OUR BRAIN AND
IN CONTROL:
NERVOUS SYSTEM

1 videocassette. ............... 25 minutes

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Introduction

How do we sense things around us? How do we learn, plan for the future, and remember things from the past? Where do emotions originate? The answers to all these questions and many more lie in the nervous system and brain.

*In Control: Our Brain and Nervous System* provides an overview of this fascinating topic. It describes how the various parts of the system function, from tiny nerve cells that relay messages throughout the body, to the different parts of the brain that are responsible for how we see, hear, feel, move, and think.

The program uses a variety of techniques to convey information. A male and a female narrator carefully explain each topic in language appropriate for the audience. Computer graphics clearly identify different parts of the brain and nervous system and clarify key points of the narration. Photomicrographs, PET scans, and MRIs offer a variety of views of the brain and nerve cells.

The video also stresses that there is much about the brain and nervous system we do not understand. It conveys to students the excitement of continuing current research on the brain and nervous system.

The video was designed for grades five through eight, but it can be used effectively for younger and older students as well.
Summary

The program begins by showing a gymnast practicing while the narrator describes how her actions, thoughts, feelings, and perceptions are controlled by the nervous system and brain.

The video compares the nervous system to another communications network, a telephone system. Just as a telephone system allows people all over the world to communicate, the nervous system allows different parts of the body to communicate. The program then describes how the nervous system is made up of the central nervous system, which includes the brain and spinal cord, and the peripheral nervous system, which links the central nervous system to muscles and sense organs throughout the body.

Next the video looks at the structure of nerve cells and shows how together they form pathways over which different kinds of signals can travel. To illustrate this point, the video shows a boy putting his hand into the ocean and shows how signals travel along sensory neurons to the spinal cord and then along other neurons to the brain. The brain then interprets these signals, so the boy can sense that the water is wet and how cold it is. Using the example of someone’s hitting a baseball, the video also describes how signals can travel from the brain along motor neurons to muscles.
An example of a student's touching a hot iron shows how reflexes bypass the brain and enable us to react quickly to things that might harm us.

The program next looks more closely at the brain and the functions of different parts. The brain stem and medulla control heart rate and breathing. The cerebellum controls our sense of balance and coordinates the actions of many different muscles. The hypothalamus, deep inside the cerebrum, regulates appetite and the temperature of our blood and also plays a key role in our emotions.

The program then looks in at the cerebral cortex, the outer layer of the cerebrum. It compares the cerebral cortex to a piece of newsprint crumpled into a ball and shows how the cortex's many folds and grooves allow its large surface area to fit inside the skull.

The video describes the functions of different parts of the cortex. Using the example of a student's enjoying the sights and sounds of a carnival, the program discusses how the auditory cortex and the visual cortex are involved in seeing and hearing. It then describes the sensory cortex, the motor cortex, and the frontal lobes, which are involved in how we think and plan.

The program also shows how the cerebrum is divided into halves or hemispheres, and how each hemisphere controls the opposite side of the body. The video
explains how the different hemispheres are associated with different abilities. The right hemisphere is often called the artistic half because it is involved more with visual skills, such as those used in drawing a picture. The left hemisphere is the logical half and is used more for tasks like solving math problems.

Next, the video looks at memory. It shows a girl looking up a phone number to describe short-term memory, memory that lasts only a few minutes. An old couple looking at a photo album illustrates how long-term memories can last a lifetime.

The program describes the role of the hippocampus in converting short-term memories into long-term ones. It describes the case of a patient called "H" whose hippocampus was removed and who could not form any new long-term memories.

Finally the program looks briefly at the effects of stimulant and depressant drugs on the brain.

A brief summary of key points concludes the program.
Objectives

After viewing the program, students should be able to:

1. Describe how the nervous system helps the body respond to its environment.

2. Explain the role of the spinal cord.

3. Describe the structure of a nerve cell.

4. Describe how nerve impulses move from nerve cell to nerve cell.

5. Explain what a reflex is and why reflexes can protect us from harm.

6. Describe the functions of different parts of the brain, including:
   - auditory cortex
   - cerebellum
   - frontal lobes
   - hippocampus
   - hypothalamus
   - motor cortex
   - sensory cortex
   - spinal cord
   - visual cortex
7. Explain the difference between short-term memory and long-term memory.

