



What Is This Module About?

Imagine yourself not being able to move parts of your body. What would you be able to do then? Practically not much. Sure, you may be able to think and plan but plans must be carried out. In order for you to do something, you need to move. In fact, it is your ability to move that helps you accomplish things. What if this wonderful ability is taken away from you? There would not be much joy in living without movement. You cannot run, jump, take a bath on your own or write letters to your friends. You cannot go to places you want to see.

This module on the muscular system is composed of two sub-modules. In this module, you shall learn about the human muscular system. You will know what it is, what its parts are and how its parts operate.

This module is composed of two lessons:

Lesson 1 — *How the Muscular System Functions*

Lesson 2 — *The Structure of the Muscular 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 muscular system;
- ◆ state how the muscular system works;
- ◆ identify the two properties of muscle tissues; and
- ◆ identify the different types of muscles found in the human body.



Let's See What You Already Know

To find out what you already know about the topics to be discussed in this module, answer the questions below. Write your answers in the blanks.

Enumerate the seven functions of the muscular system.

1. _____
2. _____
3. _____
4. _____
5. _____
6. _____
7. _____

Name the two major types of muscles that make up the muscular system.

8. _____
9. _____

Describe how the muscular system works during movement.

10. _____

Well, how was it? Do you think you fared well? Compare your answers with those in the *Answer Key* on page 27 to find out.

If all your answers are correct, very good! This shows that you already know much about the topic. You may still study the module to review what you already know. Who knows, you might learn a few more new things as well.

If you get a low score, don't feel bad. This only means this module is for you. It will help you understand some important concepts that you can apply in your daily life. If you study this module carefully, you will 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.

How the Muscular System Functions

Animals need to move. Movement is needed in order to accomplish a lot of things such as finding food, taking care of one's young and migrating to a safer place. Human beings, like animals, are able to move with the help of the muscular system.

Without the muscular system, your bones and joints would be quite useless, food would not be able to pass properly through the digestive tract and blood could not circulate through the blood vessels of the body. In short, movement of any type is impossible and life as we know it could not exist. Movement is a very important part of life. Only the muscular system can provide you with that ability.

In this lesson, you shall study the components of the muscular system. You will know more about your muscles, how they are arranged and what their functions are. Are you ready to study the muscular system? Use your muscles to move to a more comfortable position. You will need these muscles to turn the pages of this module. Let your muscles work for you and find out more about the muscular system.



Let's Try This

Do you know where to find the different muscles in your body? Locate the muscles in your arms, for example. To do so, put your right hand on top of your right shoulder. Now look at what happens to your upper arm. Can you see the bulging structure there? That is the muscle of your upper arm. Do the exercise again, slowly this time. What do you notice? Look at the same upper arm muscle you detected earlier. Do you notice it becoming bigger when you put your hand over your shoulder? This movement is called *flexing*. What do you notice about that muscle when you put your hand down? Do you now have an idea of how the muscular system works?

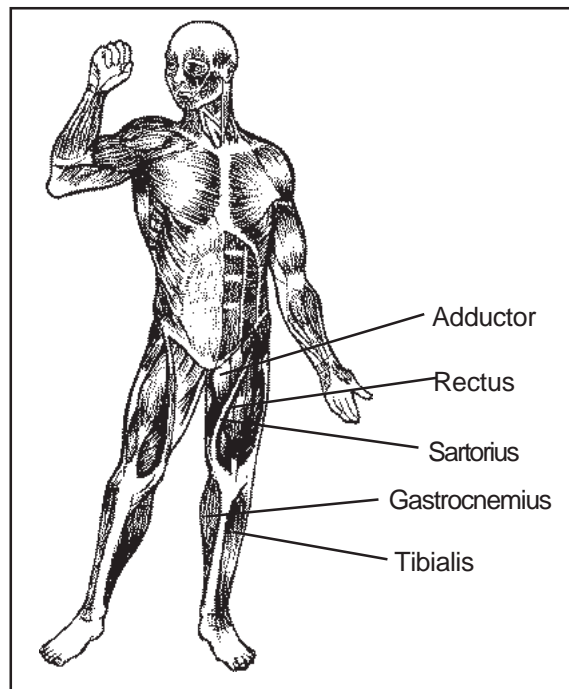


Let's Learn

The muscular system is composed of muscles that are arranged in a way that enables you to move and do a lot of things.

How many muscles do you think you have? Can you guess? You can flex other parts of your body to find out. Do you think you have about thirty muscles? a hundred? a thousand? It may surprise you to know that an adult has 620 identified muscles. This figure only represents the **skeletal muscles**, the muscles that are attached to bones. Add this to the other types of muscles found in your body and you will have many more. All of these muscles are arranged in a special way to help your body function well.

The muscular system is composed of different muscles. **Muscles** are living tissues that have the special ability to contract or shorten, thus producing movements of internal and external body parts. When you hear the word “muscle,” what images are formed inside your head? Chances are you would have an image like the one below.



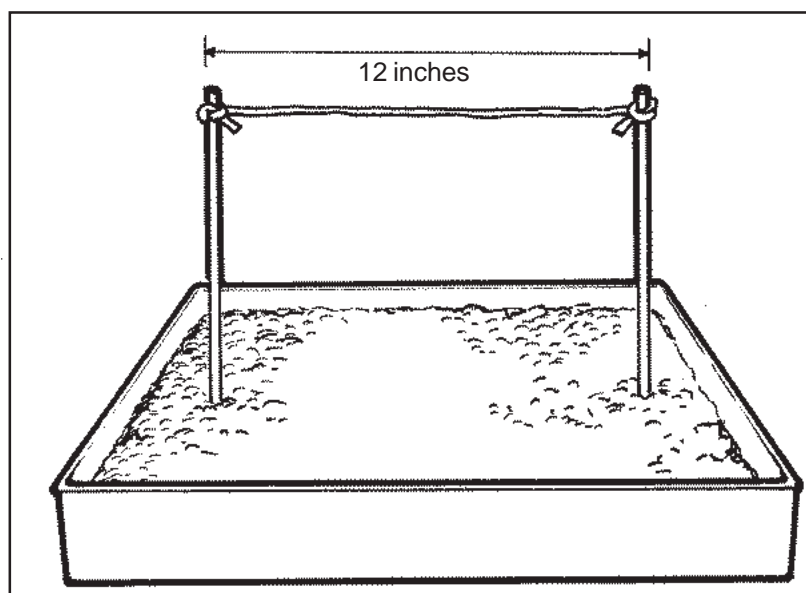
Hearing the word “muscle” would probably give you images of body builders who spend a lot of time pumping iron or sweating it out in a gym. In a way, this is true. Body builders have such big muscles because of exercise. They often have very big arms or legs. They also have well defined chests and chiseled abdomens. Would you like your own body to be like that of a body builder? If so, you have to know your muscular system quite well.



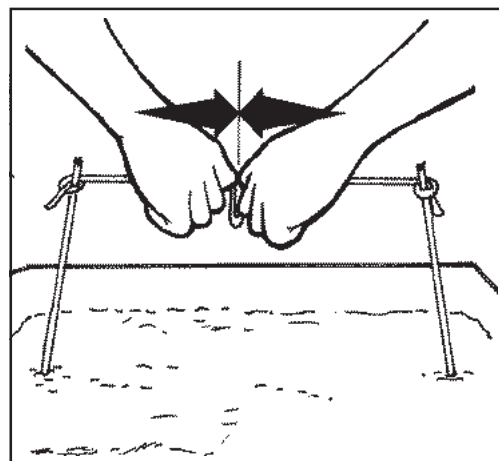
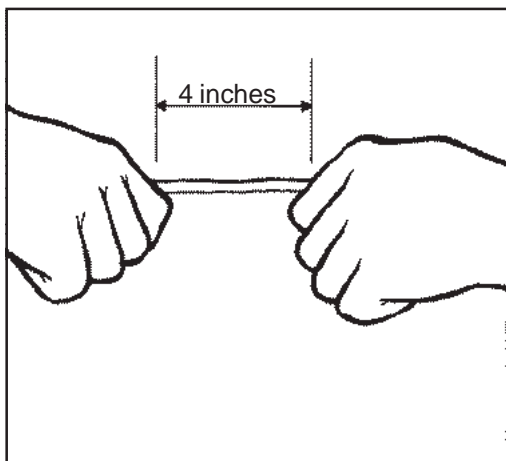
Let's Try This

Get two short sticks and push them through soil or anywhere where they can stand on their own. Make sure that these sticks are at least a foot or twelve inches away from each other. After making sure that the sticks are correctly in place, get a piece of old garter. The garter must be at least a foot and a half in length.

