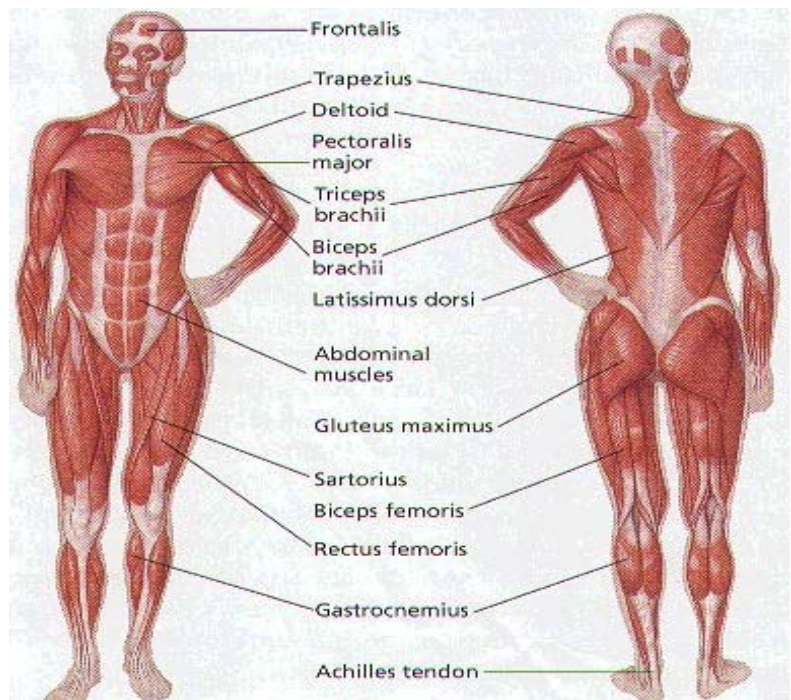


Figure 5. The Muscular System

<http://www4.tpgi.com.au/users/amegann/body/muscular.html>

When muscles contract, they pull the body parts to which they are attached. This action usually causes some movement, as when the joints of the legs are flexed and extended during walking. At the other time, muscular contraction resists motion, as when they help the body parts in postural positions. Muscles are also responsible for the movement of the body fluids such as blood and urine, and they function in heat production that helps maintain body temperature.

There are 600 muscles in the human body. Most muscles are attached to bones and extended from one bone to another. Each end of the muscles is attached to a bone by a strong connective tissue, a *tendon*. Bones of the muscles move only when the muscles attached to them pull.

Muscles do not push; they only pull. This is why most muscles come in pairs. The muscles of your arm are good examples of how muscles work as partners. The two muscles of your arms are called biceps and triceps (*Figure 7*). The biceps is a flexor muscle. It produces a flexing or bending action by pulling the lower arm bone at the joint towards the body. The triceps is an extensor muscle. It produces an extending or straightening action by returning the bone to the relaxed position.

