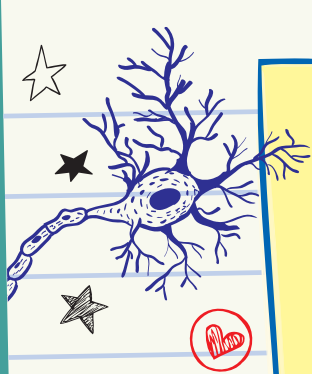


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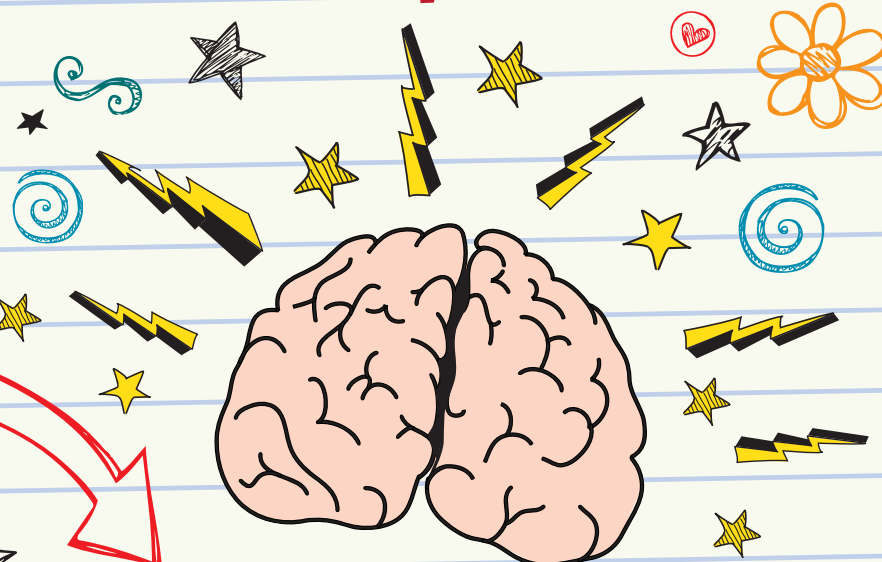
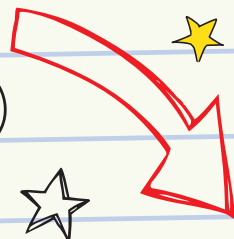
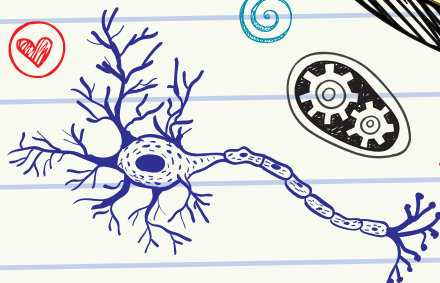
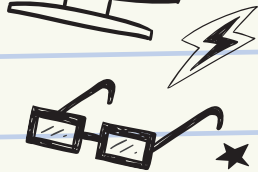
# HEALTH



# ROCKS!



## Get inside your brain



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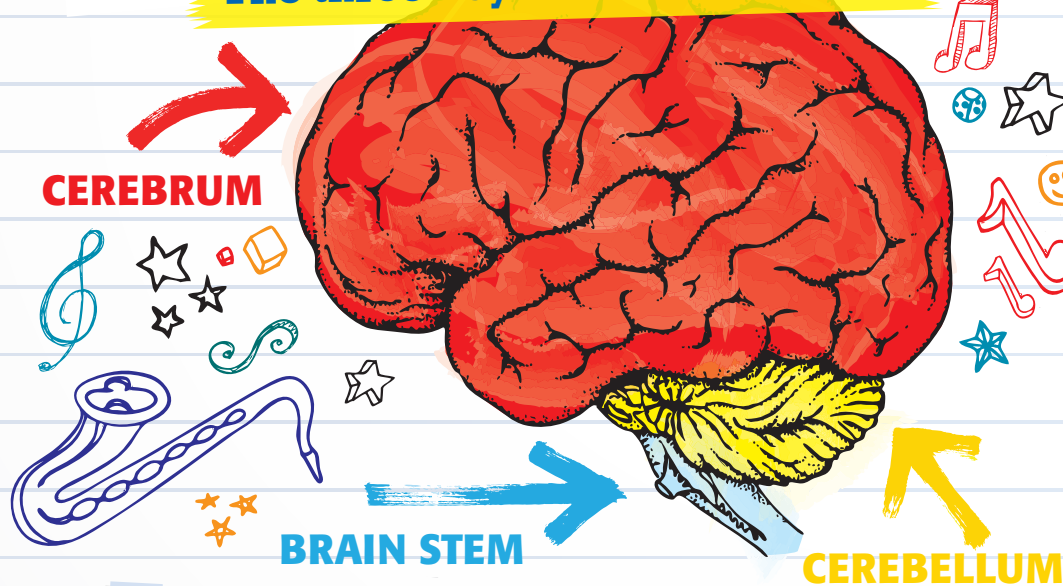


