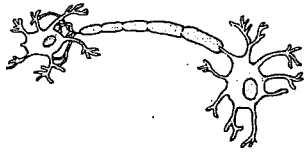
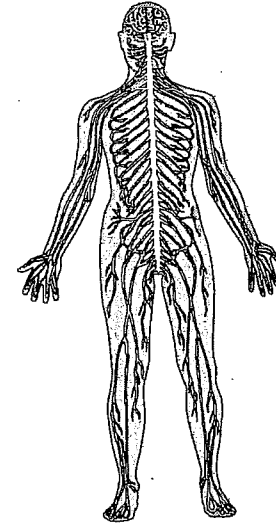


## THE NERVOUS SYSTEM

Your brain controls your body. Your five senses (sight, hearing, touch, taste, and smell) tell your brain what is happening around you, so you can make decisions. For example, if you see a car moving toward you, you move out of the way. Your eyes saw the car and sent the message to your brain. Your brain decided that the car might hit you, and your brain sent messages to your muscles to move out of the way. Your muscles did what they were told to do.



The Nerve Cell

Your brain is made of nerve cells called neurons. Neurons link other parts of your body too. Neurons don't touch each other. The messages, called impulses, jump from one neuron to another. The spaces between neurons are synapses.

The nervous system is the body's main communication system! It has over 100 billion neurons. Each neuron can get over 100,000 signals every second! Messages zoom at a speed of 270 mph. Some neurons are over four feet long! There are three main types of neurons:

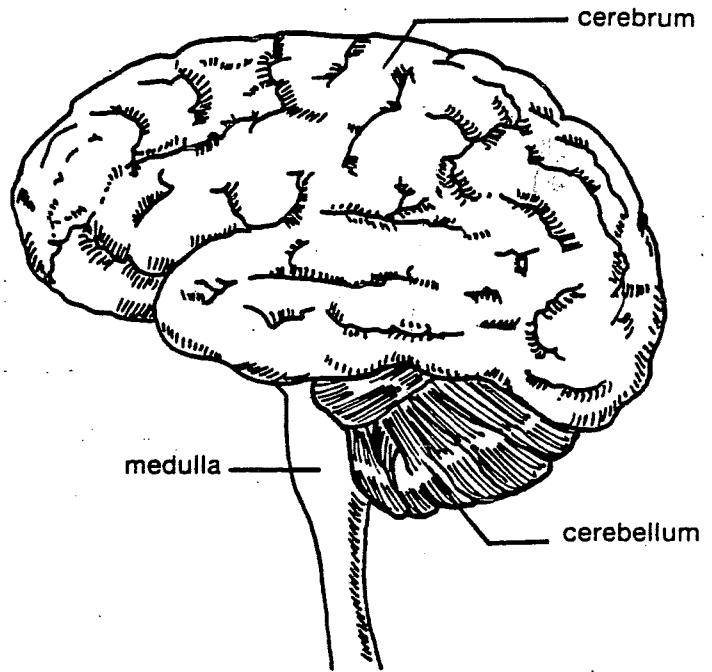
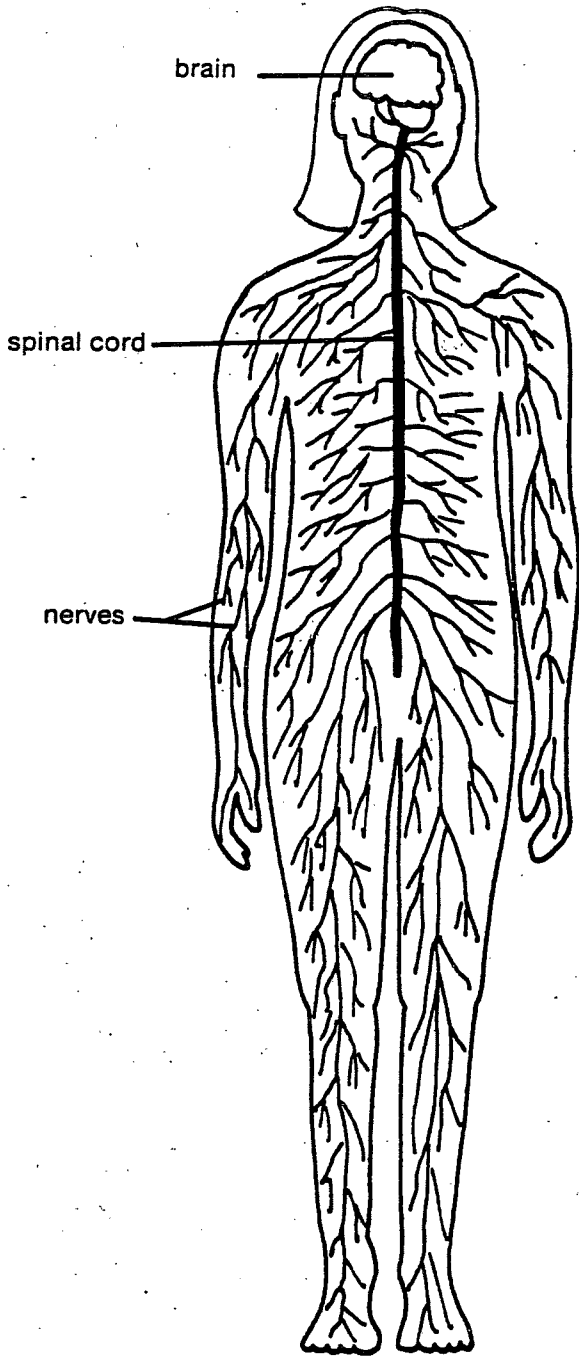
1. Sensory neurons collect information from sense organs and carry it to the brain.
2. Motor neurons carry directions from the brain to muscles, telling them what to do.
3. Connector neurons in the brain and spinal cord process and share information.