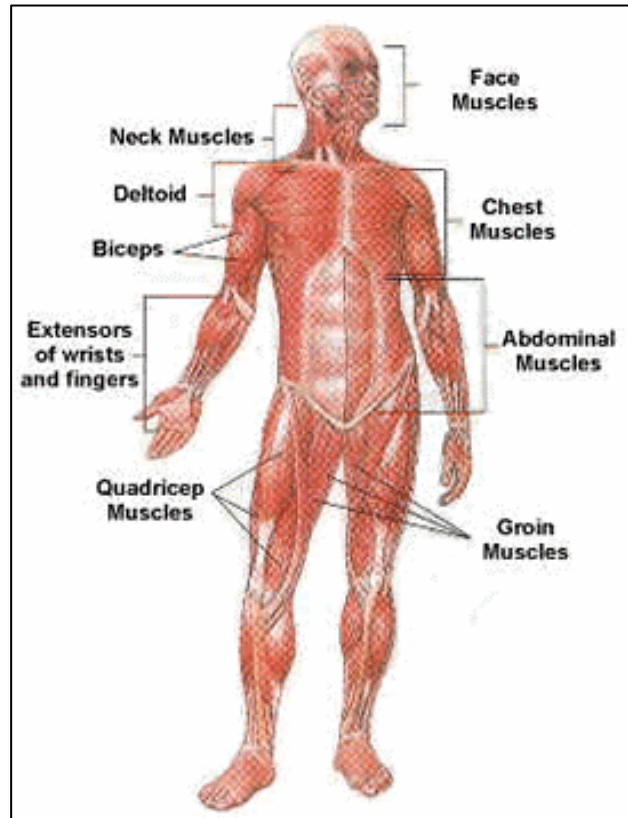


Figure 6. The Muscles
<http://www4.tpgi.com.au/users/amegann/body/muscular.html>

Not all muscles are connected to the bones. For example, heart muscles work by squeezing. Some muscles are connected to the skin. This is how you are able to smile by moving fourteen muscles. It takes 75 muscles to frown.

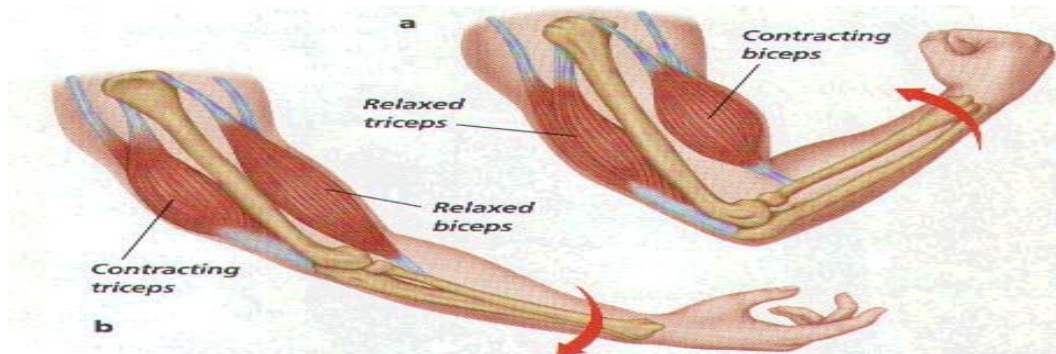


Figure 7. Muscles of the Upper Arms
<http://www.sirinet.ml/~jgjohnso/biologyII.html>

Types of Muscles

There are three kinds of muscles: (1) Skeletal muscle, also known as striated or voluntary; (2) Smooth or involuntary muscles, which forms the muscle layers of the digestive tract and other internal organs; and (3) cardiac or heart muscles.

Do you know that one type of muscle makes up about half of your body weight? This is the skeletal muscle.

The **skeletal muscle** as shown below consists of a mass of muscle fibers grouped together and are attached to bones. This muscle has a striation when seen under a microscope. Striped or striated muscles are used to make fast, precise movement.

A person can control the use of striped muscle. A muscle that can be controlled is a voluntary muscle.

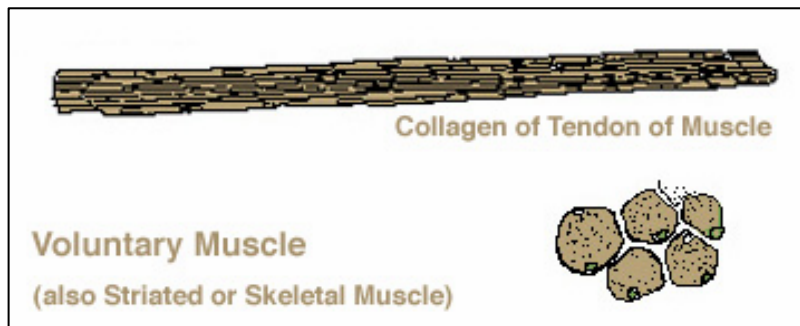


Figure 8

The **smooth muscles** in the drawing below are made of long, thin cells that form layers like a pile of rags. A person cannot decide to move smooth muscles. They cannot be controlled. The smooth muscle is a type of involuntary muscle.

