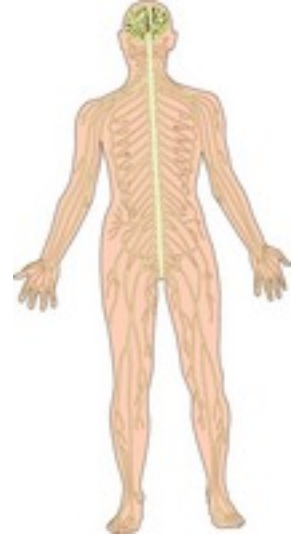


The Nervous System

By Brandi Waters

Have you every felt that tingly feeling that happens when your arm falls asleep? Have you ever hit your elbow on something and felt a sharp pain run through your arm? These strange things are caused by your nervous system. The nervous system moves information signals throughout your body. Your nervous system helps you do many things. It helps you move. It helps you feel when things are hot or cold, rough or smooth, or soft or hard. It helps you to see, hear, taste, and smell. It gives you the ability to learn, form memories, and have emotions.



The nervous system is complex. It has to be to do all of the things that it can do! It is made up of your brain, spinal cord, and nerves. The brain is the control center for your body. It learns from the things that you do. It forms memories. It allows you to feel love, anger, and sadness. It receives and sends out countless numbers of signals every moment. Signals move through your body through special tissue called nerves. A long bundle of nerves called the spinal cord is connected to the brain. The spinal cord runs from your head, where it connects to your brain, all the way down your back. Nerves connect the spinal cord to every part of your body. Nerves allow you to feel sensations. If you touch something hot with your finger, nerves send a message to your brain and your brain quickly sends a message back telling your finger to stop touching it. If you lay on top of your arm for too long, the weight of your body can cut off the supply of blood to the nerves in your arm. This can make your arm tingle; some people say that it has "fallen asleep." Your arm isn't really asleep; it's just your nerves trying to send a message to your brain!

The Nervous System

Questions

- _____ 1. The nervous system _____.
- A. is one of the simplest systems of the human body
 - B. is made up of the brain and muscles
 - C. moves information signals throughout your body to allow you to do many things
 - D. can only process signals while you are asleep
- _____ 2. The _____ is the control center for the nervous system.
- A. brain
 - B. spinal cord
 - C. nerves
 - D. heart
- _____ 3. The spinal cord is a long bundle of _____ that runs down your back.
- A. information
 - B. nerves
 - C. brain matter
 - D. all of the above
4. Memories are formed in _____.

Sleep

By Jennifer Kenny

Your body needs rest and sleep each night. It becomes relaxed and inactive. What about your brain? Well, your brain never stops. Its automatic control system keeps your heartbeat, breathing, and other vital processes going. Your sleep center is in your hypothalamus. Even though we know that your brain doesn't stop, doctors know through EEG that the patterns in your brain do differ when you are asleep than when you are awake.

Scientists know also from EEG and through observing the body's activities while sleeping that there are four main stages of sleep. The cycles last between 60 and 90 minutes each and become shallower throughout the night.

At first you sleep in a floating, daydreaming state. Then your heartbeat and breathing slow and your body temperature falls during "sleep spindles." In the third state, you are in a very deep sleep and your brain is a pattern of delta waves, which are slow. A person who sleepwalks, talks in his sleep, or wets the bed normally does it during this stage. Finally, the waves speed up and dreams begin during the R.E.M. stage. R.E.M. stands for rapid eye movements. A person's eyes move and flicker even though the eyelids are closed. A person can often remember his dream if he wakes up now. When the R.E.M. stage is over, sleep deepens again and the person usually goes through the stages once again. This deep sleep/dreaming sleep is repeated. The first delta sleep is very deep at the beginning of the night, but becomes lighter toward morning. Scientists believe people need both types of sleep. During any type of sleep, your senses still work for survival - for example, you would still hear strange noises and smell smoke while you sleep.

So why do we sleep and dream? Scientists don't have a definite answer to that question. We know that while the body rests, it saves energy. The maintenance and repair processes mend the daily wear and tear of the day. Meanwhile, the brain sorts out memories, thoughts, and feelings. We know that people who are not allowed to sleep will often hallucinate.