The nervous system has two parts. The central nervous system (CNS) is the control center. It includes the brain and spinal cord. It gets information from the senses, figures out what to do, and sends back instructions. Messages travel to and from the brain to parts of the body along neurons. Neurons are grouped in long fibers called nerves. These nerves make up the peripheral nervous system (PNS). The CNS and PNS work together.

**The Game: Underline five things you think are important about the nervous system.**

**DIAGRAM #1**  
**The Nervous System**

Color EACH  
AREA / STRUCTURE  
A DIFFERENT  
COLOR



**THE BRAIN**

**The Nervous System****The Facts****THE NERVOUS SYSTEM**

1. The nervous system sends and receives messages.
2. The three parts of the nervous system are the brain, nerve cells, and spinal cord.

**THE BRAIN**

1. The brain weighs about 3 pounds.
2. The brain is protected by the skull.
3. The brain is made of 3 parts:
  - a) The cerebrum controls talking, thinking, remembering, and moving.
  - b) The cerebellum helps keep balance and keeps the muscles working together.
  - c) The medulla keeps the heart beating and controls breathing.
4. Learning and thinking take place in the brain.
5. The brain stores up memories of the past.

**NERVES**

1. There are billions of nerve cells in every part of the body.
2. Nerve cells carry messages to and from the spinal cord and brain.
3. Sensory nerves carry messages of seeing, hearing, smelling, tasting, and touching.
4. Motor nerves carry messages to move parts of the body.

**THE SPINAL CORD**

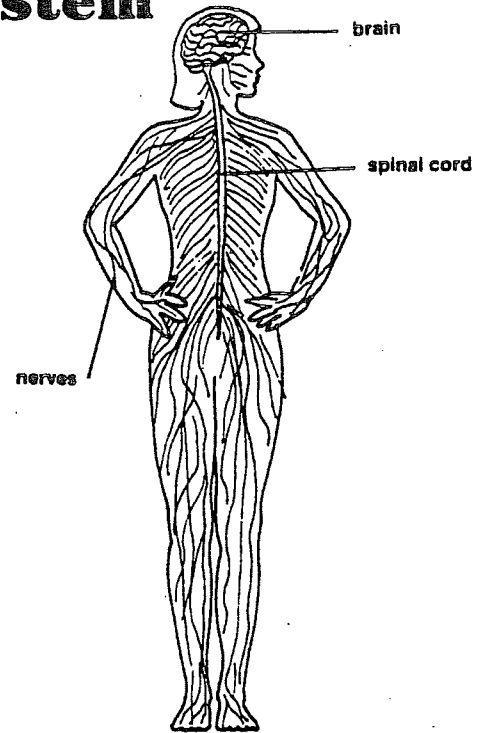
1. The spinal cord is a long bundle of nerves running up the middle of the back to the brain.
2. The spinal cord carries messages to the brain from the body.
3. The spinal cord carries messages back to the body from the brain.