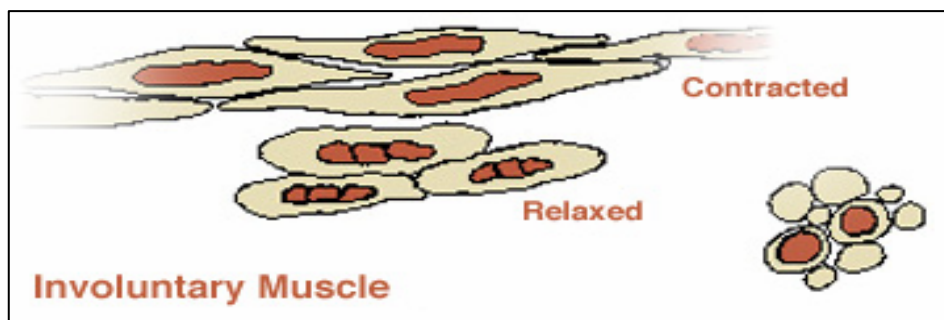


Figure 9

Smooth muscles control many of the internal organs of the body. Examples of smooth muscles are the muscles of the stomach, arteries and uterus.

Cardiac muscle is found only in the heart. The cardiac muscle works like a smooth involuntary muscle.

The illustration below shows a sample of a cardiac muscle. The cardiac muscle looks like bundles of fibers twisted into a rope. Fibers from one bundle branch into the next bundle. Thus, the bundles of cardiac muscles are all connected and can work together to keep the heart pumping.

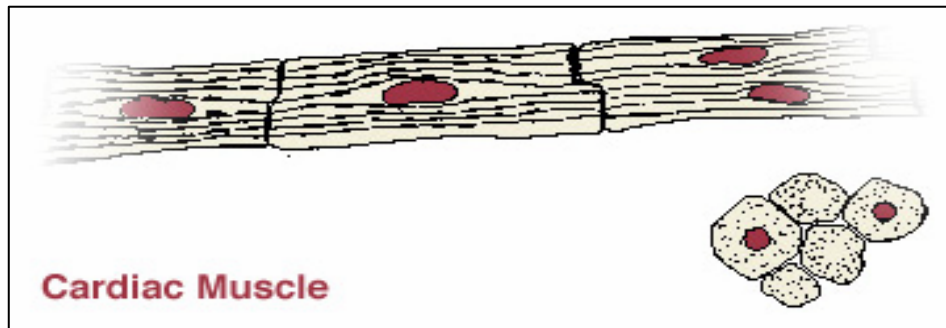


Figure 10

Pictures retrieved from <http://www.archive NCSA.uiuc.edu>.

Muscle is a special kind of tissue that can contract. The size of the muscle increases with use.

To remain healthy, a muscle must be regularly exercised. Without exercise, it undergoes atrophy (reduce in size); with extremely vigorous exercise, it undergoes hypertrophy (increase in size).



What you will do

Activity 2.1 Types of Muscles

Fill up the chart below. Check (/) whether the action is done by voluntary, involuntary or cardiac muscles.

Actions	Involuntary	Voluntary	Cardiac
1. Yawning			
2. Running			
3. Skipping			
4. Breathing			
5. Shivering			
6. Blinking of the eyes			
7. Heart beating			
8. Digesting food			
9. Stretching arms			
10. Playing piano			



Key to answers on page 22.

Lesson 3. Bone and Muscle Problems

Do you want to know more about bones and muscles? Get ready for another interesting lesson.

From studying this module, you know that the skeletal and muscular systems work together. So, a problem in one system may cause a problem in the other. Modern science is able to help solve some of the problems that affect the skeletal and muscle systems.

Skeletal Problems

Some problems with the skeletal system are diseases of the joints. **Arthritis** is a disease of bone joints. One type of arthritis results in breakdown of the bone at the joints. The result is pain and swelling at the diseased joint. In time, a person may not be able to bend or move that part of the body.

