



What Is This Module About?

Imagine yourself building a house. What's the first thing you would do? What are the first structures you would put up? You would probably set up the supporting posts first, right? This is because you need to form a framework for that house first. Other parts that you will add would probably just adapt to the form of the basic structures you have made. Now, what will happen if these posts would weaken? Your house would most likely crumble to the ground!

The human body is like the house that you built. It needs a framework, the supporting structures that maintain the shape of the body and make it function well. In your body, the framework is provided by the skeletal system. It is a system made up of bones that give strong structural support and shape to the body.

In this module, you will learn about the skeletal system. You will know what its parts are and how these parts operate. You will also find out some injuries and diseases that can harm the skeletal system and how you can best take care of it.

There are four lessons in this module. These are:

Lesson 1 — *The Skeletal System*

Lesson 2 — *The Structure of the Skeletal System*

Lesson 3 — *The Structure of a Bone*

Lesson 4 — *Common Injuries and Diseases of the Skeletal System*



What Will You Learn From This Module?

After studying this module, you should be able to:

- ◆ describe the structure and functions of the human skeletal system;
- ◆ state how the skeletal system works;
- ◆ identify some injuries and diseases associated with the human skeletal system;
- ◆ demonstrate first aid treatment for injury to the skeletal system; and
- ◆ cite ways to best take care of the skeletal system.



Let's See What You Already Know

To find out what you already know about the topics to be discussed in this module, take the following test. Write your answers on the lines.

Enumerate five functions of the skeletal system.

1. _____
2. _____
3. _____
4. _____
5. _____

What makes up the skeletal system?

6. _____

Describe how the skeletal system works during movement.

7. _____

Give three injuries or diseases associated with the skeletal system.

8. _____
9. _____
10. _____

Well, how was it? Do you think you fared well? Compare your answers with those in the *Answer Key* on page 33.

If all your answers are correct, very good! This shows that you already know much about the topics in this module. You may still study the module to review what you already know. Who knows, you might learn some more new things.

If you got a low score, don't feel bad. This module is for you and it will help you to understand important concepts that you can apply in your daily life. If you study this module carefully, you would learn the answers to all the items in the test and a lot more! Are you ready?

You may go now to the next page to begin Lesson 1.

The Skeletal System

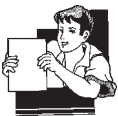
Most animals need a hard structure in their bodies to maintain shape and provide support and protection. Some, such as squids and insects, have **exoskeletons** or hard supporting structures found outside the body. However, in higher animals like mammals, the hard supporting structures are found inside the body. These structures are called **endoskeletons** or internal skeletons. Human beings have skeletons made up of bones. **Bones** are specialized hard structures that form the basic framework and supporting structure of the body.

In this lesson, you will study the components of the **skeletal system**. You will know more about the arrangement and functions of bones. The skeletal system is a very important part of your body. Are you ready to study it? The lesson is not as hard as your bones. In fact, you are going to learn a lot of new and exciting things in this lesson.



Let's Try This

Do you know where to find the bones in your body? Try feeling the hard structures under your skin. Can you feel how hard they are? Hold your head. How does it feel? The stone-hard structures that you felt are your bones. Do you think that hardness is important in maintaining the functions of your body?

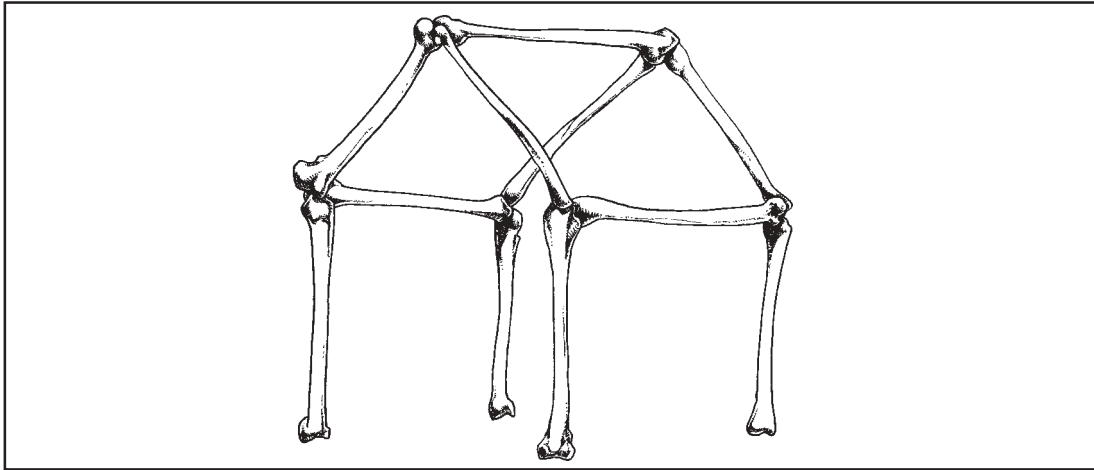


Let's Learn

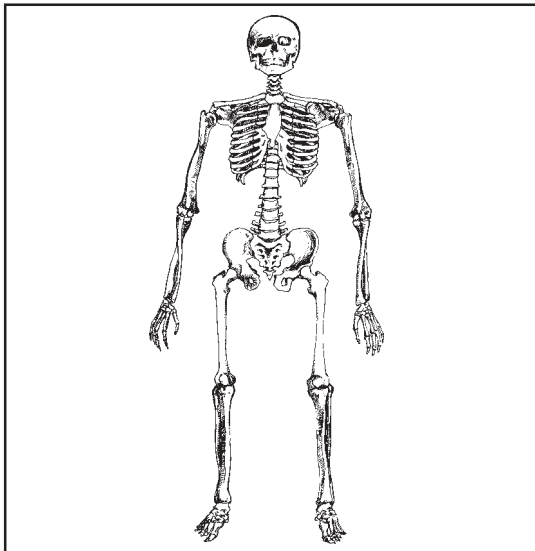
The skeletal system is composed of **bones** arranged in a way to provide the best possible support to the organs of the body and to enable you to do a lot of things.

How many bones do you think you have? Make a guess. Is it about twenty? A hundred? It may surprise you to know that there are 206 bones in the body of an adult. All these bones are arranged in a special way to make your body function well.

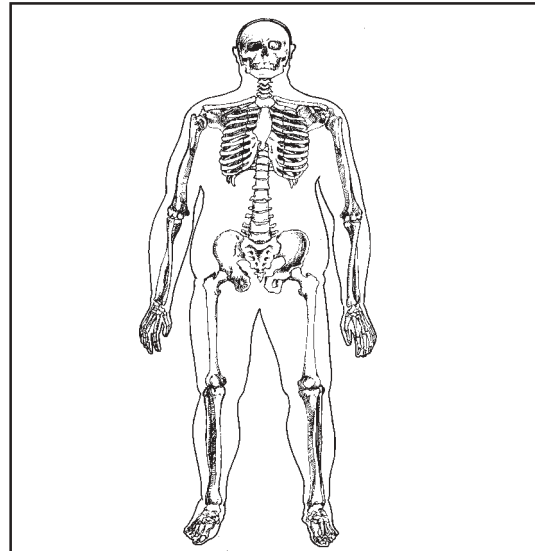
To better illustrate the functions of the skeletal system in the human body, imagine your body as a house. If the supporting structures of that house are removed it cannot stand anymore.



Much like the framework of the house, the skeletal system is necessary to maintain the shape of the body. Without it, you cannot stand erect or maintain an upright position. The bones in your back and the rest of your body support your weight to enable you to do things.



The skeletal system maintains the shape of the body.



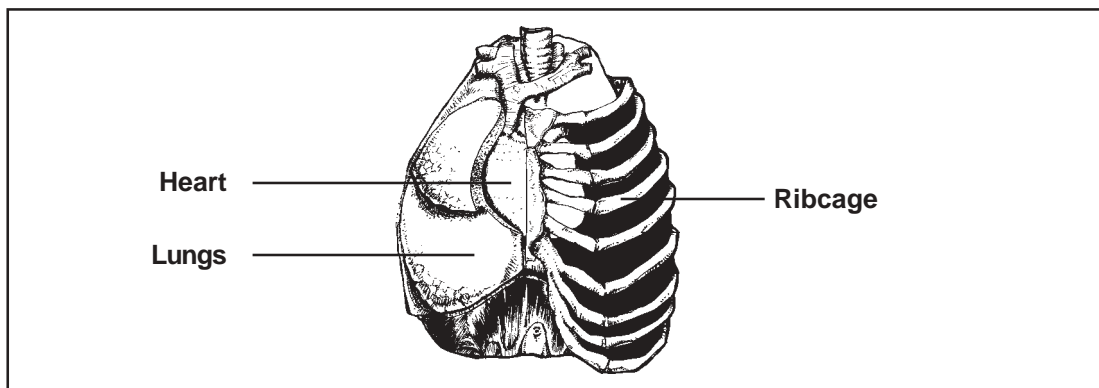
The skeletal system also supports the weight of your body.

Aside from giving support to and providing the framework of your body, the skeletal system also does a lot of other things.

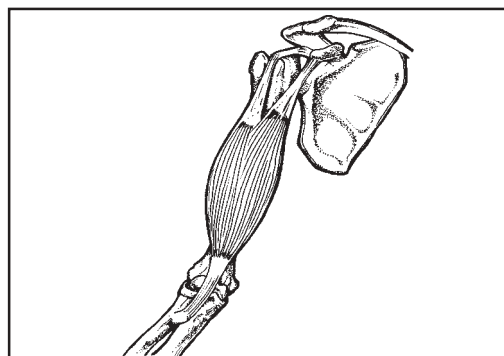
For example, you are walking in a crowded street when somebody punches you in the chest.



You feel pain from being hit. Nevertheless, your heart and lungs are unhurt, unless the force is too great. The hard structure of the skeletal system shielded your internal organs from the blow.



The bones also serve as attachments for muscles. Human beings move because of the contraction of these muscles. When the muscles contract or shorten, the bones they are attached to are also pulled by the action. This causes movement to occur.



Although muscles can move on their own, big body movements are not possible without the skeletal system. The bones have to move in order for the whole body to move.



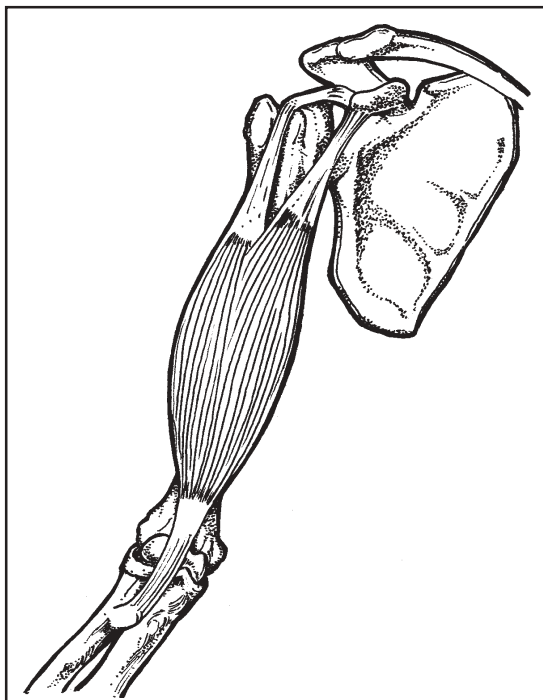
Let's Think About This

Can you think of three examples of movement that your body can make? How do you think each of these movements is achieved?

