unit six

Human Body Detectives Go to School Elementary Curriculum

The Brain and Nervous System

HBD, A Trip Through The Brain and Nervous System
Activities and Worksheets

human body detectives

Brainiacs

In Brainiacs, Merrin and Pearl venture in to the nervous system when their favorite teacher, Ms. Anderson, spills hot tea on her leg. On the way to her brain to examine how she'll react, Merrin and Pearl ride a nerve impulse, bounce among dendrites, explore the brain's gray matter, and so much more.

Dr. Heather Manley, N.D.

Human Body Detectives: Know, Want to Know and Learned

Your brain may look like a squishy coiled soft mesh of nothing, protected by your skull bones, but it is truly the boss of your body; it controls just about everything you do, even when you're snoring away. Your brain is actually works faster than your computer!

What I **KNOW** about the brain:

What I **WANT TO KNOW** about the brain:

What I **LEARNED** about the brain:

Are You a Right or Left Handed Thinker?

Left brainers are known to be good scientists, and right-brainers great artists; however, in reality, many people use a mixture of both sides. The test below will give a good indication of your personality tendency, perhaps, if you favor one side of the brain over the other, that can help you focus on your strengths.

Hand out the last page to the students, and have them use it to answer the questions below. Once answered, review the results with your students.

1) Cross your legs. Which leg is on top?
2) Look at an object and close one eye. Which eye is still open?

If you're in right-brain state of mine, you will use your left hand, left leg, or left eye.
If you're in left-brain state of mine, you will use your right hand, right leg, or right eye.
Remember: the right side of the body controls the left side of the brain, and vice versa.

1. What type of test do you prefer?
   a) multiple choice
   b) essay
2. Is your bedroom
   a) messy
   b) clean
3. When reading a book, do you
   a) read the book from front to back
   b) jump around and read the most interesting parts
4. When you are meeting a friend, getting to school, are you
   a) either on time or early
   b) late
5. When you make a decision do you
   a) think about it about all the options and choices
   b) go with your gut feeling

Your results
For each answer:
a) = 1 point
b) = 2 points

If you scored 7 or less, you tend to be more left-hemisphere dominate; if you scored, 8 or more, you tend to use your right hemisphere more.

Are You a Right or Left Handed Thinker?

Name _____

Date _____

To Begin:

1. Cross your legs. Which leg is on top?
2. Look at an object and close one eye. Which eye is still open?

A or B?

1. What type of test do you prefer?
   a) multiple choice
   b) essay

2. Is your bedroom
   a) messy
   b) clean

3. When reading a book, do you
   a) read the book from front to back
   b) jump around and read the most interesting parts

4. When you are meeting a friend, getting to school, are you
   a) either on time or early
   b) late

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   a) think about it about all the options and choices
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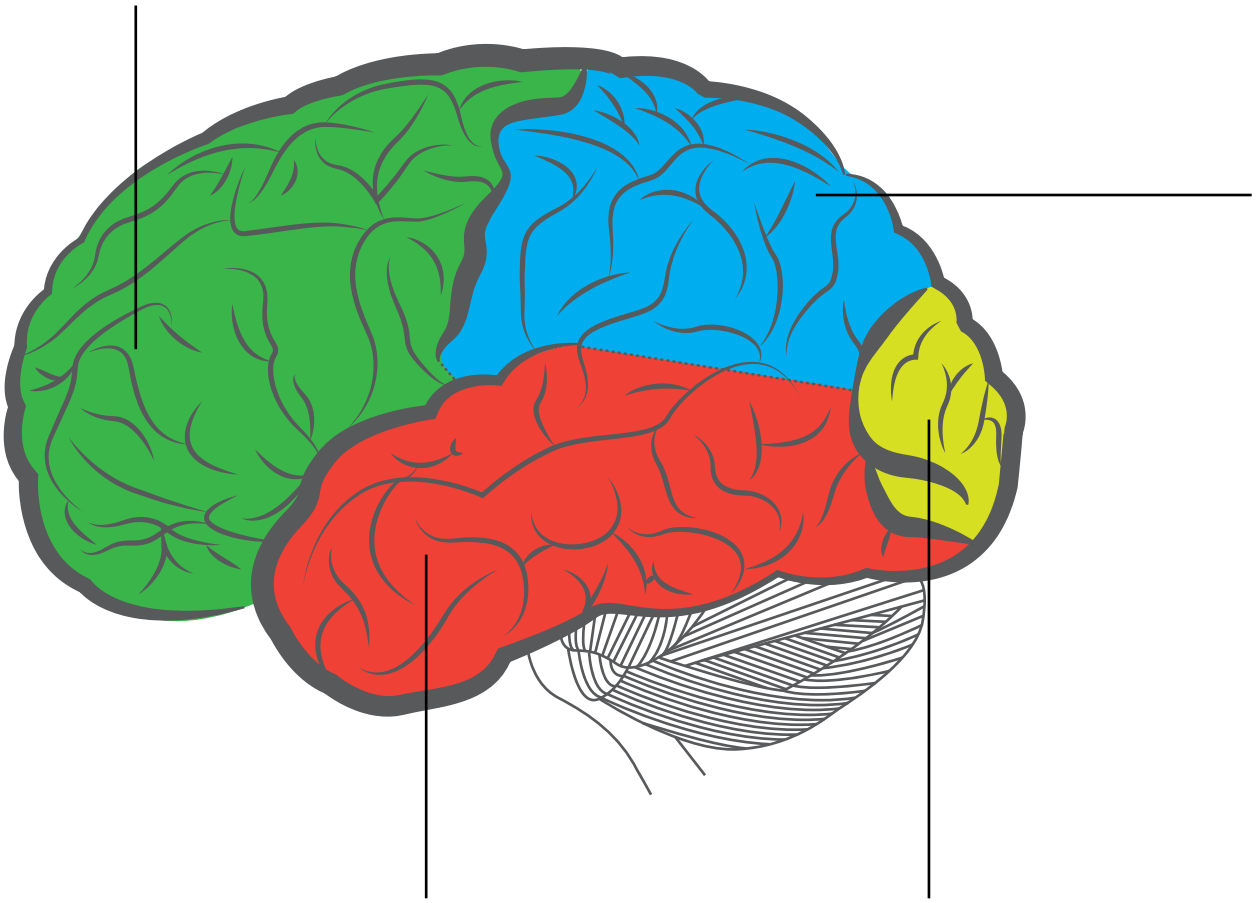
Label Your Brain Lobes