How much sleep do you really need? Each person varies with true need, but there are averages out there. Scientists do know that lack of sleep will kill more quickly than lack of food! Sleep is vital. For adults who do not get enough sleep, they become less efficient and are prone to more accidents. Sleep is essential to children because growth occurs during sleep. A newborn baby usually needs between 18 to 20 hours of sleep per day. A six year old needs 10 hours of sleep. Most adults need 7 to 8 hours. Finally, the elderly often sleep 6 hours at night but nap several times during the day.

On average, you will spend 1/3 of your life sleeping. Make sure you get enough!



Sleep

Questions

- _____ 1. Your brain is always working.
- A. False
 - B. True

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_____ 2. There are _____ main stages of sleep.

- A. three
- B. five
- C. two
- D. four

_____ 3. Sleepwalking often occurs in the _____ state of sleep.

- A. first
- B. second
- C. fourth
- D. third

_____ 4. The R.E.M. stage stands for _____.

- A. Rolling Eye Motion
- B. Rapid Eye Movements
- C. Rested Eye Movements

_____ 5. A person spends _____ of his life sleeping.

- A. $\frac{1}{3}$
- B. $\frac{1}{4}$
- C. $\frac{2}{3}$
- D. $\frac{1}{2}$

_____ 6. A newborn baby usually sleeps _____.

- A. 10 hours a day
- B. 6 hours a day
- C. 18 hours a day
- D. 9 hours a day

7. Based on your knowledge of sleep from this passage, why do you think it is important that children get enough sleep?

The Brain and Spinal Cord

By Jennifer Kenny

Your body's nervous system has many important jobs. It can also be divided into three categories. The **central nervous system**, or CNS, is made up of the brain and spinal cord. It is the center of your body and the center of control and coordination. The **peripheral nervous system**, or PNS, includes the nerves that reach the outer parts of your body. Finally, the **autonomic nervous system**, or ANS, includes the nerves that are near the center part of your body. The ANS is actually a smaller part of the PNS, which controls the automatic processes.

Now, the brain takes up the top half of the inside of the head. The brain is protected by the skull or **cranium**. The skull bones have holes to let nerves join the brain. These are the cranial nerves. There are twelve of them and different ones branch to different places – such as to the head, to the face, to the neck, and to the chest/abdomen. Many blood vessels run through the brain to give it oxygen, water, and dissolved food as well.

The **brain** is a grayish, jellylike organ. It is slightly larger than a grapefruit in size. It looks like a huge walnut with many grooves and folds. There are many parts to the brain.

The **cerebrum** makes up 85 to 90% of the brain. The cerebrum holds the centers for sight, sound, taste, smell, and touch. It is the center for thinking and memory, decision-making, and controls for muscles. The wrinkled part of the cerebrum is the **cerebral cortex**. It is made of between 10 to 14 billion neurons! The cerebrum and the cortex are divided into the right hemisphere and the left hemisphere. Each controls muscles on the opposite side of the body. The left side of the cerebrum controls your ability to read, speak, and do math. The right side of the cerebrum controls your abilities in music, art, and understanding of shape and form.

Between the two halves of the cerebrum, you can find the **thalamus**. Thalamus means "inner room." It is the brain's main relay station. The **hypothalamus** means "under the inner room." It is the control center for many functions and emotions. It helps keep your body temperature at 98.6 degrees Fahrenheit.

There is also a **brain stem**. It has four tiny **colliculi** to control eye muscles and adjust your ears to sound. Therefore, you will flinch at a loud noise or blink when something comes near your eyes.

The **medulla oblongata** blends into the spinal cord. It is only one inch long, but it is responsible for involuntary actions in your body such as your heartbeat, breathing, and digestion.

Finally, the **cerebellum** is the part of the brain that means "little brain." It takes care of movements in your body and balance. It allows you to hold a fork, run, or pitch.

The average adult has a brain that weighs around three pounds. The brain continues to grow in size until a child turns around seven years old.

The biggest nerve joining the brain is actually the spinal cord. In fact, the spinal cord is more like an extension of the brain. It actually passes through the large hole in the skull base and along a tunnel formed by the holes inside the backbone. Thirty-three separate bones of the spine help protect the spinal cord from injury. In an adult, the spinal cord is about eighteen inches long.