# Who's the boss? Your brain, that's who!

Meet the boss of your body: the brain. Most people associate the brain with thinking and reasoning, but it does a lot more than keep you smart – it keeps you alive. Your brain, part of the nervous system, is responsible for subconscious functions such as breathing, blinking and keeping our hearts beating.

Speaking of hearts, it's your brain – not your heart – that controls your emotions. It also keeps you balanced and controls every movement, from playing video games to brushing your teeth. That's a lot of work for one system of your body!

## The three key areas of the brain:



Try it! Create a dough brain

**ACTIVITY**

### Materials:

1.5 cups of instant potato flakes  
2.5 cups of hot water  
2 cups of clean sand  
1 gallon zip-lock bag

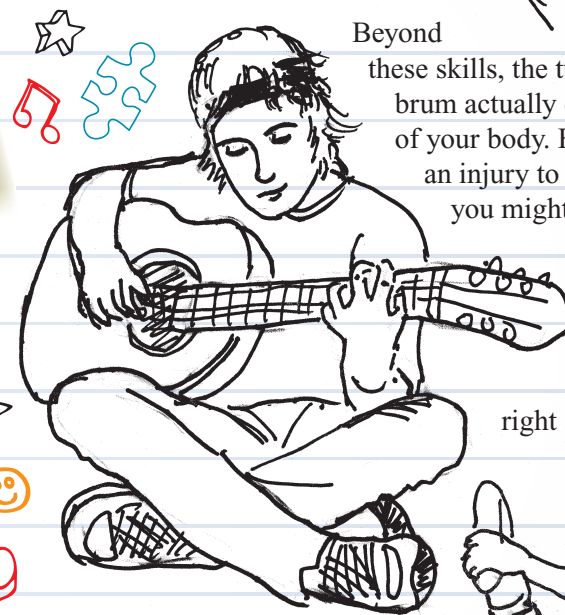
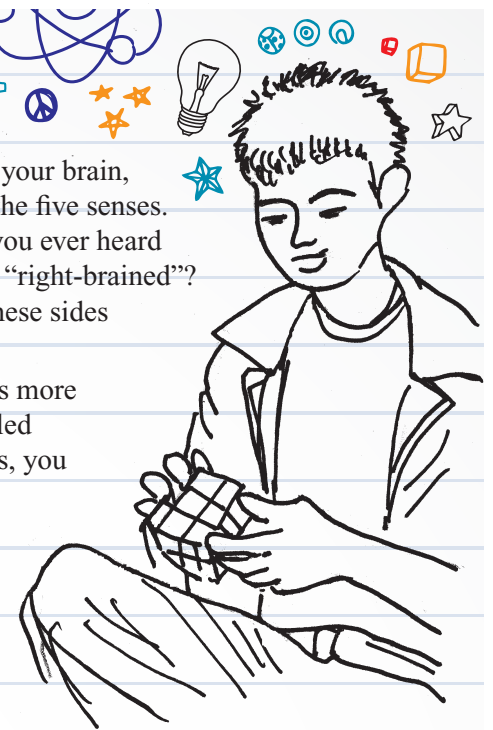
Combine the ingredients in a zip-lock bag and mix thoroughly. It should weigh about 3 pounds and have the consistency of a real brain.