8. Describe the effects of stimulant and depressant drugs on the transmission of signals in the nervous system.

9. Explain the role of the nervous system in how we perceive things using our five senses.

10. Explain how the cerebrum is divided into hemispheres and how the "left brain" and "right brain" differ.

**Review Questions**

1. What are the two divisions of the nervous system? What makes up each division? *The two divisions of the nervous system are the central nervous system and the peripheral nervous system. The central nervous system consists of the brain and spinal cord. The peripheral nervous system consists of nerves that connect the central nervous system to muscles and sense organs throughout the body.*

2. What carries signals throughout the nervous system? *Nerve cells or neurons.*
3. What are the main parts of a neuron? 
   The axon, cell body, and dendrites.

4. Are nerve cells connected to each other? 
   No. Between the axon of one nerve cell and a 
   dendrite of another there is a tiny gap called a 
   synapse.

5. How are signals relayed across the synapse that 
   separates nerve cells? By chemicals called 
   transmitters.

6. Describe how nerve signals travel through the 
   nervous system when we put a hand into water. 
   How might the brain interpret these signals? 
   Signals travel along sensory neurons to the spinal 
   cord. Other neurons then pick up these signals 
   and send them to the brain. The brain interprets 
   these signals so that we sense the water is wet and 
   what its temperature is.

7. What do motor neurons do? 
   They carry messages from the brain to muscles, 
   causing them to move.

8. How do reflexes protect us from harm? 
   Reflexes bypass the brain and allow us to react 
   quickly to things that could hurt us.
9. What does the brain stem do?
   *It regulates many things the body needs to stay alive, such as breathing and heart rate.*

10. What is the role of the cerebellum?
    *It controls our sense of balance and coordinates the actions of different muscles so that they function smoothly together.*

11. Describe some of the functions of the cerebrum and its outermost layer, the cerebral cortex. Answers may vary. Students might talk about the hypothalamus and how it regulates appetite and body temperature and is the center of emotions. Or they might talk about different areas of the cortex that are involved in senses, such as the visual cortex and auditory cortex. They might mention how the motor cortex initiates muscle movement. They might talk about how the frontal lobes are involved in reasoning and planning ahead.

12. Describe two different kinds of memory mentioned in the video.
    *Short-term memory lasts only a few minutes. It is useful for remembering things like phone numbers or shopping lists. Long-term memory involves things that are more important to us for*
some reason. Long-term memories can last a lifetime.

13. What is the role of the hippocampus in memory? The hippocampus is somehow involved in converting short-term memories into long-term ones.

14. How do different kinds of drugs affect how signals are transmitted along the nervous system? The examples in the program are depressants, such as alcohol, that slow down signals; and stimulants, such as crack and cocaine, that speed signals up.

QUESTIONS FOR DISCUSSION

1. Ask students to compare the brain to a very powerful computer. Which do they think is more powerful or can do more things?

Discuss with students how both the brain and a computer are good for doing complex computations quickly and for receiving and storing information. However, the brain also drives our emotions, is the source of a person's personality and creativity, and can form opinions—things that a computer is incapable of doing.
2. Have the students imagine that they have stepped on a tack. Ask them to trace the pathways of nerve signals as they react.

3. The program notes that the right and left hemispheres of the cerebrum seem to have different abilities. Some people seem to have greater strengths in one hemisphere than the other. Ask the students how this might affect how people learn. Would someone who is stronger in the right hemisphere learn differently from someone who has greater strengths in the left hemisphere?

As part of the discussion, you might point out that most learning in school stresses reading and listening skills that are stronger in the left side of the brain. But recently there has been greater appreciation of how the right brain learns; for example, by using its particularly strong visual skills. Talk with students about the implications of right brain learning for schools.
ACTIVITIES 1.

Observing Reflexes

Materials needed:
- clear plastic sheets
- cotton balls

Divide the class into pairs of students. Have one student in each pair hold a clear plastic sheet in front of his or her face. The other student should then, without warning, throw a cotton ball at the first student's eyes and observe the response. Have the students repeat this procedure four or five times. Then have the students in each pair reverse roles and repeat the procedure several more times.

Ask students: What was their partner's response when a cotton ball was thrown in his or her face? Was the response the same after several trials as it was the first time?