Today there are some help for the problems of arthritis. Artificial joints made of plastic or metal are sometimes used to replace diseased joints. Joints such as hip, ankle, and knee have been replaced. It is made of metal and replaces the ball part on the femur of the ball and socket joint in the hip.

Most bones in the body are connected to each other by tight bands called ligaments. Have you ever twisted your ankle? If you have, the pain you felt was caused by injury to your ankle ligaments. Sprains are injuries that occur to your ligaments. In some cases, you may have stretched the ligaments around the ankle. This stretching takes only a short time to heal. A more serious sprain results when the ligaments are torn. Torn ligaments are more painful than stretched ligaments and take much longer to heal.

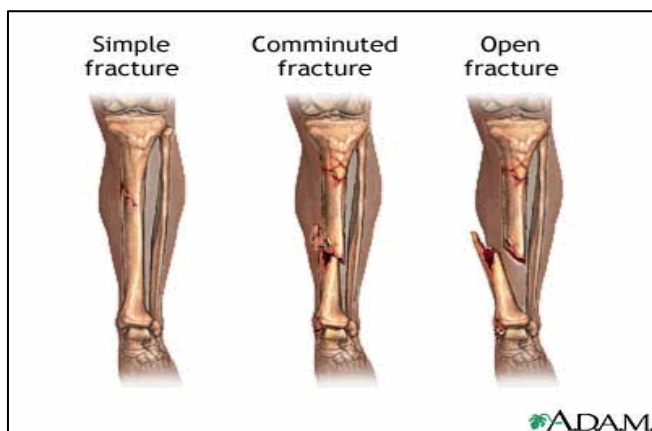


Figure 11. Types of Fractures
nml.nih.gov/medlineplus/ency/imagepages/117259.htm

Probably the most common disorder of the musculo-skeletal system is a fracture. Although the most frequent cause of fractures is that of trauma, some are the result of a bone disease that causes weakening of the structural supports that break with little or no actual trauma (injury caused by shock, violence) e.g. wound. Study figure 11. This shows the different types of fractures: green stick fracture or simple fracture, comminuted fracture, and compound fracture. The fractures may occur because of such conditions as cancer of the bone, osteoporosis (porous bones), or complication from prolonged therapy.

Dislocations. A dislocation is more severe than a sprain. The bone ends are moved out of place at the joint, and the ligaments holding them are severely stretched or torn as shown in the figure on the right. Note that the bone (radius) is not connected to the other bone below.

A dislocation must be set into a normal position and held during healing with a bandage or cast as support.

To see how dislocation and fracture differ, do the activity below.

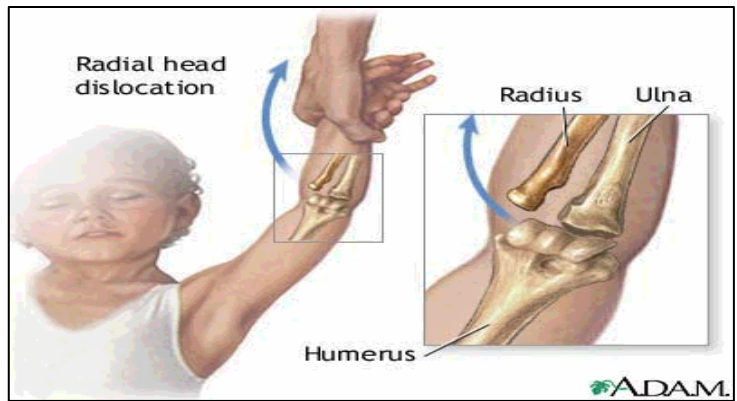


Figure 12. Bone Dislocation
nml.nih.gov/medlineplus/ency/imagepages/117259.htm



What you will do

Activity 3.1 Distinguishing Dislocation and Fracture

- A.
1. Get a chicken wing.
 2. Remove the skin and meat.
 3. Locate the joint.
 4. Twist the bones of the lower and upper wing in opposite direction so that bones will be out of place.
 5. Observe what happens to the alignment of bones. This result in a dislocation.
- B. Using the same wing break the bone. Observe. This is a fractured bone.