The spinal cord is the brain's main link to the rest of the body. The outside of the spinal cord looks white and contains the nerve fibers that deliver signals to and from the brain. The inside of the spinal cord contains the concentration of gray matter - cell bodies of motor neurons that carry signals to muscles. Thirty-one pairs of spinal nerves branch outward into the body. They keep branching into smaller branches. Each spinal nerve actually contains thousands of sensory and motor neurons. Except for a few nerves in the head, all the other nerves in the body lead to the spinal cord first. If any of these spinal nerves were injured, a person might be paralyzed because the messages would be cut off. The spinal cord takes care of many reflexes that occur



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automatically, without thought, when messages are received by the sense organs.

The nervous system is such a vital part of your body. Certainly, the spinal cord is very important to your ability to function. That's true of the brain as well and, of course, your brain makes you, you!

The Brain and Spinal Cord

Questions

_____ 1. The central nervous system includes the brain and spinal cord.

- A. True
- B. False

_____ 2. Another word for skull is _____.

- A. jawbone
- B. vertebrae
- C. cartilage
- D. cranium

_____ 3. The brain, in an adult, is about the size of a _____.

- A. grapefruit
- B. plum
- C. pea
- D. grape

_____ 4. Which part of the brain would help you remember a story?

- A. medulla oblongata
- B. cerebrum
- C. cerebellum

_____ 5. Which part of the brain would help you hold a glass of water?

- A. cerebrum
- B. medulla oblongata
- C. cerebellum

_____ 6. The size of your brain continues to grow your entire life.

- A. True
- B. False

_____ 7. In an adult, the spinal cord is about _____ long.

- A. 18 inches
- B. 28 inches
- C. 36 inches
- D. 6 inches

8. Why could a spinal injury leave someone paralyzed?

Keeping Your Nervous System Healthy

By Brandi Waters

Your nervous system contains what is probably the most important part of your body: your brain. Your brain allows you to learn. It allows you to feel emotions like love, anger, and sadness. Your brain gives you the ability to see, hear, taste, touch, and smell. It works together with the nerves and spinal cord to send the signals that make your body move. Your nervous system lets you do things like running, jumping, and dancing.

The nervous system is such an important part of your body. You want it to work at its best so that you can be at your best! There are a few things that you can do to give your nervous system everything that it needs. First, drink plenty of water. Your brain is eighty-five percent water. If you don't drink enough water, your brain won't work as well as it could. It is also important to eat healthy foods. Your brain needs minerals like calcium and potassium that can be found in milk and many fruits and vegetables. Your brain also needs healthy fats like those in nuts and fish. These fats help build new connections between nerves and brain cells. These fats may improve memory and increase learning and intelligence.

Exercise is another thing that is good for your brain. There are two kinds of exercise that your brain needs. One is exercise for your body. Exercise gets your blood pumping faster and harder. It brings more blood to your brain. That means more oxygen and nutrients for your brain cells. You also need to exercise your brain. Your brain works better when you challenge it! Doing puzzles, reading, and playing a musical instrument are all good ways to give your brain a workout. Protect your brain by wearing a helmet when you ride a bicycle or play sports like baseball, football, or hockey. Stay away from drugs, cigarettes, and alcohol. They keep your brain from working properly and can even kill brain cells. Doing these things will help keep your nervous system healthy.



Keeping Your Nervous System Healthy

Questions

- _____ 1. Your nervous system gives you the ability to _____.
- A. learn
 - B. jump
 - C. get angry
 - D. all of the above
- _____ 2. Which of the following foods is a good choice for a healthy brain?
- A. bacon
 - B. fish
 - C. white bread
 - D. butter
- _____ 3. What type of exercise is good for the brain?
- A. jogging
 - B. crossword puzzles
 - C. reading
 - D. all of the above

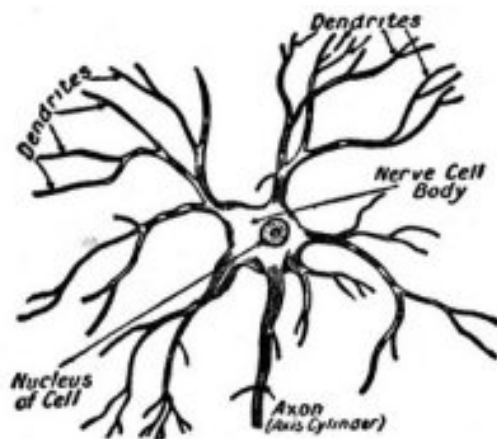
The Nerve Cells

By Jennifer Kenny

Your body is made up of millions of cells that you can't see without the help of a microscope. They come in all kinds of shapes and sizes. Different kinds of cells work together to form different body parts. For example, muscle cells form muscles and bone cells make bones.