## Cerebrum

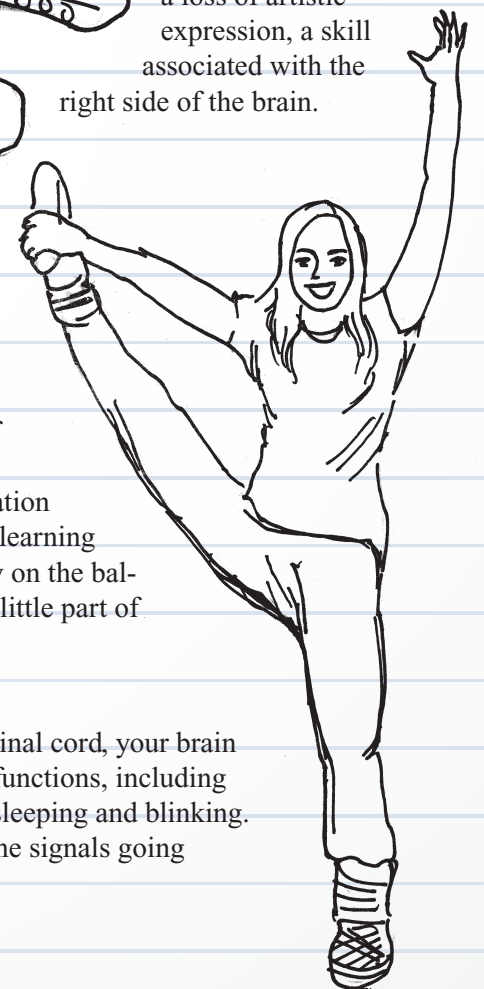
The cerebrum is the biggest part of your brain, controlling thinking, speaking and the five senses. It is divided into two halves. Have you ever heard that you are more “left-brained” or “right-brained”? Those terms come from the skills these sides of the brain control.

Left-brained people are described as more logical and analytical; if you're skilled at math, reasoning and logic puzzles, you are more left-brained. Conversely, right-brained people are described as being more intuitive, creative and artistic.

Which type describes you better?



Beyond these skills, the two halves of your cerebrum actually control the opposite sides of your body. For example, if you suffer an injury to the right half of your brain, you might have trouble controlling your left hand. Some people even experience a loss of artistic expression, a skill associated with the right side of the brain.



## Cerebellum

The cerebellum, located below the cerebrum, is the smaller section of your brain. It monitors your motor skills, such as movement, coordination and balance. The next time you're learning a new dance move or trying to stay on the balance beam, think of how hard this little part of your brain is working.

## Brain stem

Connecting the cerebrum to the spinal cord, your brain stem controls many of your basic functions, including your heartbeat, breathing, eating, sleeping and blinking. Your brain stem also coordinates the signals going from your brain to your body.

# Neurons – 100 billion mighty messengers working hard for you

In addition to your brain, your nervous system also includes neurons. While your cerebrum, cerebellum and brain stem manage functions throughout your body, neurons are busy transmitting messages to make these functions happen. You have about 100 billion neurons in your body; like the components of a computer, neurons work together to get the job done.

**BRAIN SIGNALS**, shown here as a dotted line, are electro-chemical messages that travel from one neuron to the next to carry information throughout the nervous system.

**NEURONS** — nerve cells — create and transmit electro-chemical messages throughout your brain body.

**GLIAL CELLS** are often overlooked, but they play an important role in supporting, protecting and nourishing neurons.

**AXONS** send signals from the cell body out to other neurons. Signals can also go to muscles, glands and organs.

**DENDRITES** receive signals from other neurons.

**SYNAPSES** occur where signals pass from one neuron to another. The neurons don't quite touch, so they release chemicals — called neurotransmitters — to send signals across the gap.