# The Nervous System

## NERVES

The **nerve cells** are part of the nervous system. There are billions of tiny nerve cells in every part of the body. The job of nerve cells is to carry messages from all over the body to and from the spinal cord and brain. Nerve cells which carry messages of seeing, hearing, smelling, tasting, and touching to the spinal cord or brain are called **sensory nerves**.

Nerve cells which take the messages from the brain to move the body parts are called **motor nerves**. Motor nerves tell the body when and how to move.



## SPINAL CORD

The **spinal cord** is a long, thick bundle of nerves which runs up the middle of the back to the brain. The spinal cord carries the messages to the brain and then back to all parts of the body.

- 
- 
1. What is the job of the nerve cells? \_\_\_\_\_  
\_\_\_\_\_
  2. Sensory nerves carry messages of \_\_\_\_\_,  
\_\_\_\_\_, and \_\_\_\_\_  
to the brain.
  3. Tell what motor nerves do. \_\_\_\_\_  
\_\_\_\_\_
  4. Write two facts about the spinal cord. \_\_\_\_\_  
\_\_\_\_\_

*High light*

# Nervous System Functions

Each part of the central nervous system controls certain functions of the body. Injury to any part within this system can result in impairment of the corresponding function. Match each term in the word box to its function. Then write the number of the term and function in the corresponding circle to label the diagram.

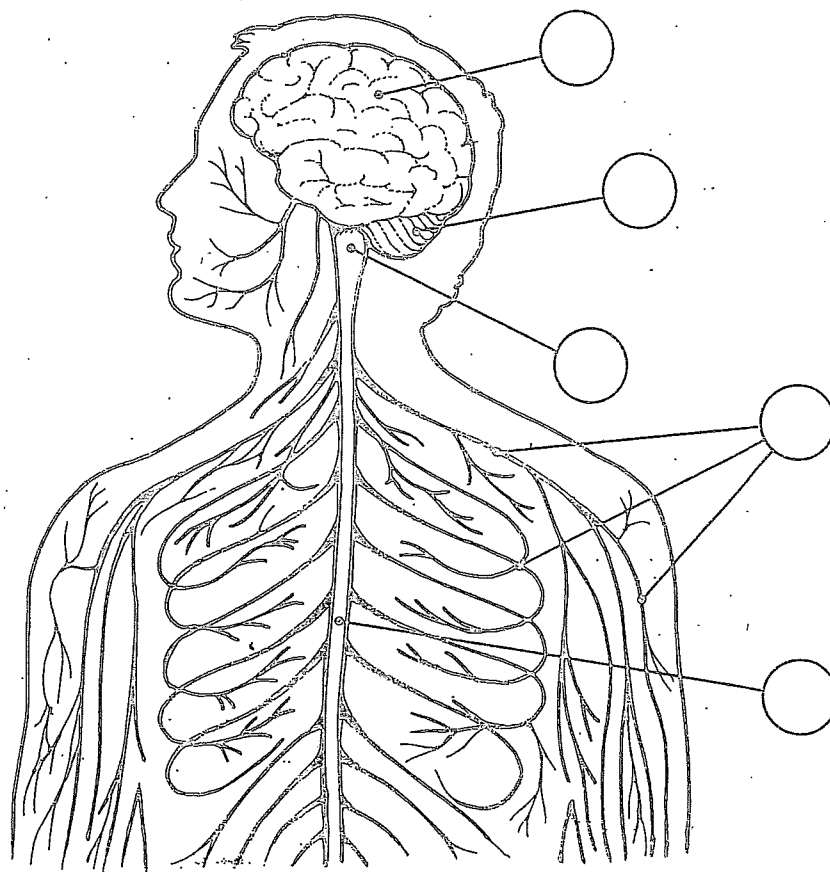
cerebrum

cerebellum

medulla

spinal cord

spinal nerves



1

\_\_\_\_\_ It controls balance and coordination of the muscles.

2

\_\_\_\_\_ It controls breathing, heartbeat, and other vital processes within the body.

3

\_\_\_\_\_ It controls thought, movement you choose to make, memory, and learning. It also processes information from the senses.

4

\_\_\_\_\_ They carry impulses between the spinal cord and body parts.

5

\_\_\_\_\_ It relays impulses between the brain and other parts of the body.

