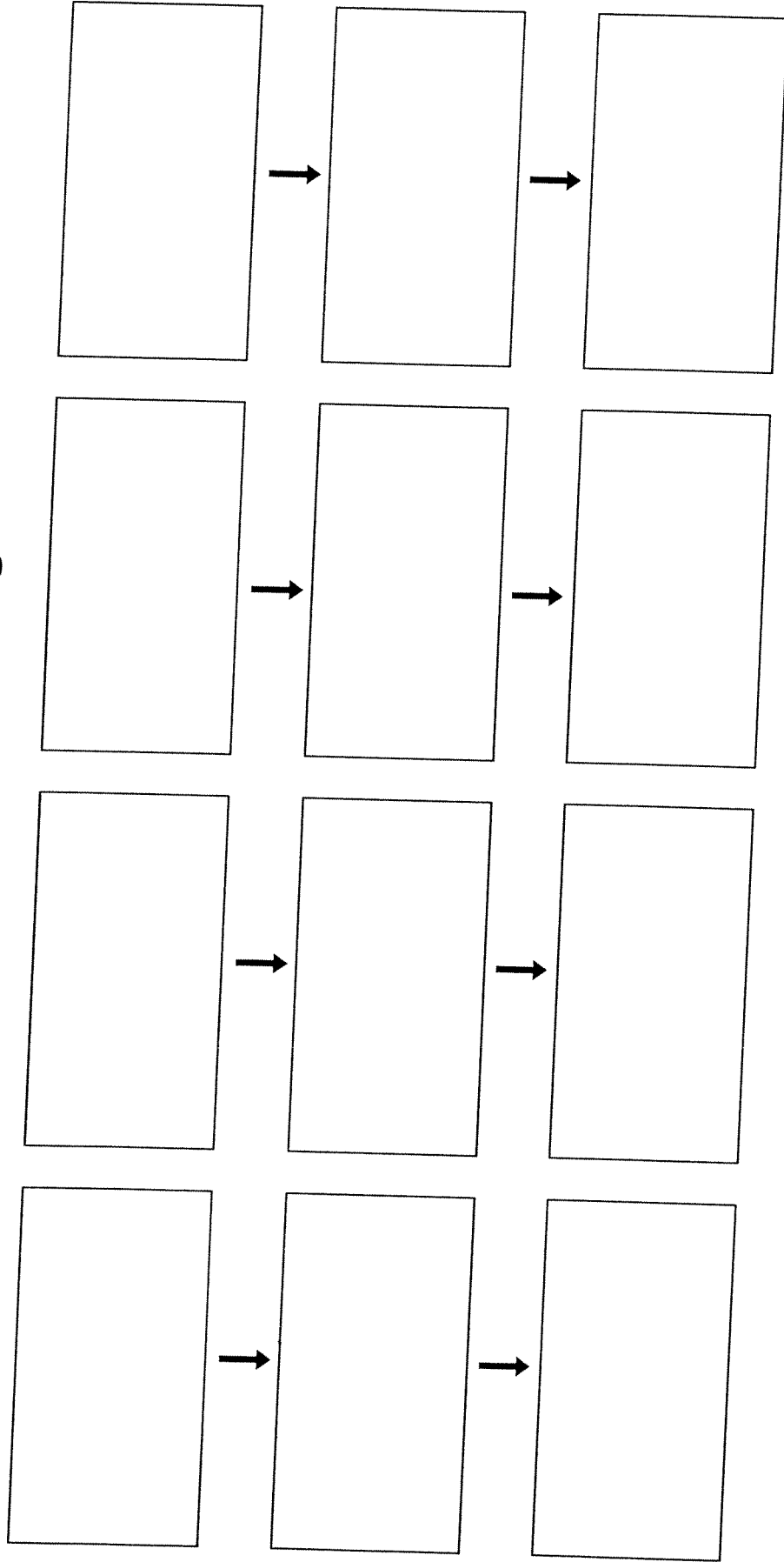


HUMAN BODY SYSTEMS STUDENT MASTER PACKET



FIFTH GRADE

Cells Have To Work Together



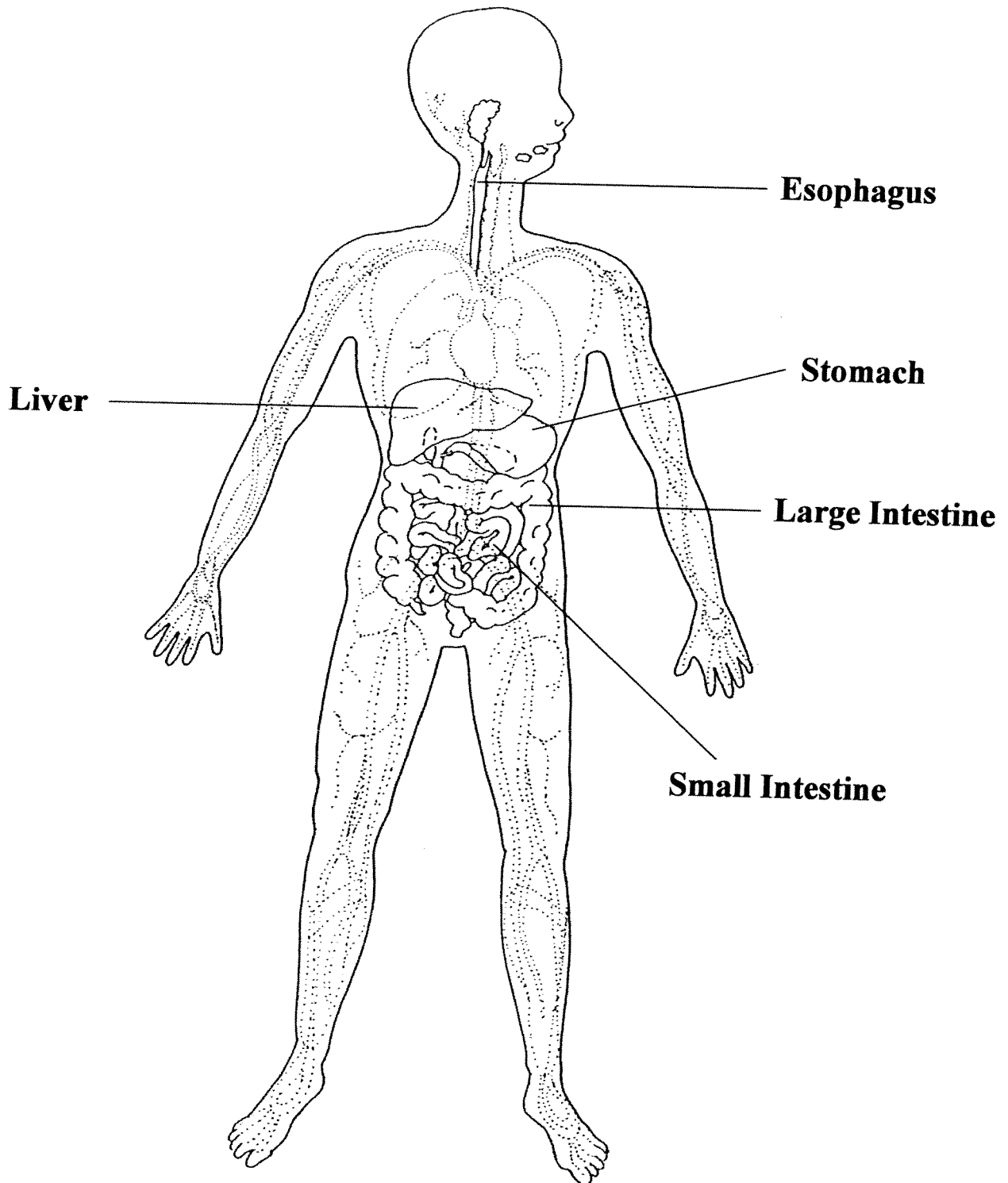
The human body consists of many different types of _____ which carry out a specific function. A group of _____ cells form a _____. Cells making up a tissue carry out the same _____. Two or more types of tissues working together form an _____. Several types of _____ carry out a specific function and form a _____.

T Chart

NAME: _____

Voluntary Actions	Involuntary Actions
<p>Definition:</p> <hr/> <hr/> <hr/> <hr/> <hr/>	<p>Definition:</p> <hr/> <hr/> <hr/> <hr/> <hr/>
<p>Examples from Lab <i>(i.e. jumping)</i></p>	<p>Examples from Lab <i>(i.e. heavy breathing)</i></p>

The Digestive System



Name: _____

Your Digestive System

by Cynthia Sherwood

This may seem like a trick question, but are you bigger than a tennis court? The answer is no, of course not! But think about this fact—your intestines have a surface area about the size of a tennis court all coiled up inside your body. They fit inside of you because your large and small intestines are like a giant Slinky that scrunches up.

These organs have a giant role to play too. They are part of your digestive system. That means they break down the food you eat. Digestion begins in the mouth when you chew and swallow. From there, your food travels through the esophagus (ee-saw-fuh-gus), which connects the bottom of your throat to your stomach. Your stomach mixes up food with liquids and then dumps it all into the small intestine.

The small intestine is a very long narrow tube. Its spongy walls soak up nutrients from your food. Then those nutrients flow into your bloodstream to be carried off to other parts of your body. Some nutrients get stored until you need them and others are used right away for all the different things your body needs to work well.

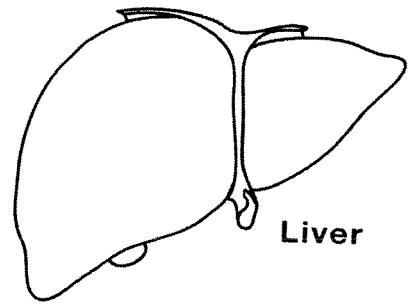
Your body cannot use every single bit of the food you eat. There will always be some that needs to be changed into waste by the large intestine. From the small intestine, leftover food gets pushed into the large intestine where it is dried up and turned into feces, or poop.

If you want to keep your digestive system healthy, you should be careful about what you eat. Healthy whole grains, fruits, and vegetables all pass through your digestive system quickly and easily. They also contain fiber, which is a nutrient that helps in digestion. Your body has a harder time digesting fatty foods, so be careful how much fat is in your diet.

Name: _____

Your Liver

by Cynthia Sherwood



A crab that loses a leg can grow another one back. A worm that loses its head or tail can grow either back from any of its segments. And believe it or not, you can do something similar!

The liver is the largest organ inside your body. If part of it is removed, it can grow back. But the liver is amazing in many other ways too because it does so many important jobs. The liver is like a giant chemical factory with three major functions. It makes something called "bile" to help your stomach break down the food you eat. It cleans your blood by removing dangerous chemicals from your body. And it makes and stores fuel for you to use when you need extra energy.

Your liver is located under your ribs on your right side. It is smooth, reddish-brown, and made up of two different parts called "lobes." Your liver weighs about three pounds.

All together, your liver does more than 500 things that are vital to your health. Besides its main jobs, the liver helps make antibodies that kill germs and makes cells that builds your muscles. It even makes a protein that stops cuts from bleeding for a long time and it keeps pollution from hurting you. The liver is so important that none of us can live for long with one that is badly diseased. You can take care of your liver by eating healthy foods, drinking water, and exercising. Drinking too much alcohol and smoking cigarettes can cause damage to the liver.

There is a rather strange side effect for some people with liver problems. Their skin and eyes can turn a shade of yellow. Even newborn babies sometimes have this problem. Doctors can help, so people who are looking "yellow" should see one right away. After all, this is one part of your body you need to keep healthy.

What Happens in the Digestive System?

Mouth

The mouth is the place where both mechanical digestion and chemical digestion begin. Your teeth and tongue work together to chop, grind and mash the food into small pieces. At the same time, the saliva in your mouth begins the chemical digestion. Saliva contains a special substance called an enzyme that works chemically to cause particles of food to break apart into even smaller components. Food remains in the mouth for about two minutes.



Esophagus

The food travels down the esophagus, pushed by muscles in the process of peristalsis. Peristalsis is responsible for the rumbling sounds the digestive tract produces. Food stays in the esophagus anywhere from four to eight seconds (one to two seconds for very soft food or liquids).

Stomach

The stomach is like a food processor; here food is broken down by a variety of substances. The processes that take place here are mainly part of chemical breakdown using both enzymes and a substance called hydrochloric acid. This latter substance is very strong and would even digest the stomach's own lining were it not for a layer of mucus that protects it. The food remains in the stomach for about four hours, taking the form of a thick liquid.

Small Intestine

The digestive process of breaking down food is finished in the small intestine. In the first part of the small intestine, the thick liquid from the stomach is mixed with a liquid called bile from the gall bladder and with other enzymes from the pancreas. Then, as it passes through the remaining twenty feet, it is digested enough so that it passes through the walls of the intestine into the blood. It takes about twelve hours for food to pass through the small intestine.

Large Intestine

Water and parts of the food that cannot be digested are passed on into the large intestine. Here most of the water is absorbed into the blood through the intestine walls. The remaining wastes are then excreted as urine and feces.

Below are descriptions of the “secondary” digestive organs – those which provide liquids and enzymes that help to break down the food but which don’t actually come in contact with the food.