Tie the ends of the old garter to the sticks in the manner shown in the diagram below. Make sure that the garter makes a straight but not so tight connection between the two sticks.

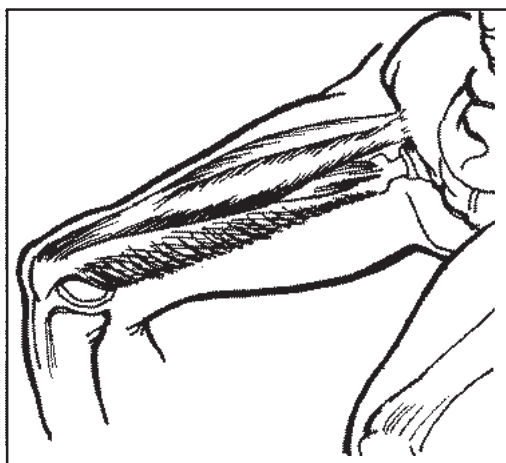


When your setup is in place, hold the garter using both hands. Your hands must be about four inches away from each other. When you are ready, make your hands meet while still holding the garter. Do this for about five seconds then release the garter from your hands.

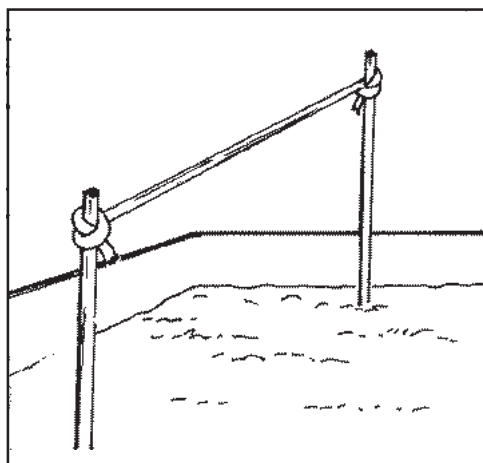


While doing this activity, notice what happens to the sticks. Did they move towards each other when you made the middle part of the garter “contract”? What happened when you released the garter from your hands?

The preceding activity gives you an idea of how your muscles work. Think of the upright sticks as your bones. Muscles attach two bones to each other through tendons. You can visualize the tendons as being similar to the garter knots you made on the sticks.



Muscles attached by tendons to bones

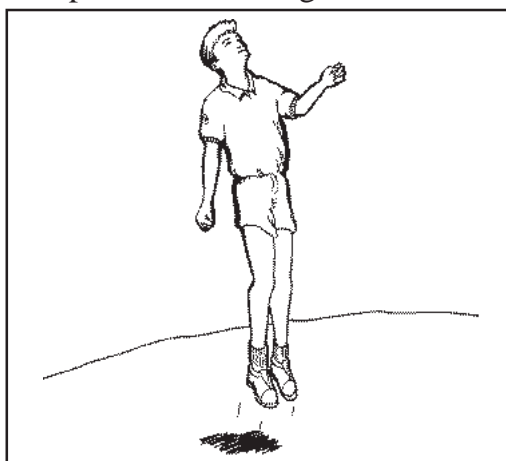


Garter attached to sticks by knots

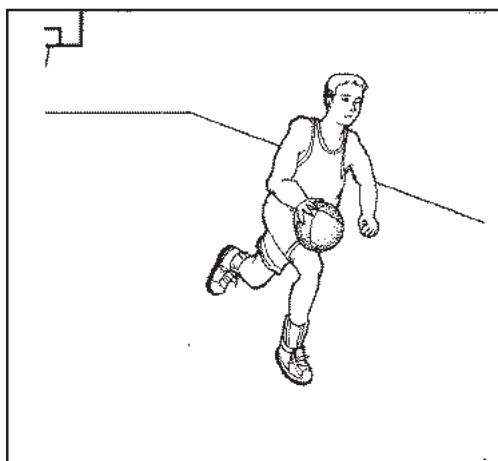
Muscles are capable of contracting. Contraction is similar to what happened when you held the garter in your hands and brought each end near each other. You noticed that the sticks moved towards each other during the contraction of the garter and moved away from each other when the contraction was released.

Muscles act like the garter which can move the bones (sticks) towards and away from each other. In the human body, what do you think happens when muscles contract? The bones move! And since the bones form the framework of the body, the body or parts of it also move!

The skeletal muscles of the muscular system are attached to the bones of the skeletal system of the human body. These allow the body to move and accomplish a lot of things.



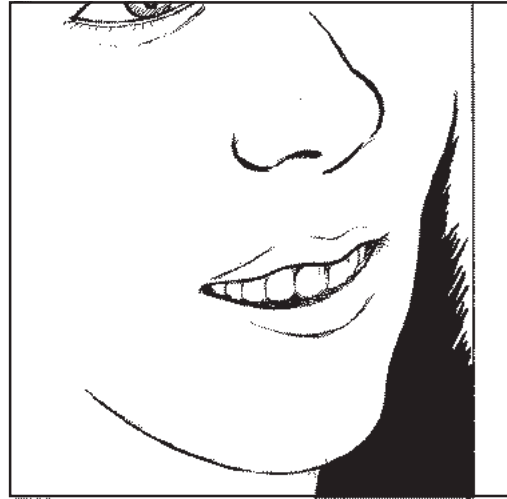
You need your muscles to jump.



You use your leg muscles to run.



Muscles allow your muscles to clap your hands



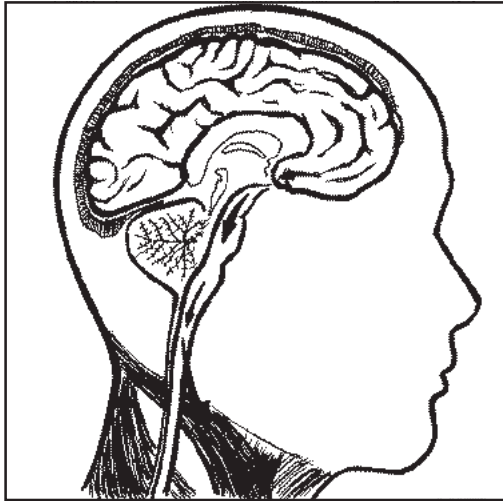
You use your facial muscles to smile and express happiness.



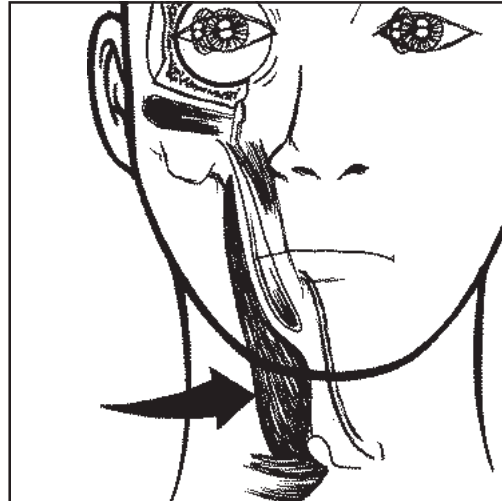
Let's Think About This

You are able to move parts of your body by contracting your muscles. Can you think of other activities you can do with the help of your muscular system? Do you remember a time you used your muscular system to do something so well? What did you do? What do you think happened to your muscles while you were doing it?

The voluntary movements of the body are accomplished by the skeletal muscles, the most common type of muscles in the body. The skeletal muscles are so-called because they are attached to the bones of the skeletal system. There are about 620 identified skeletal muscles in the human body. These muscles are controlled voluntarily by the brain. This means that these muscles move only when you want them to. Examples would be the muscles of the legs that you use when running. Another would be the muscles of the neck that allow you to turn your head from side to side.