Neurons are the special name for nerve cells. Nerve cells make up the brain, nerves, and spinal cord.

The main part of the nerve cell is called the **cell body**. It measures 0.0008 inches wide. Inside the cell body is the **nucleus**, or control center of the cell. Inside there are also mitochondria that provide energy to the cell.



Around the cell body are nerve fibers called axons and dendrites.

Dendrites are long, thin spidery-looking parts. One nerve cell may have more than 10,000 dendrites. The word dendrite comes from a Greek word meaning "tree." Around the cell body is also a longer, slightly thicker part called an **axon**. Most nerve cells have one axon each. The axon and dendrites look like microscopic wires that carry electrical signals. The axon and dendrites are wrapped in a protective covering. The inner sheath is called a **myelin sheath**. It is made of a fatty substance. Doctors and scientists believe it may act like insulation to keep nerve messages from interfering with one another. The outer sheath is called **neurilemma**. It is made of living cells. Only some nerve cells have the neurilemma. The brain's neurons and the spinal cord's neurons don't have it. Those that do, though, seem to help a cut nerve fiber grow back together.

For many years, scientists didn't even know that axons and dendrites existed because they couldn't be seen with the microscope. In 1873, Camillo Golgi, an Italian neurologist, or a nervous system specialist, added a silver-containing stain to the nerve cells, which revealed the dendrites and the axon. This led them to see the **synapses** as well.

The synapses are the junctions where nerve cells are together. The dendrites and the axons don't actually touch. Instead, the synapses are tiny gaps. So what is the importance of these tiny gaps? Well, the brain and nerves work using nerve signals, or **impulses**, which are passed along in codes and patterns. The dendrites carry the signals toward the cell body. The axon carries the signal away. At the synapses, the nerve signal can jump from one to the next. The dendrites receive nerve signals from other nerve cells and pass them to the axon. The axon carries them long distance to dendrites of other nerve cells. At the synapses, the signals always pass in the same direction. They don't work in reverse.

There are 10 billion nerve cells in the brain and nerves. Nerve cells can't reproduce themselves. We only have the ones we are born with. Logically, then, you can understand why, very often, an elderly person's brain doesn't work as quickly as a younger person's brain.

In the brain, there's another kind of cell that is important as well. They are called **glial cells**. They outnumber the neurons ten to one. While they don't carry messages, they do supply nutrients and other chemicals to the neurons. They help repair the brain after an injury. They can also attack invading bacteria. The word glial comes from the Greek word meaning "glue." This name is quite appropriate since glial cells help hold the tissue together.

A bundle of neurons make up a nerve. The thinnest nerves are narrower than a hair. The thickest nerves are like white rope.

Different kinds of **stimulus**, such as a touch or a smell, make a nerve cell fire off a message called a **response**. Sensory neurons respond to the stimuli. Motor nerves carry messages to parts of your body so you respond. For example, if you touch a hot pot (stimulus), your sensory nerves send messages to the brain and, in

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turn, your brain sends messages through your spinal cord to your motor nerves so you pull your arm away! Isn't that amazing?

The Nerve Cells

Questions

_____ 1. What is another name for a nerve cell?

- A. nucleus
- B. sense
- C. dendrite
- D. neuron

_____ 2. Which is NOT a nerve fiber?

- A. dendrite
- B. They are all nerve fibers.
- C. axon
- D. nucleus

_____ 3. A nerve cell may have thousands of axons.

- A. False
- B. True

_____ 4. All nerve cells have a neurilemma.

- A. True
- B. False

_____ 5. The _____ are the junctions where nerve cells are together.

- A. myelin sheath
- B. glial cells
- C. synapses
- D. impulses

_____ 6. If your nerve cells die, your body can make new ones.

- A. False
- B. True

7. Why doesn't an elderly person's brain work as well as a young person's brain?

_____ 8. Which is NOT a function of glial cells?

- A. They help repair the brain after an injury.
- B. They supply nutrients to neurons.
- C. They attack invading bacteria.
- D. They carry messages.