Liver

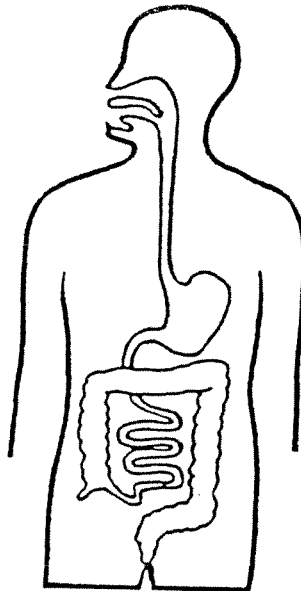
The liver has several important functions, one of which is the production of bile. Bile acts like a detergent, breaking up fats in food into tiny drops so that they can be broken down more effectively. The breakdown of food by bile is mechanical, not chemical. The bile that the liver produces is stored in the gall bladder.

Pancreas

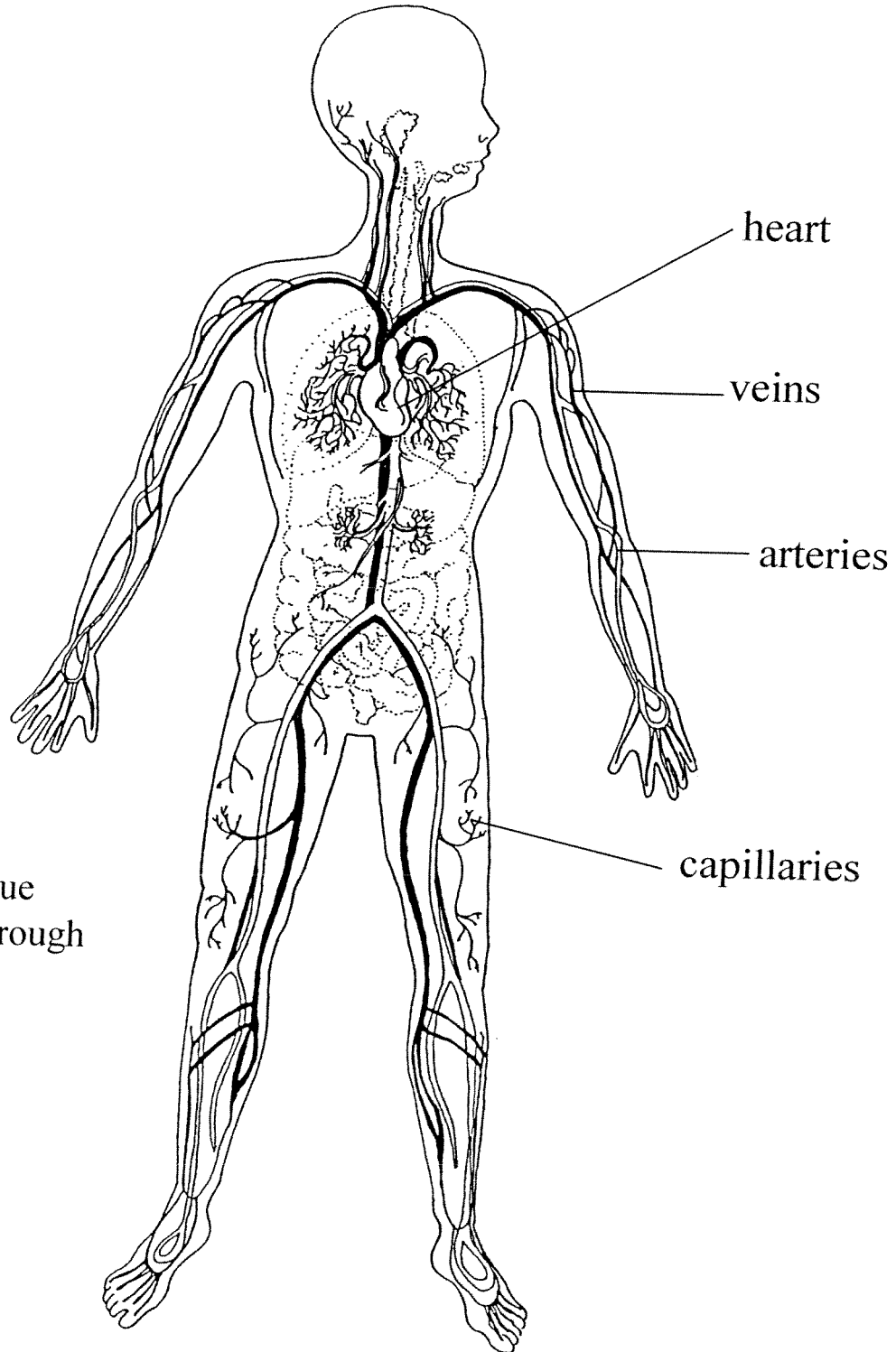
The pancreas is an organ that serves many different functions, one of which is the production of enzymes. The liquids of the pancreas work in the small intestine.

Gall Bladder

The gall bladder is a small saclike organ that stores the bile produced by the liver. The gall bladder ejects the bile into the small intestine.



The Circulatory System



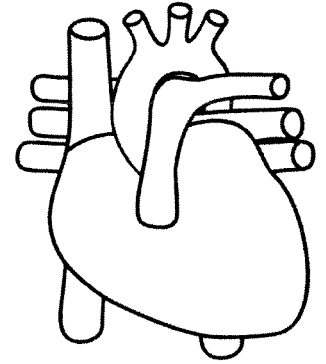
blood: a tissue
that travels through
blood vessels

Name: _____

Your Heart

by Cynthia Sherwood

Have you ever watched as your mom or dad pumps gas into your car? You may not realize it, but the most vital part of your body—your heart—is simply a fancy pump. It is designed to move your blood around your body. The heart is located a little to the left of the center of your chest and is about the size of your fist.



Your heart works very hard. When you run around a lot, you can feel your heart beating fast because it is pushing blood filled with oxygen and nutrients to the cells in your body. Your heart is a muscle too! It is divided into two parts. The right side receives blood from your body and pumps it into your lungs. The left side receives blood from the lungs and returns it to the rest of the body.

Your heart muscle beats between 80 and 120 times every minute. With each beat, blood is both entering and leaving your heart. The vessels that carry blood away from your heart are called arteries. The vessels that carry blood back to your heart are called veins.

Heart disease is common among older Americans because the heart can become clogged over time. The heart will not pump as well if someone smokes or eats a lot of unhealthy fats and sugary foods. To take good care of your heart, you should eat plenty of whole grains, fruits, vegetables, and lean proteins. You should also exercise often to get your heart pumping hard. Just like other muscles in your body, your heart needs exercise to keep strong.

If you wonder why it is so important to have a strong heart, just think about this—your heart will beat about three *billion* times in your lifetime!

The Circulatory System

(from *The Incredible Human Body* activity book)

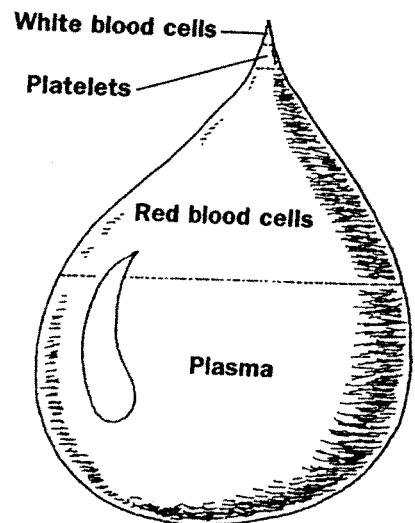
Reading for Information

The circulatory system is made up of the heart, blood vessels, and blood.

The heart is a muscular organ with open spaces on each side. These open spaces act like pumps working side by side. The left side collects oxygen-rich blood from the lungs and sends it to different parts of the body, while the right side receives oxygen-poor blood from the body to pass on to the lungs. The left side of the heart is stronger than the right because it has to send blood over longer distances.

Different kinds of blood vessels carry the blood to and from the heart. Arteries are the largest blood vessels. They carry blood from the heart to all areas of the body. They branch out into smaller blood vessels that are so narrow that only one red blood cell can go through at a time! These tiny, narrow blood vessels are called capillaries. As blood goes through the capillaries, it delivers food and oxygen to the different cells of the body. The capillaries join together to form larger blood vessels called veins. The veins lead back to the heart. (Veins look blue because the blood inside is dark red. It has picked up carbon dioxide from your body. Blood is bright red only when it has lots of oxygen in it.) Inside veins are special flaps called valves that keep the blood moving in the right direction. Muscles along the sides of the veins help to squeeze the blood upward and back to the heart.

Most people are surprised to learn that the main ingredient in blood is actually yellow in color. Plasma, made mostly of water, is a yellowish liquid that makes up 55 percent of blood. Other components in blood are made up of solid particles: red blood cells, white blood cells, and platelets. Red blood cells are the most numerous, giving blood its identifying color. These cells carry oxygen and carbon dioxide throughout the body. White blood cells act as the body's defenses, fighting against infection. Platelets contain substances that help blood clot and therefore prevent excessive blood loss.



Name: _____

Immune Troops! Move In!

by Shauna Hutton

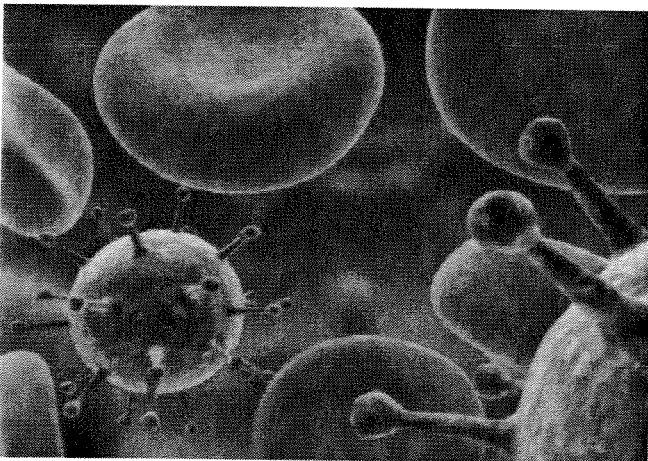
Your body has a very special system that protects you from illness and disease. It's called the immune system and it knows when there is something inside your body that should not be there.

All the cells in your body have a way to tell the immune system, "I belong here. I'm not going to do any harm." And so the immune system leaves those cells alone. Think about the cells in your body wearing name tags that say "self". Anything with a "self" name tag is a good guy. But things like bacteria, viruses, and parasites wear name tags that say "nonself". When the immune system sees a "nonself" name tag, it jumps into action and attacks those foreign invaders. Any foreign substance in your body that makes the immune system attack it, is called an antigen. These antigen invaders can be pollen from the air, a virus, or certain types of bacteria.

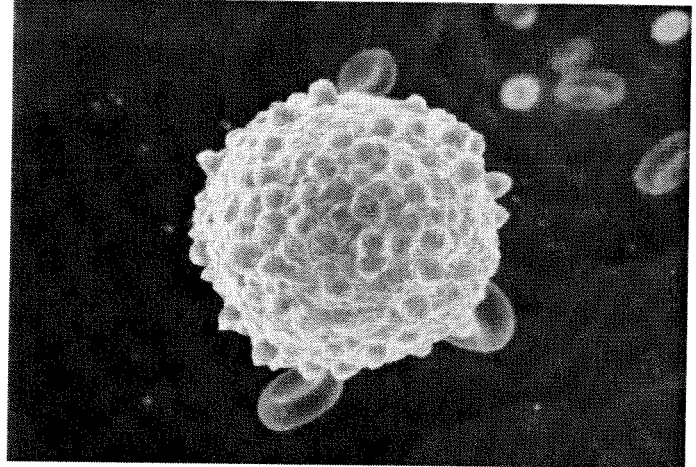
There are many different kinds of immune cells helping to keep you from getting sick. They can be grouped into phagocytes (pronounced fag-uh-sahyt) and lymphocytes (pronounced lim-fuh-sahyt).

Phagocytes are a type of white blood cell, and one of their jobs is to gobble up and digest antigens. They are always swimming around in your blood stream, always on the lookout for antigens. And when they see one, *GULP!*

Lymphocytes are also white blood cells and the main types are B cells, T helper cells, and T killer cells. Many antigens can be very sneaky (like viruses) and can hide from phagocytes, so it's the job of the lymphocytes to find them and get rid of them.



Viruses will kill healthy cells in the body.



White blood cells, like the one pictured above, attack the harmful bacteria, viruses, and parasites that enter your body.

B cells secrete (produce) substances, called antibodies, which stick to the antigen. When that happens, it alerts the T helper cells to come over and either:

1. help the B cells destroy the antigen, or
2. call the phagocytes or T killer cells to move in for the kill

T killer cells are really good at finding and killing cells that have been infected by a virus.

Once a B cell or T cell attacks an antigen, they create cells to "remember" it. Those "memory cells" hang out in your blood and if they see that same antigen again, they quickly recognize it so your immune system can act faster at killing it.