# Autonomic versus Somatic Nervous Systems

The autonomic and somatic nervous systems are controlled by the central nervous system. In the autonomic nervous system, nerves lead from the central nervous system to the smooth muscle, cardiac muscle, glands, organs, and other internal structures. The somatic nervous system connects the central nervous system to the skeletal muscles. It controls voluntary movements. Categorize the actions in the word box to complete the chart.

- |                   |                    |                 |                   |
|-------------------|--------------------|-----------------|-------------------|
| heart beats       | fist clenches      | fingers curl    | pancreas secretes |
| produces bile.    | climb stairs       | stomach digests | colon contracts   |
| make a peace sign | curl tongue        | get goosebumps  | stretch arms      |
| feel a hot pan    | release adrenaline | point toes      | diaphragm relaxes |

Autonomic Nervous System	Somatic Nervous System

# Neurons

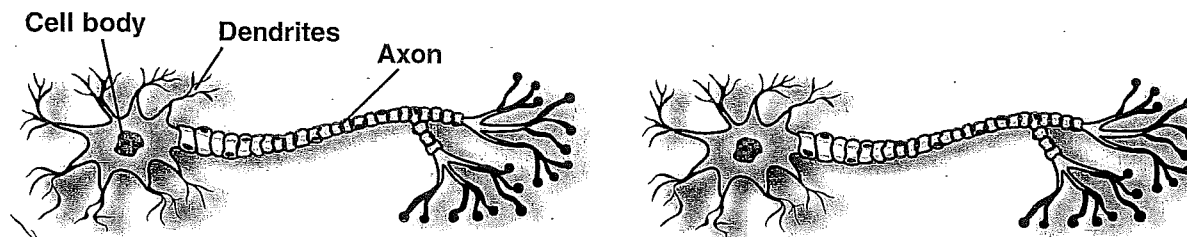
**Far Out Fact:** The brain contains over 100 billion neurons.

Neurons are cells of the brain, spinal cord, and nerves. They look somewhat like an octopus with a long tail. Each neuron has three main parts.

**Cell body:** This is the main part of the cell that includes the nucleus.

**Dendrites:** These look like arms extending off the cell body. They receive incoming messages.

**Axon:** This looks like a tail extending off the cell body. It carries outgoing messages.



A message carried by a neuron is called an **impulse**. It travels by tiny bursts of electrical power. When an outgoing message reaches the end of the axon, the axon releases a special chemical (called a **neurotransmitter**), and the message jumps the space between neurons (called a **synapse**) and continues traveling along the dendrites of the new neuron.