## DRUGS CAUSE MISSED CONNECTIONS

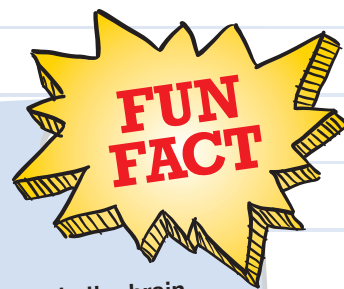
Your neurons are used to communicating with each other. But when drugs enter the body, they alter the neurons' communication style. Different drugs affect your nervous system in different ways. For example:

### Caffeine

Yes, caffeine is a drug. Ingesting it alters the natural process of your brain that monitors your nerve stimulation. When you consume food or beverages containing caffeine — such as soda, coffee, energy drinks or chocolate — the nerve transmissions across synapses speed up. This can increase alertness but can also cause insomnia or headaches, reduce coordination, raise your heart rate and constrict your blood vessels.

### Marijuana

A chemical in marijuana called THC affects the activity of nerve synapses in your brain. It connects to cannabinoid receptors, changing the typical nerve activity and interfering with processes in your cerebrum, including memory, concentration and perception. THC also affects movement controlled by your cerebellum. In other words, it slows down your thinking, coordination and reflexes.



Without any words, you may be able to determine whether someone is happy, sad or angry just by reading his or her face. A small area in the brain called the amygdala is responsible for your ability to “read” someone else's face for clues as to how they are feeling.



## Human brains vs. animal brains

All vertebrates, or animals with a backbone, have the same three parts of the brain (cerebrum, cerebellum and brain stem) that humans do. The difference is in the size, shape and weight of the brain.









Larger brains don't necessarily equal more intelligence, though; comparing the weight of a vertebrate's brain to its total body weight is a more accurate measure. For example, an adult human brain weighs about 3 pounds, making an average brain-to-body ratio of about 2%. Elephants have much larger brains, but their overall weight gives them a brain-to-body ratio of only 0.15%.

Which animal brain do you think is about the same weight as a human brain? Which do you think is double the weight? Half of the weight?

### Activity

#### Match the animals to their brains

(Note: There are 453.6 grams in a pound)

Animal	Weight of brain (in grams)
 Hamster	234
 Cat	2,940
 Dog (beagle)	1.5
 Bear	532
 Horse	72
 Human (adult)	6,000
 Whale	30
 Elephant	1,350

Answers: Hamster 1.5g, Cat 30g, Dog 72g, Bear 234g, Horse 532g, Human 1,350g, Whale 2,940g, Elephant 6,000g

## Let's take a close-up look at lobes

You already know that your brain has three main parts. The largest, the cerebrum, can be divided even further into four sections. Let's take a look at how these sections, called lobes, control your body's different functions.

### FRONTAL LOBE

The frontal lobe, located just behind your forehead, controls your reasoning, thoughts, memories, decision-making, problem-solving, planning and emotions. Since your frontal lobe is responsible for your ideas and emotions, it essentially makes you who you are. When you experience a change in mood or get a great idea, that's the unique work of your frontal lobe.

### PARIETAL LOBE

Your parietal lobe is responsible for processing information at work telling you to be careful. It's also responsible for sending messages about the books you're reading to your spatial awareness. Ever wonder why your fingers and other parts of your body, and face have many muscles?



### TEMPORAL LOBE

The temporal lobe is located at the bottom of your cerebrum. This lobe controls your sense of hearing, taste and smell and the

## PARIETAL LOBE

Responsible for your sense of touch and sense of space. For example, like standing near a bonfire, your parietal lobe is receiving information. When you are at school, your parietal lobe is receiving information from you're flipping through. Your parietal lobe also controls your sense of touch. For example, the students sitting near you in class. Your fingers and face are so much more sensitive to touch than your legs or back? That's because your fingers have more touch receptors than other parts of your body.