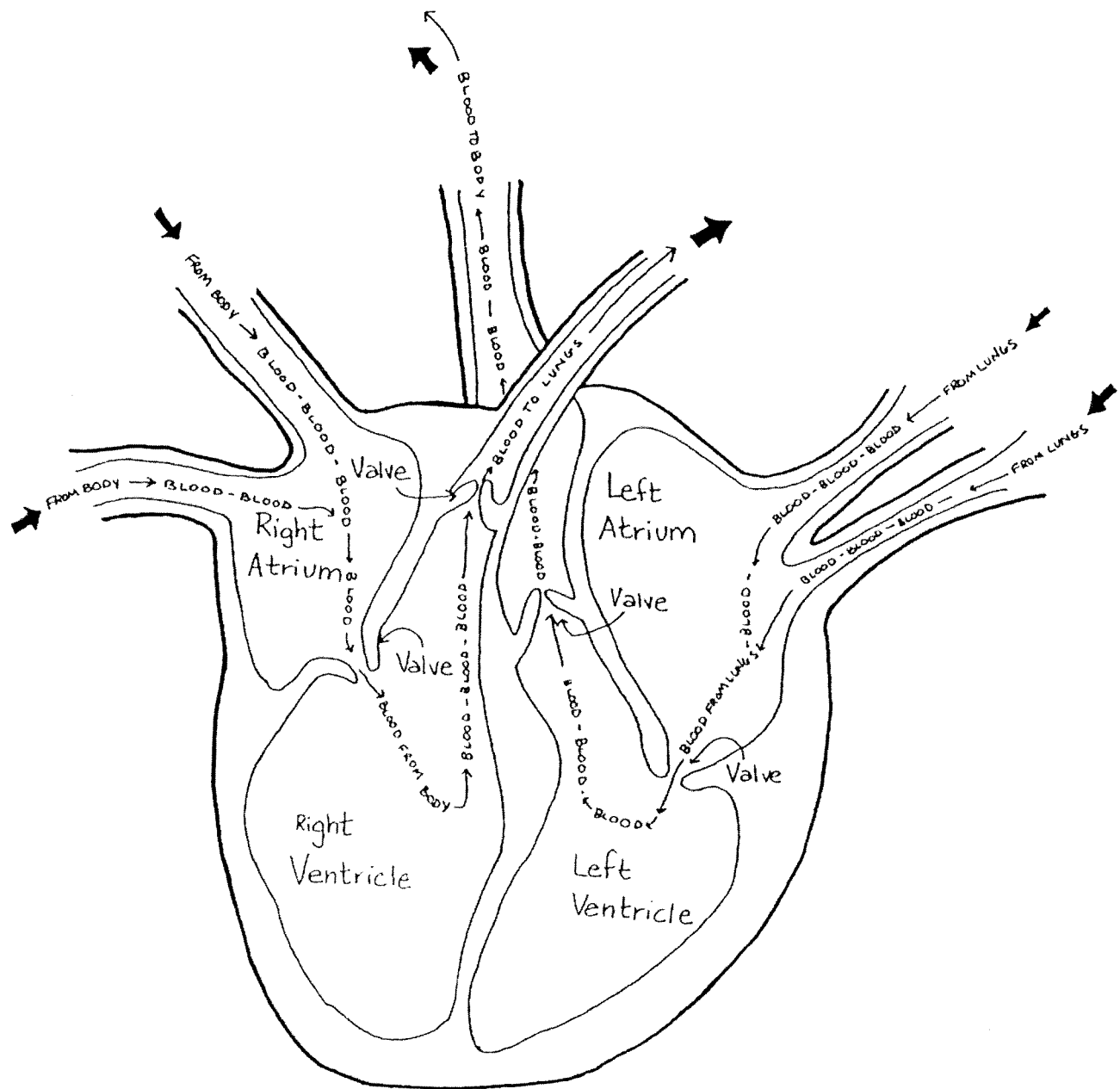
The "B" in B cells stands for **b**one marrow, which is where B cells, and all immune cells originate from. The "T" in T cells stands for **t**hymus. Young T cells start out in bone marrow, but they travel to the thymus to continue growing into mature T cells. The thymus is an immune organ located in the middle of your chest, near your heart. Its job is to produce mature T cells.

You have your own little army of cells inside you, always fighting to keep you healthy. And you can be a part of that army too! By getting plenty of sleep at night and eating nutritious foods, you'll help keep your immune system strong and ready to fight.

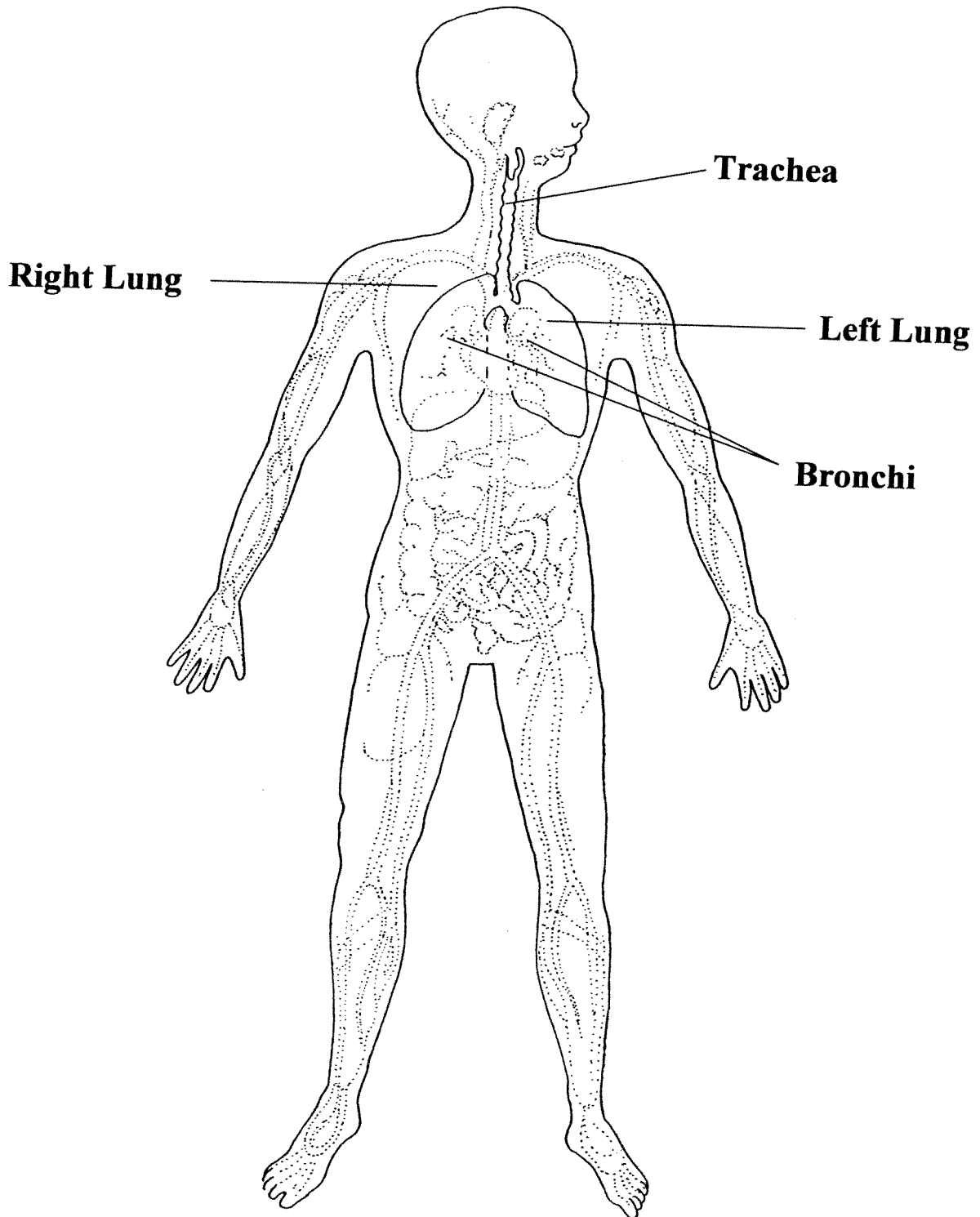
Go immune troops! Go!

Blood and the Heart

This is a diagram of the human heart. With a crayon, trace the flow of the blood as you learn about it.



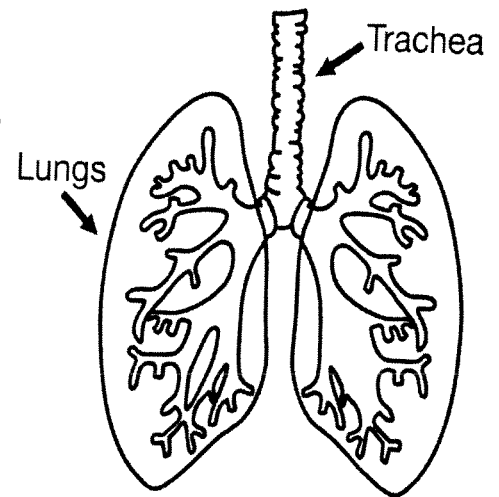
The Respiratory System



Name: _____

Your Lungs

by Cynthia Sherwood



You do something about twenty times a minute without even thinking about it—you breathe! In fact, every day you take about twenty-thousand breaths.

The organs of your body that allow you to breathe are called your lungs. You have two of them that work together, located in your chest inside the rib cage.

The main purpose of your lungs is to breathe in good air and breathe out bad air. The good air contains oxygen, which your body needs. The bad air is a gas called carbon dioxide, which your body cannot use.

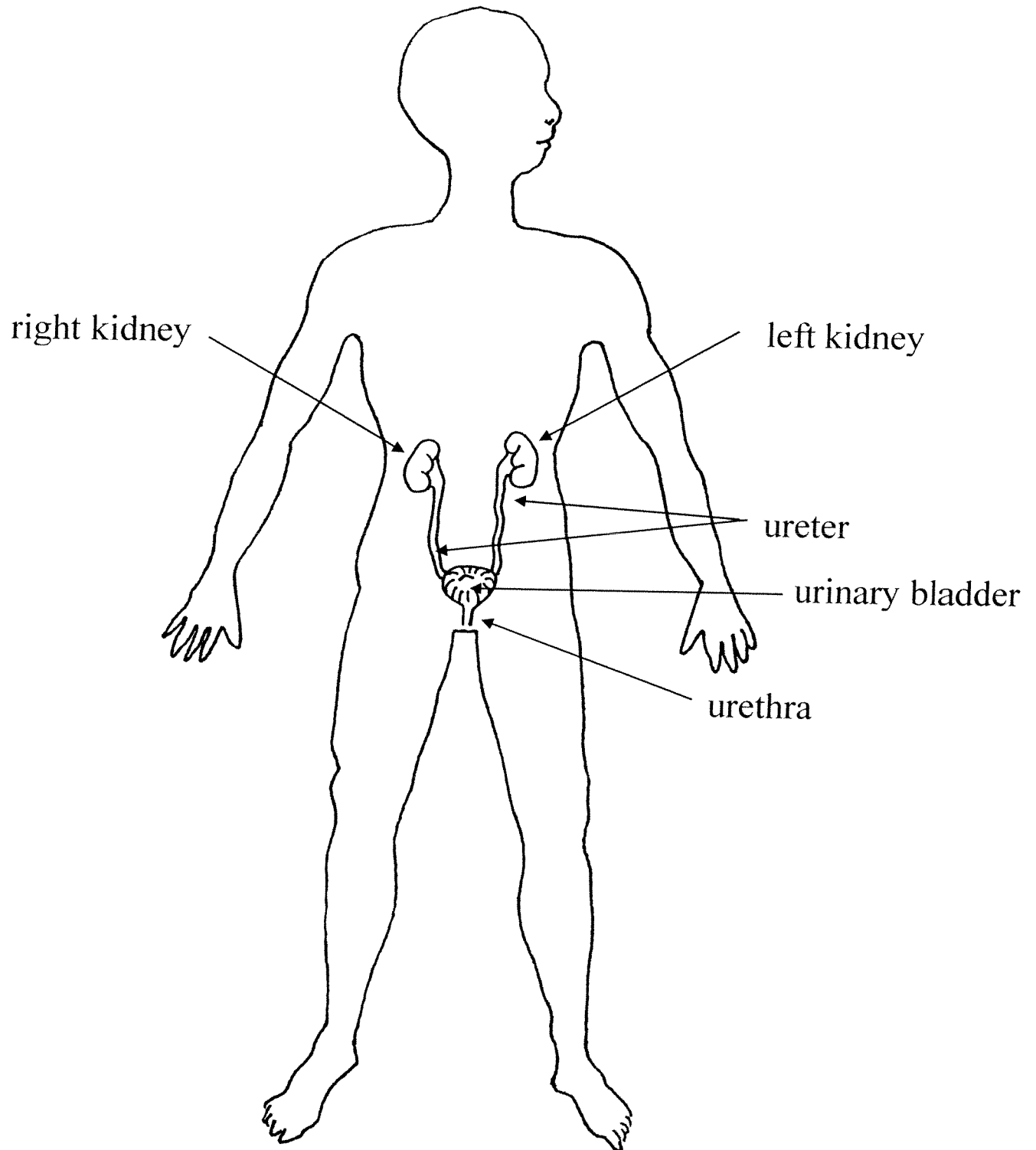
When you breathe in through your nose or mouth, air travels down the back of your throat. It passes through your voice box and into your trachea, or windpipe. Your trachea is divided into two air passage tubes. One leads to your left lung. The other leads to your right lung. Inside your lungs, oxygen is removed from the air you breathe and pumped into blood cells. Your lungs also get rid of harmful carbon dioxide from these cells. This process takes place inside hundreds of millions of tiny air sacs.

Each adult lung is about the size of a football. When they are healthy, your lungs feel a little like a sponge and are pinkish-gray. When lungs are damaged by smoking, they can appear gray or have black spots on them.

One disease that is very common in children involves the lungs. Asthma narrows the breathing tubes, making it harder to breathe. As many as nine million kids in the United States have asthma.

You probably already know that your lungs are important when you swim. But you may not know this—your lungs are the only part of your body that can float on water!