What you have done and observed is comparable to the same problems of the human skeleton.

Bursitis. A bursa is a small sac situated near a joint. There are 52 of these sacs in your body. Bursas lie between tendons that rub each other, or between tendons and bones, to prevent friction between these organs. There is a large bursa at the kneecap and several around the joint; others are found at the elbow and the ankle. The bursa in the shoulder is situated near the ball of the upper arm. A bursa may become inflamed due to injury, arthritis, or infection. The inflammation is very painful and is known as **bursitis**. It is most common in the shoulder and knee.

Torn Knee Cartilage. The cartilage pads in the knee joints are frequently torn in sports, especially football. They may then become loose and cause pain, swelling and prevents free movement. A new method of treating this injury is a surgical removal of part

or all of one or both cartilage pads in the knees. This is usually done by opening a knee joint. A new method involves using an ARTHROSCOPE, a slim viewing instrument that can be inserted, along with tiny instruments, through small holes into the joint.

Through the miracles of bone surgery, fractured bones can be joined together with pins. Crushed bones are repaired by grafting bone into the destroyed section. In bone banks, pieces of bones are available for surgery. This bone tissue can serve as a framework until it is absorbed by the body and replaced with new bone.

Muscle Problems

Have you ever had sore muscles after doing a lot of exercise or after trying to reach far objects? Have you ever had a charley horse or muscle cramps? These three problems are quite different from each other.

Muscle soreness happens when small tears occur in your muscles. This may happen if muscles have not been used for a while. A **charley horse** is a bruise in which tears may occur in the muscle. This time, however, the tears cause bleeding from inside the muscle. Bleeding results when small capillaries are broken. **Muscle cramps** result from a sudden and usually strong contraction of muscle.

All muscles have nerve cells that connect to them. When a message moving along a nerve cell reaches a muscle, the muscle contracts. Without nerve cells, muscles would not be able to contract and then move body parts.

A disease called muscular dystrophy interrupts muscles and nerves acting together. *Muscular dystrophy* is the slow wasting away of muscle tissue. People with this disease may lose the use of some or all of their skeletal muscles. Although the cause of the disease is not exactly known, nerve cells leading to muscles are thought to cause the problem.



What you will do

Self-Test 3.1

1. What is arthritis?
2. What happens to ligaments during a sprain of the ankle?
3. What is muscular dystrophy?



Key to answers on page 23.

Keeping Bones and Muscles Healthy

Have you observed that the parts of your body that are used are big and strong while those parts that are not used waste away? This is also true of your bones and muscles. Many of you do not get enough exercise. As a result, muscles grow soft and weak, and bones grow brittle and break easily. If you exercise regularly, you can keep your muscles strong and healthy. Exercise will also strengthen your bones and joints, so that they are less affected by an injury.



What you will do

Activity 3.2 Strengthening Abdominal Muscles

Follow the directions below and find out the effect on your body.

1. Lie on your back with your knee bent and your hands clasped behind your head.
2. Curl up until half of your body is off the floor.
3. Hold this position, then curl back down.
 - a. Do ten curls first; then gradually increase.
 - b. How did you feel after the exercise.

Many types of bone, muscle and joint injuries can be avoided by exercising properly to strengthen the body. Exercises for strength, endurance, flexibility, and motor control are essential to keep bones and muscles healthy. Good posture means the various parts of the body are balanced with one another. Good posture is important not only for appearance, but also for overall health.



What you will do

Activity 3.3

Follow the directions below.

1. Tighten your abdominal muscles as though you are about to receive a blow there.
2. Hold them tight for 30 seconds and relax.
3. Repeat several times.

You can do this exercise several times during the day, for example, while combing your hair or just walking down the street.