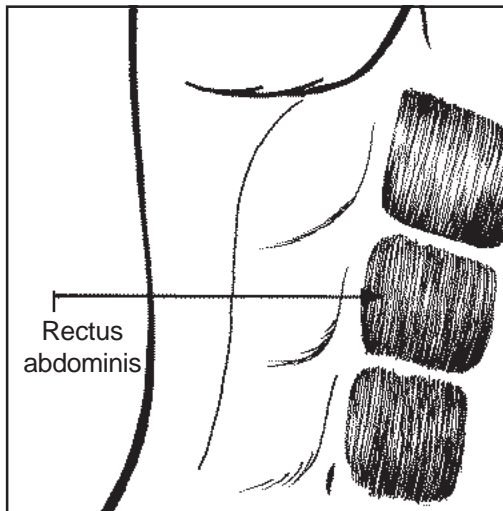


Signals from the brain are sent to the neck muscles to make them move.

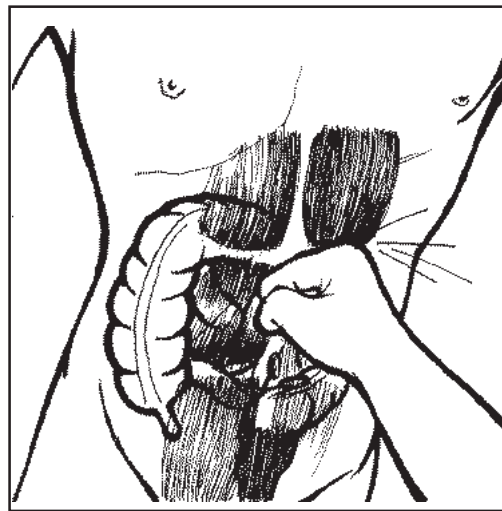


The neck muscles contract which help you move your head from side to side.

The skeletal muscles, aside from making body movements possible, also provide protection to the internal organs. For example, because of the muscles in your abdomen (called **abdominal muscles**), your intestines are protected even if somebody punches you in the stomach. This protection is achieved through the sheer size and thickness of the skeletal muscles.

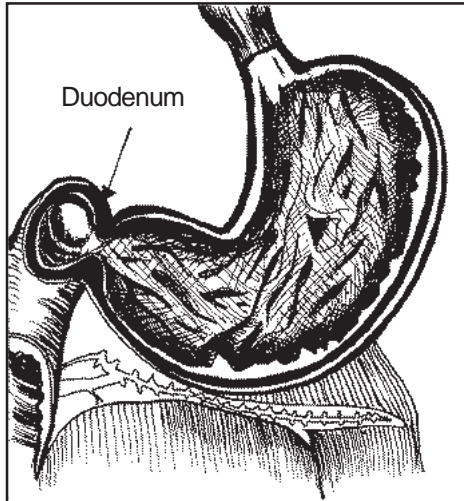


This is how the abdominal muscles look like when the skin is removed in the midsection or abdomen.

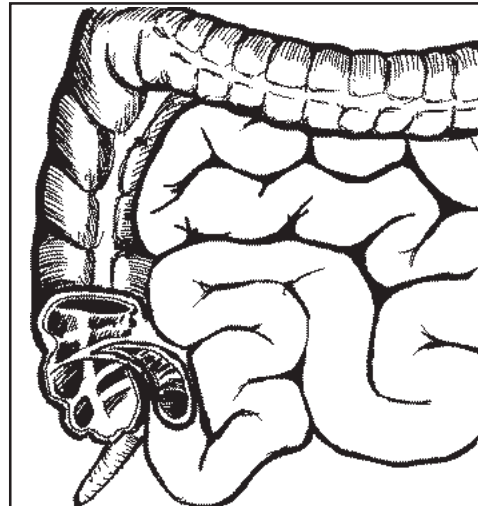


If somebody punches you in the abdomen, your intestines are protected because of your abdominal muscles.

Although being able to move body parts is in itself a wonderful ability, your muscular system can do so much more! Other organs of the body are made up of muscles as well.

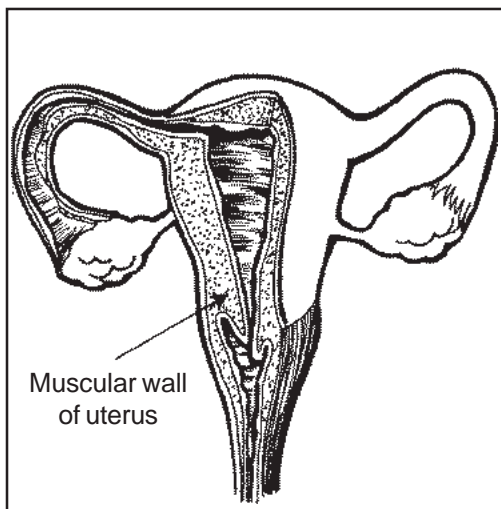


The smooth muscles of the stomach contract to digest food.

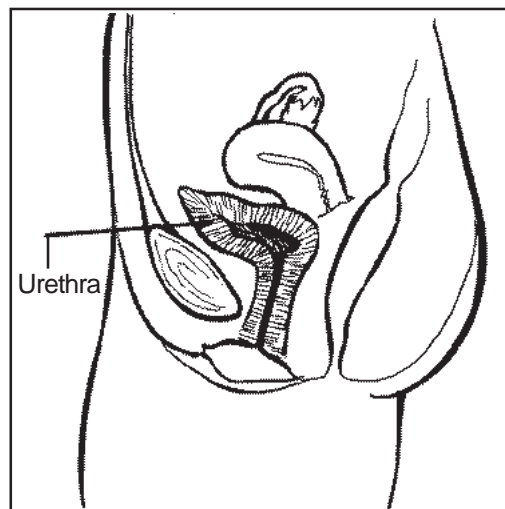


The smooth muscles of your intestines allow food to be digested and propelled towards the anus.

These are called **smooth muscles** because they feel very smooth and lack the rough appearance of other kinds of muscles. They are found on the walls of visceral or internal organs like the stomach, intestines and the uterus in females.

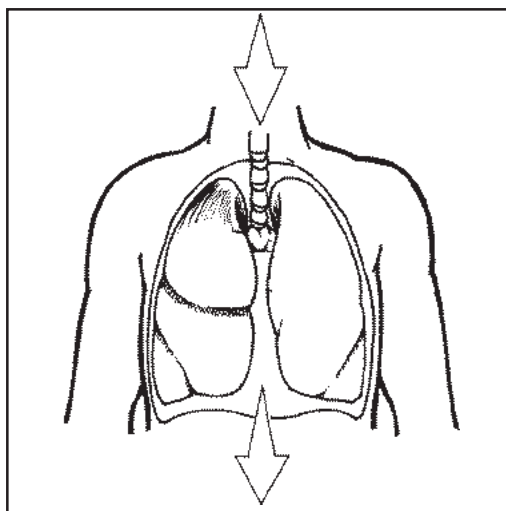


The smooth muscles of the Uterus contract to allow females to deliver a baby.

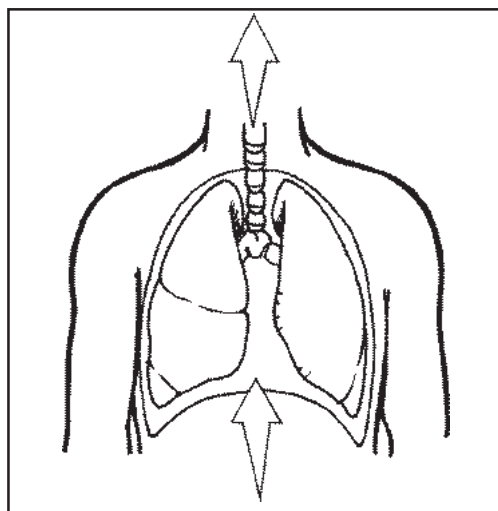


The smooth muscles of your bladder and ureters control urination.