The Excretory System

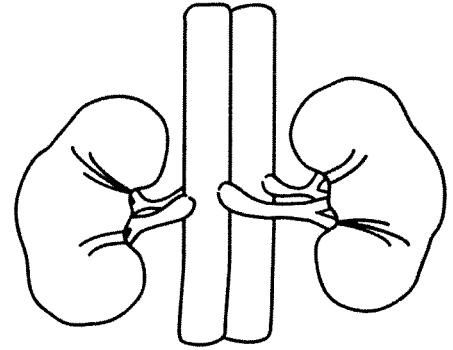


Name: _____

Your Kidneys

by Cynthia Sherwood

Many kids have moms or dads who clean up after them. But did you know that you have body parts that clean up after you too? Your two kidneys are very important organs in your body. Without them, you could not survive. They clean your blood and get rid of waste that your body produces.



To find your kidneys, slide your hands up from your hips until you feel your ribs. Then put your thumbs on your back. You cannot feel them, but that is where your kidneys are located. Each is about the size of your fist and has a funny shape. Kidney beans were named after them because they have the same shape.

The main job of the kidneys is to filter your blood for anything your body does not need. The kidneys make this waste into urine, which is then sent to your bladder. The bladder is like a storage pouch that can expand. When your bladder starts getting full, you feel the urge to go to the bathroom.

Sometimes, the kidneys do not work like they should. People usually can survive on only one kidney, so long as it is healthy. If only one kidney becomes very sick, a doctor can remove it. Other people need a special machine to clean the blood. This is called dialysis (di-a-li-siss.) Sometimes, people need a kidney transplant. That is when another person donates a kidney to be put in the sick person's body.

Keeping your kidneys healthy is easy for most kids. Just pay attention to when you feel thirsty and drink up!

The Excretory / Urinary System

Reading for Information

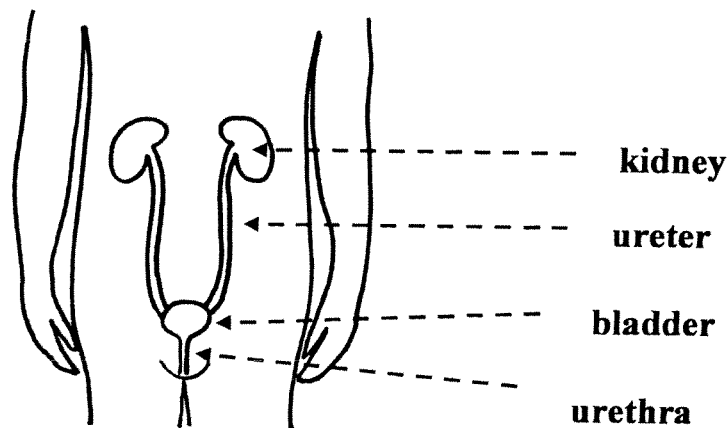
Your body has a system called the excretory (urinary) system that is made of the following parts: kidneys, bladder, ureters and urethra. This system's job is to get rid of chemical waste products that your body doesn't need. The waste produced by your cells goes into the bloodstream, and then the blood goes to organs called kidneys. (Most people have 2, although a person can live a healthy life with just 1.) The kidneys filter out the waste from the blood and send the "clean blood" back to the body.

The kidneys have other jobs too. They make sure your blood isn't too thick or too thin, not too salty, not too packed with vitamins and minerals.

Your kidneys have millions of tiny filters in them called nephrons. Hundreds of times a day your blood goes through these filters to remove the waste. The waste collects in the center of your kidneys, trickles down through tubes called ureters and into a stretchy bag called your bladder. When your bladder gets full, it sends a message to your brain telling it you have to urinate or PEE!

When you're in the right spot (hopefully the restroom!), your brain tells the muscles around your bladder to start squeezing and for the muscles at the bottom of your bladder to open. Your pee squirts through your urethra and out of your body.

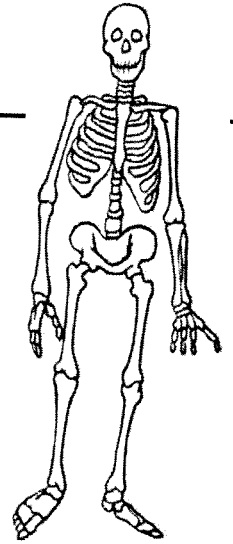
AAHH! That feels better!



Name: _____

Your Bones

by Cynthia Sherwood



Without your bones, you would be as floppy as a jellyfish. Our bones allow us to stand up straight. They support us and help us move, but they also protect our body organs.

Our skeleton is made up of all of our bones working together. If you have ever seen a real skeleton in a science class or museum, you might think that bones are dry and dead feeling. But that is not the case. Bones are made of living, growing cells. Inside most bones is soft marrow, which is where many of our blood cells are made. As a baby, you were born with nearly 300 bones. But adults only have about 206 bones because some of the smaller ones join together to form big ones.

Certain bones are especially important. The skull inside your head acts like a helmet for your soft, squishy brain. Your skull helps protect you from injuries to your head. Your spine, or backbone, lets you stand up tall. Your spine also protects the spinal column with all of its nerves inside. Your ribs make a cage to protect your vital organs like the heart, lungs, and liver.

Even though bones are very light, they are also very strong. That is why it usually takes a very bad fall or other serious accident to break a bone. If that does happen, you might wear a cast until new bone cells heal the break in a month or two.

To protect your bones, wear a helmet whenever you ride your bike or skateboard. Knee pads, wrist guards, and other safety gear for sports are a good idea too. Strong bones need the mineral calcium, so drink lots of milk and eat dairy products. Bones also need active exercise, so go out and run, jump, and dance for healthy, strong bones.

The Skeletal System

Science Background

When the skeleton first forms in a human embryo, it is made mostly out of *cartilage*, a white, rubbery substance. At 6 weeks, *ossification* starts—hard bone, made with minerals like calcium and phosphorus, slowly replaces the cartilage. By the time a baby is born, it has more than 300 bones in its body. Ossification continues through early adulthood, fusing together some bones in the process. An adult skeleton contains 206 bones that give the human body shape and support.

The outer part of a bone consists of a hard material called *compact bone*. Compact bone is the second hardest material in the body, after the teeth's enamel. It is made up of tiny bony tubes, through which blood vessels and nerves run. These tube-like structures help strengthen the bone so it can support the body's weight. The inner part of the bone is made of spongy material, which is less dense than compact bone and helps make the skeleton lighter. The spongy bone contains *bone marrow*, which manufactures blood cells and stores fat for the body.

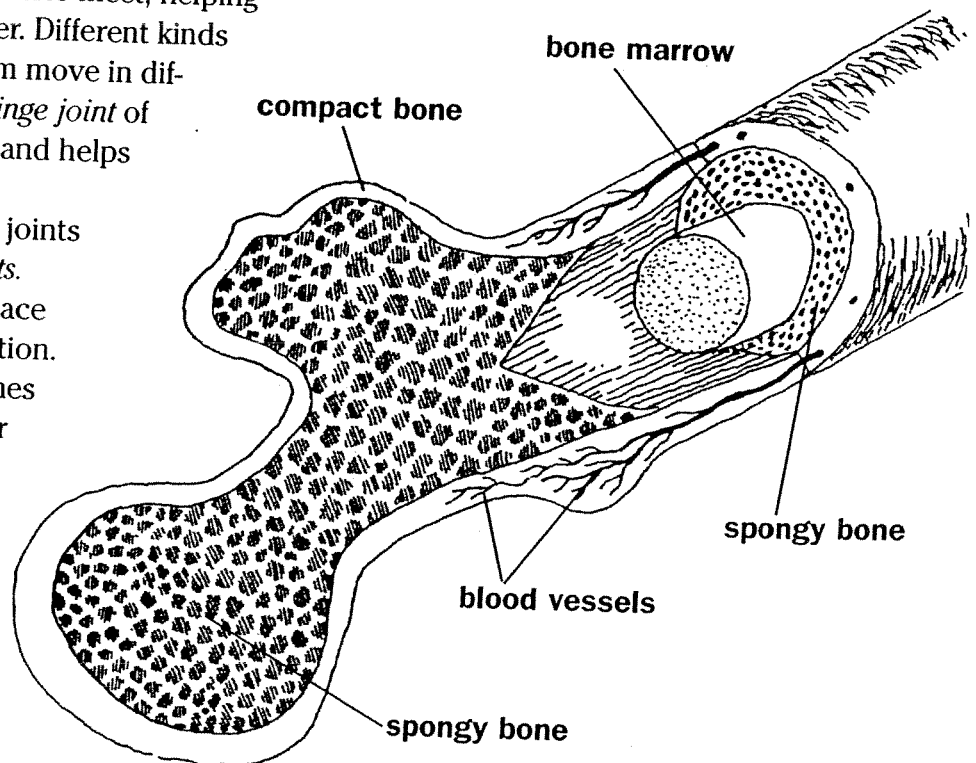
Joints can be found where bones meet, helping them to move against each other. Different kinds of joints help the skeletal system move in different ways. For example, the *hinge joint* of the elbow functions like a lever and helps the arm bend and extend.

Connecting the bones to the joints are strong fibers, called *ligaments*. Ligaments help keep bones in place and ensure against bone dislocation. Ligaments are so strong that bones are more likely to give way under stress before ligaments do.

Aside from shape, support, and movement, parts of the skeleton also provide protection to important internal organs. For example, the skull protects the brain, and the ribs protect the lungs.

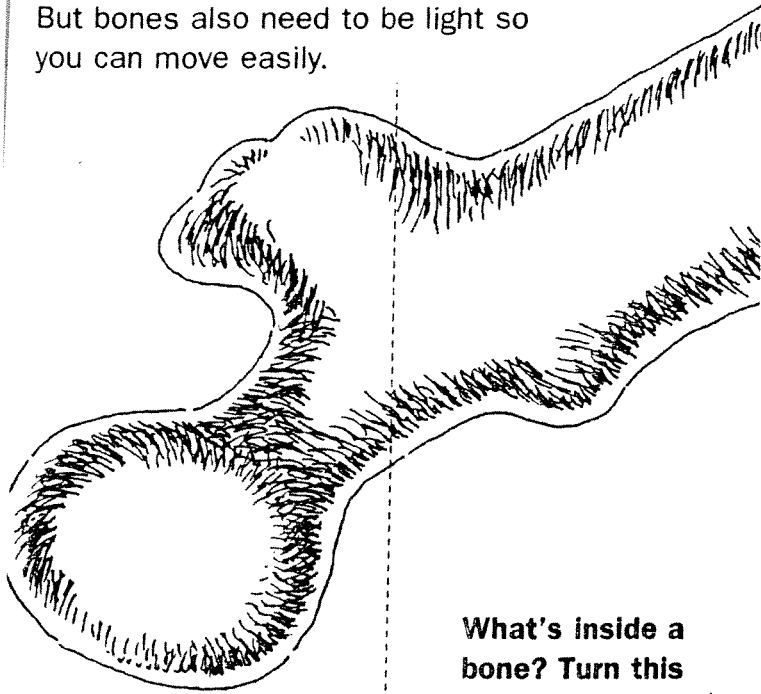
LESSON OVERVIEW

- ✓ The skeletal system helps support the body and give it shape.
- ✓ With the help of muscles, the skeleton enables the body to move.
- ✓ Parts of the skeleton also protect internal organs.



A Bone's Story

Bones need to be strong to support the body and protect important organs. But bones also need to be light so you can move easily.



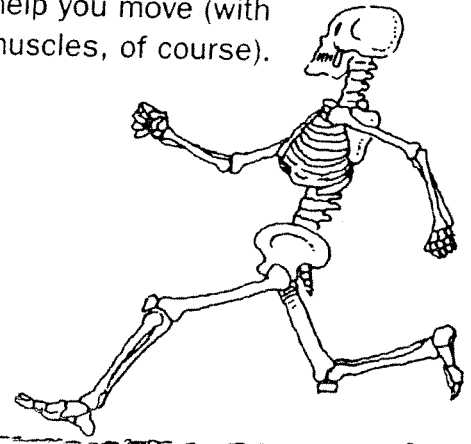
What's inside a bone? Turn this flap to find out! →
Skeletal & Muscular

What are bones for?

Bones hold up and support your body. Without bones, you'd be a blob!

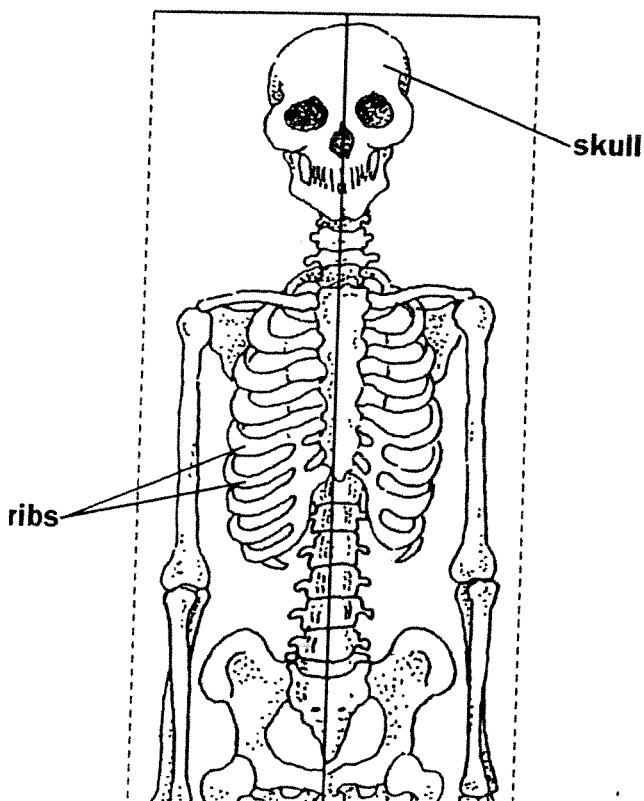


Bones also help you move (with the help of muscles, of course).