Almost every student will blink the first time a cotton ball is thrown in his or her face. This is a reflex that protects the eyes from possible harm. After several trials, however, they may not blink, because they are concentrating more and because they can better anticipate what is going to happen.
2. Memory

The program notes that short-term memories last usually only a few minutes—just long enough for us to accomplish what we need to do, like make a phone call or buy the items on a short shopping list. Also, most people can remember only a very limited number of things.

Students can test their own short-term memory. Make a number of different "shopping lists" of common objects. The shortest list might have only 4 or 5 things. The longest list might have 12 to 15.

Divide the class into pairs and have the students in each pair quiz each other on these different lists. One student can read the list aloud. After a 30-second interval, the other student should then try to recite as many things on the list as possible. The first student should keep track of the number of correct responses. Afterwards, students can compare results. Ask the students when it became difficult to remember all the items on a list.

Students might also experiment with the amount of time that elapses between the first student's reading the lists and the second's reciting them from memory. Try 1-, 2-, 5-, and 10-minute intervals with lists that have seven or eight items. Have students compare the results. Was there an interval after which most students had great difficulty in remembering things?
3. Visual Illusions

The program describes how the visual cortex interprets signals from the eye, enabling a person to see. But sometimes the brain does not interpret this information correctly. This often happens with visual illusions.

Students can experiment with a variety of visual illusions. For example, you might draw the figures below on the board before class, then ask students to write down which figure they think is longer. Make sure the horizontal lines are exactly equal.

Students can research other visual illusions and prepare posters or a report.
TOPICS FOR FURTHER EXPLORATION

The topics below are among the subjects that more advanced students might research and report on.

1. **Split-brain research**: The program touches on the differences between the left and right hemispheres of the cerebrum. The two halves of the cerebrum are connected by a part of the brain called the corpus callosum. This bridge allows the two hemispheres to communicate with each other. There have been cases, however, where the corpus callosum has been surgically cut. This situation has enabled researchers opportunities to study in more detail the differences in the two hemispheres. Students can investigate and report on this fascinating area of brain research.

2. **Sensory Receptors**: The program briefly describes how the brain and sense organs interact. Interested students could research this topic in more detail. Among possible topics are the specialized nature of various sensory receptors, cells that detect changes in the environment. Students could report on how sensory receptors in the eyes, ears, and nose detect light, sound, and odors; how receptors in the skin detect heat and cold, pressure, and pain; and how receptors in the tongue detect different tastes.
3. Electrical Activity in the Brain: The program points out that the signals that travel through the nervous system are partly electrical in nature. These signals can be detected and measured using electrode sensors. They can then be displayed as wave-like traces, or brain waves. Such a display is called an electroencephalogram, or EEG.

The shapes of different brain waves indicate different types of brain activity. For example, intense thought produces sharp, jagged waves called beta waves. When you are asleep, the brain produces large slow waves called delta waves.

Students can research different brain wave patterns and what they mean.

4. Injuries to the Brain and Spinal Cord: Students can investigate different kinds of injuries to the nervous system. Among the topics they might explore are the causes and consequences of concussions and paralysis.
**GLOSSARY**

**Auditory cortex:** the part of the cortex that interprets signals from the ears

**Axon:** long fiber extending from the cell body of a neuron

**Brain:** the control center of the nervous system

**Brain stem:** the bulge at the top of the spinal cord that forms the bottom part of the brain; controls many vital functions, such as breathing and heart rate

**Central nervous system:** the brain and spinal cord

**Cerebellum:** the part of the brain that controls balance and coordinates the actions of different muscles

**Cerebral cortex:** the outermost layer of the cerebrum

**Cerebrum:** the largest part of the human brain; controls thinking and planning

**Cortex:** the outer layer of the cerebrum

**Dendrite:** a nerve fiber that carries messages to the cell body of a nerve cell

**Frontal lobes:** a part of the cortex that is involved in thinking and planning

**Hemispheres:** the two halves of the cerebrum
**Hippocampus:** a pan of the brain that is somehow involved in turning short-term memories into long-term memories

**Hypothalamus:** small structure inside the cerebrum; among other things, regulates body temperature and appetite and is the center of emotions

**Long-term memories:** memories that last a long time

**Medulla:** part of the brain stem

**Motor cortex:** the part of the cortex involved in giving instructions for muscle movements

**Motor neurons:** nerve cells that carry messages from the brain to muscles

**MRI (magnetic resonance image):** a way of imaging that provides fine detail of different brain structures

**Neuron:** nerve cell

**Peripheral nervous system:** network of nerves that branch off of the central nervous system and carry signals to and from all parts of the body