Another important muscle works to help you breathe. This is the **diaphragm** found below your lungs. The process of breathing is generally automatic. It occurs even if you don't think about it. But at times, you can control your breathing. This means that your diaphragm can move either voluntarily or involuntarily.



When you inhale, your diaphragm contracts pulling your lungs down and making them expand or inflate to allow air to enter.



When you exhale, your diaphragm relaxes, making lungs deflate. The deflation of your lungs allows air to exit from your body.

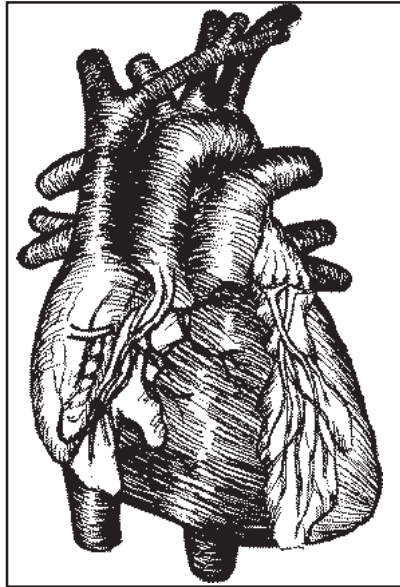


Let's Think About This

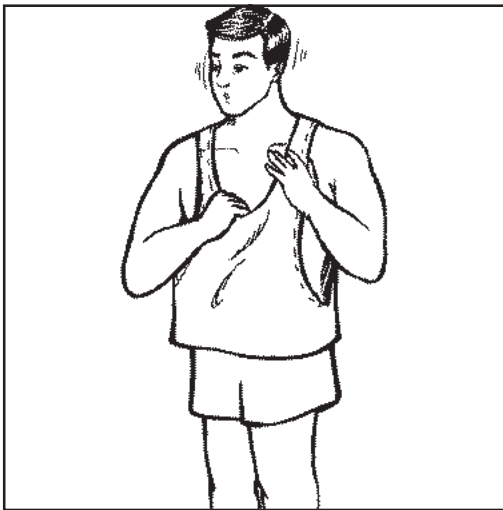
What do you think would happen if the smooth muscles of your body fail to do their job? What kind of life would you have? Would life still be possible without the wonderful smooth muscles that make your internal organs work?

Life is not possible without the smooth muscles of the muscular system. To further emphasize this point, without you knowing it, a small organ in your body, which is mostly made up of muscles, is working 24 hours a day, seven days a week, without rest. It pumps blood continuously throughout your body. Without blood, the organs in your body will die because blood supplies the oxygen necessary for life and normal function. Can you guess what organ I am talking about? Hold your hand to your chest. Now, do you know what it is?

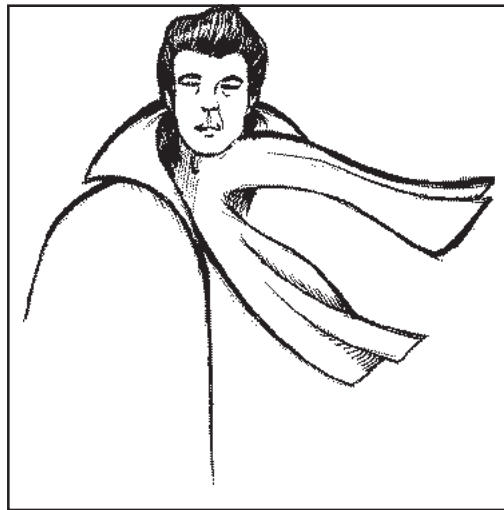
This hardworking muscular organ is your **heart**. It pumps blood throughout your body. It does so involuntarily, which means it works without you attending to it constantly. The muscles found in the heart are called **cardiac muscles**. These are very special muscles that never stop working. If they do, life would not be possible anymore.



So far, you have learned that the muscular system makes the body and its internal organs move to enable life to go on. Also, you have learned that skeletal muscles also provide some amount of protection to internal organs. But there is another very important function that the muscular system performs. Muscles provide heat to the body. A lot of energy is used up to make the muscles contract. And when muscles contract, heat is released. This heat is used by the body to maintain a normal temperature range for the optimum function of all its organ systems. Proper body temperature is important for living.



People move less when the weather is hot because moving would mean releasing more energy and therefore producing heat.



People also put on warm clothes during cold weather to maintain their body temperature.

Human beings are warm blooded. This means that we need to maintain a range of body temperature that is most favorable for survival. Temperatures that are too warm or too cold are bad for the body. The muscular system provides most of the heat the body needs. Without the muscular system, life again as we know it, is not possible.



Let's Think About This

Roy noticed that the weather was cold but he still went to school without bringing his jacket or wearing warm clothing. The weather became colder still while he was in school. His teacher then noticed that Roy was shivering.

What do you think was happening inside Roy's body? Why was he shivering?

In the example above, shivering was an automatic response of the body to produce heat. This occurs when the environment is too cold, which can affect the internal organs such as the heart and intestines. Shivering means that muscles are contracting all over the body. You have learned earlier that muscle contraction produces heat. Therefore, Roy's muscular system is doing its best to produce the heat needed by his body. Isn't the muscular system wonderful?



Let's See What You Have Learned

Write **True** in the blank if the statement is correct. Write **False** if it is not.

- _____ 1. The human muscular system is made up of different kinds of muscles.
- _____ 2. Muscles only move voluntarily.
- _____ 3. Muscles are able to work because of their strength.
- _____ 4. Contraction of the smooth muscles allows the body to move.
- _____ 5. The muscular system makes movement possible through a series of contractions.
- _____ 6. The muscular system provides some protection to vital organs like the intestines and the stomach.
- _____ 7. Life as we know it is still possible without the muscular system.
- _____ 8. Childbirth is made possible by the contraction of the uterus.
- _____ 9. The muscular system does not provide heat to the body.
- _____ 10. Shivering is the body's own way of producing heat.

Compare your answers with those found in the *Answer Key* on page 27. If your score is 6 or higher, congratulations! You have learned a lot from the first lesson of this module.

If your score is 5 or below, you need to reread this lesson. Don't worry, maybe you just need more time and effort. Go back to the parts you missed and study them again. After reviewing this lesson, proceed to the next one.



Let's Remember

- ◆ The **muscular system** is a system of voluntary and involuntary muscles in the human body. It greatly contributes to the well-being of the body by:
 1. allowing movement to occur;
 2. providing protection to internal organs;
 3. facilitating the movement of internal organs such as the heart, lungs, intestines and bladder to function properly; and
 4. producing heat that the body needs to function properly.
- ◆ Muscles produce movement by contracting or shortening. Some actions of the muscular system are voluntary as in the case of the skeletal muscles that are attached to the bones of the body. Some are involuntary as in the case of the smooth muscles especially the muscles lining the walls of the intestines.

The Structure of the Muscular System

In the previous lesson, you have learned the many important functions of the human muscular system. It is a well organized system of muscles that generally function to enable movement of body parts as well as protect the internal organs such as the intestines. It is also responsible for generating heat that the human body needs. The muscles of the muscular system make life, as we know it, possible. But how does the muscular system accomplish the many wonderful things it does? To better understand this, it is important to know how the muscles are arranged in your body.

In this lesson, you shall study the arrangement of the muscles that comprise your muscular system. But first, you have to review the module on the skeletal system. Are you ready to learn more? Stretch your muscles and prepare to study them.



Let's Try This

From the previous lesson, do you remember how many skeletal muscles there are in your body? There are 620 skeletal muscles in all. Can you tell where these skeletal muscles are located? Hold a friend's arms as he/she flexes them. Can you feel his/her muscles moving? Ask your friend to do the same to you. Then put your hands on top of your legs as you squat and stand up alternately. Can you feel your leg muscles contracting? Hold your face as you smile in front of a mirror. Do you have muscles in your face, too?