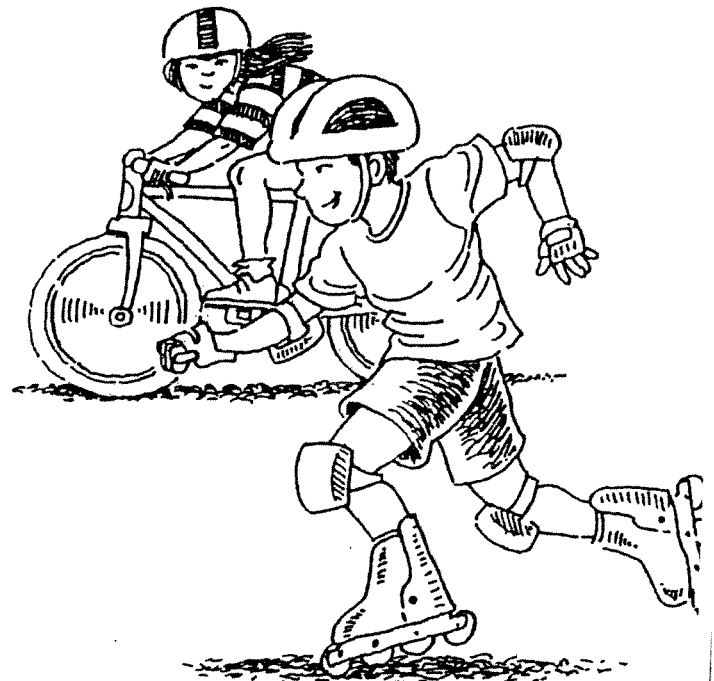
The Incredible Human Body, pag

Some bones protect important organs inside your body.

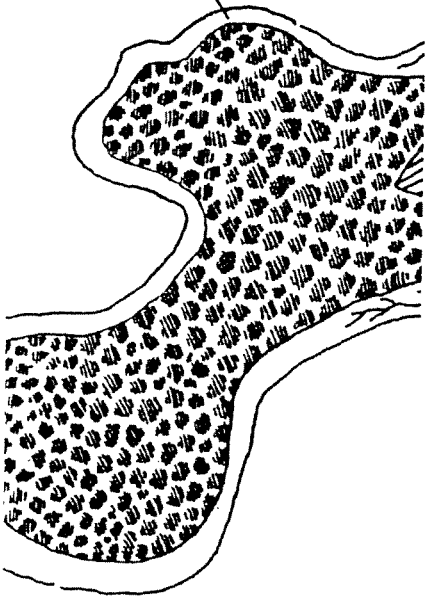


Think About It:

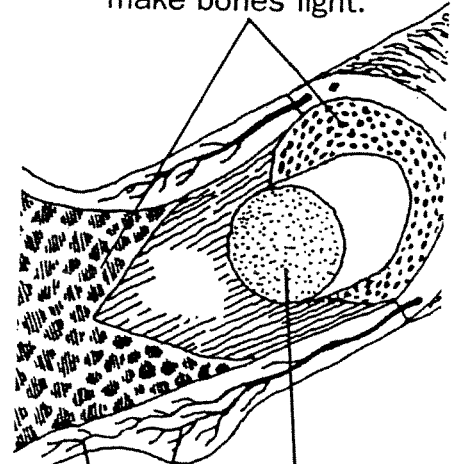
If your skull naturally protects your brain, why do you need to wear a helmet when biking or in-line skating?



compact bone—
hardest part of
the bone.



spongy bone—
filled with bone
marrow and air
spaces, which help
make bones light.



bone marrow—
makes blood
cells and
stores fat.

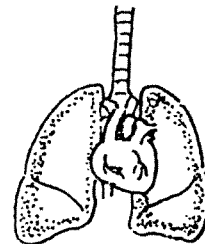
blood vessels—bring
new minerals to bones
to keep them strong
and healthy.

The Incredible Human Body, page 48

The skull
protects
your brain.



The ribs
protect
your heart
and lungs.





How Many Bones?

(Taken from page 42 *The Incredible Human Body*)

How many bones are in the adult skeleton? Use the following information to calculate the total amount.

skull	-----	22 bones
backbone	-----	26 vertebrae
hyoid bone (base of throat)	-----	1 bone
scapulas (shoulder blades)	-----	2 bones
collarbones	-----	2 bones
rib cage	-----	24 ribs
sternum (breastbone)	-----	1 bone
arms	-----	6 bones
hands	-----	54 bones (27 in each hand)
pelvis	-----	2 hipbones
legs	-----	6 bones
patella (kneecap)	-----	2 bones
feet	-----	52 bones (26 in each foot)
ears	-----	6 tiny bones

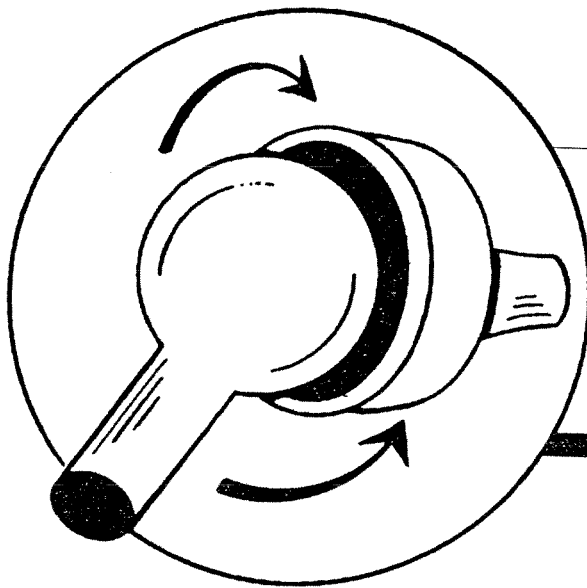
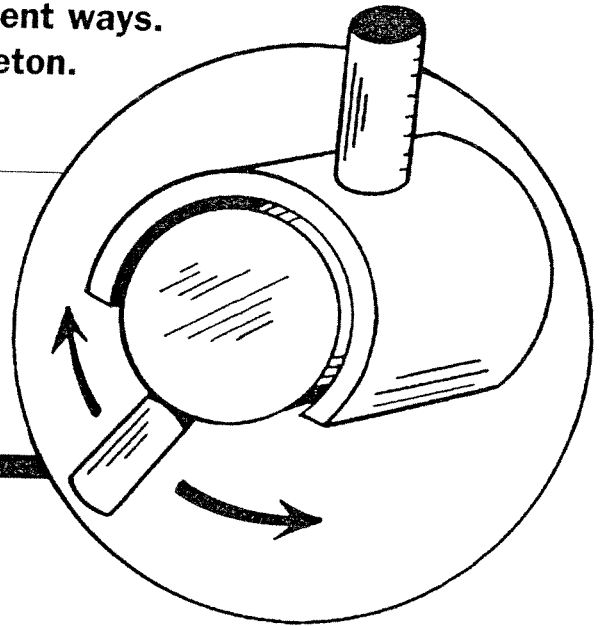
TOTAL: _____ **bones**

A Joint Exploration

Joints are places where bones meet and fit together. Your joints help your skeleton move in different ways. There are several types of joints in the skeleton.

Hinge joint

Similar to the hinges on a door, this joint lets bones swing fully in one direction (for example, up and down, but not side to side).

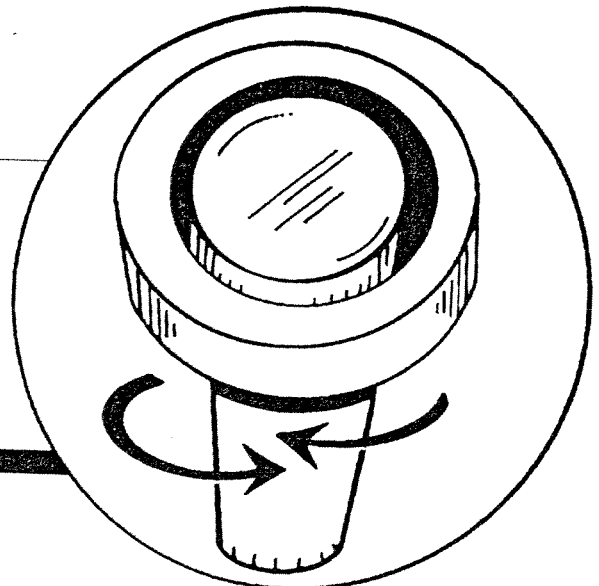


Ball-and-socket joint

This is the most flexible joint in the body. It allows bones to move freely in many directions.

Pivot joint

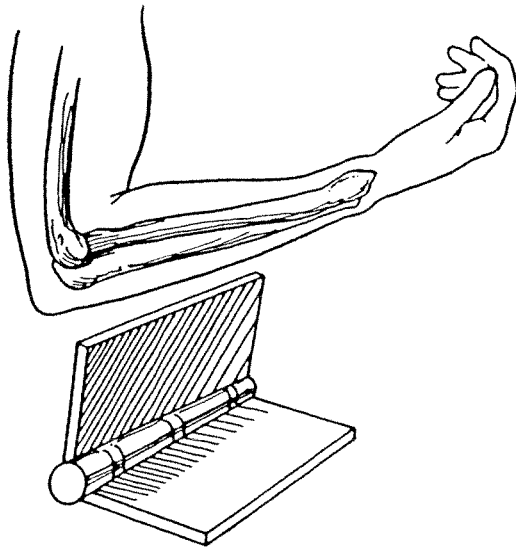
With this joint, one bone twists around another bone, allowing it to rotate, or turn from side to side.



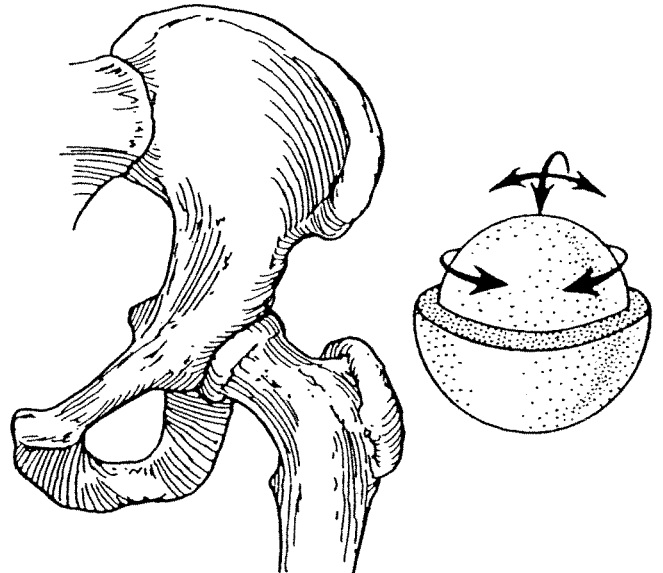
Student Information Sheet

Types of Joints

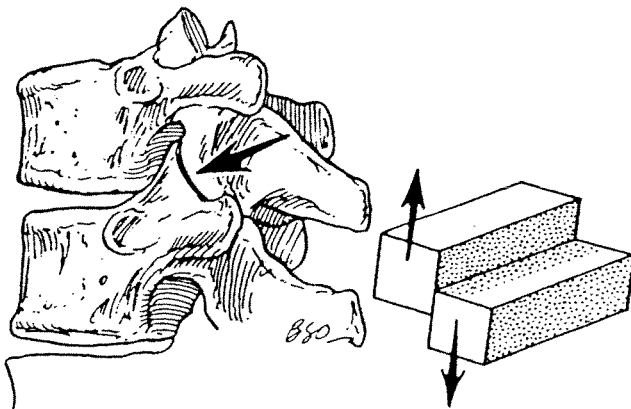
Hinge – elbow



Ball and Socket – hip



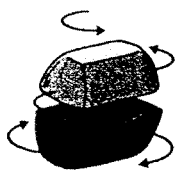
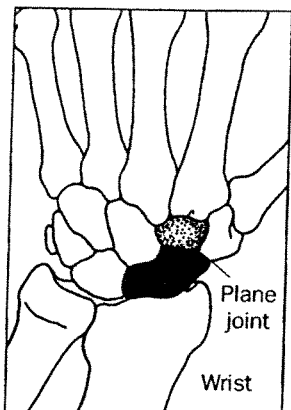
Gliding – between vertebrae



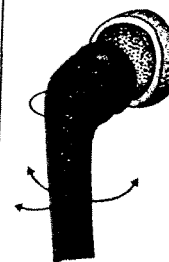
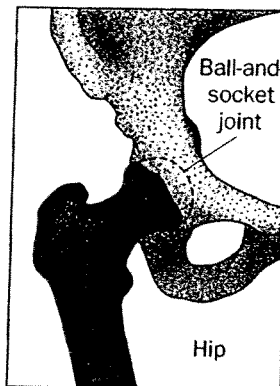
Student Information Sheet