**PET scan:** a way of providing images of the brain that indicate brain activity

**Reflex:** a response by the body that does not involve the brain
**Sensory cortex (sensory strip):** a part of the cerebral cortex that is involved in receiving tactile signals

**Sensory neurons:** nerve cells that carry messages from sense organs to the brain or spinal cord

**Short-term memories:** memories that last only a few minutes

**Spinal cord:** bundle of nerves that runs from the brain down the back; part of the central nervous system

**Synapse:** the gap between the dendrite of one neuron and the axon of another

**Transmitters:** chemicals that relay signals across the synapse that separates the axon of one neuron from the dendrite of another

**Visual cortex:** the part of the cortex that interprets signals from the eyes
BIBLIOGRAPHY


Related Videos from Rainbow

Breath of Life: The Respiratory System
Food into Fuel: Our Digestive System
Pumping Life: The Heart and Circulatory System
Our Flexible Frame: The Skeletal and Muscular Systems
Male Narrator

As this gymnast practices, many things happen at the same time.

Her senses provide information about where she is and where she needs to move.

Her heart pumps faster and her rate of breathing increases...

She may pause a moment to think ahead and plan what she is going to do...

And when she acts upon her plans, every movement involves the carefully coordinated actions of hundreds of different muscles.

All these things—the gymnast's movements, thoughts, feelings and sensations- are controlled by one system in her body.

This system is the nervous system...

And at the center of this system is the body's most remarkable and complex organ...the human brain.

TITLE: In Control: Our Brain and Nervous System
In some ways, the nervous system is like a telephone system. We normally see only a small part of this system...the telephones through which we speak and listen.

But what makes this system possible is a vast network of wires, optical fibers, and underground cables that transport many of our messages.

And all this is coordinated by a network control center that makes it possible for people in different parts of the country to communicate.

Like a telephone system, the nervous system is a communications network. It allows different parts of the body to communicate and exchange information.

The control center of this system is the brain. The brain coordinates most of the activities of the nervous system.

Most messages reach or leave the brain through the spinal cord. The spinal cord stretches from the brain about halfway down the back. Together, the brain and spinal cord form the central nervous system.

The peripheral nervous system spreads out from the central nervous system. It connects the central nervous system to muscles throughout the body. It also
links the central nervous system to sense organs such as our eyes and ears.

**Male Narrator**

In a telephone system, our voices become signals. Often, these signals travel back and forth over wires or cables.

In the nervous system, messages are carried by nerves. Nerves are made up of nerve cells, which are also called neurons.

There are different kinds of neurons, but they all have the same basic structure. The main part of a neuron is the cell body. It looks a little like a knot with lots of threads coming out of it.

Most of these threads are short. These are called **dendrites**.

Each neuron also has a single long thread called the **axon**. In some neurons, like those that go from the spinal cord to our toes, the axon is as long as three feet.

Together, the neurons of the brain and nervous system provide pathways along which messages can travel throughout the body.

These messages travel as electrical signals from the dendrite through the cell body and along the axon of
each neuron. A signal is then passed to the dendrite of the next neuron and continues on its way.

But neurons don't actually touch each other. Between the axon of one neuron and the dendrite of another there is a tiny space called a synapse.

When an electrical signal reaches the end of an axon, it triggers chemicals called transmitters. Electrical signals then become chemical ones as the transmitters cross the synapse. When they reach the dendrite of the next neuron, they spark a new electrical signal that then travels the length of that nerve cell.

Female Narrator

In this way, neurons are like runners in a relay race in which the baton is the message. Each runner carries the baton for part of the way and then hands it off to the next runner, who carries it farther.

The signals that travel from neuron to neuron make it possible for the body to function. There are many different pathways these signals can take.

There are billions of nerve cells in the nervous system...over 10 billion in the brain alone. Where signals start, what pathways they take, and where they end up determine what we think and do.
These signals also determine how we perceive the world around us through our senses. For example, when you put a hand into water, signals travel along special nerve cells called sensory neurons. These sensory neurons go to the spinal cord.

Here, other nerve cells pick up the signals and send them to the brain. The brain then figures out what these signals mean so that we sense that the water is wet and what its temperature is.