## Three Types of Neurons

**Sensory neurons:** receive information and send impulses to the spinal cord and the brain

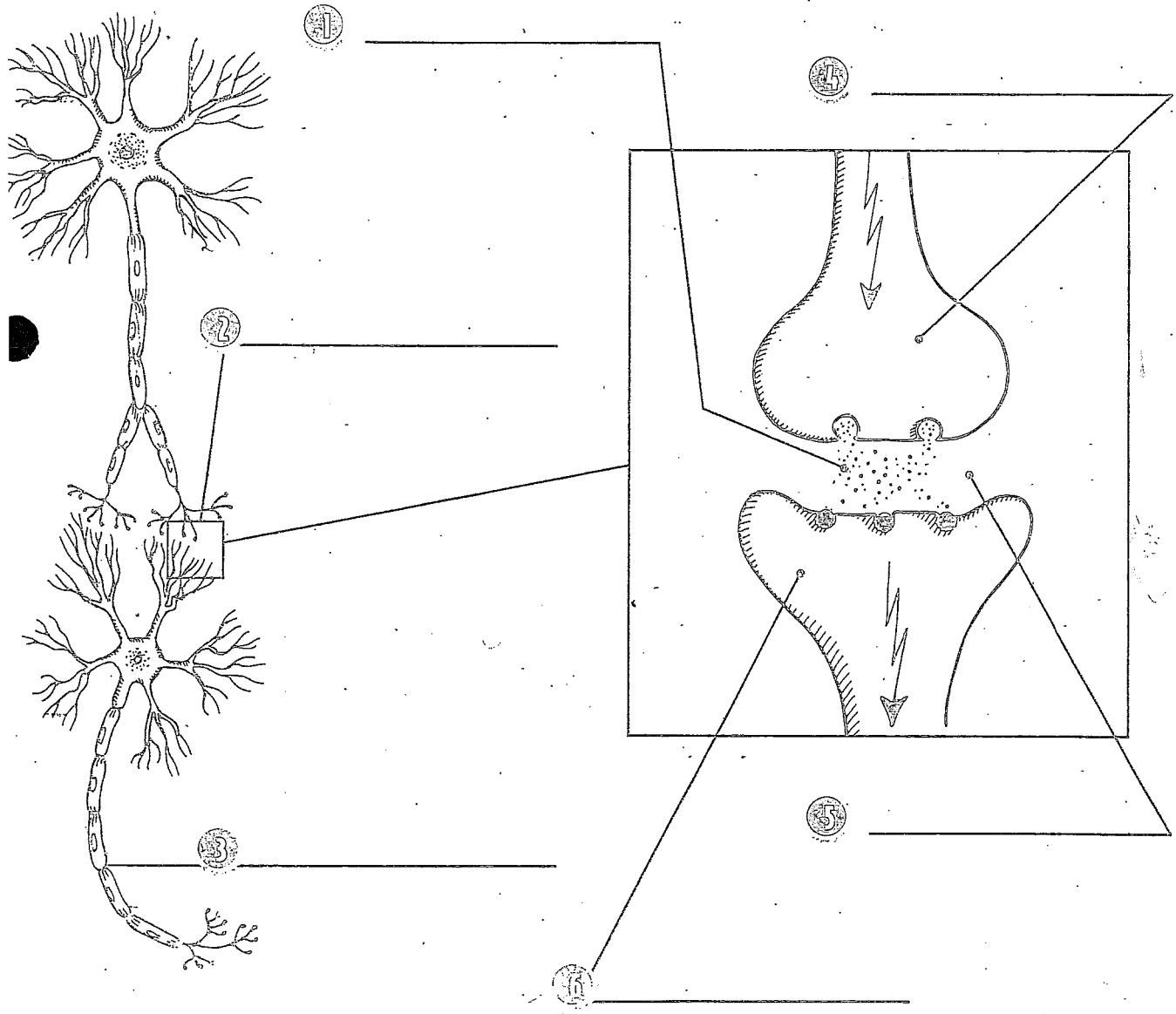
**Motor neurons:** relay impulses from the brain or spinal cord to muscles and glands throughout your body

**Interneurons:** relay impulses between the sensory and motor neurons

# Impulse Transmitters

Neurons transfer information to and from one another through electrical impulses. These impulses pass from one neuron to another through connections called synapses. Use the terms in the word box to label the diagram.

synaptic cleft    axon    axon terminal    transmitting molecule    dendrite    synapse





**The Senses****The Facts****THE SENSES**

1. The human body has five main senses: seeing, hearing, smelling, tasting, and touching.

**HEARING:**

1. The ear has three parts: outer ear, middle ear, inner ear.
2. Part of the outer ear can be seen on both sides of the head.
3. The outer ear catches sound and sends it to the middle ear.
4. The middle ear is made of three tiny bones.
5. The inner ear is a hollow, snail-shaped bone.
6. The eardrum is a thin piece of skin which shakes when sound hits it.
7. The bones in the middle ear are pushed by the eardrum.
8. Liquid in the inner ear moves around and bumps into tiny nerve cells.
9. The nerve cells carry the sound to the brain.
10. Liquid in the canals of the inner ear help to keep balance.

**SEEING:**

1. The eye is protected by bones, eyelid, eyelashes, and eyebrow.
2. Tears wash dust and dirt out of the eye.
3. The iris is the colored part of the eye.
4. The pupil is a tiny hole in the middle of the iris that lets light into the eye.
5. Muscles move the iris to make the pupil get bigger or smaller.
6. In bright light, the pupil becomes small.
7. In dim light, the pupil becomes big.
8. The lens is the part of the eye that helps it to see near and far.
9. The optic nerve carries pictures from the back of the eye to the brain.

**The Senses****The Facts****TOUCH:**

1. Skin is the organ of touch.
2. Millions of nerve endings feel heat, cold, pain, and touch.
3. The skin has two main layers.
4. The epidermis is the outside layer of the skin made of dead cells.
5. The dermis is the inside layer of the skin made of living cells.
6. The dermis has blood vessels, nerve cells, muscle cells, sweat glands, and hair roots in it.
7. A sweat gland is a tiny tube in the skin.
8. A pore is an opening in the skin.
9. Sweat comes out of the pores.
10. The skin keeps the bones and organs from getting hurt.
11. The skin keeps germs out of the body.
12. The skin helps the body get rid of wastes.
13. The skin keeps the body from getting too hot or too cold.