Major Joints

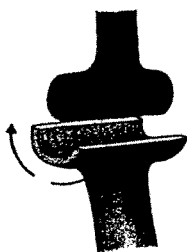
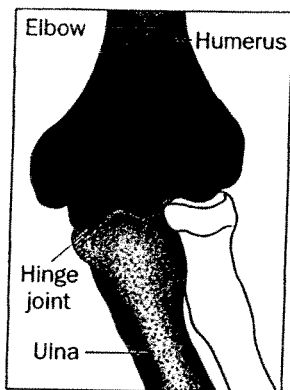
Plane Joint



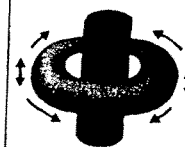
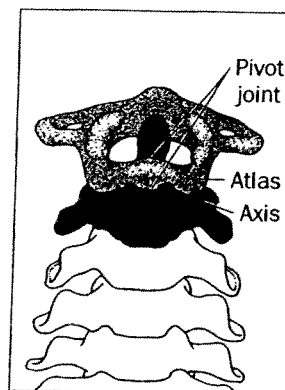
Ball and Socket Joint



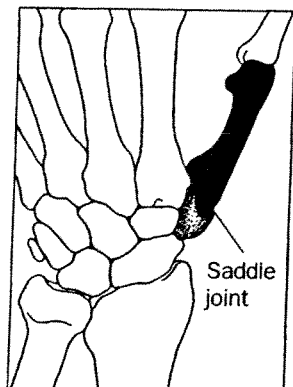
Hinge Joint



Pivot Joint

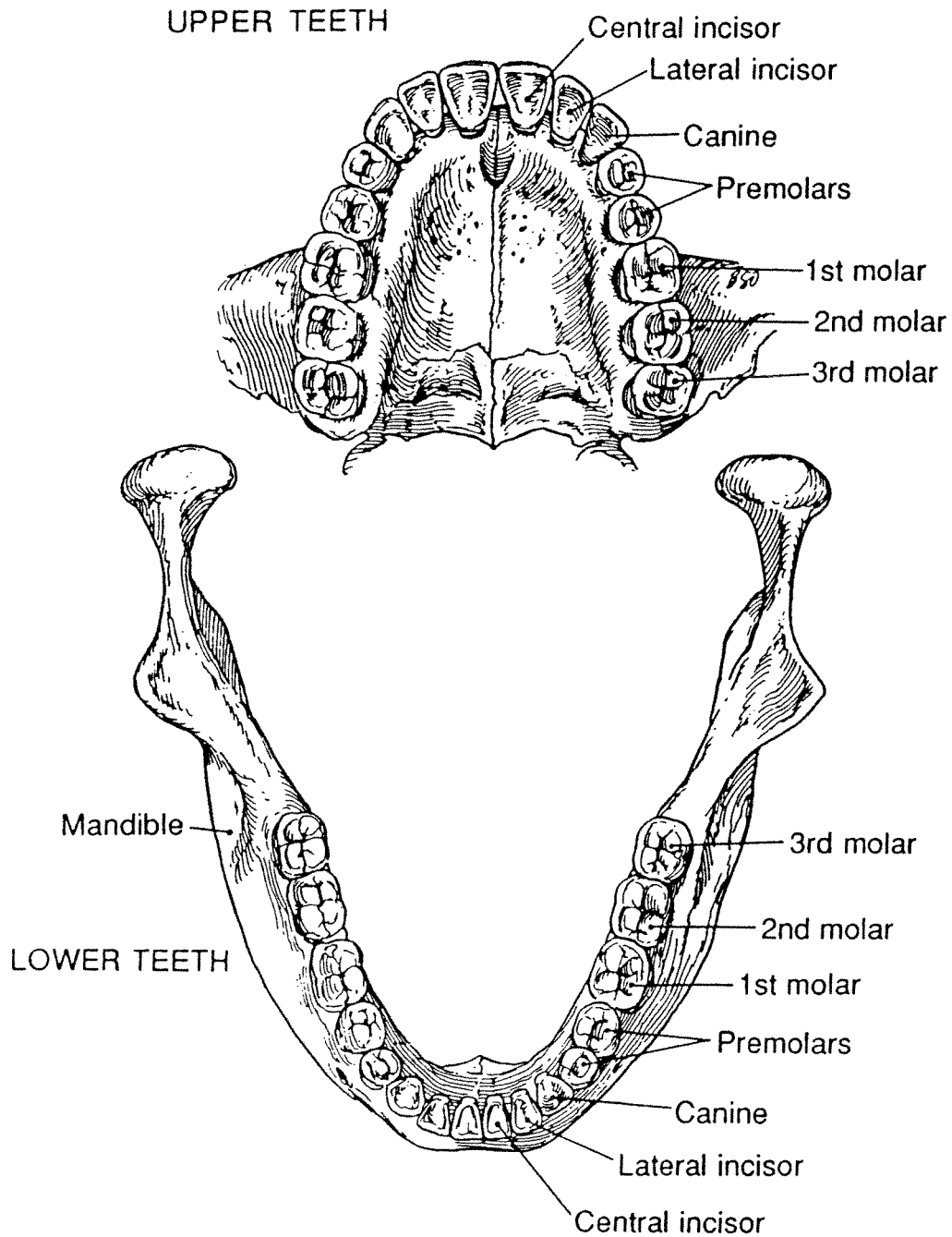


Saddle Joint



Reference Sheet

Teeth



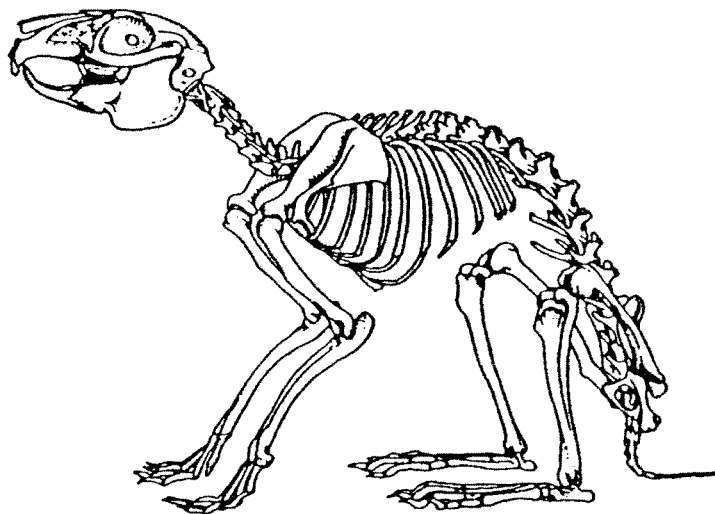
Student Information Sheet - Page 1

Animal Skeletons

Skeleton 1 – Bird



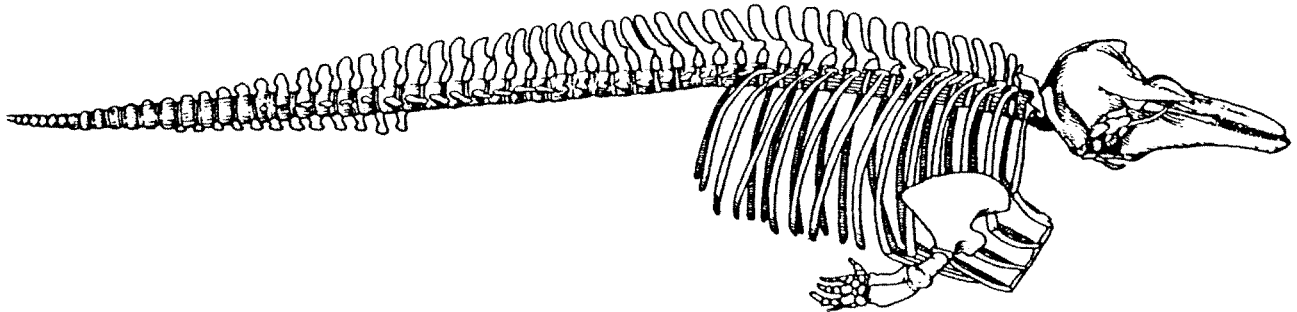
Skeleton 2 – Rabbit



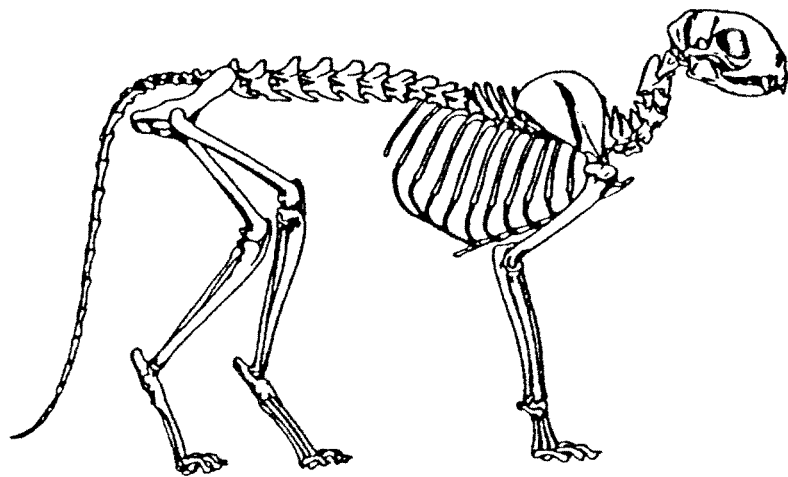
Student Information Sheet - Page 2

Animal Skeletons

Skeleton 3 - Whale

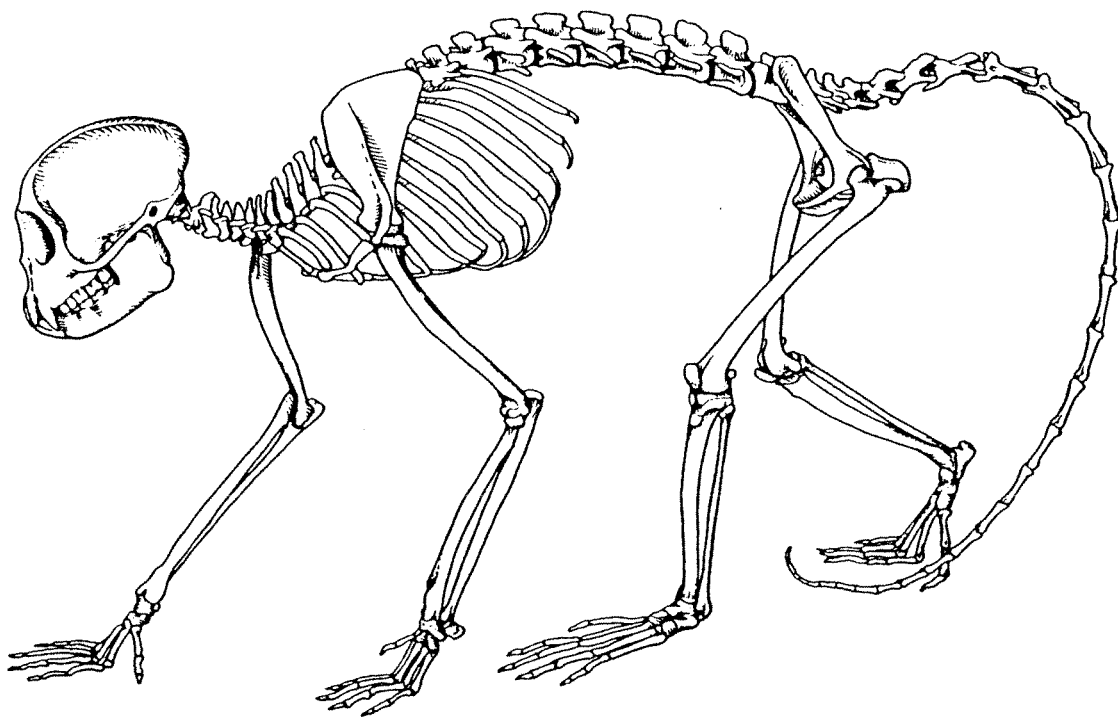


Skeleton 4 - Cat



Animal Skeletons

Skeleton 5 – Monkey



Name: _____

Your Muscles

by Cynthia Sherwood

When you think of muscles, you might picture a bodybuilder with big, bulging arm and chest muscles. But your muscles do not have to look like that to work well. Every time you write your name, you use the twenty different muscles in your hand. Every time your heart beats, you use your cardiac muscle. When you chew your food, you use your tongue muscles. You're even using muscles when you blink your eyes. In fact, every time you move, you are using some of the amazing muscles in your body.



A muscle is made of tiny fibers. Fiber is a type of tissue that feels a little like a rubber band. Thousands of these fibers are packed together to make a single muscle. We all have the same number of muscles—around 700 or so. Men and women with extra-big muscles simply have thicker bundles of fibers.

There are three different types of muscles. *Smooth muscles* are ones you cannot control. They work behind-the-scenes to keep your body running. Smooth muscles include the ones that help you digest your food. The *cardiac muscle* makes the heart pump blood in and out. *Skeletal muscle* is the kind you can control. These are the muscles you use to raise your hand, swim laps, or ride your scooter. Usually, a skeletal muscle is attached to the end of a bone. Muscles and bones work together to give your body power, strength, and movement. In fact, every year, your leg muscles help you take about five-million steps!

Even your face uses muscles. But if you want to save your energy, try smiling instead of frowning. It takes seventeen muscles in your face to smile, but forty-three muscles to frown!