Your body is able to move because muscles are attached to bones. Muscles are made up of tissue fibers that are able to contract. You can feel your muscles contract whenever you flex your arms or lift heavy objects. Contracting muscles bulge. Flex your arms now. Can you feel your muscles contracting?



Muscles are attached to bones on at least two points by dense fibrous structures called **tendons**. When muscles contract, bones are moved and brought closer to each other. This series of muscle contractions causes your body to move.

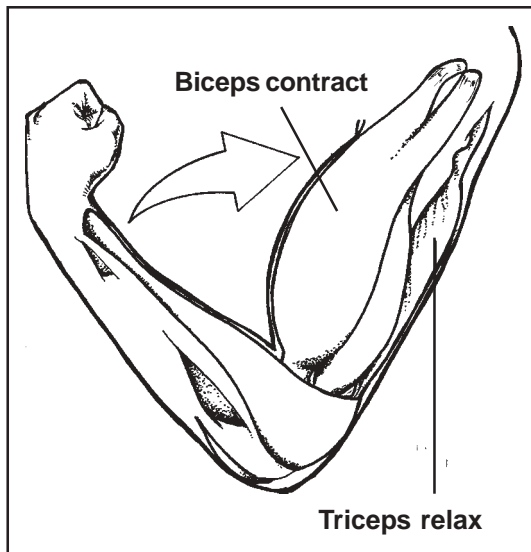


Muscles are attached to bones on at least two points.

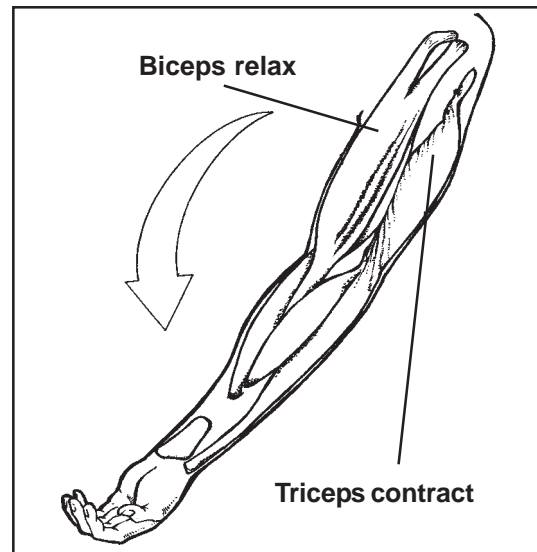


When muscles contract, bones are brought closer to each other.

Study the series of movements below. These movements are caused by the orderly contractions of muscles, one after the other.

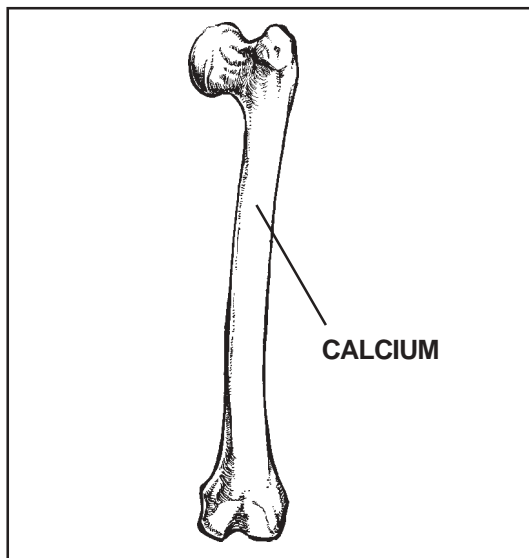


When your arm muscles flex, the bones in your arms are brought closer to each other.

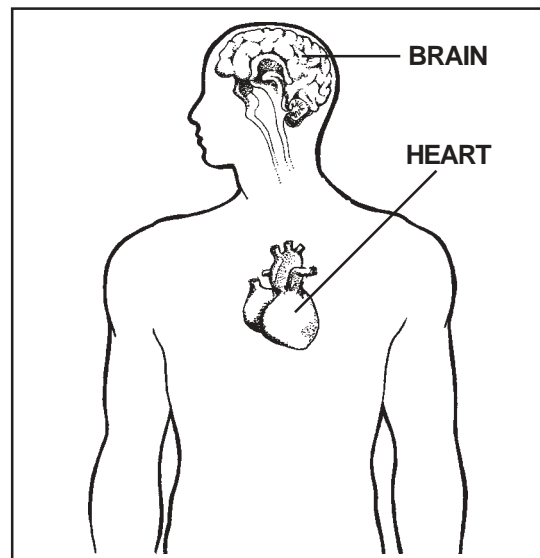


Another set of muscles contract while the previous contracting muscles relax. These series of contractions cause the body to move.

The skeletal system is made up of bones that are very hard. Bones are hard because they contain calcium. **Calcium** is a mineral that gets deposited in our bones and teeth to make them tough and sturdy. Aside from providing bones with strength, calcium also has an important role in other bodily functions. It is an important requirement for impulse transmission in the nervous system and the movement of the heart muscle. Hence, because bones store calcium, the skeletal system has a role in regulating the calcium supply of the body.

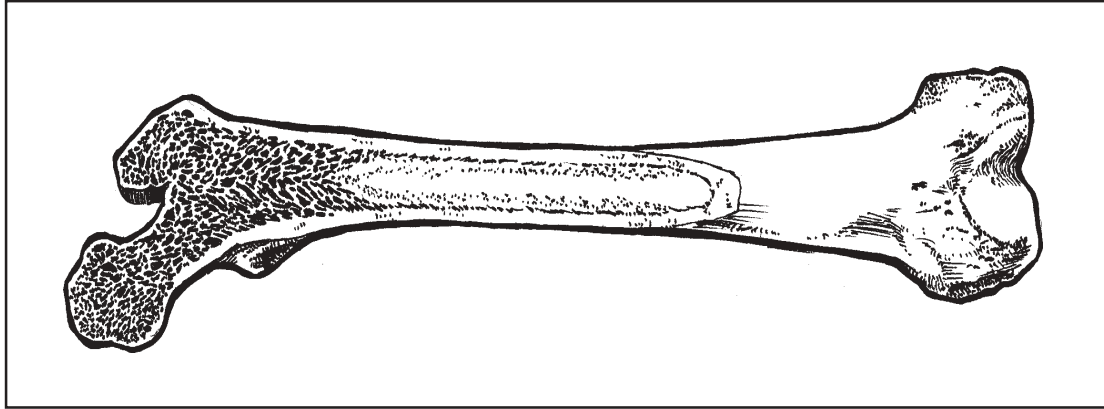


Bones are hard because they contain calcium. 99% of the body's stored calcium is found inside the bones.



Calcium is also needed for the proper functioning of the nervous system and the heart.

Lastly, the bones of the skeletal system contain bone marrow, which is important in the production of blood. It is found in the middle portion of long bones. Hence, the skeletal system also has an important role in the production of blood through the bone marrow.



Bones contain bone marrow, the site of production of blood cells that supply oxygen and nutrients to the body.



Let's Think About This

Imagine waking up one day and discovering that you do not have a single bone in your body. Your entire skeletal system is gone! What would you do? Imagine how you would look. What things would you not be able to do? How will you move?

Do you now realize how important the **skeletal system** is?



Let's See What You Have Learned

Write **True** before each correct statement and **False** before each incorrect statement.

- _____ 1. The human skeletal system is found inside the body.
- _____ 2. Bones make up the skeletal system.
- _____ 3. Bones are hard because of the mineral phosphorus.
- _____ 4. Teeth and bones are similar in mineral content.
- _____ 5. The muscular system makes the body move with the help of the bones through a series of contractions.
- _____ 6. The skeletal system protects vital organs like the heart and lungs.
- _____ 7. The skeleton acts as the framework of the human body.

- _____ 8. We could stand upright even without the skeletal system.
- _____ 9. The skeletal system is valuable only because of its strength.
- _____ 10. Bone marrow is important for blood production.

After you have finished, compare your answers with those in the *Answer Key* on pages 33 and 34. If your score is 6 or higher, congratulations! You are learning well. Review some parts you missed to refresh your memory. You may proceed to the next lesson after going through the items you missed.

If you got 5 or below, don't be discouraged. You just need more time and effort. Go back to the parts you missed and study them again. After reviewing this lesson, you may proceed to Lesson 2.

The Structure of the Skeletal System

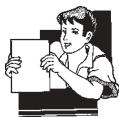
In the previous lesson, you learned the many important functions of the human skeletal system. It is a well-organized system of bones that generally functions as the framework of the body. Aside from serving as an attachment for muscles and as the site of blood production, it is also an important storage site for calcium. You might have seen advertisements saying that calcium makes your bones strong. It is indeed true. Your bones need to be strong to function well and to keep your body healthy. But how does the skeletal system accomplish the many amazing things it does? To better understand this, it is important to learn the structure and arrangement of the skeletal system in your body.

In this lesson, you will study the arrangement of the bones that comprise your skeletal system. Are you ready to learn more?



Let's Think About This

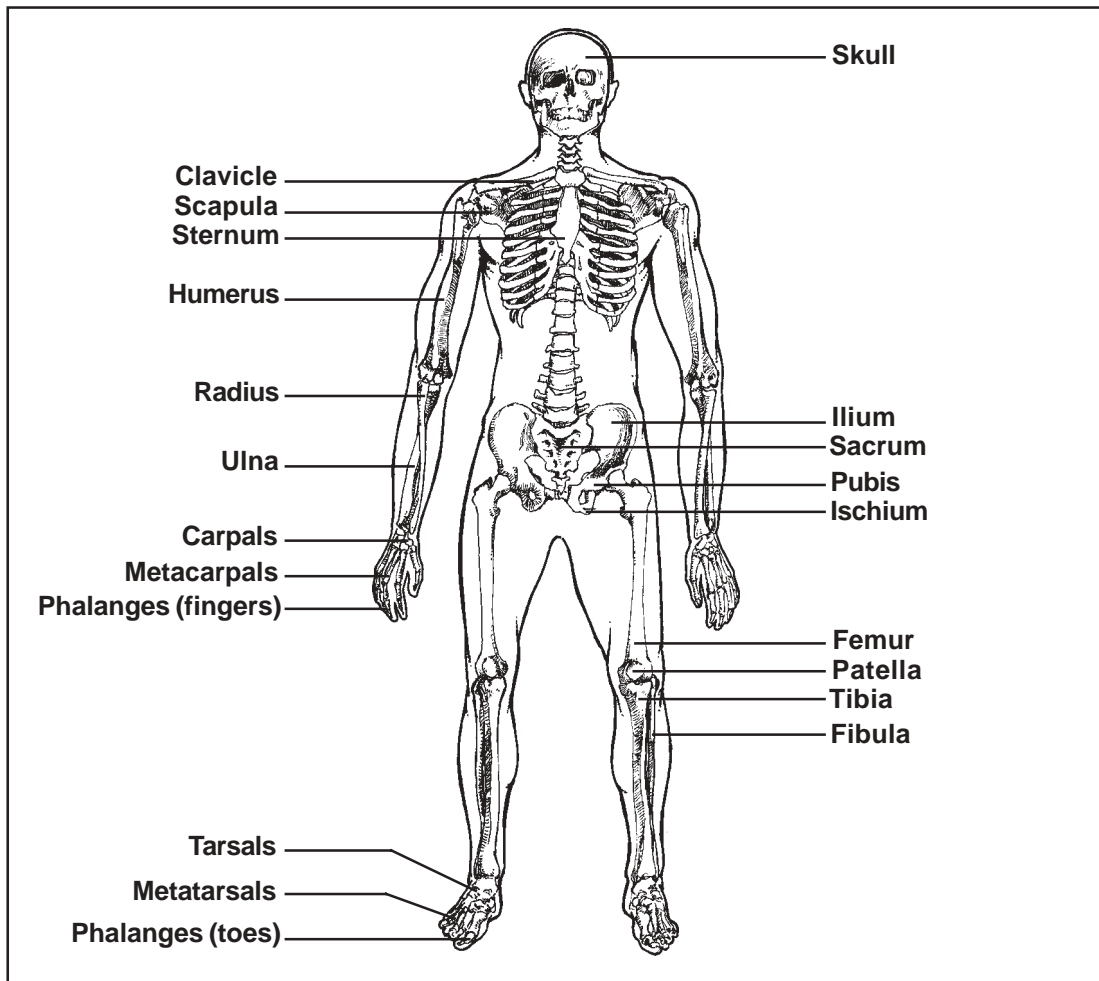
From the previous lesson, do you remember how many bones there are in the body? If you cannot remember exactly, you can try to feel your bones and estimate how many you have. While feeling your bones, where do you think you can find the longest bone? Can you guess where your smallest bone is located? You'll be surprised that you might have taken your bones for granted! Remember, your bones give shape to your body and help it function well.