You must be very tired after performing the activities, but think about the benefits you got from doing them. They surely will help keep your bones and muscles healthy.



Let's Summarize

1. The skeletal system protects the vital organs inside the body, serves as attachment for muscles, and produces blood cells.
2. The bones, cartilage, ligaments and tendons make up the skeletal system.
3. There are 206 bones in an adult human skeleton.
4. Bone is a hard living tissue.
5. Cartilage is a tough, flexible tissue.
6. Ligaments attach one bone to another where two bones connect.
7. Tendons are tissues that connect the bone to a muscle.
8. The five parts of the human skeleton are the skull, ribcage, backbone, front appendages, and the back appendages.
9. Joints connect bones.
10. The five types of joints are hinge joint, pivot joint, ball-and-socket joints, gliding joints and the fixed joints.
11. There are 600 muscles in the human body.
12. Muscles give shape to the body, make movement possible, and protect delicate organs.
13. The three kinds of muscles are the skeletal or voluntary muscles, the smooth or involuntary muscles, and the cardiac or the heart muscles. Muscles always act in pairs.
14. Skeletal muscles are muscles attached to bones. They can be controlled.
15. Smooth or involuntary muscles cannot be controlled.
16. Cardiac muscles are involuntary muscles found only in the heart.



Posttest

Multiple Choice. Choose the letter of the best answer. Write the chosen letter on a separate sheet of paper.

1. The system that provides form and support to the body is called
 - a. digestive
 - b. circulatory
 - c. muscular
 - d. skeletal
2. The connective tissue which connects a muscle to a bone is the
 - a. blood
 - b. joint
 - c. ligament
 - d. tendon
3. What system provides the body with movement?
 - a. circulatory
 - b. digestive
 - c. muscular
 - d. skeletal

4. What do you call the place where two bones meet?
- a. cartilage
 - b. medullary cavity
 - c. joint
 - d. periosteum
5. What tissue serves as a cushion found at the end of the bones where they meet?
- a. cartilage
 - b. ligament
 - c. muscle
 - d. tendon
6. Which connects a muscle to a bone?
- a. cartilage
 - b. ligament
 - c. muscle
 - d. tendon
7. The joints of the skull do not move. What do you call this kind of joint?
- a. ball-and-socket
 - b. fixed
 - c. hinge
 - d. sliding
8. Which bone protects the heart and lungs?
- a. cranium
 - b. pelvis
 - c. rib cage
 - d. spinal column
9. When our ankle is sprained, which tissue in the joints is stretched or torn?
- a. cartilage
 - b. ligament
 - c. periosteum
 - d. tendon
10. Which of the following statements is **NOT** true about muscles?
- a. Muscles work alone to provide movement.
 - b. Cardiac muscles are found only in the heart.
 - c. When a muscle contracts it pulls one bone toward another bone.
 - d. All muscles are connected to bones.
11. What two muscles of the arms perform bending or extending actions?
- a. carpals and phalanges
 - b. tarsals and phalanges
 - c. biceps and triceps
 - d. deltoid and brachialis
12. Which muscles are used to make fast and precise movements?
- a. cardiac
 - b. involuntary
 - c. voluntary
 - d. smooth
13. Muscle increases in size with use. The statement is
- a. correct
 - b. not correct
 - c. sometimes true
 - d. not known
14. The most abundant of the three types of muscles in the human body are the
- a. cardiac
 - b. involuntary
 - c. ligaments
 - d. voluntary

15. A joint that allows movement in all directions is the
- ball-and-socket
 - gliding
 - hinge
 - pivot
16. The part of the bone which contains nerves and blood vessels is the
- cartilage
 - ligaments
 - periosteum
 - tendon
17. The soft center of a bone is the
- cartilage
 - marrow
 - periosteum
 - spongy layer
18. Movements of the arms, head or the fingers can be controlled. The muscles of these parts are
- cardiac
 - involuntary
 - skeletal
 - voluntary
19. The mineral used by the body and is a part of all bones is
- calcium
 - carbohydrates
 - phosphorus
 - protein
20. Which type of muscles do most digestive organs have in their walls?
- cardiac
 - involuntary
 - skeletal.
 - voluntary



Key to answers on page 23.