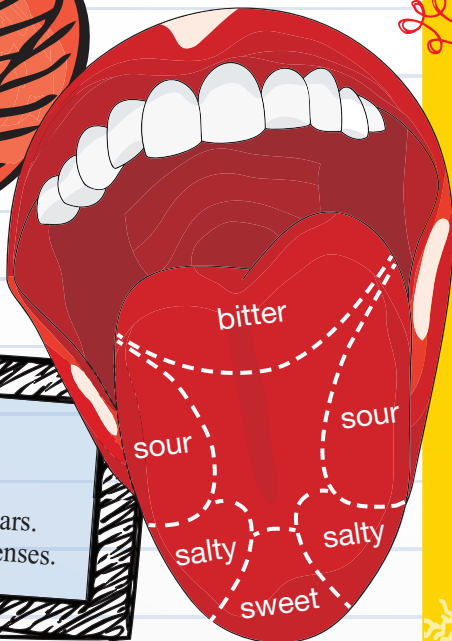
## OCCIPITAL LOBE

Your occipital lobe controls your vision and visual memories. It is also the part of the brain where dreams originate.



## TEMPORAL LOBE

Responsible for taking up the space between your ears. It is also responsible for the memories associated with these senses.



## Activity

### Competing senses

The Stroop effect, a phenomenon discovered by psychologist Ridley Stroop, illustrates how different regions of the brain control different senses. Since the frontal lobe interprets words and the occipital lobe interprets color, there is a conflict in the way your brain processes the two pieces of information.

Look at the following words one at a time. Each time, identify the color of ink the word is written in. How did you do? Do you think looking at the words upside-down or taking the test again would improve your ability to name the correct color?

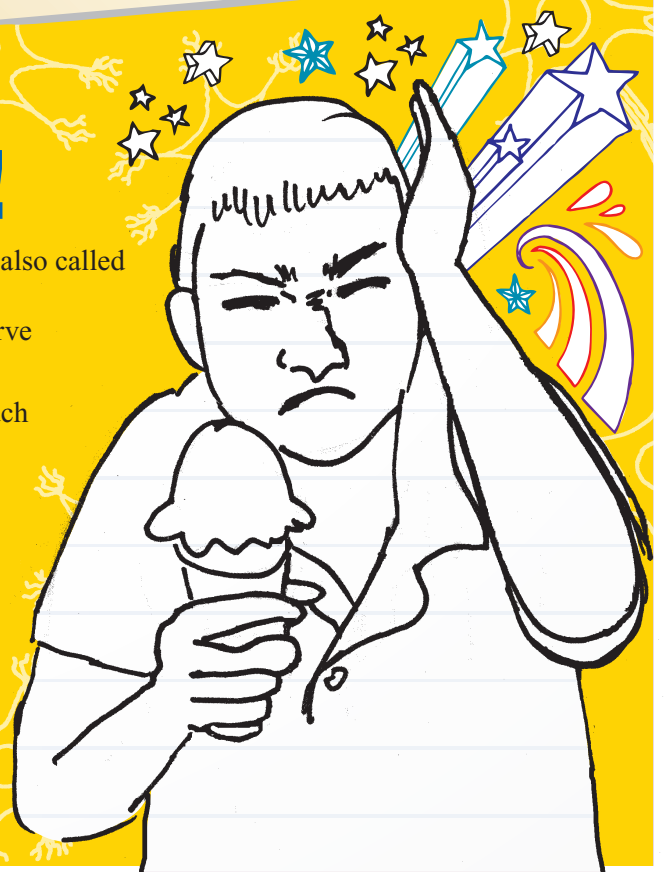
**Green Red Orange**  
**Brown White**  
**Pink Green Yellow**

## Brain freeze!

You've probably heard the term "brain freeze" (also called "ice-cream headache"). Has that ever happened to you? If so, what you are experiencing is a nerve response to the cold.