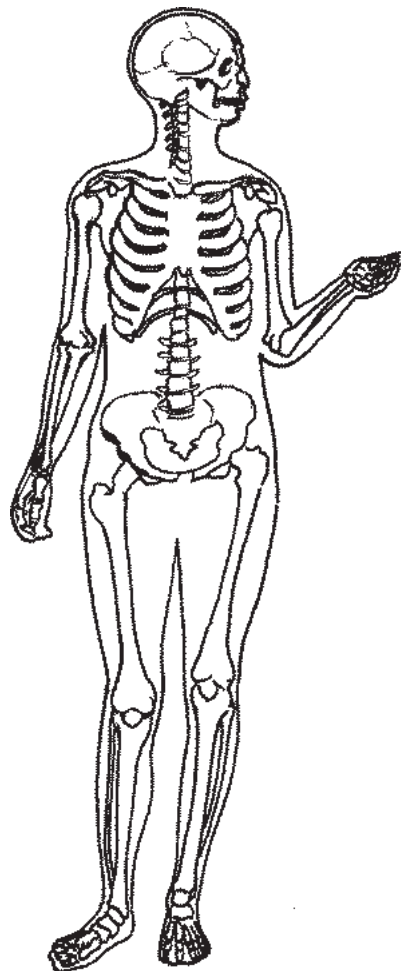


Let's Learn

An adult has 620 skeletal muscles arranged in the best possible way to make parts of the body move. It is not surprising why people only think of the skeletal muscles when the word “muscle” is mentioned. But there are different kinds of muscles. In fact, they comprise the major bulk of one’s body. In males, the skeletal muscles make up 42% of the adult body weight. In females, who are less heavy generally, skeletal muscles comprise 36% of their entire body weight. Muscles are indeed numerous and heavy because they weigh three times more than bones do!

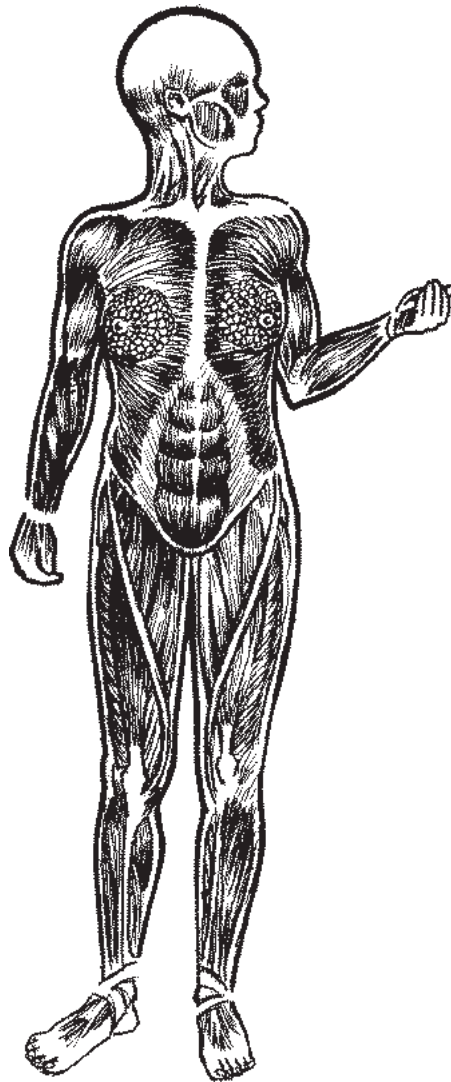
The skeletal muscles are so named because they are closely associated with the skeletal system. The skeletal system is made up of bones that form the foundation and give shape to the human body. Look at the drawing of the skeletal system below, which acts as the framework of the body.

The Human Skeletal System



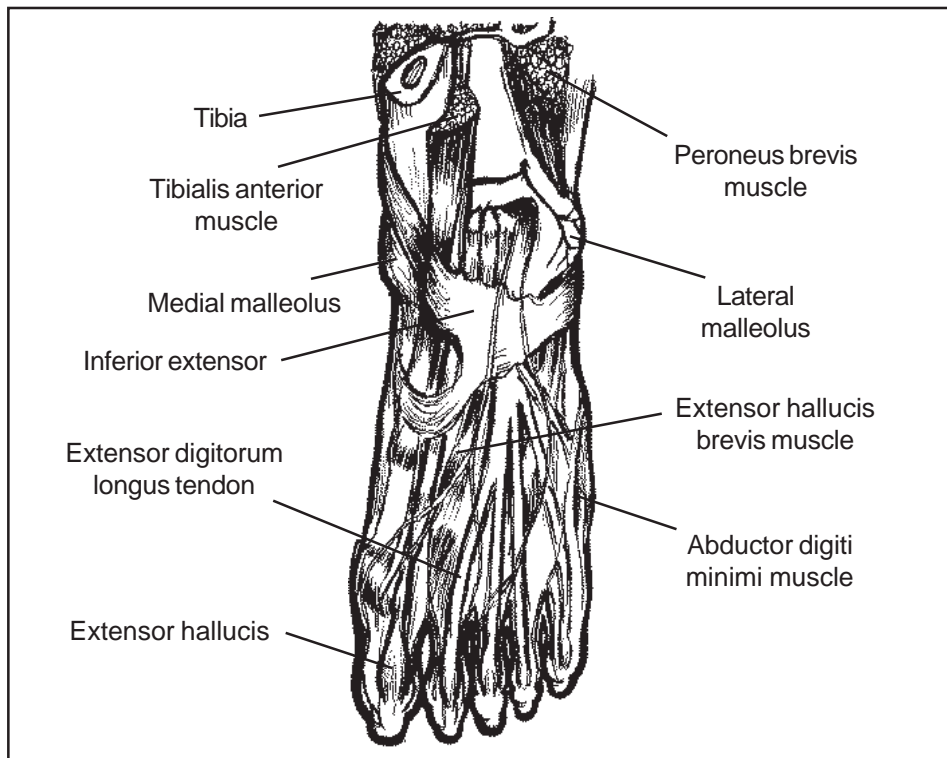
In the module on the skeletal system, you learned that the skeleton serves as the framework of the body. The skeletal muscles, on the other hand, act like the walls of a house, which connect bones to each other. Although the bones are already connected to each other by tough fibrous bands of tissue called **ligaments**, the skeletal muscles reinforce these connections and make them stronger. Study the drawing of the skeletal muscles of the human muscular system below.

The Skeletal Muscles of the Human Muscular System



What did you notice from the drawing of the skeletal muscles on the previous page? They look somewhat scary, don't they? But don't be scared. Just think that because of this orderly arrangement of skeletal muscles in your body, you can do a lot of activities like running, jumping, swimming and playing.

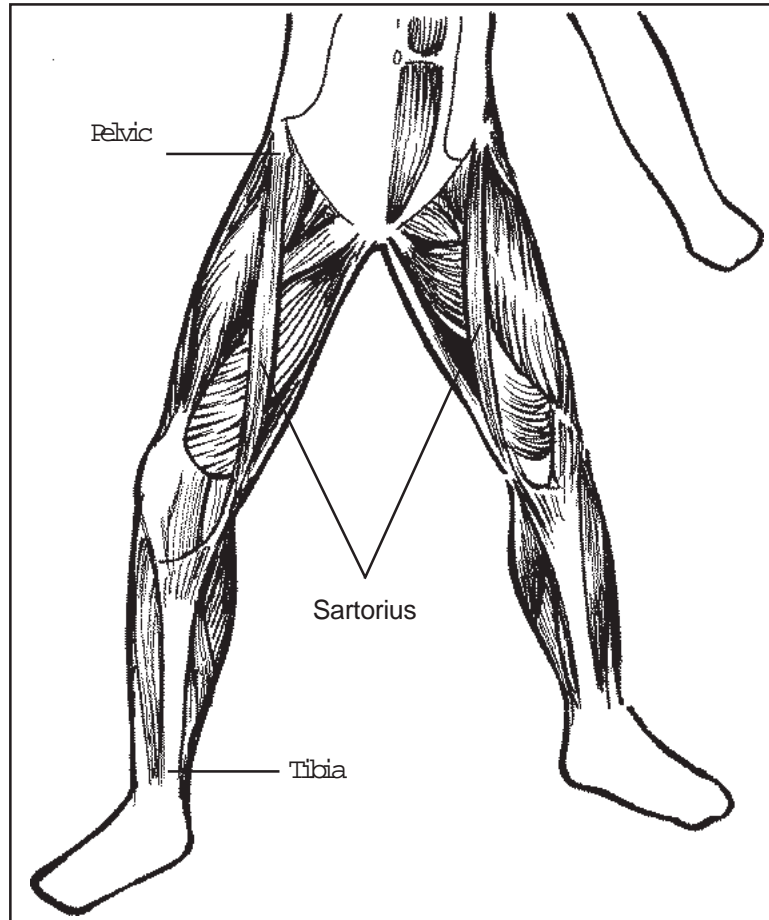
To better understand how the skeletal muscles are attached to the bones, look at the drawing below which will show you how the **tendon**, a connective tissue, attaches a muscle to a bone.