Let's Learn

In an adult, the skeletal system is made up of 206 bones arranged in the best possible way to provide you with a lot of strength and mobility. Because of this special arrangement, it might seem that your skeletal system is made up of one continuous bone when it is actually made up of a lot of bones. It may also surprise you to learn that there are about 220 bones in a newborn child. Some of these bones fuse together as the child grows older. Hence, adults have only 206 bones!

Have you seen a skeleton before? It might look scary but keep in mind that your own skeleton is important in making your body stand straight and move. Study the structure of the skeletal system on the next page. Some of the more important bones are identified.



From the drawing, what did you notice about the skeletal system? Look at the figure one more time and write down your observations about the skeletal system in the blanks below.

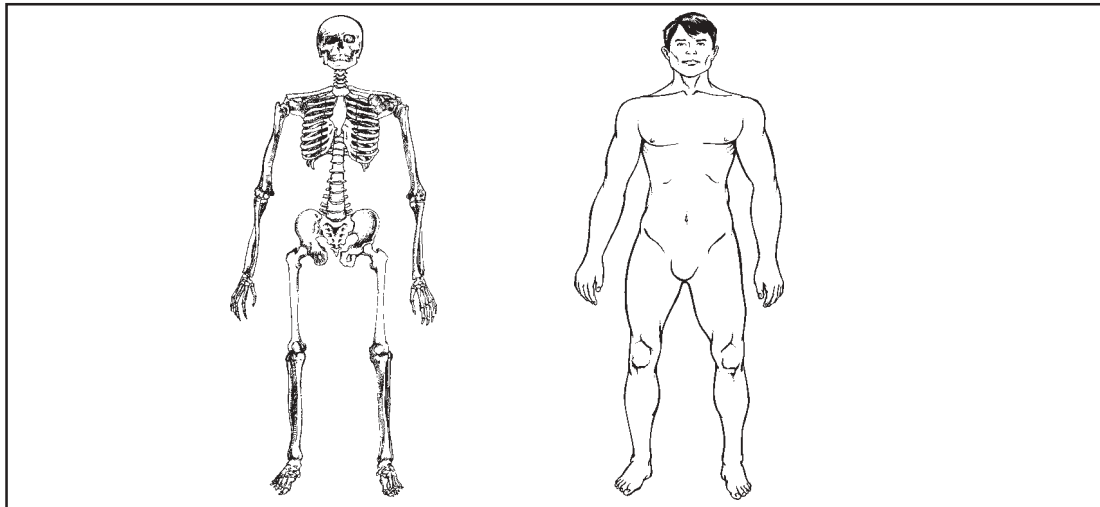
1. _____
2. _____
3. _____

If you answered that the skeletal system is made up of many separate bones, you are correct. In fact, as previously stated, there are 206 bones in the adult skeletal system.

Also, if you wrote that not all bones appear similar, that's very good! The bones are indeed of varying shapes and sizes. Each one is so designed to perform a specific function. Some of these bones will be discussed later.

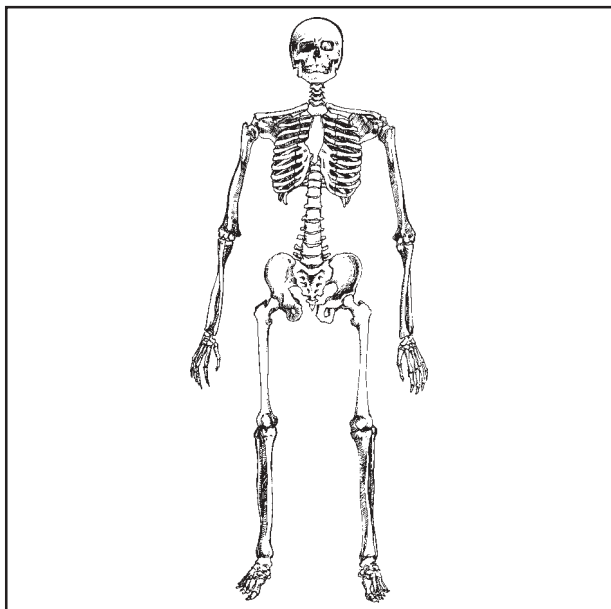
If you noticed that the skeletal system is symmetrical, well done! **Symmetry** means having similar parts on the left and right sides of the body. This symmetry is visible in the way your body looks from the outside. This is because the skeletal system is symmetrical too!

Look at the figures below. They show how symmetry is maintained both inside and outside the body.



Let's Try This

Pause for a while and look carefully at the skeletal system again on page 11. Which parts of the body do you think are composed of longer bones? Which parts are composed of smaller bones? Why are there larger bones? Why are the smaller bones found in those particular parts of the body?



The skeletal system is made up of bones that are arranged in a unique structure. Bones are held together by fibrous structures called **ligaments**. Ligaments maintain the arrangement of the bones. Study the skeletal system on the left.

Larger bones like the skull and bones of the pelvis are found in the central parts of your body. Smaller bones like the digits of your hands and the bones of your toes are farther away from the center of the body.

The bones in the central or middle portions of the body are for making **gross motor movements**. These are big and powerful movements that you make when you jump, run, or somersault. The more peripheral or sideward parts have smaller bones. These bones are for **fine motor movements**. Examples of these fine movements are writing and stitching. The above examples give you an idea of how the skeletal system's arrangement makes you move and perform better.

Can you think of other examples of fine motor movements? How about gross motor movements? The gross motor movements develop earlier than fine motor movements. This pattern of development is called **proximodistal growth**, which means growth that proceeds from the center of the body to the extremities. Because of this, you would expect adults to have finer motor movements than babies.



Let's Review

In the spaces before each statement, write **True** if the statement is correct and **False** if the statement is incorrect.

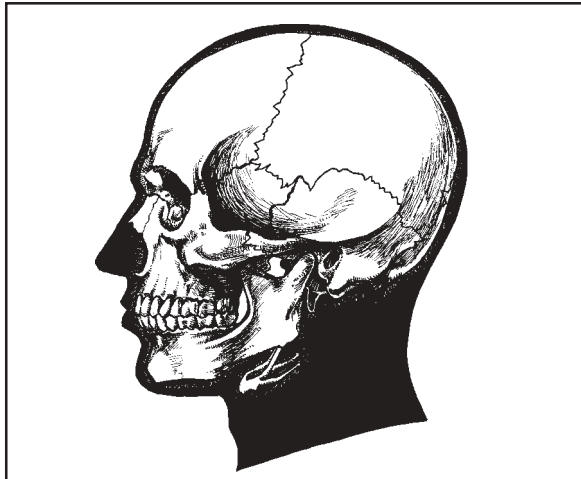
- _____ 1. There are 208 bones in the human body.
- _____ 2. The skeleton is the structural arrangement of bones in the human body.
- _____ 3. All bones are of the same size.
- _____ 4. All bones are of the same shape.
- _____ 5. Bones give shape to the body.
- _____ 6. Painting a picture is a fine motor movement.
- _____ 7. Writing is a gross motor movement.
- _____ 8. The bones in the central part of the body are generally larger.
- _____ 9. Proximodistal pattern of bone development means bone development starts from the center and progresses to the extremities of the body.
- _____ 10. The bone of the head is called the skull.

Compare your answers with those in the *Answer Key* on page 34. If your score is 6 or higher, very good! You already know your skeletal system better. Review some parts you missed to refresh your memory. You may proceed to the next part of this lesson after you finished going through the items that you missed.

If your score is 5 or below, it's okay. But you may need to go back and study the items you missed. After doing so, you may proceed to the next section.

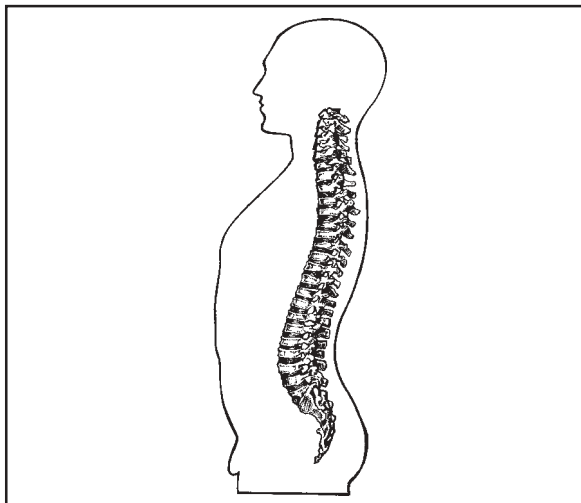
Recognizable bones in your body

In this part of Lesson 2, you are going to study some of the more recognizable bones in your body. All bones are important because each one works with another to create a functioning whole. Studying more about these bones will make you know more about the skeletal system. Go over each bone discussed and try to feel that bone in your body while reading how it is described.



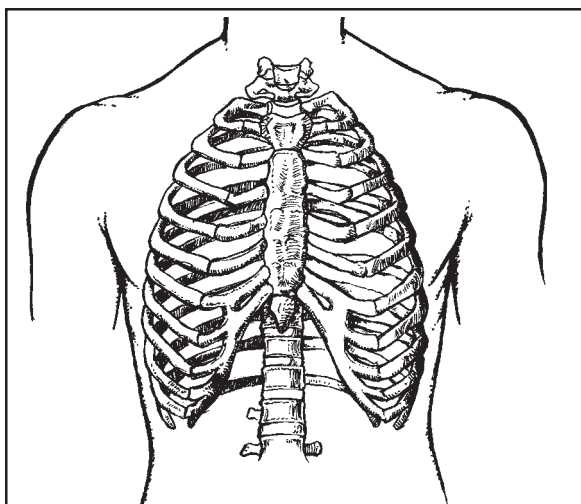
Skull

The skull is the bone of your head. It protects the brain and other sensory organs from harm. It is one of the strongest bones in your body. The skull is not a single bone; it is composed of 26 bones fused together to protect the structure of the head.