**Male Narrator**

But even as the brain is receiving messages from sensory nerves, it sends out signals along other neuron pathways that tell our bodies how to act. This image, magnified many thousands of times, shows the axon of a nerve cell draped over a muscle fiber. This kind of nerve cell is called a *motor neuron*. Motor neurons carry messages from the brain to muscles and cause them to move.

Almost everything we do involves both sensory neurons and motor neurons. A batter's eyes send signals along sensory neurons so that the brain can figure out a ball's speed and location,

and based on this information the brain sends messages along motor neurons to muscles that make it possible to hit the ball.
In almost everything we sense or do, the brain is similarly involved by both receiving and sending signals.

**Female Narrator**

But there are situations in which nerve signals do not involve the brain. When you touch a hot iron, you jerk your hand back even before you feel any pain.

This is called a reflex. A reflex is faster than other actions because it bypasses the brain.

When you touch something hot, for example, messages race along sensory neurons to the spinal cord.

The spinal cord then sends messages immediately back along motor neurons to muscles in the hand and arm, signalling them to pull back.

Meanwhile, other signals have reached the brain. The brain interprets these signals as pain, but by this time you have already reacted by pulling back your hand and arm.

In this way, reflexes protect you from things that might seriously harm you if you reacted more slowly.

**Male Narrator**

Reflexes are an exception, however. Most of the time the brain plays the central role in the activities of the
nervous system. Weighing only about three pounds, the brain is an unimpressive looking organ.

But more than anything, it is the brain that makes each person unique. If we could somehow change our looks, each of us would still be essentially the same person because the brain would remain the same...and the brain is the center of all our thoughts, memories, and emotions.

All civilization is a tribute to the abilities and creativity of the brain. The bridges, buildings, and highways of our cities...

our music, art, and literature...

the accomplishments of our scientists and engineers— in fact, all human accomplishment reflects the power of the brain.

**Female Narrator**

It is only natural that the brain itself has been the subject of intense interest. Scientists have been trying to determine how the brain functions and what different parts of the brain do.

A guided tour of the brain could begin with the brain stem, a bulge at the top of the spinal cord. Here we see a cutaway view of the brain in order to see the brain stem more clearly. The brain stem takes care of many of the things that our body needs to do to stay alive.
One part of the brain stem is called the *medulla*. It controls our breathing and makes sure that the heart pumps blood. Because the medulla does these things automatically, we don't have to think about them.

**Male Narrator**

Nestled in the back of the brain is the *cerebellum*. This part of the brain controls our sense of balance.

The cerebellum also coordinates the actions of many different muscles so that they function smoothly together.

Without the cerebellum, it would be impossible for a gymnast to take even a simple step without falling, much less do a series of tumbles.

**Female Narrator**

The largest part of the human brain is the *cerebrum*. The cerebrum sets humans apart from other forms of life. No other animal has a cerebrum as well developed as humans.

Deep inside the cerebrum, just above the brain stem is a pea-sized part of the brain called the *hypothalamus*. The hypothalamus is the body's thermostat. It regulates the temperature of our blood.

It also regulates our appetite... making us feel hungry when our bodies need food and full when we have
eaten enough.

The hypothalamus also plays a key role in our emotions.

It somehow affects the different feelings that have always fascinated artists, including happiness... sadness... and fear.

**Male Narrator**

Perhaps the most studied part of the cerebrum is its outermost layer, the *cerebral cortex*. With its many folds and grooves, the cortex gives the cerebrum its walnut-like appearance.

If we cut through the cerebrum, we would see that the cerebral cortex is only about the thickness of a popsicle stick. However, its folds and grooves dramatically increase the amount of its surface area.

In this way, the cerebral cortex is like the page of a newspaper that is crumpled so that it is small enough to fit in our hand.

Spread out it would cover most of a table top. In the same way the many folds of the cortex make it possible for it to fit inside the confined space of the skull. Just as many words can cover the page of a newspaper...
the large surface of the cortex allows it to contain the biggest share of the nerve cells in the brain...over 9 billion. Scientists have been able to map parts of the cerebral cortex and identify what different areas do.

**Female Narrator**

Among the things they have discovered is that several distinct areas of the cortex are involved in how we perceive things with our senses.

A carnival, for example, delights us with different colors and patterns and the sounds of music and voices.

Our eyes and ears pick up these sights and sounds and send signals to different parts of the cortex.