**SMELLING AND TASTE:**

1. The nose is the organ for smelling.
2. Nerve cells in the nose carry smells to the brain.
3. The senses of smell and taste work together.
4. The tongue is the organ for tasting.
5. Thousands of tiny cells called taste buds cover the tongue.
6. The tongue can taste things that are sweet, sour, salty, and bitter.
7. Taste buds have tiny nerve cells in them.
8. The nerve cells carry the message of taste to the brain.

# The Senses

*Highlight*

Everything you learn about the world you learn through your senses. The human body has five main senses. They are seeing, hearing, smelling, tasting, and touching. The nervous system makes the senses work.

## HEARING

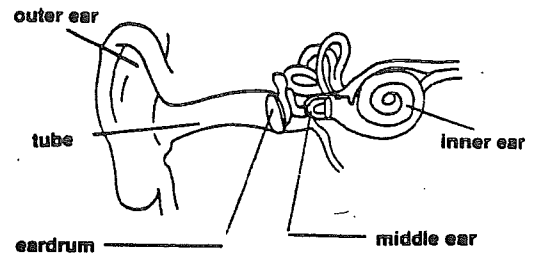
The ear is the organ for hearing. It has three parts. They are the outer ear, middle ear, and inner ear.

The **outer ear** is the part that you see on both sides of the head. A **tube** goes from the outer ear to the eardrum. The **eardrum** is a thin piece of skin stretched across the end of the tube. The outer ear catches the sound and carries it to the middle ear.

The **middle ear** is made of three tiny bones that carry the sounds on to the inner ear.

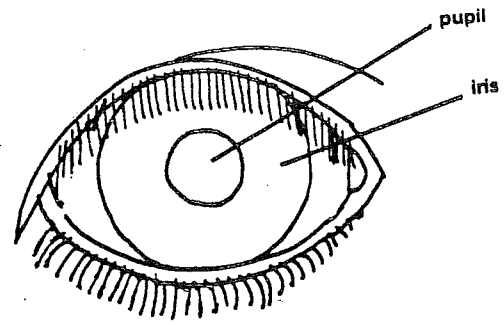
The **inner ear** is made of a hollow bone shaped like a snail shell. Inside this bone is liquid and many nerve cells.

How does the ear hear? Sound goes into the outer ear and travels through the tube until it hits the eardrum. The eardrum begins to shake. The eardrum pushes against the tiny bones in the middle ear. These bones bump against the hollow bone of the inner ear. When this happens, a liquid in the inner ear begins to move around. As the liquid moves around, it bumps into the nerve cells. The nerve cells carry the sound to the brain. The brain tells you what you are hearing!



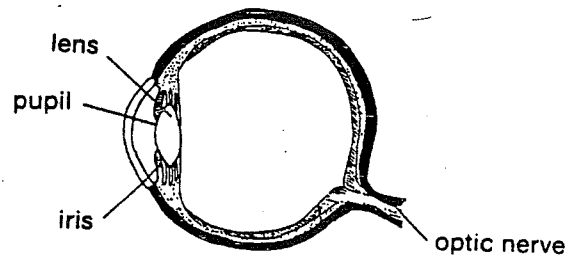
1. What is the organ for hearing? \_\_\_\_\_
2. Name the 3 parts of the ear. \_\_\_\_\_  
\_\_\_\_\_
3. What is the job of the outer ear? \_\_\_\_\_  
\_\_\_\_\_
4. How does sound get to the brain? \_\_\_\_\_  
\_\_\_\_\_

# Seeing



The eye is the organ for seeing. The human eye is shaped like a round ball. It is about one inch across. The eye is protected by four body parts. The bones of the head keep the eye from getting hit. The eyelid closes to keep out things that might hurt the eye. The eyelashes keep dust out of the eye. The eyebrows also keep out dust and keep sweat from running into the eyes. Tears wash dust and dirt out of the eye.

The **iris** is the colored part of the eye. In the middle of the iris is a tiny hole called the **pupil**. The job of the pupil is to let light into the eye. Tiny muscles are hooked to the iris. In dim light, the muscles pull the iris back. When this happens, the pupil becomes big and more light is let in. In bright light, the muscles make the iris into a tiny opening letting only a little light go into the pupil.