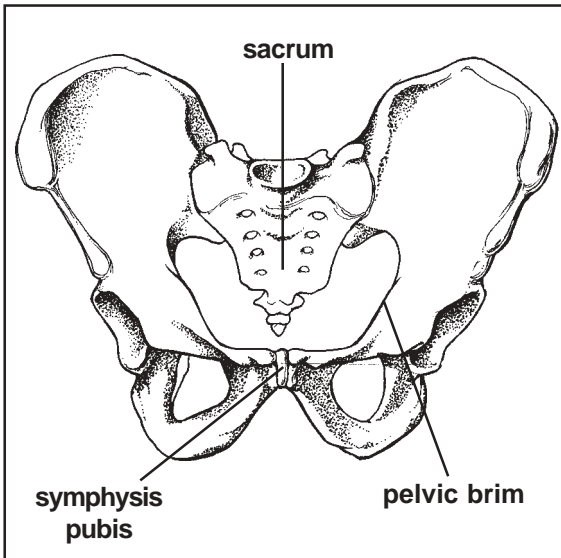
Vertebrae

The vertebrae are small but thick bones that comprise the spine or the backbone. The structure of the vertebrae allows a greater range of motion to the trunk of the body. The vertebrae protect the spinal cord.



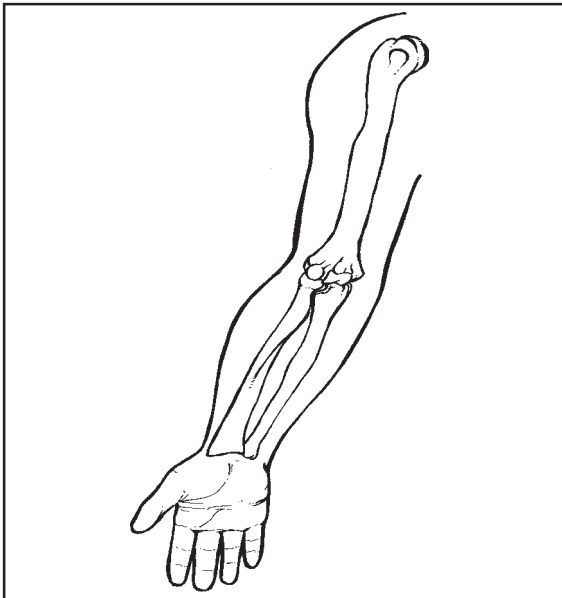
Ribs

Twelve pairs of ribs are attached to the sternum or breastplate to form the ribcage. The ribcage protects the vital organs of the body such as the heart, lungs, and liver.



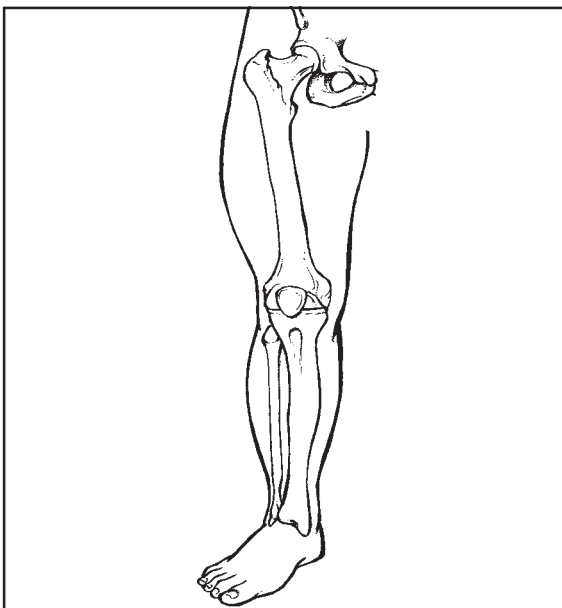
Pelvis

The pelvis is made up of several thick and wide bones that protect the organs of the reproductive and urinary systems. The structure of the pelvis greatly affects the outcome of a pregnancy. Wider pelvises in women allow the passage of the baby at birth.



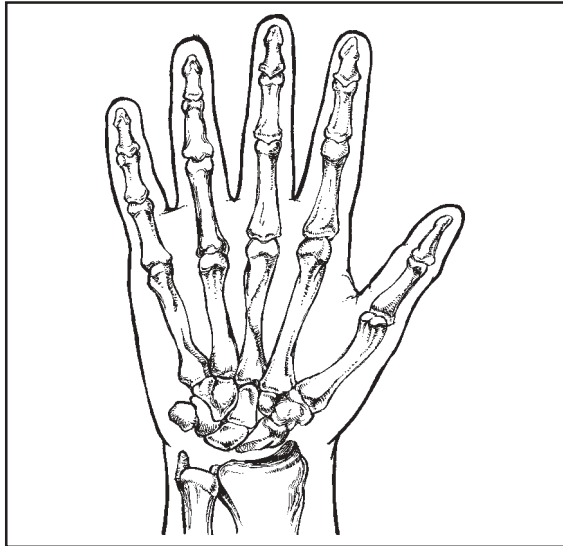
Humerus

The humerus is the bone of the upper arm. The humerus makes arm movements possible.



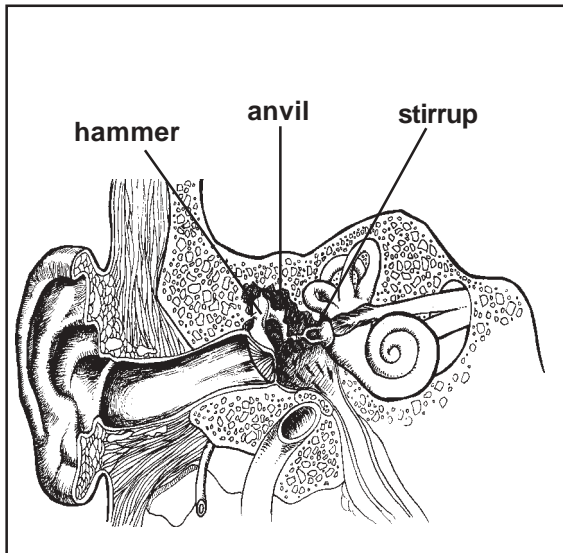
Femur

The femur is the bone of the upper leg. It is the longest bone in the body and it greatly contributes to your height.



Phalanges

The phalanges are the bones of the hands and fingers. There are approximately 20 bones in each hand. The smaller bones of the hands and fingers allow finer motor movements to be performed.



Ossicles

The ossicles are a group of bones found inside the middle ear. There are three ossicles. These are the hammer, anvil, and stirrup. The ossicles are the smallest bones in the body that vibrate to amplify sound to allow better hearing.

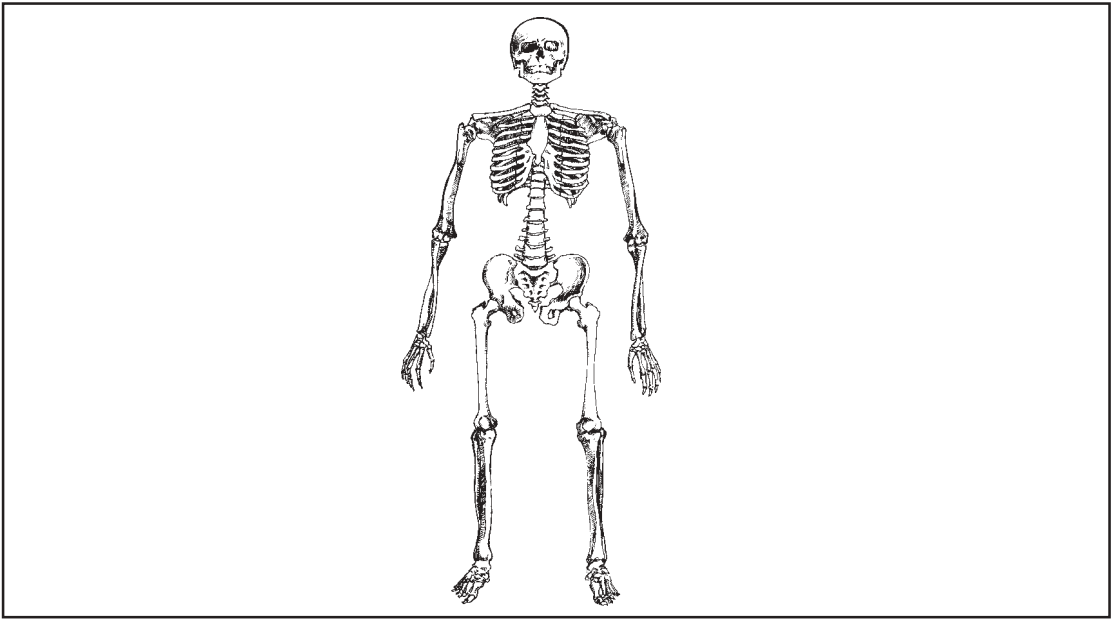


Let's See What You Have Learned

From the drawing of the human skeletal system on page 17, identify the location of the following structures.

Skull	Humerus	Vertebrae
Ribcage	Femur	Pelvis
Sternum	Phalanges	

The Human Skeletal System



Compare your answers with those in the *Answer Key* on page 34. If your score is 6 or higher, congratulations! You are now able to identify the more important bones of the body. Review the items you missed to refresh your memory. Afterwards, you may proceed to the next lesson.

If your score is 5 or below, you might need to study the lesson again. After doing so, you may proceed to the next lesson.



Let's Remember

- ◆ Bones are arranged in a very organized manner that provides the body support, protection, and the easiest movements possible.
- ◆ The adult human skeleton is made up of 206 bones, some of which are made up of smaller bones fused together.
- ◆ Bones are of varying sizes and shapes.
- ◆ The human body is symmetrical because of the skeletal system.
- ◆ Bones are attached to each other by ligaments.
- ◆ Bones in the center of the body are capable of gross motor movements. Bones in the periphery are involved in producing fine motor movements.
- ◆ Each bone has a name and a distinct location. The bones discussed in the lesson are the skull, vertebrae, ribs, pelvis, humerus, femur, phalanges, and ossicles.

The Structure of a Bone

In the previous lesson, you learned about the structure and organization of the skeletal system. You also studied more closely some of the bones found in the body. To help you better understand what makes bones function so well, this lesson will introduce you to the characteristics and properties of individual bones. A typical bone will be analyzed to show how each bone works.

Think of this lesson as you look closer at a piece of bone. Knowing how that single bone works will give you an idea of how the entire skeletal system functions. Are you ready?



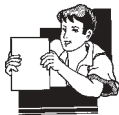
Let's Think About This

Have you ever seen a human bone? Even if you haven't seen one yet, chances are you have already seen bones of other animals. Examples would be chicken or beef bones found in some of your favorite dishes. Do you remember what these dishes are? How do they look? Close your eyes and imagine what animal bones look like.