Signals from our eyes are interpreted by an area called the visual cortex at the back of the brain...

while signals from the ears are interpreted by the auditory cortex on either side of the brain.

Another part of the cortex, the sensory strip, is associated with our sense of touch.

The sensory strip allows us to feel the leather and seams of a baseball.

Throwing the ball involves still another part of the cortex.
This part is called the motor cortex. Scientists have discovered that different areas of the motor cortex control muscles in specific parts of the body and that larger areas are devoted to those muscles that require more finely tuned movements.

The area of the motor cortex controlling a hand and fingers is very large—larger, in fact, than the area controlling a leg.

This makes it possible for a person to play a piano or do other things requiring complex movements of the hands and fingers.

Perhaps the most intriguing areas of the cortex are the frontal lobes...one on each side of the brain. Their importance to human activity is immense.

Among other things, the frontal lobes are the thinking parts of the brain. When we play a game of chess, the frontal lobes plan the next move or even many moves ahead.

Male Narrator

Our actions and thoughts are linked to another feature of the cerebrum and cerebral cortex.

The cerebrum is divided into halves or hemispheres, and each hemisphere controls the movements of the opposite side of the body.
If we write with our right hand, it is the motor cortex of the left hemisphere that controls how we move the muscles of the right hand and fingers.

The right hemisphere controls muscles on the left side of the body. Each hemisphere also receives signals from sense organs on the opposite side of the body...

so that what the left eye sees is made sense of by the visual cortex on the right half of the brain.

The two halves of the cerebrum are connected and work together, but each half also seems to have special abilities and to work in different ways.

The right side is sometimes called the artistic brain. It is connected more with visual skills such as those used in drawing a picture.

The left side of the cerebrum is sometimes called the logical brain. It controls how we solve a math problem.

The left side also seems to be the stronger side in terms of understanding words, whether they are spoken or written on a page.

**Female Narrator**

Scientists have learned much about how the brain works, but many challenges remain. For example, we
still understand little about how memories are formed, where they are stored, and how they are recalled.

We do know that there are different kinds of memory. Sometimes we need to remember something for a short time...like a telephone number.

Look at this number and try to memorize it.

Now even though the number is covered, you may be able to recall it, at least for a while.

This kind of memory is known as short-term memory. We rely on short term memory for things like phone numbers and short shopping lists. We usually remember such things just long enough to do what we need to do...like dial a number.

If we use a phone number frequently enough, however, it may become part of long-term memory. Long-term memory is more permanent and involves things that are important to us for some reason.

**Male Narrator**

Long term memories can last a lifetime. Old people often have vivid memories of friends, places and events in their past. In fact, their memories of things that happened long ago are sometimes more vivid than their memories of something that happened much more recently.
How long-term memories are formed, however, remains one of the brain's most puzzling mysteries.

But scientists have learned that a part of the brain called the hippocampus is somehow involved in changing short-term memories into long-term ones.

The importance of the hippocampus became evident partly from studying an unfortunate patient whom doctors called "H".

"H" had an operation in which his hippocampus was removed. As a result, he couldn't form any new long-term memories.

He might read the same magazine over and over again, and the information would always seem new to him.

People he would see every day seemed like strangers to him because he couldn't remember them from the day before.

And yet "H" had no trouble remembering people he knew or experiences that occurred before his hippocampus was removed.

**Female Narrator**

Besides memory, there are many other things about the brain we still don't clearly understand, but researchers now have sophisticated tools that can help them.
This picture of the brain is a magnetic resonance image, or MRI. MRIs provide images so precise that it is possible to distinguish features as small as a millimeter across.

Another tool, called a PET scan, is valuable for seeing how active the brain is in different circumstances.

For example, researchers have used PET scans to track brain activity of people while they played the video game Tetris.

They've learned that a person's brain is much more active when he is just learning the game than after he has had some practice.

Here is a PET scan of a novice Tetris player. The bright reds and yellows show parts of the brain that are very active.

After practice, the red and yellow areas are much smaller, and this seems to indicate that with learning, the brain functions with less effort

**Male Narrator**

Other research focuses on the ways different drugs affect how signals are transmitted along the neuron pathways that make up the nervous system.

We saw earlier that chemicals called transmitters relay these signals across the tiny gap that separates the axon of one neuron from the dendrite of another.
Scientists have learned a great deal about how different drugs can affect how transmitters function.