Remember that the tendon is very important in making the muscles function. Without tendons, the skeletal muscles will not be able to make the bones move.

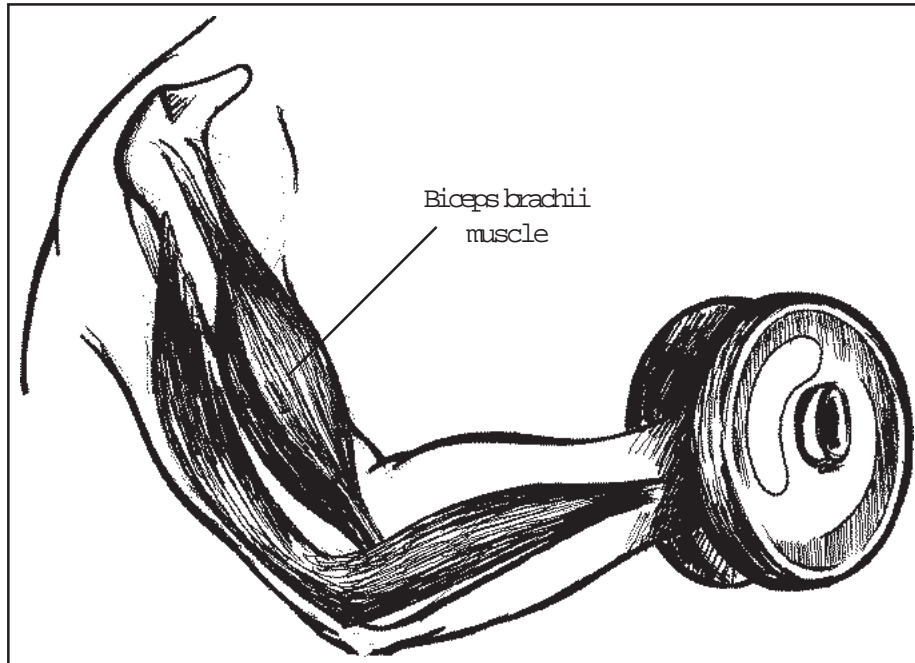
How do skeletal muscles make body parts move?

Muscles are attached to at least two bones in at least two points, one on each point. These points are called the **origin** and **insertion**. These terms are interchangeable. The following is a drawing of the sartorius muscle. The word **sartorius** means “tailor” in Latin. Tailors use this muscle to pedal a sewing machine. Notice that the sartorius is attached to the pelvic bone (origin) and the tibia (insertion). The **tibia** is the bigger bone found in the lower leg.



Notice that the **sartorius** is a long skeletal muscle which is attached to two bones, the pelvic bone and the tibia. If the sartorius contracts, which is basically what a muscle does, which bones move closer to each other? What kind of movement happens? If the sartorius muscle relaxes, what happens?

When the sartorius contracts, the bones of the pelvis and the tibia of the lower leg are brought together. Remember your activity using the sticks and a piece of garter in Lesson 1. When a muscle contracts, it shortens, hence the distance between the two bones shorten, too. When the sartorius contracts, the leg is moved upwards. This movement is very important for tailors who use sewing machines.



It's quite simple, isn't it? Remember that muscles are attached to two bones in at least two points, one on each bone. This is also true for the sartorius. But there are more complicated muscles in the body which have three or more bone attachments! These attachments are needed to provide more stability to the movement of the bones. This is especially needed for work requiring more effort like lifting weights.

When you lift weights using your hand, as in exercising using a dumbbell, you use the biceps brachii muscle found in your upper arm. The word **bi** means "two." The word **ceph** is Latin for "head" and **brachii** means "a branch of a tree." True to its name, the biceps brachii muscles of the upper arm, has three attachments. Two attachments in the upper part of the arm and another one in the **radius**, a bone in the lower arm. When your biceps contract, your arms flex enabling you to pull dumbbells up to your chest.



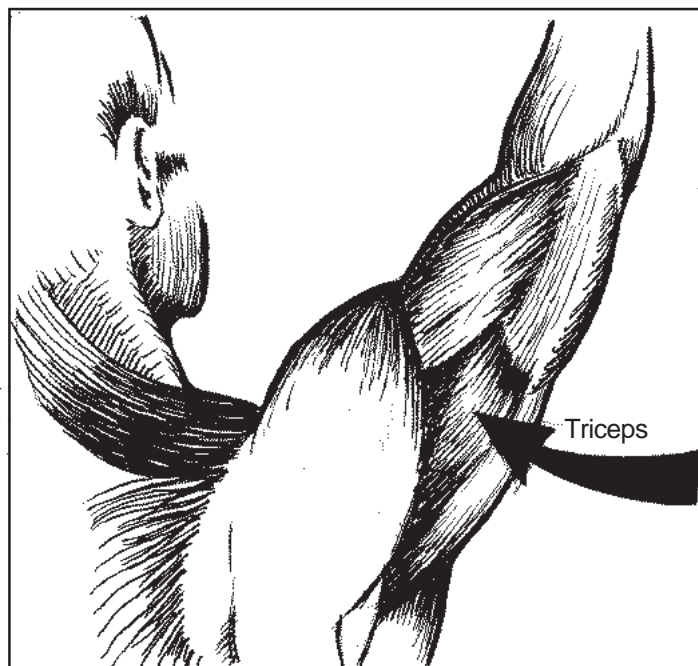
Let's Try This

When a muscle contracts, two bones move towards each other making movement possible. Take the case of the biceps muscle of the forearm. When it contracts, the bones of the upper and lower arms move towards each other. This movement is called **flexion**. But what if the biceps muscle relaxes, will the arm automatically go back to its original position? or will another muscle need to contract? Try to answer this problem by holding the biceps muscle of your own arm when you flex. When you want to straighten your arm, is there another muscle that has to contract to bring the arm to that position?

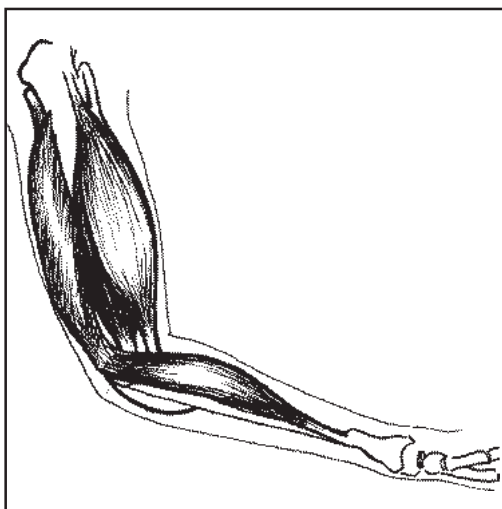
If you can't figure out the answer, try holding the back portion of your upper arm as you straighten it. Can you feel something contracting? Can you think of a possible relationship between the muscles of the front and back parts of the upper arm?

In the preceding activity, you were asked to feel for the triceps brachii or simply triceps muscle found at the back of the arm. Study the location of the **triceps**, a muscle with four attachments, in the drawing below.

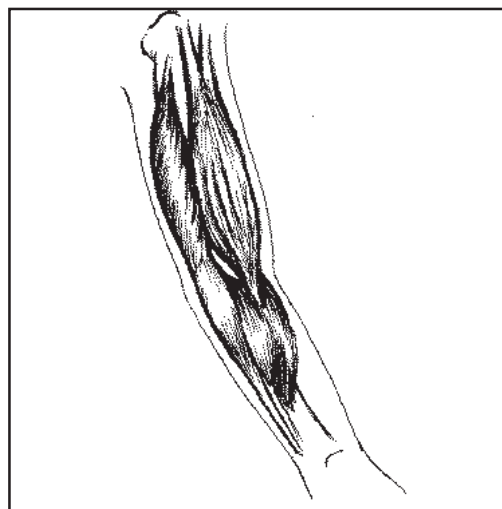
The Location of the Triceps Brachii Muscle



When you flex your arm, your biceps contract. When you straighten your arm, your triceps, in a position opposite your biceps, contracts.



Contraction of the biceps leads to the flexion of the arm



Contraction of the triceps enables the arm to straighten.

The biceps and triceps muscles are **antagonistic muscles**. Antagonistic muscles are located opposite each other. The biceps, in this case, is found in the front portion of the upper arm and the triceps is found at its back portion. One muscle does not contract when the other is also contracting. These muscles work well by letting each other contract alternately. You can think of these muscles as having a give-and-take relationship. Since the biceps flexes and the triceps straightens the arms, they have opposing actions. Hence, these two muscles are also called **opponent muscles** because of their relationship.

Some groups of muscles work together to perform a similar action. These muscles are called **synergistic muscles**.

Do you think the different kinds of muscles provide you with continuous, steady and proper body movements? Since there are 620 skeletal muscles working together almost at the same time, say when you are running, can you imagine how well organized muscle contractions need to be to make movements occur properly?

Your muscular system is composed of muscles of different shapes and sizes working together to fine tune your movements and enable you to perform actions well. Do you think the muscular system deserves more recognition because of this? Sure it does, and I know you would agree with me, too.



Let's Review

In the space provided before each statement, write the word **True** if the statement is correct. Write **False** if you think that the statement is incorrect.

- _____ 1. There are 320 skeletal muscles in the human body.
- _____ 2. The skeletal muscles move voluntarily.
- _____ 3. All muscles are of the same size.
- _____ 4. All muscles are of the same shape.
- _____ 5. Skeletal muscles are attached to bones.
- _____ 6. Tendons attach muscles to bones.
- _____ 7. Muscles primarily work by contracting.
- _____ 8. Contracting one's muscles makes bones move away from each other.
- _____ 9. The triceps and biceps of the upper arm are examples of synergistic muscles.
- _____ 10. Opponent muscles contract at the same time.

Compare your answers with those found in the *Answer Key* on page 28. If your score is 7 or higher, well done! You are getting to know your muscular system better.

If your score is 5 or below, that's good, but you need to review this section. Go back and study the parts you missed. After doing so, you may proceed to the next section.

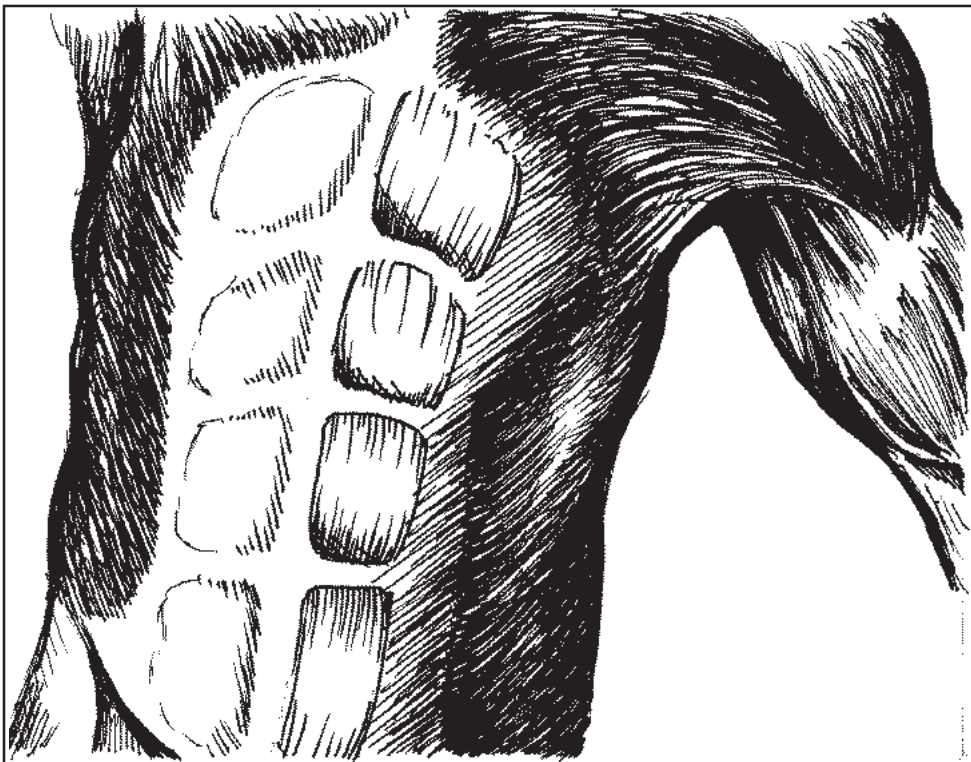
The Smooth Muscles

After learning about the skeletal muscles, you will now study the involuntary muscles of the internal organs. Muscles are important because they make you move. But there are movements inside your body that happen without you knowing about them. In fact, these internal movements are even more important because they maintain life. All muscles are important because each one works with another to create a functioning whole, whether inside organs or near bones.

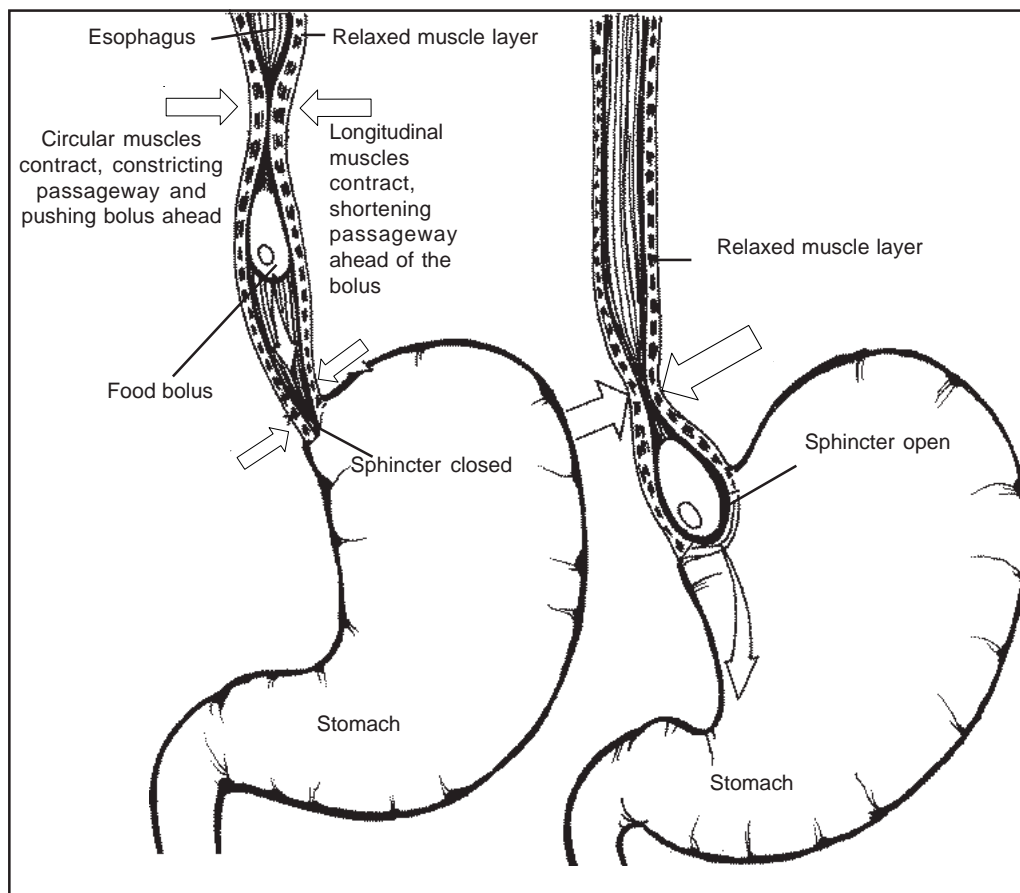
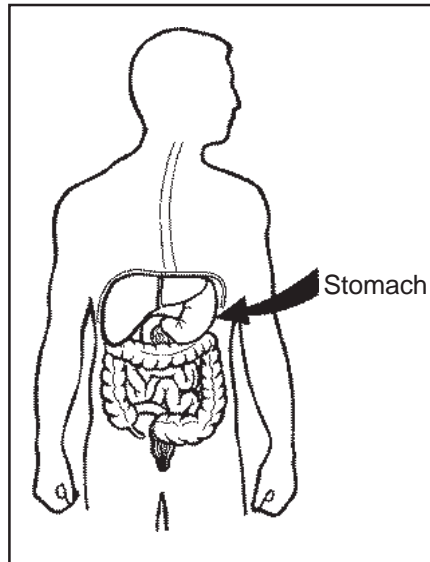
The smooth muscles are found in the walls of internal organs such as the heart, intestines, stomach, uterus and bladder. These are involuntary muscles that mediate functions such as circulation, digestion, urination and reproduction, which are necessary for living and the continuation of life. Basically, smooth muscles are made up of a special form of muscle tissue under automatic control of the nervous system.

Since smooth muscles are similar, in this lesson, you shall focus only on one internal organ, the stomach.

The Muscles of the Stomach



The **stomach** is the part of the digestive system found in the abdomen. It functions primarily to digest food through the secretion of acids. When the smooth muscles of the stomach contract, food is pushed towards the intestines to continue the process of digestion until it is finally expelled. This process is called **peristalsis**. Without peristalsis, digestion of food will not be possible.





Let's See What You Have Learned

Write the word that is best described by each statement in the blank space provided.

- _____ 1. The series of contractions of the digestive system which propels food.
- _____ 2. The type of muscle found in the walls of internal organs.
- _____ 3. Organ of the digestive system that secretes acids.
- _____ 4. Type of muscle of the internal organs in terms of the system that controls it.
- _____ 5. The main function of the digestive system.

Enumerate five functions accomplished because of the presence of smooth muscles in the internal organs of the body. Your answers may be written in any order.

6. _____
7. _____
8. _____
9. _____
10. _____

After you have finished, compare your answers with those found in the *Answer Key* on page 28. If your score is 6 or higher, congratulations! You are now able to identify the important muscles in the body.

If your score is 5 or below, you need to review this lesson. Go back and study the parts you missed. After doing so, you may proceed with the rest of this module.



Let's Remember

- ◆ The different kinds of muscles are:
 1. Skeletal muscles — the muscles attached to the bones which move voluntarily
 2. Smooth muscles — are involuntary muscles that mediate functions such as circulation, digestion, urination and reproduction
- ◆ Muscles can also be classified according to how they move, they are:
 1. Antagonistic muscles — contract one after another or alternately to create opposing movements of body parts
 2. Synergetic muscles — muscles that work together to create movements

Well, this is the end of the module! Congratulations for finishing it. Did you like it? Did you learn something useful from it? A summary of its main points is given on the next page to help you remember them better.



Let's Sum Up

- ◆ Muscles are very important parts of the human body because they do a lot for it to function properly.
- ◆ Muscles provide some amount of protection to the body organs. The most important function of muscles is their ability to make parts of the body move through a series of contractions and relaxations of different muscle groups. Smooth muscles found in the internal organs like the stomach, provide the movements needed by these organs to do their work. Muscles are also needed to produce heat that the body needs. The muscles of the heart allow blood to be pumped throughout the body.
- ◆ Antagonistic muscles contract one after another or alternately to create opposing movements of body parts. Synergistic muscles work together. Smooth muscles are involuntary muscles responsible for the movements that the internal organs of the body need to perform their work well.



What Have You Learned?

Match the items in Column A to those in Column B. Write the answers in the space provided.

Column A	Column B
_____ 1. Voluntary muscles	a. One of the functions of muscles
_____ 2. Cardiac muscles	b. Move under conscious control
_____ 3. Involuntary muscles	c. Produce movement even without one's knowledge
_____ 4. Movement	d. Muscles attached to bones
_____ 5. Contraction	e. Muscles of the heart
_____ 6. Antagonistic muscles	f. Cause muscles to move
_____ 7. Heat production	g. Make up internal organs
_____ 8. Smooth muscles	h. Opponent muscles
_____ 9. Synergistic muscles	i. Role of muscles in regulating movements
_____ 10. Skeletal muscles	j. Muscles that contract together

Compare your answers with those found in the *Answer Key* on page 28. Check your own answers. If your score is 6 or higher, congratulations. You did great!

If your score is 5 or below, you need to review this module. Go back and study the parts you didn't understand. After doing so, you may proceed to Part 2.



Answer Key

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

1. Permits movements to occur through contraction
2. Provides some protection to the internal organs of the body such as the intestines
3. Produces heat for the body's use
4. Allows balance to be accomplished
5. Helps in the circulation of blood through movements of the heart
6. Allows the stomach and intestines to digest food
7. Makes the bladder contract when urinating
8. Voluntary muscles
9. Involuntary muscles
10. The muscular system is closely associated with the skeletal system. Muscles attach bones to one another. When muscles contract, the bones they are attached to, move, allowing parts of the body to move as well. Smooth and cardiac muscles are not attached to bones. Nevertheless, these muscles still contract to allow involuntary movements inside the body such as the beating of the heart and the digestion of food.

B. Lesson 1

Let's See What You Have Learned (page 12)

1. True
2. False. Not all muscles move voluntarily. Some move involuntarily and function even without one's knowledge.
3. False. Muscles are able to work primarily because of their ability to contract.
4. False. Skeletal muscles move body parts. Smooth muscles are responsible for the involuntary movements of internal organs.
5. True
6. True
7. True
8. True
9. False. Much of the heat needed by the body is produced by skeletal muscles.
10. True

C. Lesson 2

Let's Review (page 21)

1. False. There are 620 identified skeletal muscles.
2. True
3. False. Muscles vary in size.
4. False. Muscles vary in shape.
5. True
6. True
7. True
8. False. Contracting one's muscles makes bones move towards, not away, from each other.
9. False. The triceps and biceps are antagonistic muscles.
10. False. Opponent muscles contract alternately. Synergistic muscles contract together.

Let's See What You Have Learned (page 24)

1. Peristalsis
2. Smooth muscle
3. Stomach
4. Involuntary muscle
5. Digestion of food
6. Digestion of food through movements of the stomach
7. Digestion and propelling of food through movements of the intestines
8. Excretion of urine through the ureters
9. Control of urination through the bladder
10. Delivery of a baby through the uterus in females

D. What Have You Learned? (page 26)

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



Glossary

Biceps brachii Muscle of the upper arm causing flexion.

Cardiac muscles Muscles of the heart.

Contraction Decrease in length of muscles creating movements.

Diaphragm Muscle responsible for breathing.

Duodenum The portion of the small intestines into which the contents of the stomach first enter.

Extension Straightening.

Flexion Folding.

Framework Supporting structure.

Muscle Fibrous tissue that has the ability to create movements in the body.

Muscular system Body system composed of muscles.

Opponent muscles Also called antagonistic muscles or muscles that work against each other and contract one after the other.

Relaxation Going back to one's original length.

Sartorius Muscle found in the thighs.

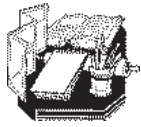
Skeletal muscles Muscles that are attached to bones also known as voluntary or striated muscles.

Smooth muscles Involuntary muscles.

Synergistic muscles Muscles that work together and contract at the same time.

Tendons Fibrous tissues that connect muscles to bones.

Triceps brachii Muscle of the upper arm responsible for extending one's arm.



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