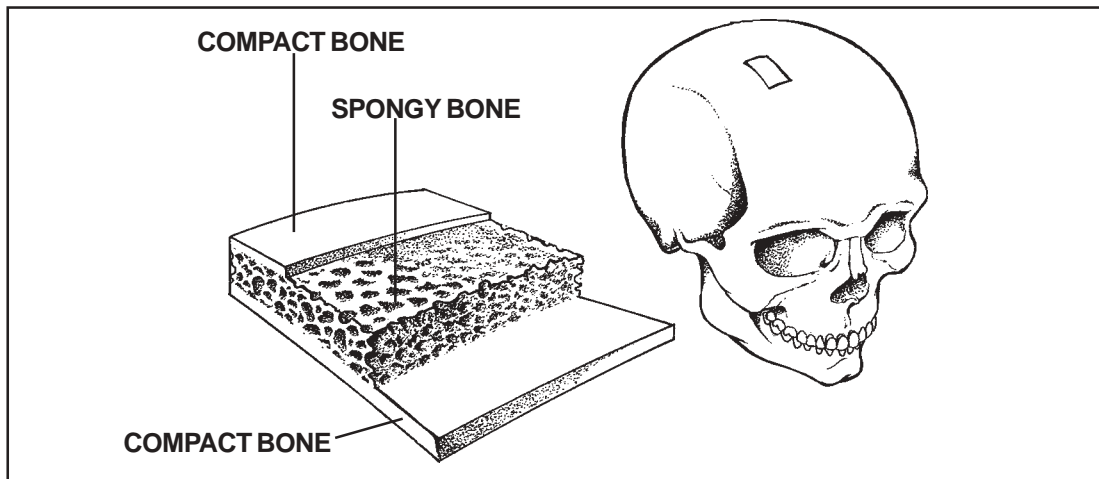
Let's Try This

After imagining, maybe you can go much further by actually getting an animal's bone. It may be from a chicken or any other animal. If you already have one, touch that bone. How does it feel? Have you ever wondered how this small bone works?

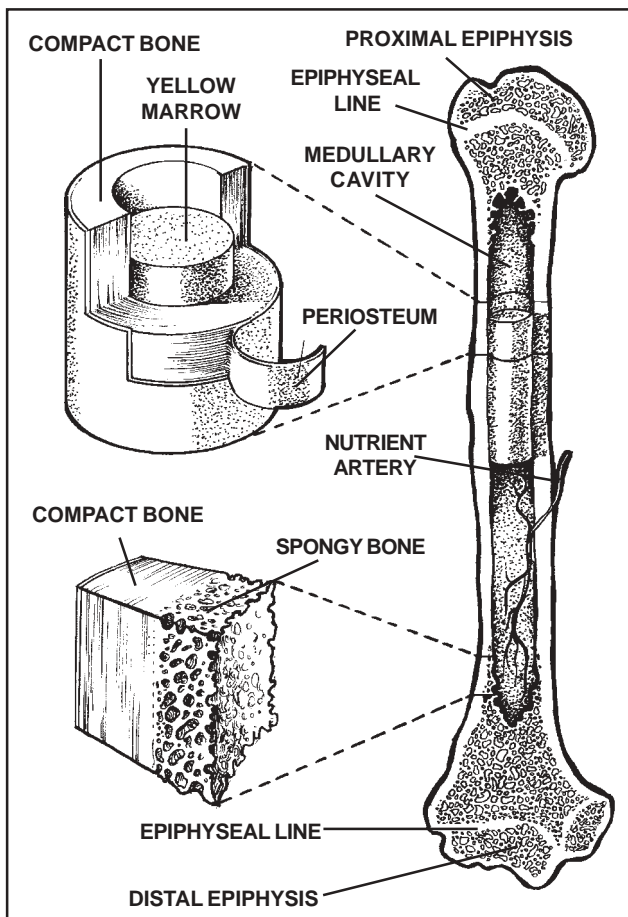


Let's Learn

A bone is a special form of connective tissue made up of a special protein material called **collagen** — which is saturated with calcium. There are two structural types of bones — compact and spongy bones. **Compact bone** is solid and dense, and it forms the outer shell of the bone. **Spongy bone** is less dense than compact bone and is made up of thin threads of bones. All bones are made up of a combination of these two. Study the structure of the cross section or cut specimen of a bone in the drawing on the next page. Notice how the collagen acts like a scaffolding or a framework in which calcium is deposited.



Calcium is a stone-like mineral that makes your bones strong. It is the reason why bones appear white on X rays. It is also the same material that makes teeth hard enough to chew food. Calcium allows bones to respond to the stress and strain you put on them. It is found in foods like cheese and milk.



When calcium enters your body, 99% of it goes to your bones for storage. As previously stated in Lesson 1, calcium is also important for the other functions of the body especially in the nerves and muscles. When these organs need calcium, they absorb the calcium deposits inside the bones through a special process called **bone resorption**. In this process, calcium is released through the destruction of actual packets of bony tissue. Hence, bones are continuously being built up and destroyed.

Contrary to popular belief, bones are not static or unchanging. Bones are living tissues that are continuously being built up and absorbed, constructed and destroyed. Hence, it is important for you to get a lot of calcium in your diet to keep your bones strong. Proteins are also

needed to maintain normal bone structure and function. Soybeans, meat, fish, and vegetables are important sources of protein.

Bones are **vascularized**. This means that they have a rich blood supply. In adults, human blood flows through the bones at an average of 200 to 400 milliliters (mL) per minute.

Most bones start out as cartilage. **Cartilage** is a whitish fibrous material that is both tough and strong but contains a lot of water. You may have seen cartilage in the breast of a chicken. As you grow older, the cartilage ossifies. **Ossification** is the process of hardening due to the deposition of minerals, especially calcium. Adults have stronger bones than children because their bones are already much more ossified. Most long bones in the body have bony centers and cartilage in the ends. This type of cartilage is called **epiphysis**. The epiphyses are the areas where bone growth happens. The elongation of your bones allows you to become taller. The drawing on page 19 the left shows the epiphyses of a long bone like the femur.

Note also that inside the long bones, you can find the bone marrow. The centers of these bones are hollow, where cells that form blood are found. Hence, this illustrates how important bones are in the process of blood production.



Let's See What You Have Learned

Write in the blank the letter of the phrase in Column B that matches the term in Column A.

A	B
_____ 1. calcium	a. process of calcium deposition
_____ 2. 200 to 400 mL	b. having a rich blood supply
_____ 3. epiphyses	c. sites of bone growth
_____ 4. collagen	d. whitish fibrous material
_____ 5. bone marrow	e. mineral stored in bones
_____ 6. ossification	f. nutrient found in meat and fish
_____ 7. protein	g. important for blood production
_____ 8. cartilage	h. protein material that makes up a bone
_____ 9. vascularized	i. average amount of blood that flows through the bones per minute
_____ 10. bone resorption	j. bone destruction

Compare your answers with those in the *Answer Key* on page 35. If your score is 6 or higher, you did great! You have learned a lot about the structure and functions of a bone. Review the items that you missed, then proceed to the next lesson.

If your score is 5 or below, that means you need to study this lesson again. Afterward, you may proceed to the next lesson.



Let's Remember

- ◆ Bones are living tissues. They are continuously being formed and absorbed in a process called **bone resorption**.
- ◆ Bones are made up of collagen fibers saturated with calcium.
- ◆ Calcium is stored in bones and is important for the nerves and muscles to function well.
- ◆ Proteins are also important to bone structure and function.
- ◆ Bones are **well vascularized** or rich in blood supply.
- ◆ Bone marrow is found in the hollow center of long bones. The bone marrow is made up of cells that produce blood.
- ◆ Bones start out as cartilage and become hard through the process of **ossification** or the deposition of minerals, especially calcium.
- ◆ Ossification centers, which are important for the growth and elongation of the long bones, are found in the **epiphyses**.

Common Injuries and Diseases of the Skeletal System

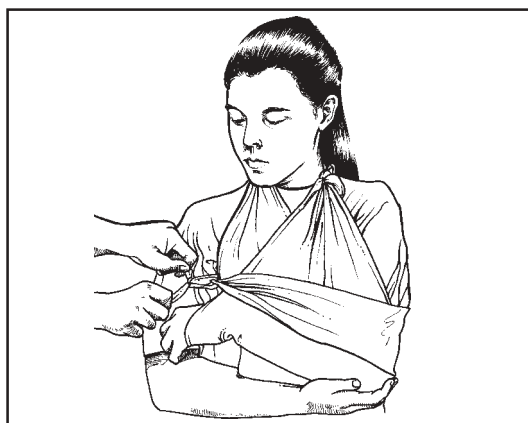
Have you ever seen somebody with a plaster cast around his arm? What do you think happened? Have you ever had a bad fall? What were the injuries you sustained? Was your skeletal system affected? If you have seen somebody with a plaster cast on his leg or arm, chances are, he has a fracture. A **fracture** is a break in a bone.

In the previous lessons, you learned about the structure and functions of the skeletal system. You already have an idea of the great responsibility of the bones in protecting you and allowing you to do your work. Although the skeletal system is the strongest structure found in your body, it is still prone to a lot of injuries and diseases. In this lesson, you will learn about these injuries and other conditions that can affect your skeletal system. You will also know how to best take care of your skeletal system and keep it healthy and functioning well.



Let's Try This

To experience how difficult life is if the skeletal system is injured, do this exercise: Wrap the arm that you use for writing with enough layers of cloth to keep it from moving. After making a “cloth cast,” put a sling around your arm following the illustration below. Make sure that you do not wrap the cast too tightly to avoid a decrease in blood supply to your “affected” arm. Continue doing your daily routine with the cast on for about 6 hours. Try taking a bath and eating with your cast on. Then write down your observations by the end of the period while the cast is still on. What did you learn from this exercise? Were you able to appreciate the bones of your body more?



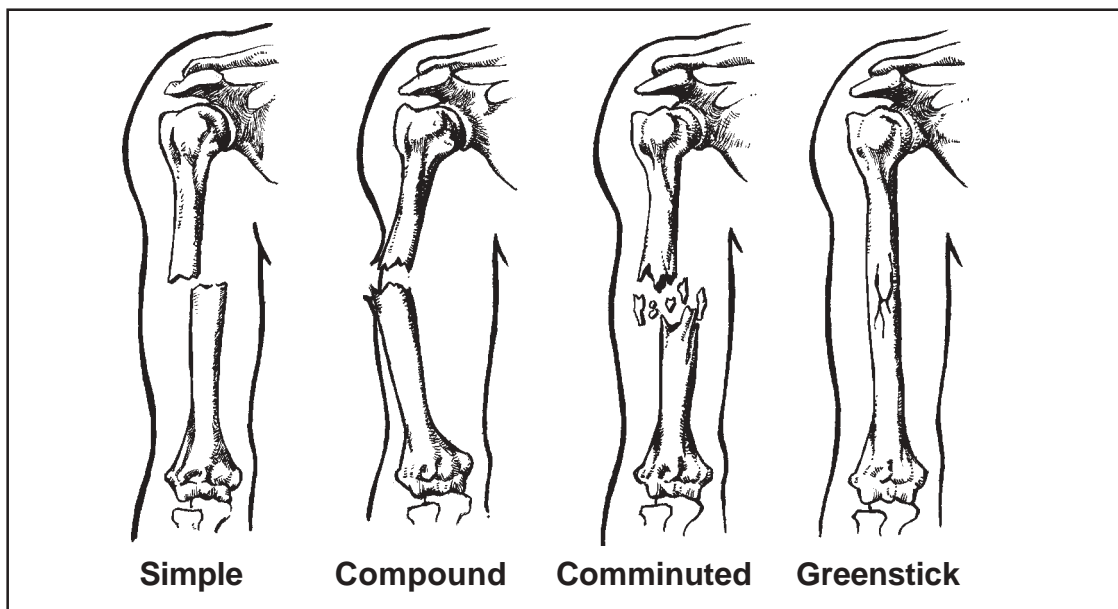
How to make a sling for the cloth cast

Although the skeletal system is strong, it is still prone to diseases. There are a lot of injuries and disorders that can affect this system. The following are just some of them. While reading about each, think of anybody you know who might have a similar injury or bone disorder. Visualize that person as you learn more about the condition.

Fracture

A fracture is a broken bone. Some fractures are closed, some are open. **Closed fractures** are broken bones with unbroken skin. **Open fractures** have broken skin, usually with the bone coming out of the site of injury. Open fractures are worse because they are more prone to infection and indicate a larger amount of damage to the bone. Fractures are most often caused by traumatic accidents and bad falls.

The figures below show several types of fractures of the humerus — the bone of the upper arm.

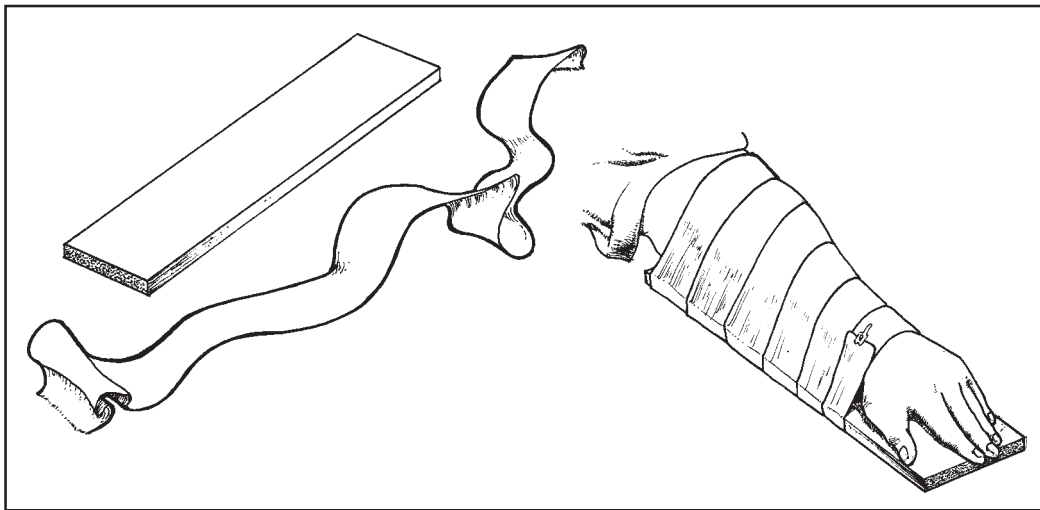


First Aid for Suspected Bone Injuries (What to do when there is a fracture)

1. When a person suffers a traumatic accident or a bad fall, it is best to assume that a bone is broken.
2. When a fracture is present, there is usually swelling of the fractured area and the patient is unable to move the affected body part. Fractures are most often painful and the patient might cry in agony.
3. When the affected area is an extremity like a leg or an arm, check the area. If there is an open wound (usually with a protruding bone part) call for help immediately. You may ask someone else to call for help while you attend to the patient.

4. Control bleeding by putting a direct, steady pressure on the area using a cloth or any dampening material. Never attempt to put back the bone to its original position by pushing or pulling it. Other structures like the muscles, nerves, and blood vessels might be damaged. This might cause more harm than good.
5. The most important thing to do for any type of fracture is to immobilize the affected area. **Immobilization** means limiting movement and hence avoiding further damage.

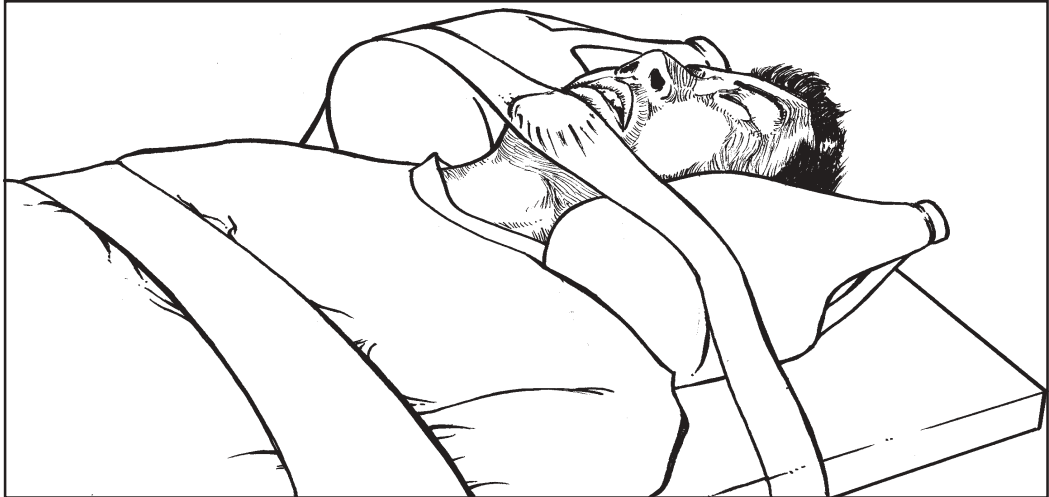
Immobilization can be achieved through splinting. You can use any hard and steady material available such as a piece of flat wood, folded paper, carton, or cloth. The diagram below shows how a basic splint is constructed.



If a splint is not available, you can immobilize the affected body part by creating a sling. A **sling** is a large piece of cloth used to create temporary immobility, usually in the arms.

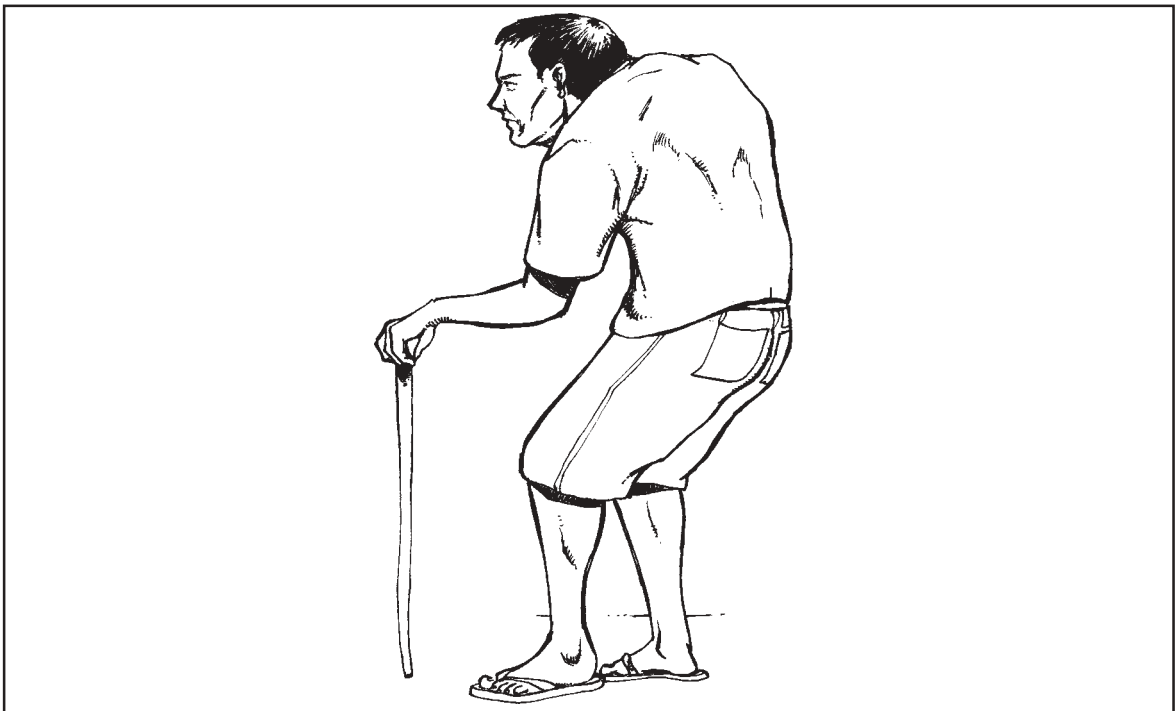
6. While the patient is immobilized, call for help. Stay with the patient. Make him/her as comfortable as possible with the least amount of movement.
7. If a closed fracture is noted, the same procedure is followed. Again, remember the important principles in management of fractures, namely immobilization and immediate referral for medical attention.
8. Even if the affected area is movable and there is very minimal pain, it is still advisable to seek medical attention. Some fractures are small in scale and are only detected through X rays. It is best not to rule out any body injury in traumatic events.

9. The principle of immobilization is more important when a neck fracture is suspected. This is most common after a bad fall from a high position. Never attempt to move the patient. Neck fractures are potentially life threatening. Seek medical attention immediately. While waiting for help, you can ensure immobilization by doing a makeshift cervical collar using two bottles or any other similar hard objects and placing them on each side of the patient's neck.

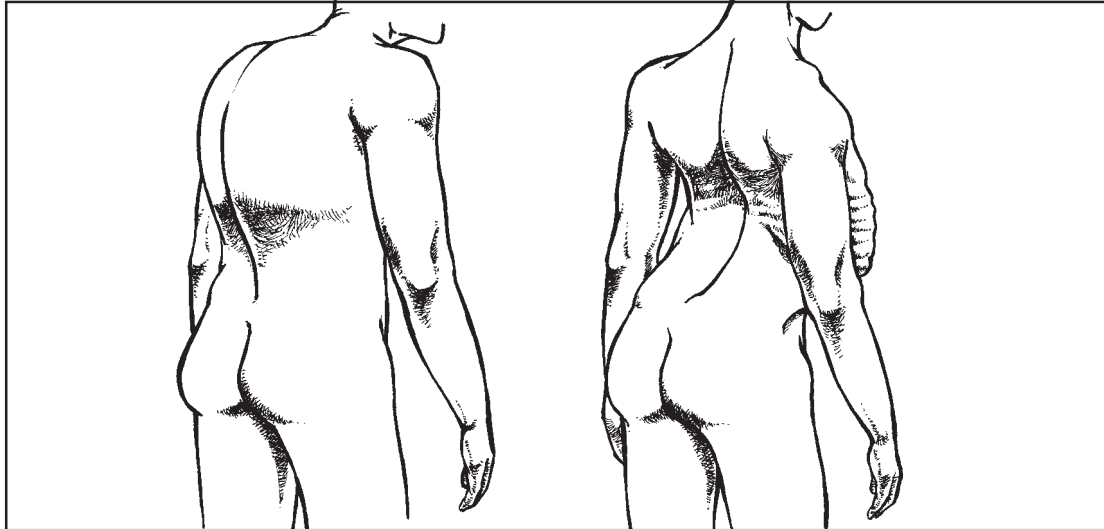


Disorders of the Spine/Backbone

You are walking to school one day when you notice somebody who has an unusually arched back. Because of this condition, he finds it very difficult to walk or move fast. What do you think happened to the bones of this person's back?



A **hunchback** is someone who suffers from **kyphosis**, a condition caused by too much outward curvature of the vertebral bones. This makes it difficult for the person to move fast. Too much sideward movement of the same bones would also lead to a deformity called **scoliosis**. Both kyphosis and scoliosis result from unknown causes. They usually develop during adolescence. Traumatic injuries may also cause these conditions. Treatment involves the use of back braces, physical therapy or surgery.



To check if somebody has scoliosis, ask that person to bend and touch his/her toes with both hands while standing. Observe the person from behind. He/She might have scoliosis if the slope of his/her back is not smooth as shown below.

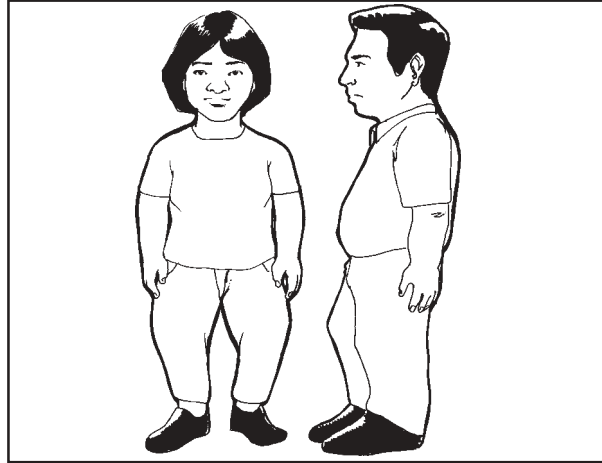


Rickets

Rickets is caused by vitamin D deficiency, especially in children. Vitamin D is important in the deposition of calcium inside the matrix or inner structure of bones to provide bone strength. Persons with **rickets** have very weak bones because of low calcium content. A lot of them are bow-legged and weak. They can only do very limited movements. Most of the time, too much damage has been done to the bones that they are already impossible to cure.

Dwarfism

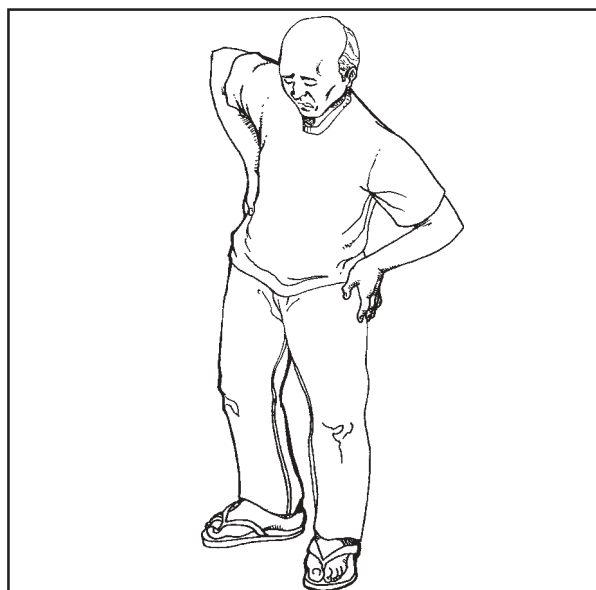
Jose and Rosa are very small people. They were born that way. Their bodies look normal in size but their arms and legs are very short. What do you think are the difficulties Jose and Rosa have to face every day?



Dwarfism has two types. A true dwarf is called a **midget**. Midgets have proportional body structures but are very small. They are usually 3 feet or below in height. Achondroplasia, which Jose and Rosa have, is the more common type of dwarfism. **Achondroplastic dwarves** have normal-sized bodies but they have very short arms and legs. Both conditions are genetic and inborn, and they have no known cure.

Osteoarthritis

Lolo Antonio is 75 years old. He often complains of very painful joints. He suffers constant pain in his hips, knees, and hands. Sometimes these parts swell, making the pain worse. Because of this, he avoids too much physical activity and just stays at home.



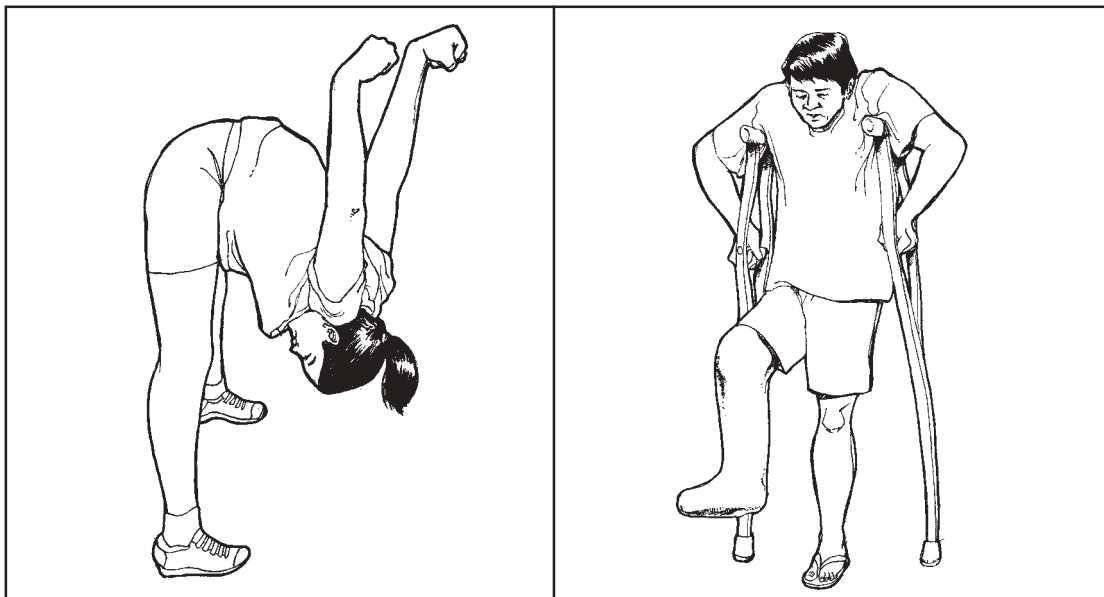
Osteoarthritis literally means inflammation of the joints. Osteoarthritis is more common among the elderly. Joints are inflamed because of the abrasion of the joint linings due to old age or constant physical exertions. People with arthritis usually complain of very painful and sometimes swollen joints. Arthritis can also occur among the young. Painkillers are the first line of treatment.

Osteoporosis

A condition very common in old women is **osteoporosis**. It is the loss of bone minerals that lead to brittle, easily fractured bones. This condition is very common among post-menopausal women due to lack of **estrogen**, a hormone that inhibits bone resorption. Patients are treated with calcium supplementation, hormone replacement, and physical therapy.

Sprain

A **sprain** results from the overstretching of the ligaments that connect bones. Ligaments are stretched too much when an extreme motion is abruptly performed like reaching too far for an object or twisting an ankle. To avoid sprains, stretching exercises should be performed before a stressful activity such as dancing or playing basketball. Like fractures, sprains are healed through immobilization.



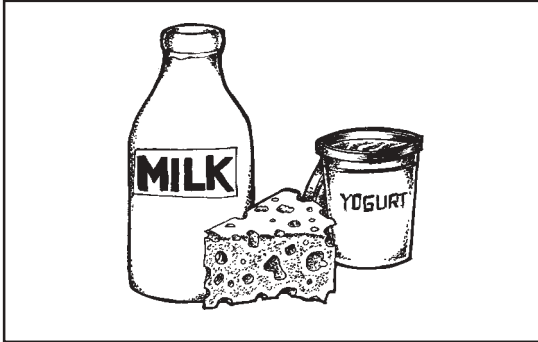
You have just studied some of the most common injuries and disorders of the skeletal system. Of course, there are other conditions that can possibly affect your bones. Hence, proper care should always be observed.



Let's Think About This

Think of some ways you can promote the health of your bones and avoid diseases of the skeletal system? List down as many as you can on a separate sheet of paper. Now go back to your list. Are you observing proper care of your skeletal system?

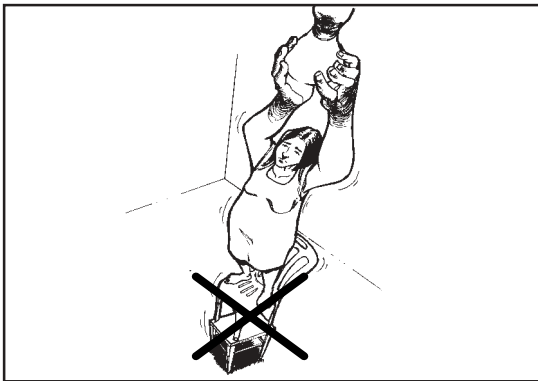
Proper Care of the Skeletal System



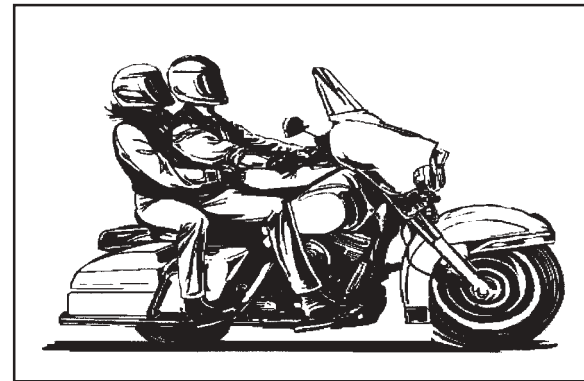
Eat a lot of foods rich in calcium such as milk and dairy products.



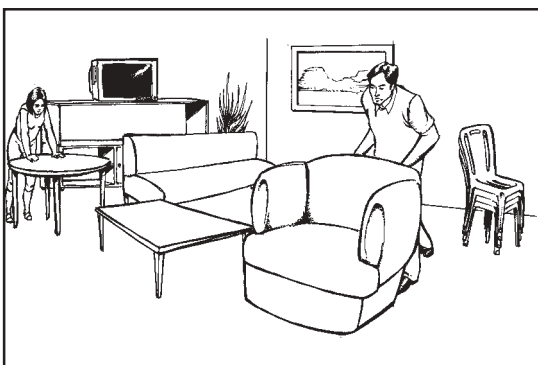
Eat a lot of protein-rich foods such as soya beans, vegetables, meat, and fish.



Avoid activities that may cause traumatic body injuries and bad falls such as climbing on top of an unstable furniture.



Always wear or use protective gear when a traumatic injury or fall is likely to happen, such as in motorcycling.



Properly arrange furniture and other equipment around you to avoid accidents.



Keep floors dry to avoid slipping.