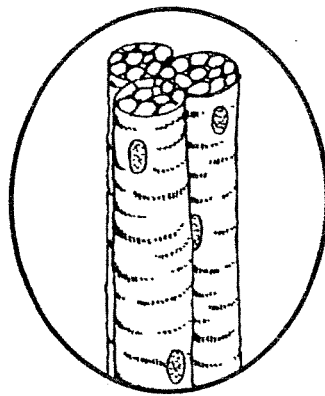
The Muscular System

LESSON OVERVIEW

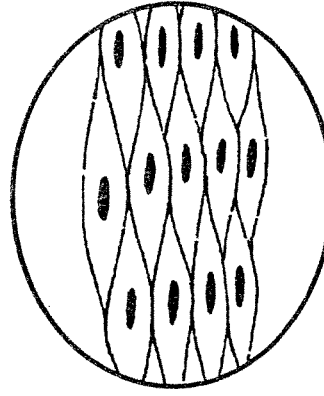
- ✓ The muscular system works with the skeletal system to enable the body to move.
- ✓ *Voluntary* muscles move under conscious will; *involuntary* muscles move under the direction of the nervous system.
- ✓ The cardiac muscle can be found only in the heart.

Science Background

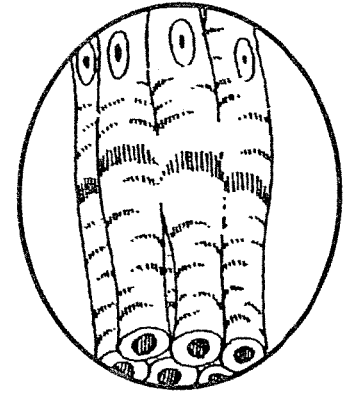
There are more than 600 muscles in the human body, all working together toward one purpose: movement. These muscles are divided into three groups: *skeletal muscles*, *smooth muscles*, and the *cardiac muscle*.



skeletal muscles



smooth muscles



cardiac muscle

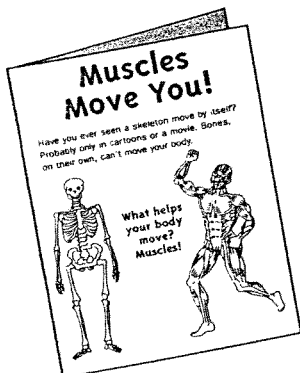
Skeletal muscles pull on bones to move them. To do this, the muscles work in opposing pairs: when one muscle contracts, the other relaxes. Strong fibers, called *tendons*, connect skeletal muscles to bones. These thin extensions allow muscles to exert their force over great distances. For example, arm muscles control the delicate movement of fingers. Skeletal muscles are also called *voluntary muscles* because they move under conscious will.

Smooth muscles can be found in various organs throughout the body, such as in the esophagus and stomach, as well as blood vessels. They contract and relax rhythmically without the conscious control of the brain. For this reason, they are also called *involuntary muscles*—they move under the direction of the nervous system and various chemicals in the body.

The cardiac muscle can be found only in the heart. This muscle contracts and relaxes about 70 times a minute without ever stopping or getting tired.

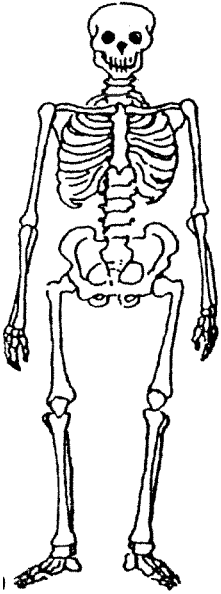
Before You Begin

To give students an overview of this unit, have them read the Close-up Book *Muscles Move You!* (pages 59–60) and display the *Muscles 'n' Bones* side of the poster.

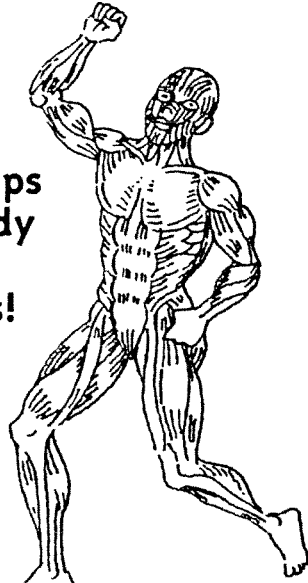


Muscles Move You!

Have you ever seen a skeleton move by itself? Probably only in cartoons or movies. Bones, on their own, can't move your body.



What helps your body move?
Muscles!

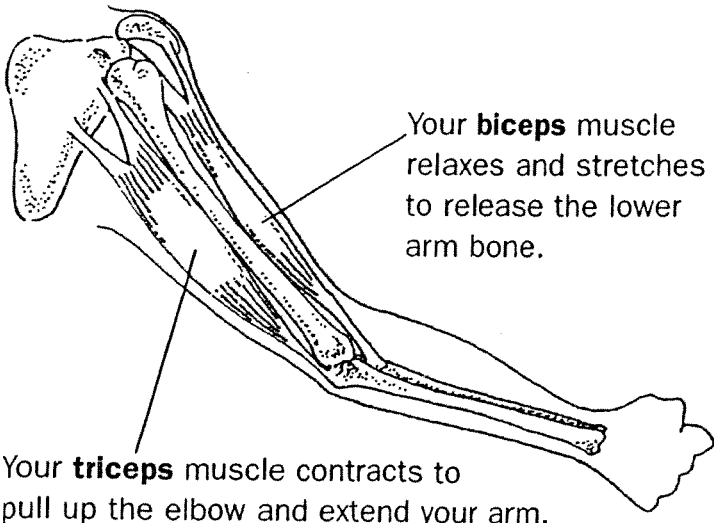


Skeletal & Muscular

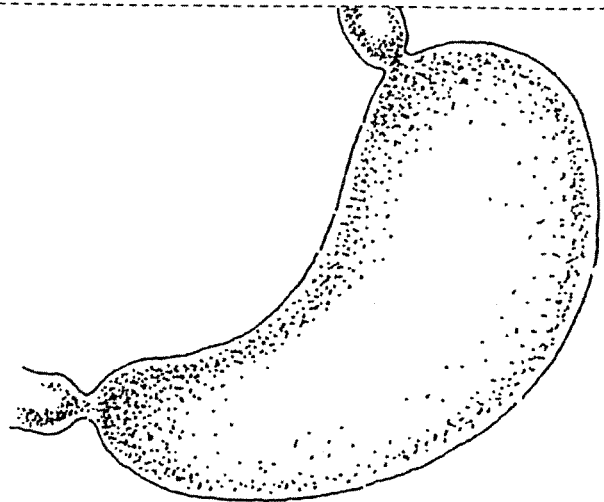
There are three kinds of muscles in your body.

Skeletal muscles are attached to bones by strong fibers, called **tendons**. These muscles work in pairs to pull bones. For example, look at the arm muscles below.

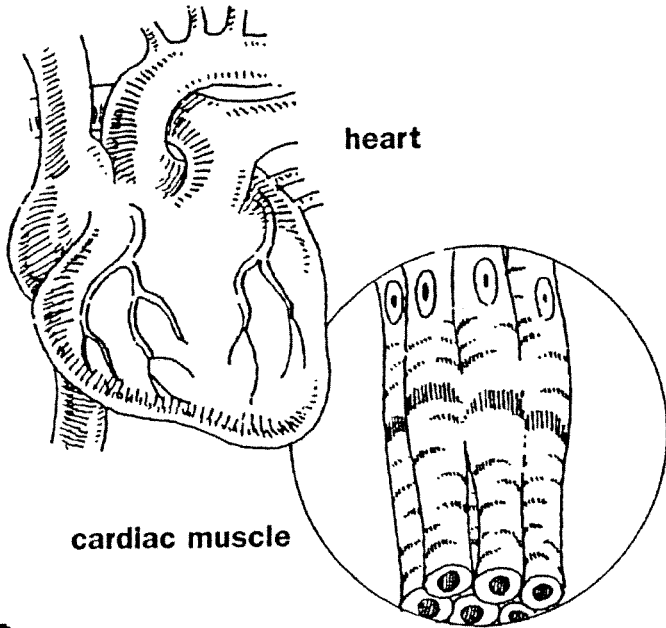
What happens when you straighten your arm?



Smooth muscles are also called involuntary muscles. That's because they move on their own, without the brain telling them to do so. Muscles in the stomach contract and relax automatically when there's food to digest. What other parts of your body do you think use smooth muscles?



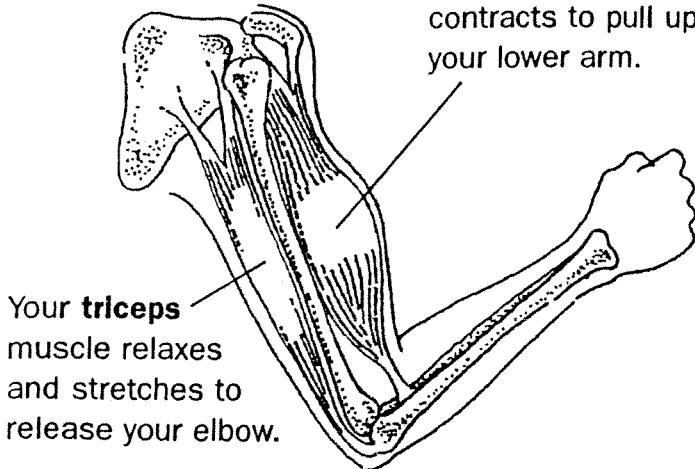
The third kind of muscle can be found in only one place—the heart. The **cardiac muscle** contracts and relaxes about 70 times each minute. It never stops and never gets tired. Why do you think it's important for the heart never to get tired?



4

What happens when you bend your arm?

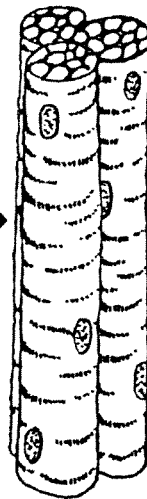
Your **biceps** muscle contracts to pull up your lower arm.



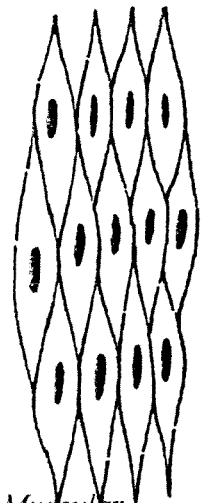
To see what a skeletal muscle looks like close up, lift the flap on the next page. →

81

skeletal muscles →

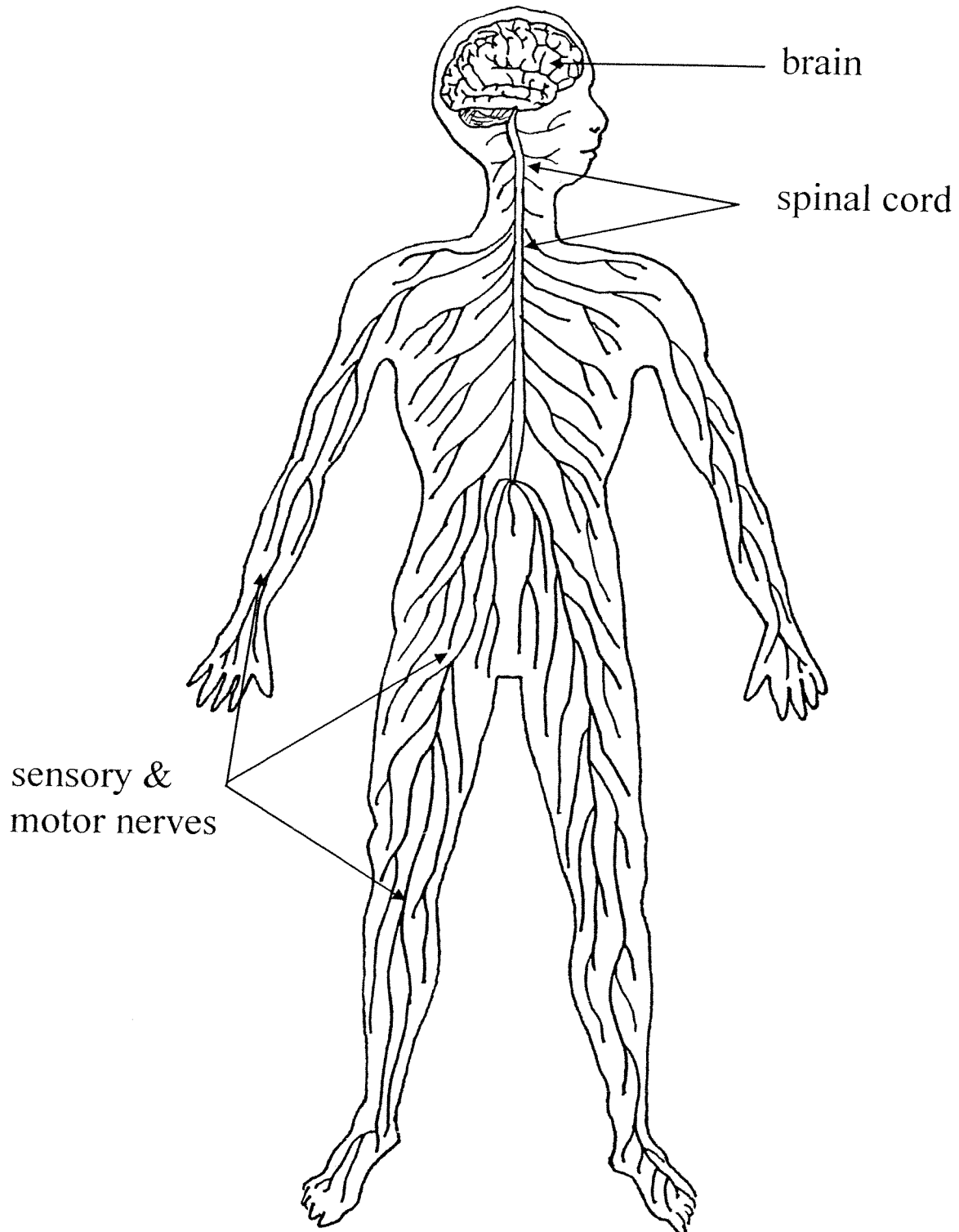


smooth muscles →



Skeletal & Muscular

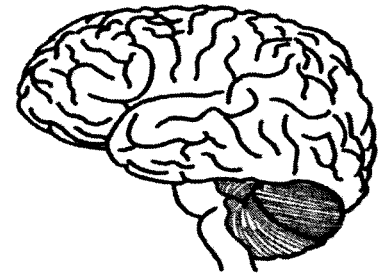
The Nervous System



Name: _____

Your Brain

by Cynthia Sherwood



You may not realize that you have a boss, just like adults do at work. But when it comes to your body, your brain is your boss! It is in charge of just about everything you do. When you remember what you ate for breakfast, you use your brain. When you jump up and down, you use your brain. When you draw a picture, you use your brain. Even when you are dreaming, you use your brain.