Key to Answers

Pretest

- | | | | |
|------|-------|-------|-------|
| 1. b | 6. a | 11. d | 16. d |
| 2. a | 7. b | 12. a | 17. c |
| 3. d | 8. a | 13. d | 18. b |
| 4. b | 9. a | 14. c | 19. a |
| 5. a | 10. d | 15. c | 20. c |

Lesson 1

Activity 1.1

- No
- Yes, because the wire gives support.

- c. Served as support
- d. It also bent in different directions.
- e. Bones
- f. Smooth or easy bending

Activity 1.2

Item Tested	Bubbles Form with acid? (Yes or No)	Is calcium present? (Yes or No)
Chalk	Yes	Yes
Glass	No	No
Cow bone	Yes	Yes
Chicken bone	Yes	Yes
Pigs meat	Yes	Yes
Wood	No	No

1. When hydrochloric acid was poured, bubbles appeared.
2. When hydrochloric acid was poured, no bubbles appeared.
3. Cow bone and chicken bone
4. Calcium straightens and shape bones.
5. No, because it is not a skeleton.

Self-Test 1.1

1. Bone, cartilage, ligaments and tendons
2. A connective tissue with a solid matrix, bone is alive and made of cells.
3. Cartilage are soft bones.
4. Tendons connect muscles to bones.
5. Ligaments connect a bone to another bone.
6. Cranium, rib cage, backbone, front appendages, back appendages.

Lesson 2

Activity 2.1

Actions	Involuntary	Voluntary	Cardiac
1. Yawning		/	
2. Running		/	
3. Skipping		/	
4. Breathing	/		
5. Shivering		/	
6. Blinking of the eyes	/		
7. Heart beating			/
8. Digesting food	/		
9. Stretching arms		/	
10. Playing piano		/	

Lesson 3

Self-Test 3.1

1. Arthritis is a disease of the joints of the bones.
2. The ligaments are stretched.
3. Muscular Dystrophy is a slow wasting away of the muscle tissue. The muscle becomes small.

Posttest

- | | | | |
|------|------|-------|-------|
| 1. d | 6. d | 11. c | 16. c |
| 2. d | 7. b | 12. c | 17. b |
| 3. c | 8. c | 13. a | 18. d |
| 4. c | 9. b | 14. d | 19. a |
| 5. a | 10.d | 15. a | 20. b |

References

Books:

- Daniel, L. (1994). *Life science*. Westerville, OH: Merrill Publishing Co.,Mcmillan/McGraw-Hill.
- Grabowski, T. (2003). *Principles of anatomy and physiology*. N.Y.: John Wiley and Sons, Inc.
- Holo, W. (1984). *Human anatomy and physiology*. (3rd Ed.) Iowa: W. C. Brown Publishers. Dubuque.
- Hopson, J.L. & Wessells, N.K. (1990). *Essentials of biology*. USA: McGraw-Hill Publishing Company.
- Kaskel, A., Hummer, P.J. & Daniel, L. (1981). *Biology on everyday experience*. USA: Merrill Publishing Co.
- Mariele, E.N. (1998). *Essentials of human anatomy and physiology*. (3rd Ed.) New York, USA: Addison-Wesley Longman, Inc.
- Payne, H. (1995). *Understanding your health*. St Louis, Missouri: Mosby Publishing Company.
- Pikering, W.H. (2000). *Complete biology*. New York: Oxford University Press Wong.

Electronic Sources:

Retrieved January 10, 2005 <http://www4.tpgi.com.au/users/amcgann/body/.html>

Retrieved January 10, 2005 from <http://www.innerbody.com>

Retrieved January 10, 2005 from <http://www.bartleby.com>

Retrieved January 10, 2005 from <http://www.sirinet.ml/~jgjohnso/biologyII>.