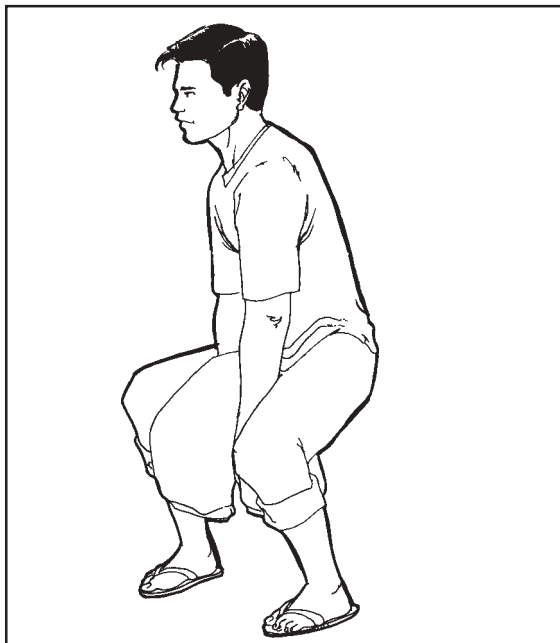
Keep things orderly. Playthings left on the stairs might cause accidents.



Rest regularly. Avoid too much strain on your bones and joints.



Lift objects properly. Avoid bending forward when carrying a heavy load.



Always seek medical help when a bone injury is likely to have occurred.



You have just learned some ways of taking care of the skeletal system. In this module, you were introduced to the structure and functions of the skeletal system, the structure and function of a bone, and the injuries and disorders that can affect the skeletal system. Indeed, the skeletal system is a wonderful structure that serves a very important role in your life.



Let's See What You Have Learned

Identify what is being described by each phrase.

- _____ 1. broken bone
- _____ 2–3. two important principles in handling fractures
- _____ 4. common bone defect in old women
- _____ 5. also known as a midget
- _____ 6. hormone that inhibits bone resorption and thus prevents osteoporosis
- _____ 7. vitamin that can prevent rickets
- _____ 8. inflammation of the joints
- _____ 9. two most important food nutrients for the skeletal system
- _____ 10. large piece of cloth used to immobilize an arm

Check your answers against those in the *Answer Key* on page 35.

Review the parts you missed in the last lesson of this module. Feel free to go back to any lesson you may have had difficulty with.



Let's Remember

- ◆ Bones, strong as they are, are still prone to injuries and disorders.
- ◆ Injuries to the bone and its ligaments can cause fractures and sprains.
- ◆ Bone disorders include kyphosis, scoliosis, rickets, arthritis, and dwarfism. These can be inborn or due to old age, improper nutrition, infections, or traumatic injuries.
- ◆ Taking care of the bones requires proper nutrition, avoiding injuries, seeking medical help, and maintaining proper hygiene.

You have now reached the end of the module. Congratulations! Did you enjoy reading it? Did you learn a lot from it?

The following is a summary of its main points to help you remember them better.



Let's Sum Up

- ◆ The skeletal system is a well-organized system of bones that has many functions. The skeletal system serves as the framework of the body, supports its weight, maintains its shape, and protects internal organs. Bones also participate in the storage of calcium needed to maintain the body's functions.
- ◆ Bones are arranged in the best possible way to allow movements of the body. Bones serve as attachments for muscles that contract during movements. A bone is made up of a collagen matrix or structure laden with minerals, mostly calcium, that make it strong.
- ◆ Injuries to the bones such as fractures and sprains are common. Immobilization or preventing movement is the primary aim in the management of fractures. Medical help is also very important. Several disorders affecting the bones are rickets, arthritis, and osteoporosis.



What Have You Learned?

Write **True** if the statement is correct and write **False** if the statement is incorrect.

- _____ 1. The skeletal system is made up of bones.
- _____ 2. Bones are hard because of the calcium deposited inside.
- _____ 3. Bones provide the framework of the body.
- _____ 4. Bones usually start as cartilage.
- _____ 5. Bone growth occurs in the epiphyses.
- _____ 6. All bones in the body have the same name.
- _____ 7. A break in the bone is called a sprain.
- _____ 8. Broken bones should be moved constantly.
- _____ 9. A sling is made of wood only.
- _____ 10. Protein and calcium should be included in your diet to keep your bones strong.
- _____ 11. Scoliosis is a backward curvature of the spine.
- _____ 12. The spine is also called humerus.
- _____ 13. Injuries can be avoided by wearing protective gear.
- _____ 14. Running is an example of a gross motor movement.
- _____ 15. All bones look the same.

After you finish answering the questions, check your answers in the *Answer Key* on page 35. If you got 13 or more correct answers, well done! You learned a lot from this module. Keep it up! Apply what you have learned about the skeletal system to better take care of your bones. If your score is 12 or below, it's okay. But you need to go back to the parts of the module where the answers you missed can be found.



Answer Key

A. Let's See What You Already Know *(page 2)*

1. Provides framework to maintain body shape
2. Protects internal organs
3. Acts as surface attachment for muscles that are important for movements
4. Serves as a storage site for calcium and helps in the metabolism of calcium
5. Supports the body when lifting objects

(Another possible answer: Contains the bone marrow, which is the site of blood formation)

6. Bones
7. The skeletal system is closely associated with the muscular system. Bones act as attachments for muscles. When muscles contract the bones move, thus enabling motion.
8. Fractures
9. Rickets
10. Osteoporosis

(Other possible answers: scoliosis, kyphosis, dwarfism, osteoarthritis, sprains)

B. Lesson 1

Let's See What You Have Learned (pages 8–9)

1. True
2. True
3. False. Bones are hard because of the mineral calcium.
4. True
5. True
6. True
7. True

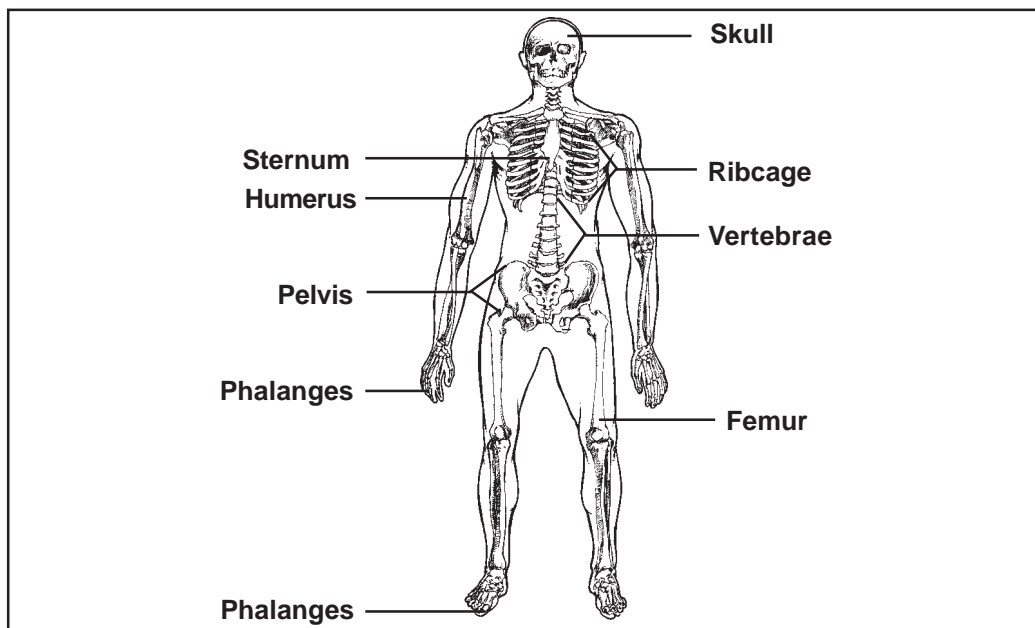
8. False. Only the bones are strong enough to support the weight and structure of our body.
9. False. The functions of the skeletal system are not all strength-related, for example, the blood formation inside the bones.
10. True

C. Lesson 2

Let's Review (page 13)

1. False. There are 206 bones in the human body.
2. True
3. False. Bones vary in size.
4. False. Bones vary greatly in shape.
5. True
6. True
7. False. Writing is a fine motor movement because it requires the use of the fingers.
8. True.
9. True
10. True

Let's See What You Have Learned (pages 16–17)



D. Lesson 3

Let's See What You Have Learned (page 20)

- | | |
|------|-------|
| 1. e | 6. a |
| 2. i | 7. f |
| 3. c | 8. d |
| 4. h | 9. b |
| 5. g | 10. j |

E. Lesson 4

Let's See What You Have Learned (page 31)

- | | |
|----------------------|------------------------|
| 1. fracture | 6. estrogen |
| 2. immobilization | 7. vitamin D |
| 3. medical attention | 8. osteoarthritis |
| 4. osteoporosis | 9. calcium and protein |
| 5. true dwarf | 10. sling |

F. What Have You Learned? (page 33)

1. True. Bones make up the human skeleton.
2. True. The mineral calcium makes bones strong.
3. True. Bones also provide support to the body and maintain the body's shape.
4. True. The cartilage undergoes the process of ossification or bone formation.
5. True. Bone growth occurs in epiphyses of the long bones.
6. False. Each bone has its own name.
7. False. A break in the bone is called a fracture.
8. False. Broken bones should be immobilized to prevent further injury.
9. False. A sling is usually made of a triangular piece of cloth.
10. True. Both are needed for proper bone function.
11. False. Scoliosis is a sideward curvature of the spine.
12. False. The spine is also known as backbone. The humerus is found in the upper arm.
13. True. Protective gear such as helmets and gloves should be worn when doing potentially dangerous activities.
14. True. Running is an example of gross motor movement, it involves the bones of the central part of the body.
15. False. Bones vary in shape and size.



Glossary

- Achondroplasia** Genetic bone abnormality manifested by very short arms and legs.
- Bone** The basic component of the skeletal system.
- Bone marrow** Site of blood production inside bones.
- Bone resorption** The process in which calcium found in bones is reabsorbed by the body.
- Calcium** Mineral needed for bone strength and hardening.
- Cartilage** “Soft bone”; the common origin of hard bones.
- Collagen** Protein matrix of bones.
- Dwarfism** A condition characterized by shortness, usually 3 feet or below.
- Epiphysis** Site of bone growth.
- Exoskeleton** The hard outer covering of some animals.
- Femur** Bone of the thigh; longest bone in the body.
- Fine motor movements** Small movements like writing; involve the fingers or smaller bones.
- Fracture** A break in the bone.
- Gross motor movements** Big movements, such as running, involving bigger bones.
- Humerus** Bone of the upper arm.
- Immobilization** Limiting or preventing movement to prevent complications in fractures.
- Kyphosis** Hunchback, outward curvature of the spine.
- Ligaments** Fibrous tissues that connect bones.
- Ossicles** Bones of the inner ear composed of the hammer, anvil, and stirrup.
- Osteoarthritis** Inflammation of bone joints common in the elderly.
- Osteoporosis** Weakening of bones due to calcium loss, especially evident in older women.
- Pelvis** Bones of the buttocks and groin.
- Phalanges** Bones of the fingers or toes.

Proximodistal growth Pattern of bone development starting from the center of the body to the extremities.

Ribs Bones of the chest protecting the heart and lungs.

Rickets Weakened bones due to vitamin D deficiency.

Scoliosis Abnormal sideward curvature of the spine.

Sprain Overstretched ligaments.

Skeletal system An organ system made up of bones that give structural support to the body.

Skull Also known as cranium; houses the brain.

Spine Also known as backbone or vertebral column.

Strain Overstretched tendons.

Tendons Fibrous structures that connect muscles to bones.

Vascularized Rich in blood supply.



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