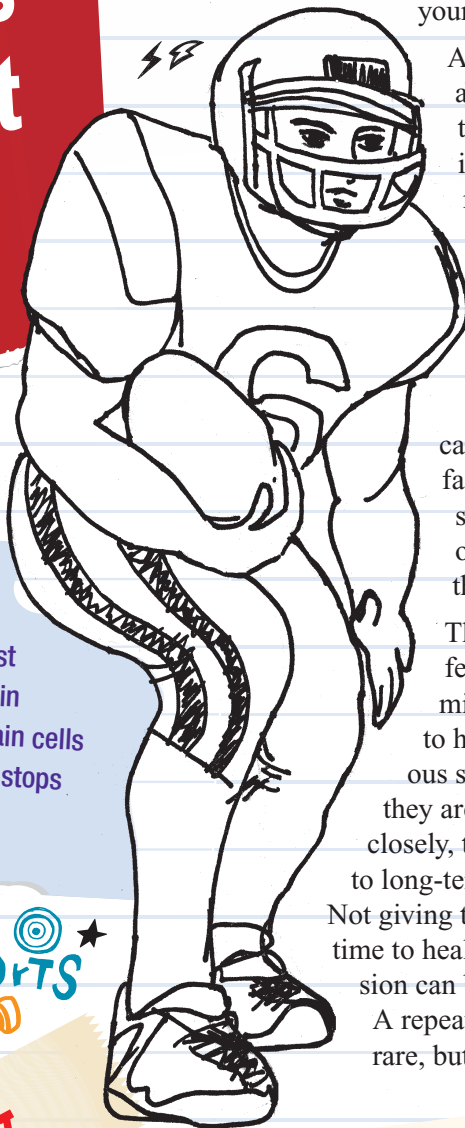
When foods such as ice cream or smoothies touch the roof of your mouth (your palate), the nerves send a signal to your temporal lobe that you are eating something cold. Blood vessels contract and expand to regulate body temperature. This rapid constriction and swelling results in a brief headache.

To prevent brain freeze, try consuming cold food or drinks more slowly. If it happens, put your tongue up against the roof of your mouth for a few seconds to help calm the nerve activity.



# What happens when you hurt your head?

Your brain controls so many functions; an injury to even a small area can have lasting consequences. Traumatic brain injury occurs when something hits your head, or when your head hits something hard, and your brain moves inside your skull.



A concussion is a type of mild traumatic brain injury. It temporarily alters the way the brain works and can last for varying lengths of time. Traumatic brain injury can be caused by falls, car crashes, sports injuries or any blow to the head.

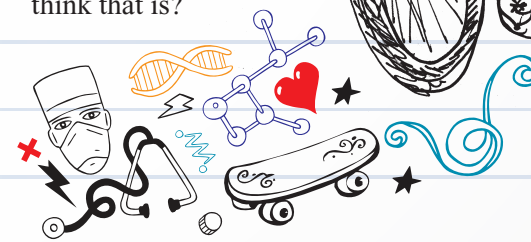
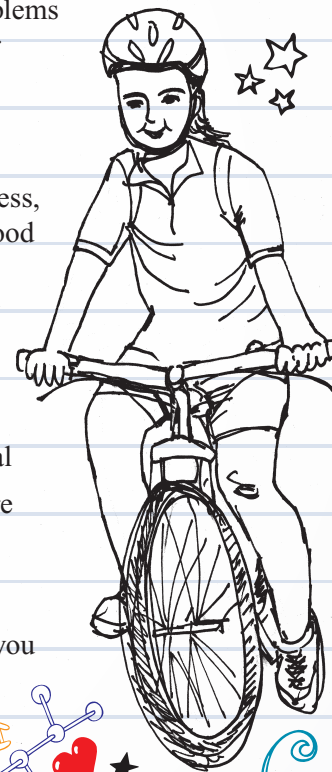
Those who suffer a concussion might not appear to have any serious symptoms, but if they aren't monitored closely, they could lead to long-term problems. Not giving the brain enough time to heal after a concussion can be dangerous. A repeat concussion is rare, but can occur

before the brain heals from the first one. This can increase the chances for long-term health problems. In fact, Washington law requires that people wait 24 hours before participating in a sport after getting a brain injury.

If you experience any of the symptoms below after a concussion, it's important to not participate in any high-risk activities, such as sports or PE, and to limit activities that require a lot of thinking or concentration. Otherwise, you could be at risk of further injury and even permanent brain damage.

Some symptoms of a mild traumatic brain injury, such as a concussion:

- Physical: Headaches, balance problems, sensitivity to light, nausea
  - Thinking: Problems concentrating or remembering, feeling foggy
  - Emotional: Irritability, sadness, nervousness, mood swings
  - Sleeping: Unusual drowsiness, sleeping more or less than usual
- Brain injuries are more common among men and people ages 15-19. Why do you think that is?



## FUN FACT

At birth, your brain was almost the same size as an adult brain and contained most of the brain cells for your whole life. Your brain stops growing at age 18.

3.1415926535897932384

## Activity

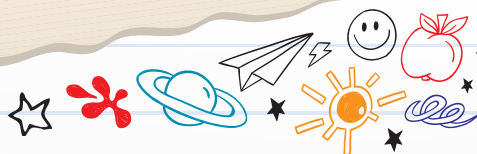
### Slice of pi

In math, the pi symbol ( $\pi$ ) represents a number that relates the measurements of different parts of a circle. Its exact value has an unlimited number of digits. Here are the first 20; how many can you remember?

3.1415926535897932384

## FUN FACT

You can't tickle yourself because your brain distinguishes between unexpected external touch and your own touch.



# How do we remember to remember?

## Short-term memory

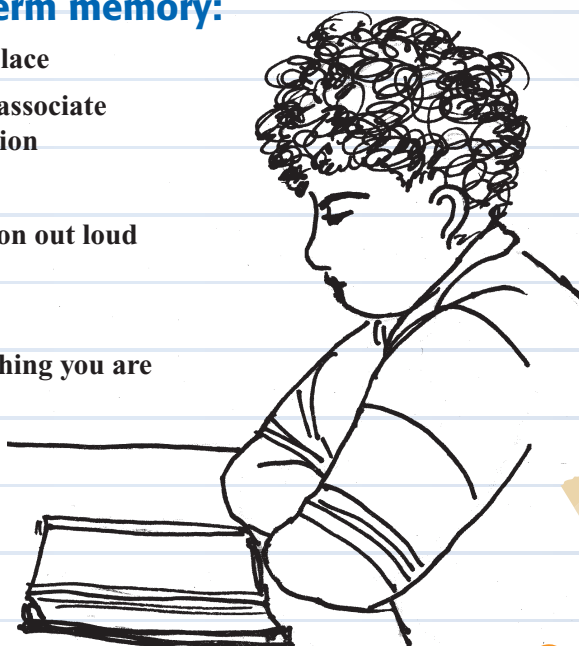
Which part of your brain controls your memory? If you answered cerebrum, congratulations — you have good short-term memory! We use our short-term memory when we look up information, apply or share it, and then forget it. Even though short-term memory can handle only six or seven things at a time, the good news is that it can be converted to long-term memory.

## Long-term memory

Long-term memory can store information for years. Because of that, retrieval is not as automatic as with short-term memory. Long-term memory actually contains three subsets of memories: procedural, such as learning to play a sport; semantic, such as memorizing state capitals; and episodic, such as remembering personal events.

## Try these study tips to retain information in your long-term memory:

- Study in a quiet place
- Create images to associate with the information
- Take notes
- Say the information out loud and repeat it
- Take breaks
- Relate it to something you are interested in
- Review what you learned
- Apply what you learned (use it or lose it!)



## Quick quiz

What type of long-term memory are you using when you are:

- Running through multiplication tables?
- Recalling when you met your best friend?
- Riding a bike after you haven't done it for a while?
- Thinking back to your favorite vacation?
- Reciting the alphabet?

### Sources:

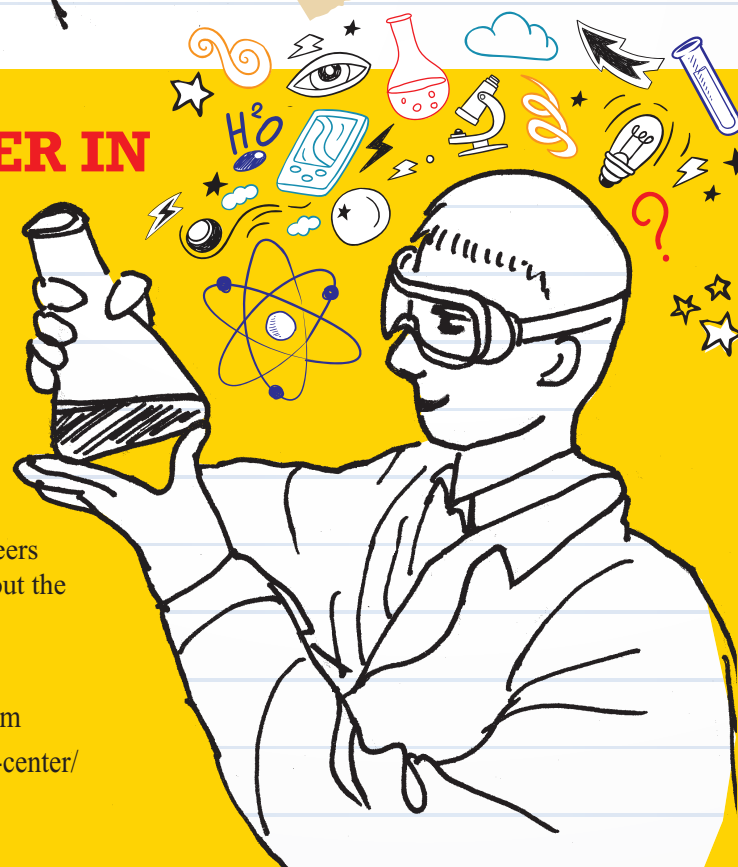
faculty.washington.edu/chudler/chmodel.html  
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alz.org/braintour/neuron\_forest.asp  
news-medical.net/health/What-is-the-Nervous-System.aspx  
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www.cdc.gov/concussion/headsup/pdf/ACE\_care\_plan\_school\_version\_a.pdf  
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www.cls.utk.edu/pdf/ls/Week3\_Lesson19.pdf  
teachhealthk-12.uthscsa.edu/curriculum/brain/pa03pdf/0303E-THO.pdf  
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teachervision.fen.com/tv/printables/structurebeginnerlesson2.pdf  
enchantedlearning.com/subjects/anatomy/brain/Animals.shtml  
faculty.washington.edu/chudler/facts.html

## CONSIDER A CAREER IN NEUROSCIENCE

Many professions across fields apply principles of neuroscience in their careers. Neurochemists and Neurobiologists study the nervous system in a research capacity, while psychiatrists utilize this knowledge in diagnosing and treating those with mental disorders. Pharmacists and those working in drug rehabilitation programs incorporate knowledge of neurons and chemical effects on the brain as part of their daily practice. What other careers can you think that apply what you have learned about the brain?

### Neuroscience career resources:

www.utdallas.edu/~kilgard/neuroscience\_careers.htm  
www.sfn.org/careers-and-training/neurojobs-career-center/careers-in-neuroscience



# CROSSWORD CONTEST

Enter to win a family membership to Pacific Science Center, behind-the-scenes tours, a family four-pack, swag from the store and much, much more!

## ACROSS

4. A type of drug that causes the nerve transmissions across synapses to speed up
5. Sends signals from the cell body out to other neurons
7. This brain weighs 1,350 grams
9. What sometimes happens when you eat something cold (two words)
12. This lobe is responsible for your sense of touch and sense of space
14. A part of the brain that is divided into two halves
15. If you are creative, you are using this side of the brain

## DOWN

1. This lobe controls your reasoning, thoughts, memories, decision-making, problem-solving, planning and emotions
2. Symptom of a mild traumatic brain injury
3. Like the components of a computer, these work together to get the job done
6. This lobe controls your vision and visual memories
8. When learning to dance, you use this
10. This type of memory helps you remember personal events
11. This lobe controls your sense of hearing, taste and smell and the memories associated with these senses
13. An easy way to protect your brain

Receive a complimentary composition notebook when you bring your entry form into your local Bartell Drugs store!



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### FIRST PRIZE

Family four-pack to Pacific Science Center plus IMAX, planetarium and a laser show

### SECOND PRIZE

Family four-pack to Pacific Science Center

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Parent or guardian name \_\_\_\_\_

Address \_\_\_\_\_

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Students can enter the contest by completing the crossword puzzle, filling out the entry form and dropping it off at a Bartell Drugs store or by mailing it to Bartell Drugs, 4025 Delridge Way SW, Suite 400, Seattle, WA 98106. Only children 8-15 years of age and living in Washington state are eligible for the contest. Deadline for all entries is September 20, 2013.

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