Aspirin, for example, can relieve a headache by blocking transmitters in the part of the brain that normally tells us we're feeling pain.

But the effect of chemicals on the brain can be harmful. Alcohol, for example, is a kind of *depressant*, a drug that slows down signals in the nervous system. For this reason alcohol can make a person clumsy and unable to think clearly.

Other kinds of drugs, called *stimulants*, speed up signals in the nervous system. Cocaine and crack are stimulant drugs that can cause a person's brain to work in unpredictable and destructive ways. Researchers are studying the effects of such drugs and why people become addicted to them.

**Female Narrator**

The brain is the most complex organ of the body. Some people say that it is the most complex thing that we have discovered in the universe.

In this program, we've seen how the brain is the center of the body's nervous system, the communications network that is necessary for everything we do.

This network is made up of billions of nerve cells or neurons,
and these nerve cells provide pathways for signals that reach all parts of the body.

Male Narrator

We've seen that when we put a hand into water, signals travel along sensory nerves to the spinal cord and then to the brain, which interprets these signals and makes it possible to feel how cold the ocean is.

We've also looked at how signals from the brain to muscles make it possible to hit a ball.

Female Narrator

We've looked at the different parts of the brain.

The brain stem controls many of the body's functions that keep us alive.

Among other things, the brain stem regulates our breathing and heart rate, and it does these things without our having to think about them.

Male Narrator

The cerebellum controls our sense of balance and coordinates the actions of many different muscles... making it possible for a gymnast to perform somersaults and flips.
Female Narrator

We've looked at the cerebrum and particularly at some of the parts of its outermost layer, the cerebral cortex.

One part, the auditory cortex, processes signals from our ears...

while another area, the visual cortex, processes signals from the eyes.

Together, the auditory and visual cortices make it possible to appreciate the sights and sounds of a carnival.

Male Narrator

Perhaps the most interesting parts of all are the frontal lobes...for it is the frontal lobes with which we think and plan ahead.

Female Narrator

We also have seen that the cerebrum is divided into halves...

and that each half controls and receives signals from the opposite side of the body..
Male Narrator

There is much about the brain that we still don't understand. For example, how are memories formed, where are they stored, and how are they retrieved?

But as we learn more about the brain, well learn more about ourselves...

for more than anything, it is the brain that defines who we are and what we do.

END
IN CONTROL: OUR BRAIN AND NERVOUS SYSTEM

DIRECTIONS: Select the answer from the four choices given. Circle the correct letter.

1. The human body is quite remarkable and there are specific body systems that make it function so well. The ____ and nervous system controls our thoughts, feelings and all the ways we respond to the world around us. It is a complex body system, but we can understand it.

2. The main organ of the nervous system is the brain. The next important component is which extends from the brain halfway down the back. This part of the system connects the millions of nerves throughout the body to the brain so that we can send and receive messages.

3. The millions of nerves receive messages from all parts of the body and the brain responds to them in various ways. This ____, or nerve, is made up of various parts. One part of a nerve is the dendrites which are the fine thread-like projections that pick up sensory signals.

4. There are specific types of neurons found throughout the body. One type is called a and its job is to transmit messages from the brain to the muscles. When the brain interprets a signal it relays a message that causes the neurons to act.

5. The brain is a complicated organ with specific parts. The largest part of the brain is the ____, and it is the thinking portion of the brain. Humans have the largest brain among all the animals.

6. The front part of our brain enables us to balance. This part, called the which is smaller than the cerebrum. It is also responsible for helping to coordinate our muscular system that provides ease of movement as we walk, run and play.

7. Deep inside the brain is another vital component. The ___ regulates the temperature of our blood. That is why warm blooded creatures like mammals can live where the outside temperatures might be very hot or very cold. This part of the brain is tiny, yet it is very important.

8. There is one area of the brain that has been the most studied. That is the ____, which is the outermost layer of the brain. It is made up of many folds and grooves, and processes all of the sensory messages from our environment.

9. Our brains and bodies can be affected by chemicals in foods as well as drugs. Substances such as alcohol act as a ____ on the brain. When we take this drug we slow down in terms of our reflexes and ability to think. This substance is harmful to other body parts, too.

10. There are other drugs that affect the brain and body in other ways. Substances like caffeine in soda and coffee act as ____ on the brain. There are more harmful drugs like cocaine and crack that can be very destructive to the brain and body in general. In fact, death can result from using these.

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