The brain looks like a wrinkled, wet sponge. In adults, it weighs only about three pounds, but it is made up of billions of nerve cells. These cells send and receive electrical signals that direct all of your body's activities. Sometimes, like when you are learning at school, you know you are using your brain. Many times, though, your brain controls your body without you even thinking about it. The "brain stem" takes care of things your body does automatically, like breathing air, pumping blood, and digesting food.

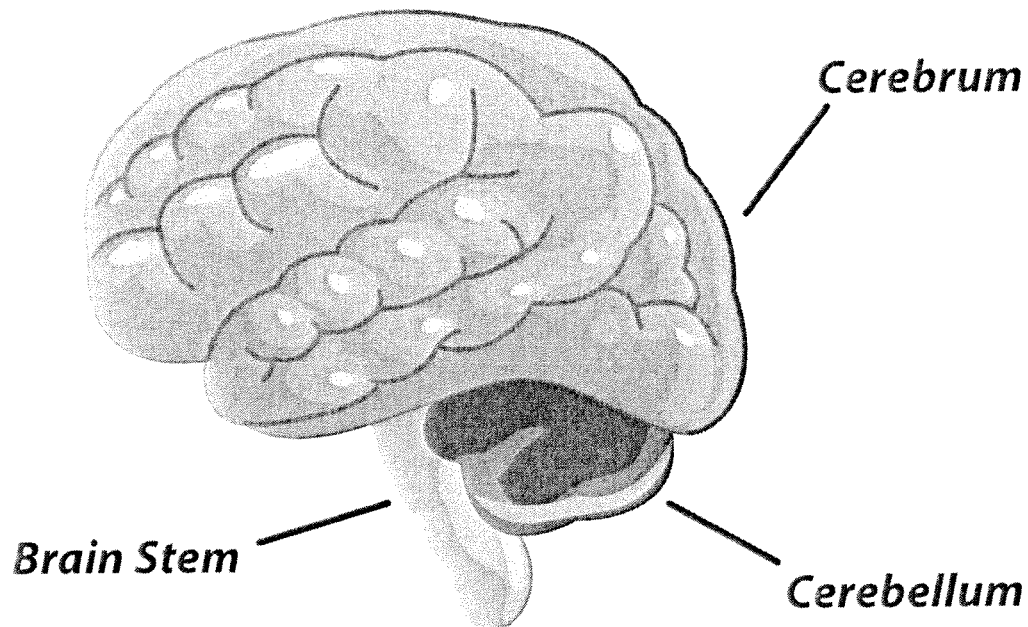
The biggest part of your brain is called your "cerebrum" (suh-ree-brum). This is the thinking part of your brain. It controls your memory, the movements you choose to make, your ability to figure things out, and your imagination. The cerebrum is made up of two halves. It may sound mixed up, but the left side controls the right side of your body and the right side controls your left side.

Even your feelings come from your brain. Scientists think emotions are controlled by a part of your brain called the "amygdala" (uh-mig-duh-luh). It is shaped like an almond and is only an inch long. So next time you get in a bad mood, you can blame it on your brain.

You should be glad you have a human brain. It is very complex, which means we can think in different, more complicated ways than other animals. In fact, every day your brain produces about 70-thousand thoughts. No wonder your head hurts when you have too much homework!

What is Your Brain?

Your brain is the boss of your body. It controls almost everything you do even while you are asleep. The biggest part of your brain is called the **cerebrum**.



Vocabulary

Cerebrum: the thinking part of your brain.

Brain Stem: the part in charge of the most important jobs in your body, like breathing and making your heart beat.

Cerebellum: the part in charge of balance and muscle movement.

The Nervous System & the Senses

(from *The Incredible Human Body* activity book)

Reading for Information

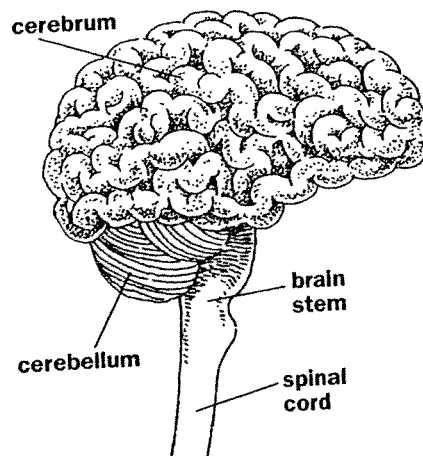
You've got a lot of nerve! It's true! Your whole body is "wired" with billions of special cells called neurons, or nerve cells, that carry electrical signals. Neurons are bundled together in cordlike fibers to form the nerves. Nerves spread out from the brain and the spinal column, reaching all parts of the body. The nerves form pathways that help collect information from a person's surroundings and send it to the brain for processing. After the brain analyzes the information, it sends back instructions to various parts of the body so that the body can respond to the information.

The nervous system has two parts: the central nervous system and the peripheral nervous system. The brain and spinal cord make up the central nervous system. Together, they analyze incoming information from outside the body, store it, and send out instructions on how the body should respond. All messages must travel through the spinal cord to specific areas of the brain, which then must recognize the message and relay a correct response to the information received.

The brain consists of three parts: the cerebrum, the cerebellum, and the brain stem. The cerebrum is the largest part of the brain and controls the sense organs. All your thoughts, memories, imagination, and decisions take place in the cerebrum. The cerebellum controls your balance and posture, and coordinates your movement. The brain stem connects the cerebrum to the cerebellum and to the spinal cord.

The peripheral nervous system consists of nerves that act as a liaison between the central nervous system and the rest of the body.

The sense organs help provide the brain with information by detecting what's happening outside the body. Sense organs differ in both the types of messages they receive and the way these messages are received. Eyes and ears receive energy - light and sound. The nose and mouth both receive chemical molecular messages. The skin senses pressure, pain, warmth, cold, and touch.



The Nervous System and the Senses

LESSON OVERVIEW

- ✓ The nervous system consists of the brain, the spinal cord, and a network of nerves.
- ✓ The body's sense organs—eyes, ears, nose, taste buds, and skin—gather information from outside the body and pass it on to the brain for processing.
- ✓ The senses are vital adaptations for survival.

Science Background

You've got a lot of nerve! It's true! Your whole body is “wired” with billions of special cells called *neurons*, or nerve cells, that carry electrical signals. Neurons are bundled together in cordlike fibers to form the nerves. Nerves spread out from the brain and the spinal column, reaching all parts of the body. The nerves form pathways that help collect information from a person's surroundings and send it to the brain for processing. After the brain analyzes the information, it sends back instructions to various parts of the body so that the body can respond to the information.

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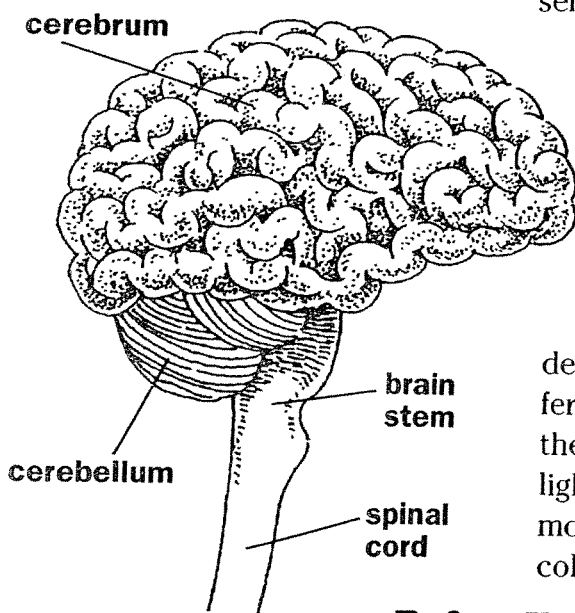
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Before You Begin

This chapter is organized differently from the other chapters in this book. It contains five additional sections on each of the body's senses.



Brain at Work!

What if each part of your body did its own thing?



I smell smoke!

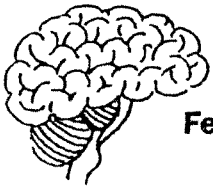


I see fire!

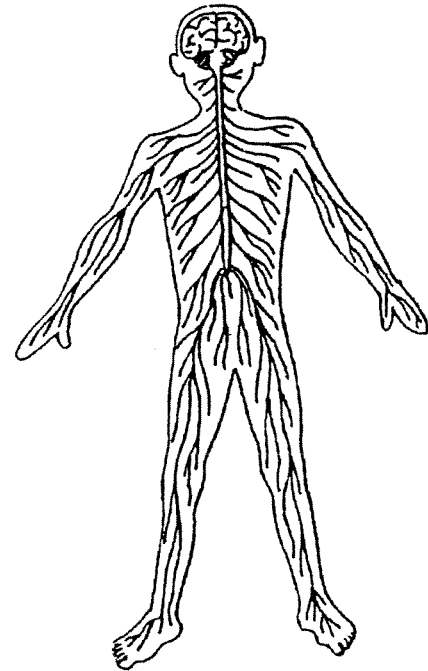


We're too tired.
We're not going anywhere!

The brain is your body's control center. It receives information about what goes on inside and outside the body. Then it sends messages to different parts of the body and instructs them what to do.

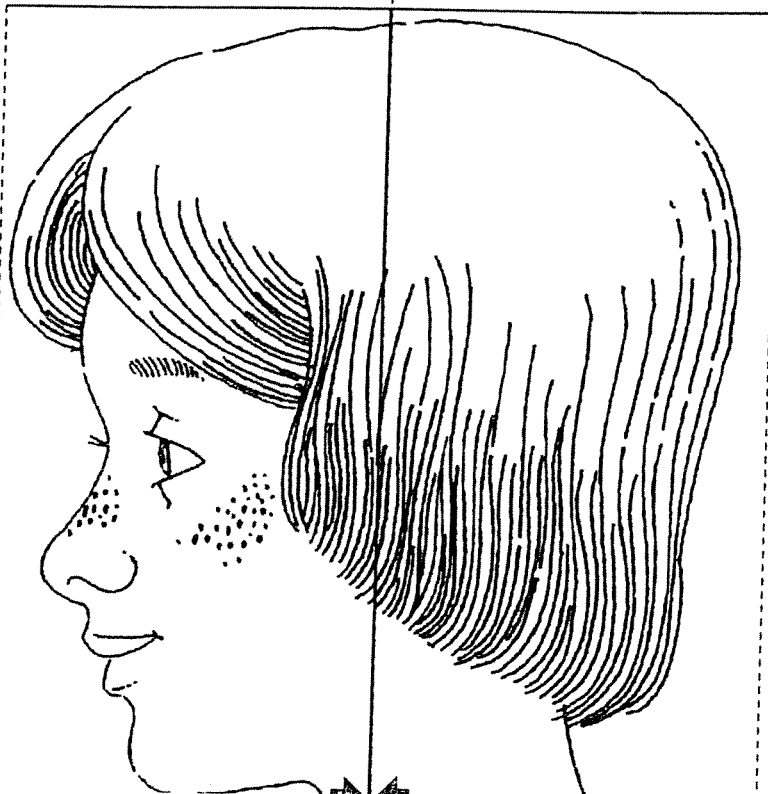


Feet, move away from the fire!
Nervous



Together, the brain, spinal cord, and a network of nerves throughout your body make up the **nervous system**. The nervous system collects, processes, and distributes all the information your body needs to work.

How does your brain know what's happening outside your body? Through your five senses!



Your eyes send messages to your brain about what they **see**. Your ears tell it what they **hear**. Your nose lets your brain know what it **smells**. Your tongue informs the brain what it **tastes**. And your skin sends the brain signals about what it **touches**.

Each sense organ (eyes, ears, and so on) relays information to different parts of the brain. Open the flaps to find out where the brain processes each kind of information.

The brain has three parts: the **cerebrum**, **cerebellum**, and **brain stem**.

The cerebrum makes up more than three-quarters of the brain. This part of the brain receives messages from the sense organs, controls movement of the skeletal muscles, and analyzes, processes, and stores information.

The cerebellum controls the body's balance and posture, and coordinates movement.

The brain stem connects the cerebrum and the cerebellum to the **spinal cord**, which relays information from the body to the brain.

The Incredible Human Body, page 22