Behind the iris is the **lens**. The lens is like glass. It helps the eye to see near and far. If you did not have a lens, everything would be blurry. Nothing would look clear.

How does the eye see? When light brings a picture into the pupil, it passes through the lens and to the back of the eye. Nerve cells in the back of the eye carry the picture to the brain through the **optic nerve**. The brain tells you what you are seeing.

1. What is the organ for seeing? \_\_\_\_\_

2. Four body parts protect the eye. Name them and tell what they do.

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

3. What is the iris? \_\_\_\_\_

4. How do pictures get to the brain? \_\_\_\_\_

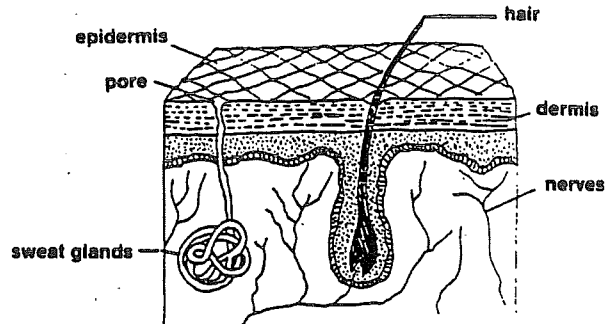
\_\_\_\_\_

# Touch

The skin is the organ of touch and feeling. The outside of the human body is covered with skin. In the skin are millions of nerve endings that feel heat, cold, pain, and touch.

These nerve endings send messages to the brain. Then, when you touch something, you can tell if it is hot, cold, soft, smooth, sharp, rough, or sticky.

How does your sense of touch work? Remember that nerves run all over your body. The nerve endings in the skin pick up messages and carry them to the brain. Your brain tells you what you have felt.



The skin has two main layers. The outer layer is called the **epidermis**. It is made of dead cells. The inner layer, which is made of living cells, is called the **dermis**. The dermis has blood vessels, nerve cells, muscle cells, sweat glands, and hair roots in it.

The skin is an important organ for the sense of touch. But, it also has other jobs to do.

The skin helps protect the body. It helps keep the bones and organs from getting hurt. The skin also helps to keep germs out of the body.

The skin helps the body get rid of wastes. It has two to three million **sweat glands**. A sweat gland is a tiny tube in the skin. The opening of the tube is called a pore. There are many pores in the skin. Sweat, which is water and salt, comes out of the pores.

The skin helps keep the body from getting too hot by giving off sweat. The skin also helps keep the body from getting too cold.

---

1. What is the organ of touch and feeling? \_\_\_\_\_

2. Name four things that the skin feels.

\_\_\_\_\_

\_\_\_\_\_

3. How is the dermis different from the epidermis? \_\_\_\_\_

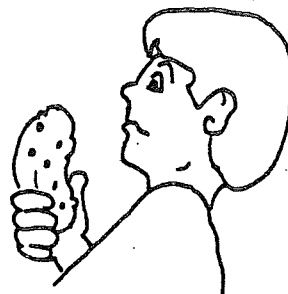
\_\_\_\_\_

# Smelling and Tasting

The nose is the organ for smelling. Smells float around in the air. Good smells and bad smells. The air carries the smells into the nose. Tiny nerve cells in the nose carry the message to the brain. The brain tells you what you are smelling.



The senses of smell and taste work together but you can smell many more things than you can taste. Pinch your nose closed and eat a piece of onion. You can not taste the onion. This is because some **tastes** are really **smells**!



The **tongue** is the organ for tasting. The tongue is covered with thousands of tiny cells called **taste buds**. They can taste **sweet, sour, salty, and bitter**.

The four **tastes** are caused by taste buds on different parts of the tongue. The tip tastes sweet things. The sides and part of the tip taste salty things. The sides taste sour things and the back tastes bitter things. You can see that the sides and tip of the tongue have two kinds of taste.

The taste buds have tiny nerve cells on them. The nerve cells carry the message to the brain. The brain tells you what you are tasting!

Tasting helps you enjoy your food.



1. What is the organ for smelling? \_\_\_\_\_

2. How do messages of smells get to the brain? \_\_\_\_\_



3. What is the organ for tasting? \_\_\_\_\_

4. Name four tastes:

