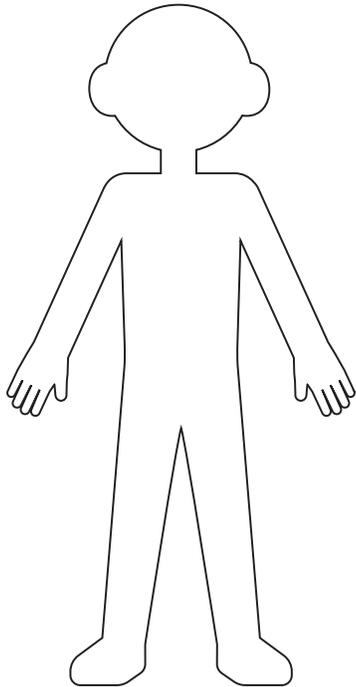


BRAIN WAVES

Activity Booklet

Create your character!



Name:

Grade:

Teacher:

Favourite activity or sport:



Contents

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Brain Waves Vision

To inspire children to learn about the vital role of the brain and spinal cord in our daily activities and to understand the importance of protecting themselves from injury.

Contact Information

BC Injury Research and Prevention Unit
F508 – 4480 Oak Street
Vancouver, BC, V6H 3V4
Email: bcinjury@bcchr.ca

Objectives

- To demonstrate the importance of the brain and its vital role in every aspect of life.
- To provide engaging hands-on science lessons showcasing the five senses.
- To introduce the concept of brain injury, including causes and consequences to one’s health.
- To support an understanding of concussions, including causes, signs, and symptoms.
- To motivate students to protect their brains through an interactive injury prevention component.
- To instill an injury prevention message for a lifetime!

About the BCIRPU

The BC Injury Research and Prevention Unit serves as a provincial hub, providing evidence-based research, surveillance, leadership, and coordination to provincial and national partners in order to reduce the societal and economic burden of injury among all age groups in British Columbia. Learn more at injuryresearch.bc.ca

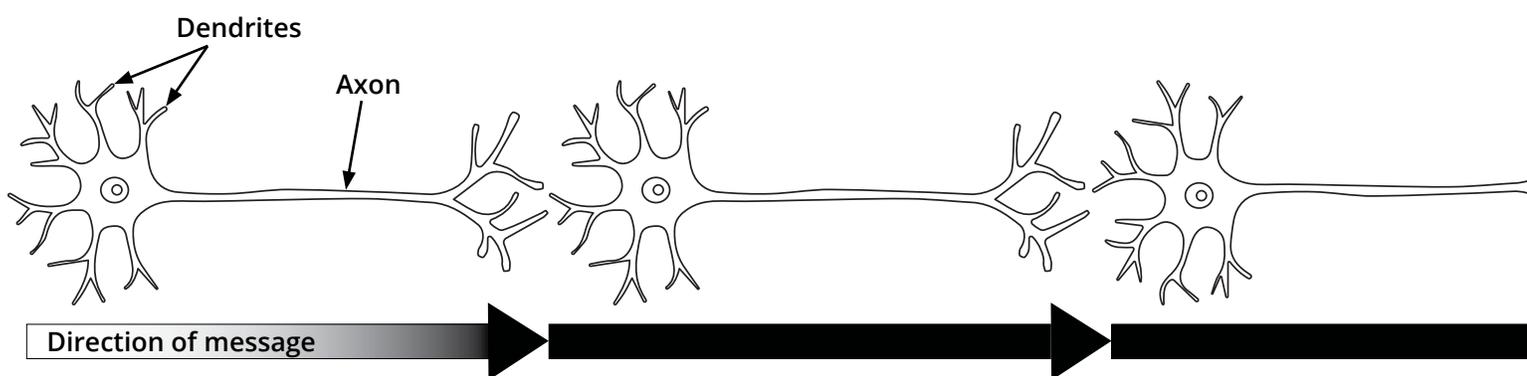
Parachute is a national charity dedicated to preventing injuries. Our aim is an injury-free Canada. Parachute wants to bring attention to the issue of preventable injury and to help people living in Canada reduce their risks of injury and enjoy long lives lived to the fullest. Learn more at parachute.ca

The Neuron

Your body is made up of tiny building blocks called **cells**—they're so small you need a microscope to see them! There are different kinds of cells for different jobs—they help you grow, heal, and think.

The human brain is made up of billions of special cells called **neurons**. Neurons work together to send signals all over the body through the spinal cord. This is done through special branches called **dendrites** and **axons**.

Dendrites receive signals from other neurons, and axons send signals away to other neurons.



If your neurons get damaged, they cannot repair themselves. This is why it is important to protect our brain and spinal cord.

Let's Investigate

A. Neurons repair themselves. **True / False**

B. _____ receive signals and _____ send signals.

C. Neurons travel to different parts of the body through the _____

Anatomy

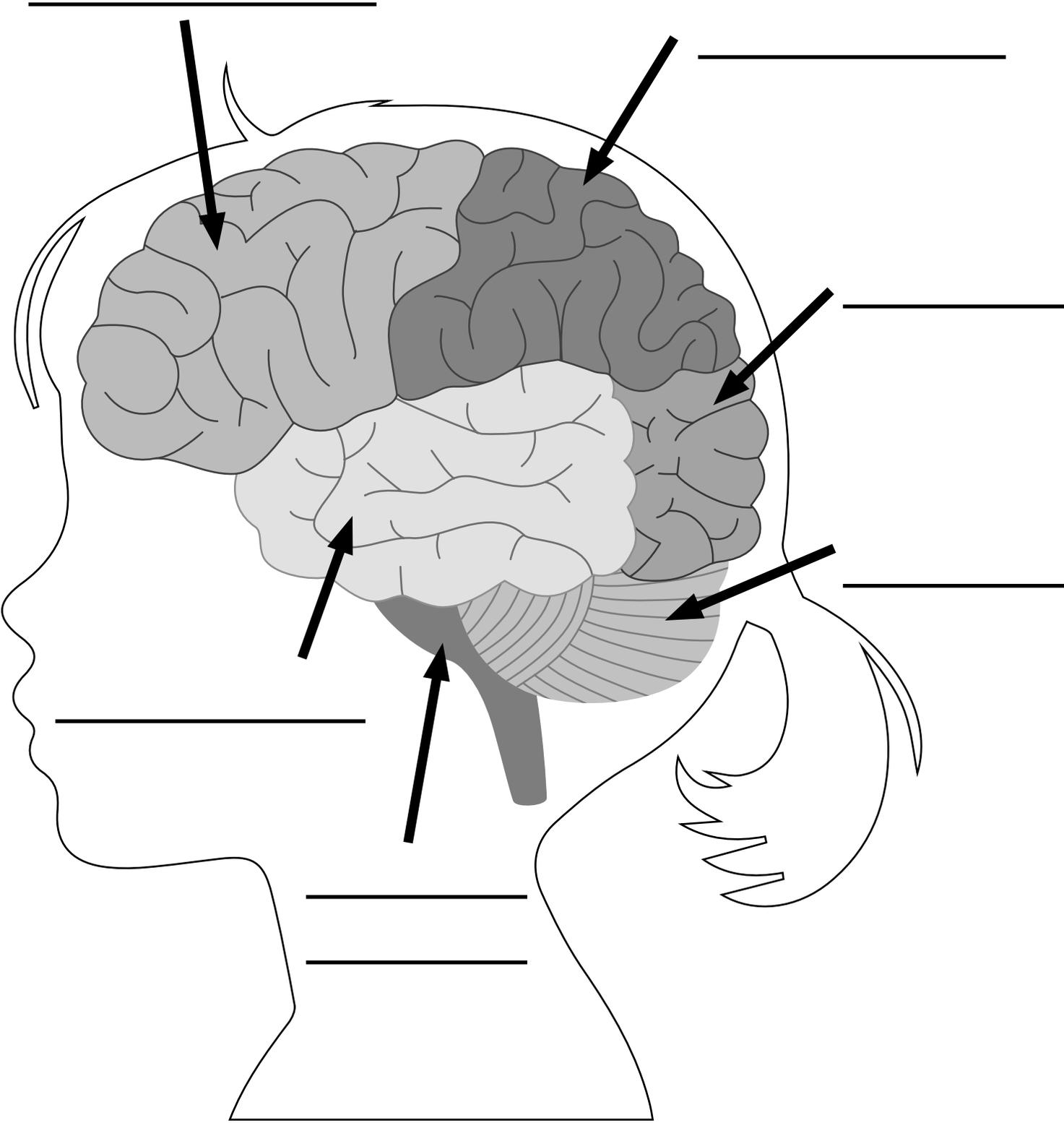
Your brain is important for everything that you do! The parts of your brain are called **lobes**, and there are four pairs that each help with something different.

- >> The **frontal lobe** is at the front of your brain. It helps you solve problems and make choices. It also helps shape your personality, making you who you are!
- >> The **parietal lobe** is at the top of your brain. It processes sensory and touch information, so you know what you are touching and tasting. It also allows you to move and react to things happening around you.
- >> The **temporal lobe** is on the side of your brain. It helps you hear sounds, understand smell and taste, make memories (in the hippocampus).
- >> The **occipital lobe** is at the back of your brain. It is in charge of your vision.
- >> The **cerebellum** is at the bottom of your brain. It coordinates your body movements and balance.
- >> The **brain stem** connects the brain to the spinal cord and controls essential life functions like heart rate, breathing, and body temperature.
- >> The **spinal cord** is the body's information highway and carries messages back and forth between the brain and the rest of the body.

! Match the Lobe to its Function

- | | |
|-------------------|---------------------------|
| 1. Occipital lobe | 1. Doing math homework |
| 2. Parietal lobe | 2. Smelling fresh cookies |
| 3. Frontal lobe | 3. Petting a soft puppy |
| 4. Temporal lobe | 4. Balancing on one foot |
| 5. Cerebellum | 5. Watching TV |

Label the Lobes



The 5 Senses

Smell

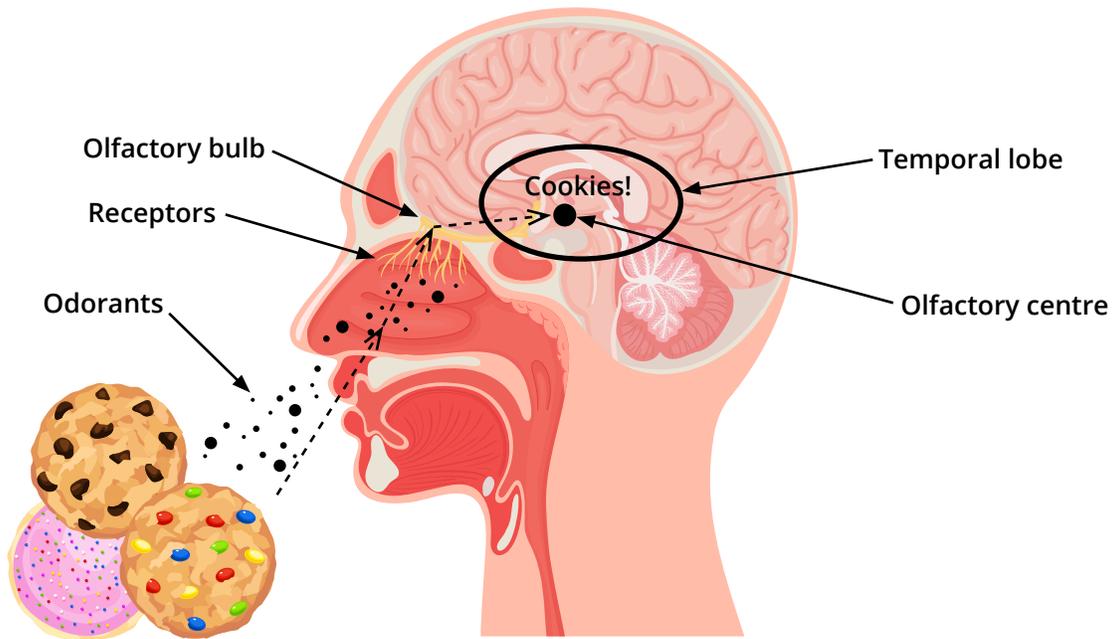
Our sense of smell lets us detect tiny chemicals in the air. It helps us enjoy pleasant smells, like fresh cookies, and notice not-so-nice ones, like stinky socks! Smells can warn us about danger, like when something is burning. Another name for the sense of smell is **olfaction**.



>>What are Receptors?

Receptors are used in all our senses. When a message hits a receptor, it sends a signal to the brain using neurons bundled into nerves.

Once an **odorant** lands on a receptor in your nose, a signal is sent to the **olfactory bulb**, a big group of neurons in your brain. That's when the brain tells us what we're smelling!



Let's Investigate

A. Where are the odorants received?

B. When the signal leaves the nose, where is it sent?

.....

Can a smell change?

Have you ever noticed that a smell seems to go away or get less strong? The smell isn't going away—you are actually getting used to the smell in the air. This is called **adaptation**.

As your smell receptors become used to a scent after a few minutes, the smell does not activate as many receptors.

The part of your brain that helps you to smell is right next to the **hippocampus**—the part that makes memories. That's why smells can trigger strong memories. For example, the smell of smoke might remind you of a cozy campfire—or warn you of danger.

Why did the nose feel tired?
Because it was always running!



Brain Food

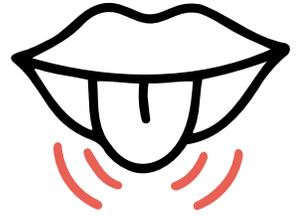
Some people do not have a sense of smell. This is called anosmia. A serious head injury may cause **anosmia**.

What kinds of good smells would you miss smelling if you had anosmia?

Can you think of any situations where anosmia could be dangerous for someone?

Taste

The tiny molecules in our food that help us taste are called **tastants**. They are released when we chew and break down food. Tastants move around our mouths and land on special receptors found in our **taste buds**—the little bumps on our tongue.



Once a tastant sticks to a receptor, a signal is sent to the parietal lobe to help figure out what kind of taste we are experiencing. The brain then helps us recognize whether something is **sweet, salty, sour, bitter, or umami**.

When you have a cold, your food doesn't taste as good. Why is that?

Smell and taste work together to bring out the flavour of our favourite foods. They help us know what is safe to eat and what might be spoiled or dangerous.

Brain Food

Can you think of different foods for each of the five different tastes?

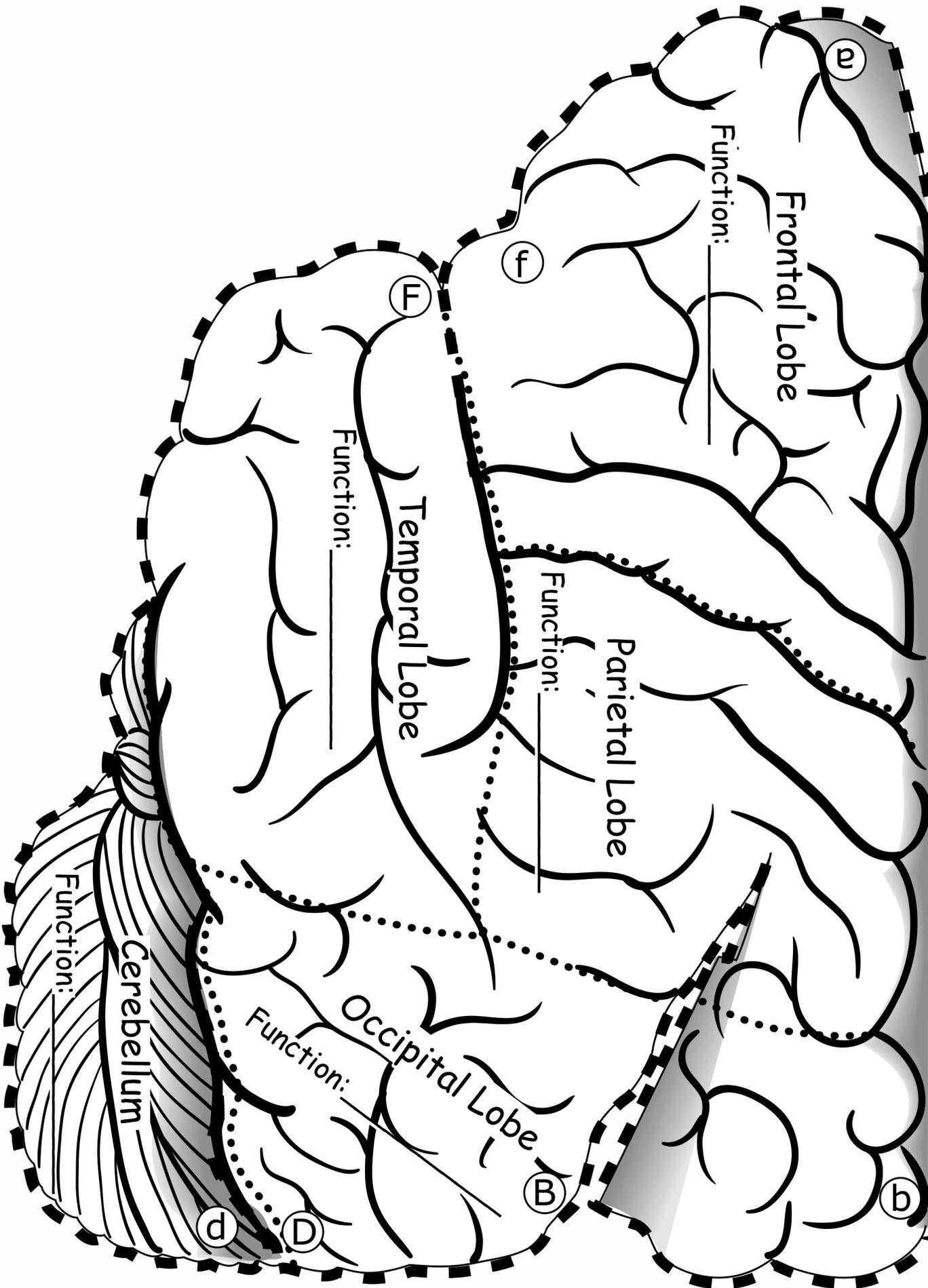
A central graphic titled "THE FIVE BASIC TASTES" in a stylized, bold font. Surrounding the title are five colored circles, each containing an icon and a label for a basic taste: a pink circle with a donut icon labeled "SWEET", a yellow circle with a lemon slice icon labeled "SOUR", a blue circle with a salt crystal icon labeled "SALTY", a green circle with a coffee cup icon labeled "BITTER", and a purple circle with a shrimp icon labeled "UMAMI".

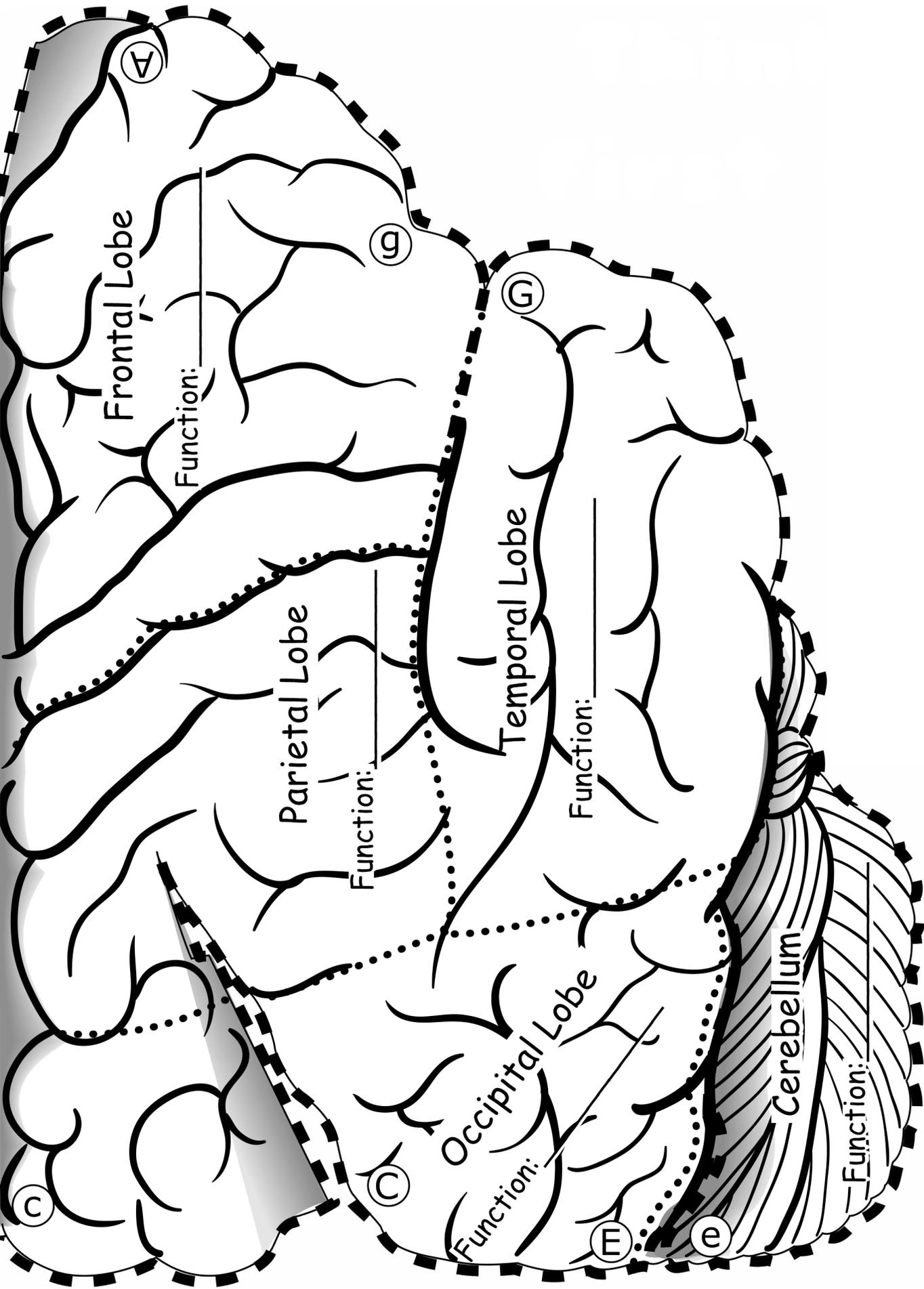
Thinking Cap

Directions

1. Fill in the blanks on the brain pattern on the next two pages. Colour the different lobes.
2. Remove this centre sheet in one piece from the booklet.
3. Cut along the heavy dashed line around the brain to cut out the pattern in one piece.
4. Fold or curl the paper so that "A" is on top of "a". Tape in place. Tape "B" on top of "b", "C" on top of "c", and so on, to create your Thinking First Cap.

**Carefully remove this
page from the booklet!**





Let's Investigate

1. What do you call the molecules that you taste?
2. Where are the molecules received?
3. Where in the brain is the signal sent?

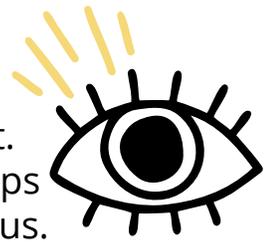
_ □ ×

 **Fun Fact**

Spicy and minty are not types of tastes! They are sensations that trick your brain into thinking there is something hot or cold in your mouth.

 Word Search	C	F	T	E	E	W	S	F	T	R	O	K	J	W	H
Bitter	V	Q	L	B	F	W	M	A	R	E	O	Z	Q	W	Y
Parietal lobe	X	M	W	U	E	H	S	X	O	C	G	P	M	B	J
Receptor	N	G	P	O	I	T	L	I	J	E	P	M	J	T	H
Salty	E	C	N	A	E	L	C	M	O	P	Y	N	V	O	G
Sour	C	O	R	B	R	H	Q	A	K	T	A	S	O	U	R
Sweet	V	F	U	L	Y	I	B	M	W	O	C	P	H	H	K
Tastants	B	D	B	M	D	V	E	U	X	R	G	X	X	I	I
Taste buds	S	I	G	G	T	A	S	T	A	N	T	S	J	C	A
Tongue	J	P	T	B	A	D	H	T	A	E	U	G	N	O	T
Umami	S	S	G	T	K	S	K	L	U	L	I	B	O	U	I
	S	I	V	Z	E	F	L	D	Z	V	L	N	J	J	B
	G	R	Y	D	R	R	R	D	H	W	B	O	W	G	M
	B	O	L	U	L	E	I	S	A	L	T	Y	B	P	Z
	C	C	D	V	J	H	D	Q	W	K	N	F	O	E	M

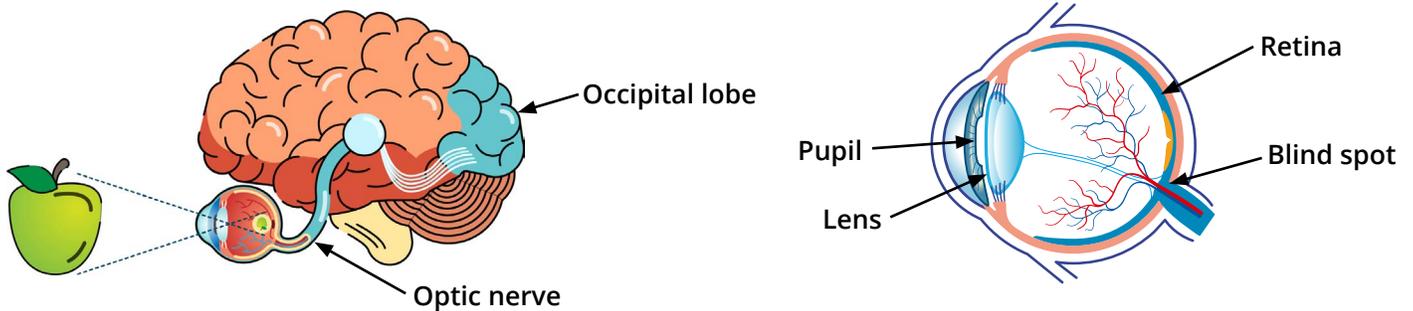
Vision



Our sense of vision helps us detect light, colour, shapes, and movement. This allows us to recognize people, read books, and stay safe. Vision helps us understand our environment and react to what's happening around us.

Light enters the eye through the **lens** and passes through the **pupil** until it reaches the **retina**: the part at the back of your eye where all the light rays gather. Inside the retina, we have two types of special cells called **photoreceptors**. **Cones** help us see colours, and **rods** help us see in low light.

These photoreceptors collect information and send it to the **optic nerve**—a big bundle of neurons! The message exits the eye at the **blind spot**, then travels all the way to the occipital lobe at the back of your brain. That's where your brain puts the picture together of what you are seeing!



Fact #1

 **Fun Facts**

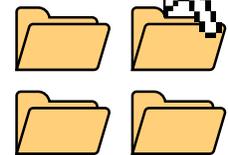
Some people can only see the world in shades of black and white. This is known as **achromatopsia**. This could happen because of damage to cones in the retina or in specific areas of the occipital lobe.

Fact #2

Humans have 3 types of cones: blue, green, and red. The signals from these cones combine together in the brain to help us see different colours.

Fact #3

Dogs see shades of blue and yellow the best.



Let's Investigate

- A. We can see because _____ enters our eyes. This travels to the _____ at the back of the eye.
- B. Information exits the eye along the optic nerve at the _____
- C. Which lobe receives the signal? _____

! Blind Spot Activity

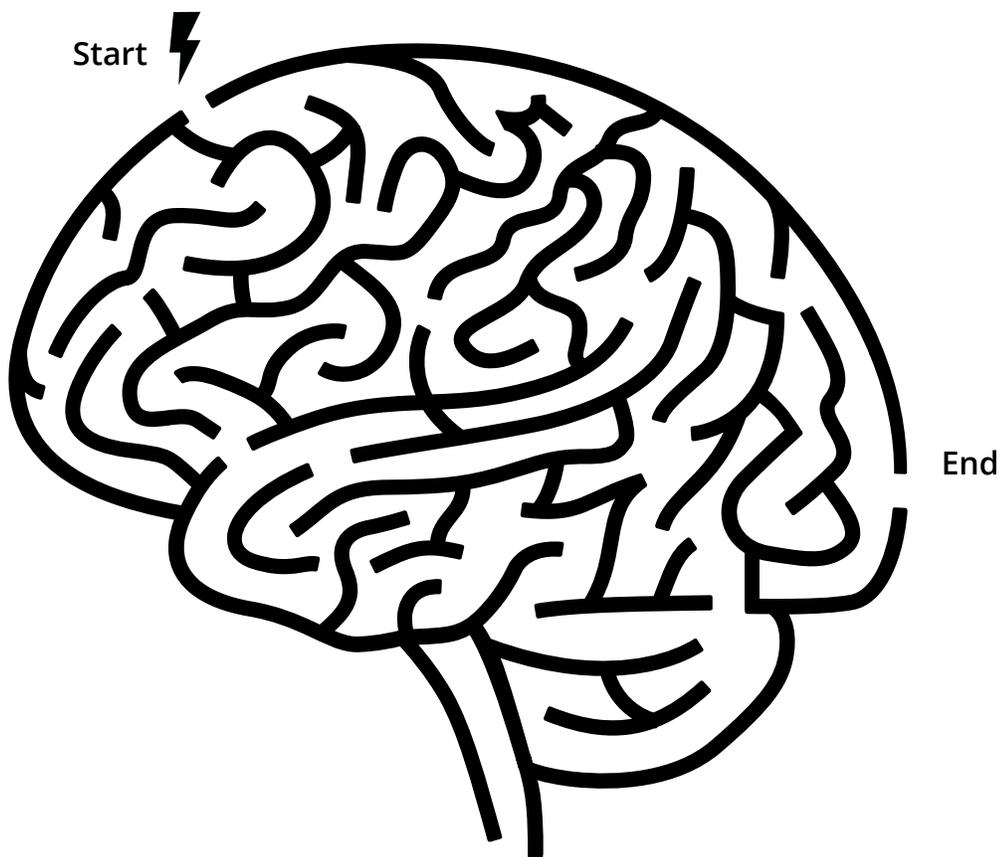
The blind spot is where your optic nerve attaches to your retina. Anything that falls into this spot will disappear from your vision. You don't usually notice, because you see with two eyes.

Let's test our blind spots!

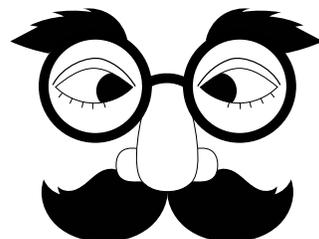
1. Hold the paper in front of you, close one eye, and focus on the dot.
2. Slowly move the paper toward your face until the X disappears.



! Help the signal get from your eyes to the occipital lobe



What did the left eye say to the right?
Between you and me, something smells!



Hearing

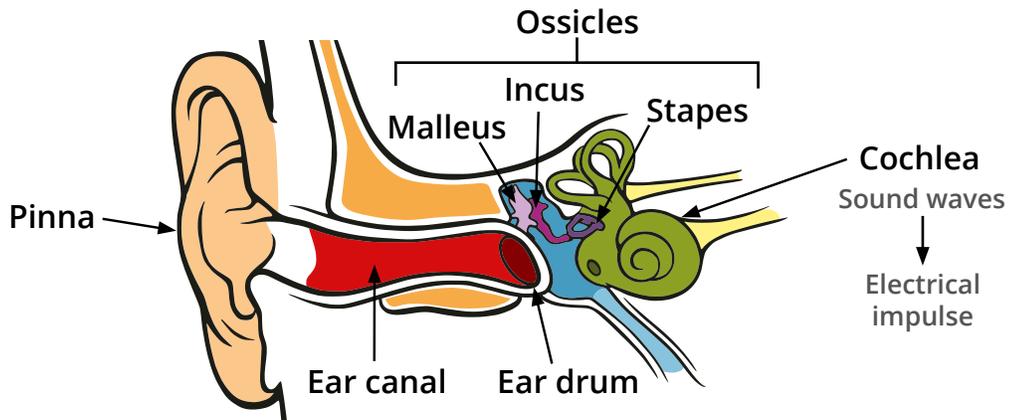
Mammals and birds have the best-developed sense of hearing. Sound travels through the air in **waves** and is measured in **hertz (Hz)**. A low number means low sounds, like a rumbling thunderstorm or a tuba, and a high number means high sounds, like a whistle or bird chirping.



Humans can hear sounds in a range of frequencies from 20 to 20,000 Hz. But some animals, like dogs and bats, can hear sounds at higher frequencies. That's why you can't hear a dog whistle, but dogs can!

Fish: 20 - 3,000 Hz	Dogs: 67 - 45,000 Hz
Crickets: 500 - 5,000 Hz	Whales: 20 - 100,000 Hz
People: 20 - 20,000 Hz	Bats: 1,500 - 100,000 Hz

Sound waves enter our ears through the **pinna**, the outer part of your ear, and then travel through the middle ear and hit the **eardrum**, causing it to vibrate—just like drums in music class! **Ossicles**, the tiniest bones in your body, make these vibrations even bigger and pass them to the **cochlea**. The cochlea is filled with fluid and tiny hair cells that vibrate when sound waves pass through. The vibrations send a signal to the temporal lobe of your brain, which helps you understand what you're hearing.



Brain Food

Hair cells are like little antennae. They transmit auditory information to the brain where you actually hear it. Which lobe in the brain is the signal sent?

Let's Investigate

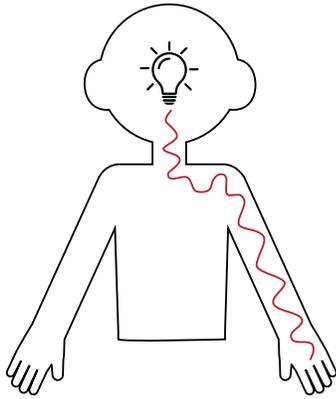
Sound waves hit our eardrums and passes to the _____ inside our ears.

Fun Fact

Inside your ears are semicircular canals, tiny loops that contain fluid. When you spin and then stop, the fluid in your ears continue to move. That is why you feel dizzy!

Touch

Special receptors in our skin feel four sensations—**pressure**, **pain**, **temperature** (hot and cold), and **vibration**. When you touch something, these receptors get activated and send messages to your spinal cord. From there, the signals travel all the way up to the parietal lobe where it gets processed.



Brain Food.....

The **Homunculus** is a drawing of person that shows us where our skin has more receptors. Areas like the **hands, lips,** and **face** are bigger on the homunculus because they are more sensitive to touch.



Let's Investigate

A. Touch receptors are in our

B. Touch receptors allow us to feel four different sensations:

C. Where in the brain is the signal sent?

>>What is Braille?

Many people who cannot see well have a heightened sense of touch. Braille is a type of writing system that uses raised dots to represent letter and numbers. This helps people who have vision loss to use their sense of touch to read and learn.

Brain Injuries & Helmets

We cannot live without our brain. For example, if your occipital lobe is damaged, you might not be able to see—even if your eyes work just fine!

A **brain injury** is any damage to the brain that affects how it works. It can happen from an outside hit to the head or body, or from something inside the body like a bleed, blocked blood vessel, or an infection. Some brain injuries are milder and relatively temporary, like a **concussion**, while others can be more serious, such as a skull fracture. In severe cases, a brain injury might cause permanent changes in how a person moves, thinks, or feels. Even a small injury can have a big impact!

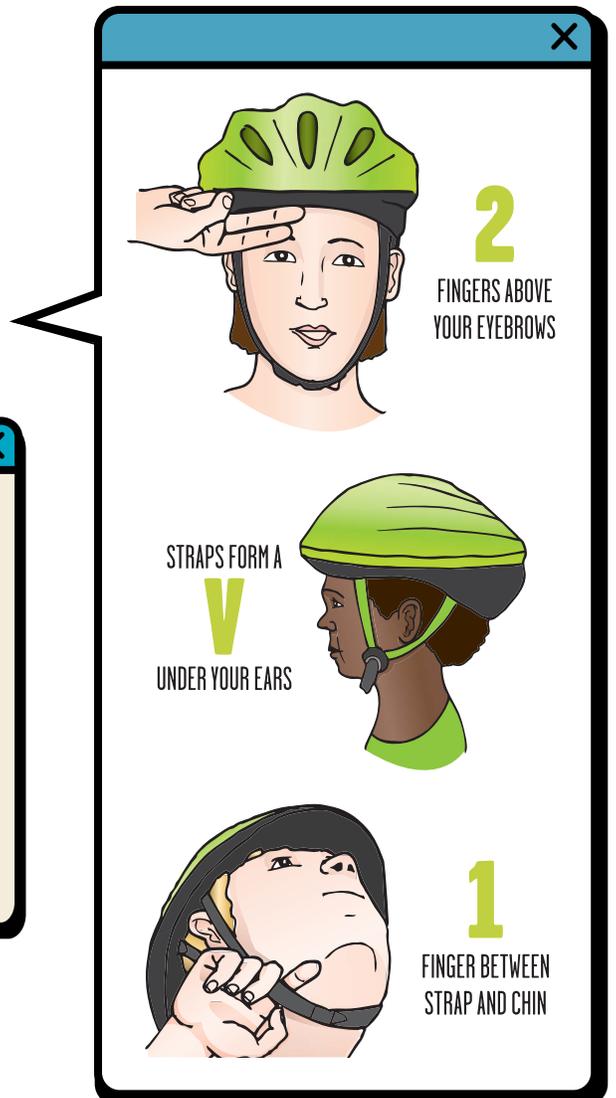
Protect Your Head!

A **helmet** is an extra layer of protection for your brain. It acts like a cushion, softening the force from an impact. While helmets can't prevent every injury, they can make a big difference in how severe an injury is.

The **2v1 rule** is a simple way to check if your helmet fits properly.

>>Helmets

The best helmet is one that is certified and free of cracks or damage. Most helmets should be replaced every 3 to 5 years, or if they have been in a crash even if it looks okay. Some helmets, like hockey helmets, are designed to take multiple hits and only need to be replaced if you can see it is damaged or expired.



2v1 graphic courtesy of Parachute

Concussions

Wearing a helmet can help lower the risk of a severe brain injury, but it can't stop you from getting a concussion.

A concussion is a type of brain injury caused by a hit to the head, face, neck, or any part of the body that makes the brain shake inside the skull. Concussions can happen when someone falls, or is in a car crash, or while playing sports.



Signs of concussions are things you can see:

- Be slow to get up if knocked to the ground
- Be unconscious or passed out
- Look dazed or confused
- Seem clumsy or off balance
- Seem slow to respond
- Not know where they are or what has happened
- Repeat questions
- Act differently and not like their usual self
- Have a change in mood, becoming upset or angry

Symptoms of concussion are things someone is feeling:

- Physical symptoms include headaches, feeling sick to the stomach, feeling dizzy, being sensitive to bright lights or loud sounds.
- Cognitive symptoms include having trouble remembering things or concentrating, or feeling foggy.
- Emotional symptoms include feeling sad, grumpy, anxious, or depressed.
- Issues with sleep can include trouble falling asleep, staying asleep, or sleeping more than usual.

When in Doubt, Sit Out!

If you think you might have a concussion, stop what you're doing, tell an adult, and take a rest.

Getting help early means you can get the care you need. Symptoms of a concussion can sometimes take two days to show up, so even if you feel okay at first, you might still have a concussion. That's why it is important to always tell an adult right away.

Decode the Message

1	2	3	4	5	6	7	8	9	10	11	12	13
I	D	X	O	T	P	Q	S	U	Z	F	R	Y
14	15	16	17	18	19	20	21	22	23	24	25	26
C	K	L	B	W	E	G	J	N	M	A	H	V

12	19	14	4	26	19	12	13
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5	24	15	19	8
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5	1	23	19	!
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