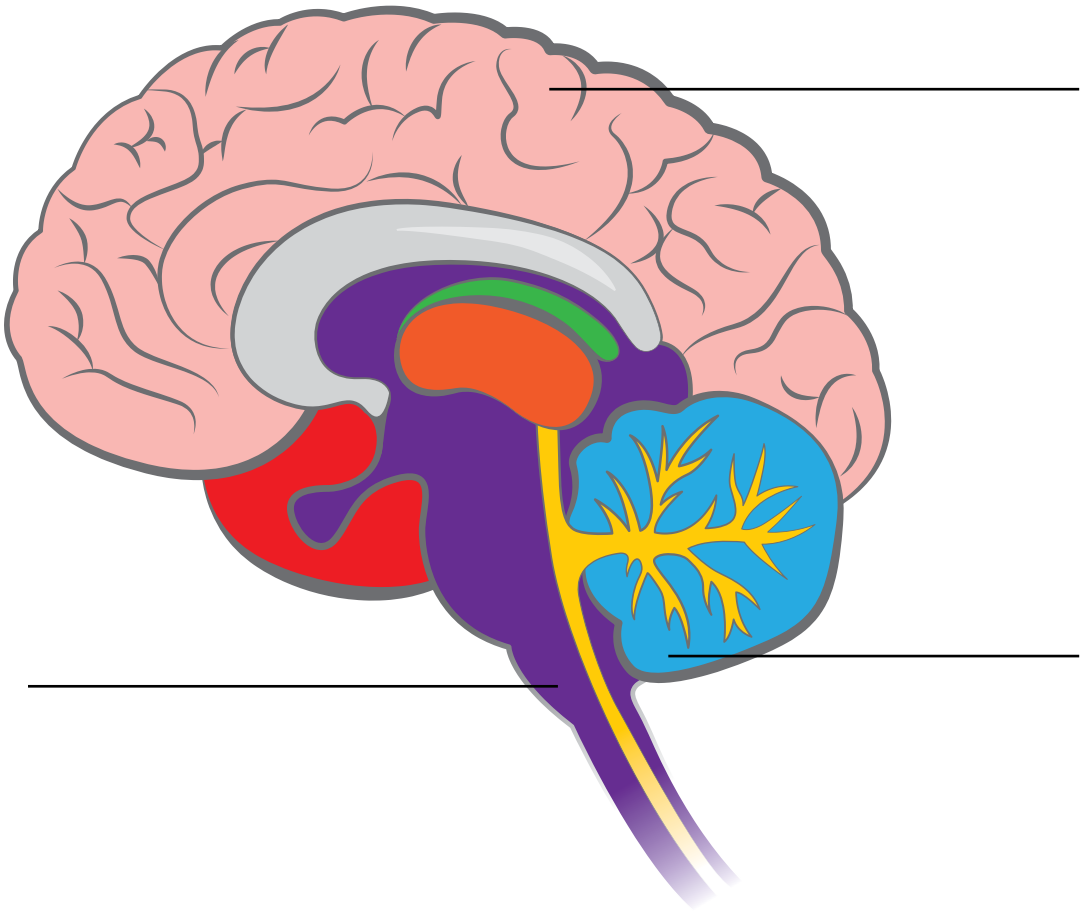
Can you label the different lobes and what they are responsible for?



TEMPORAL LOBE	Problem Solving & Planning
FRONTAL LOBE	Word production
PARISTAL LOBE	Vision
OCCIPITAL LOBE	Word understanding
	Memory & Emotion (not visible)
	Behavioural Control & Emotion

Label Your Brain

Use the terms below to label the different parts of the brain.



BRAIN STEM CEREBELLUM CEREBRUM

Your Brain Hat

OBJECTIVE

To learn about (or review) the major lobes of the brain.

MATERIALS

1. Copies of the pattern pages printed onto card stock, or heavier computer paper
2. Scissors
3. White glue
4. Clear tape
5. Crayons, colored markers or colored pencils

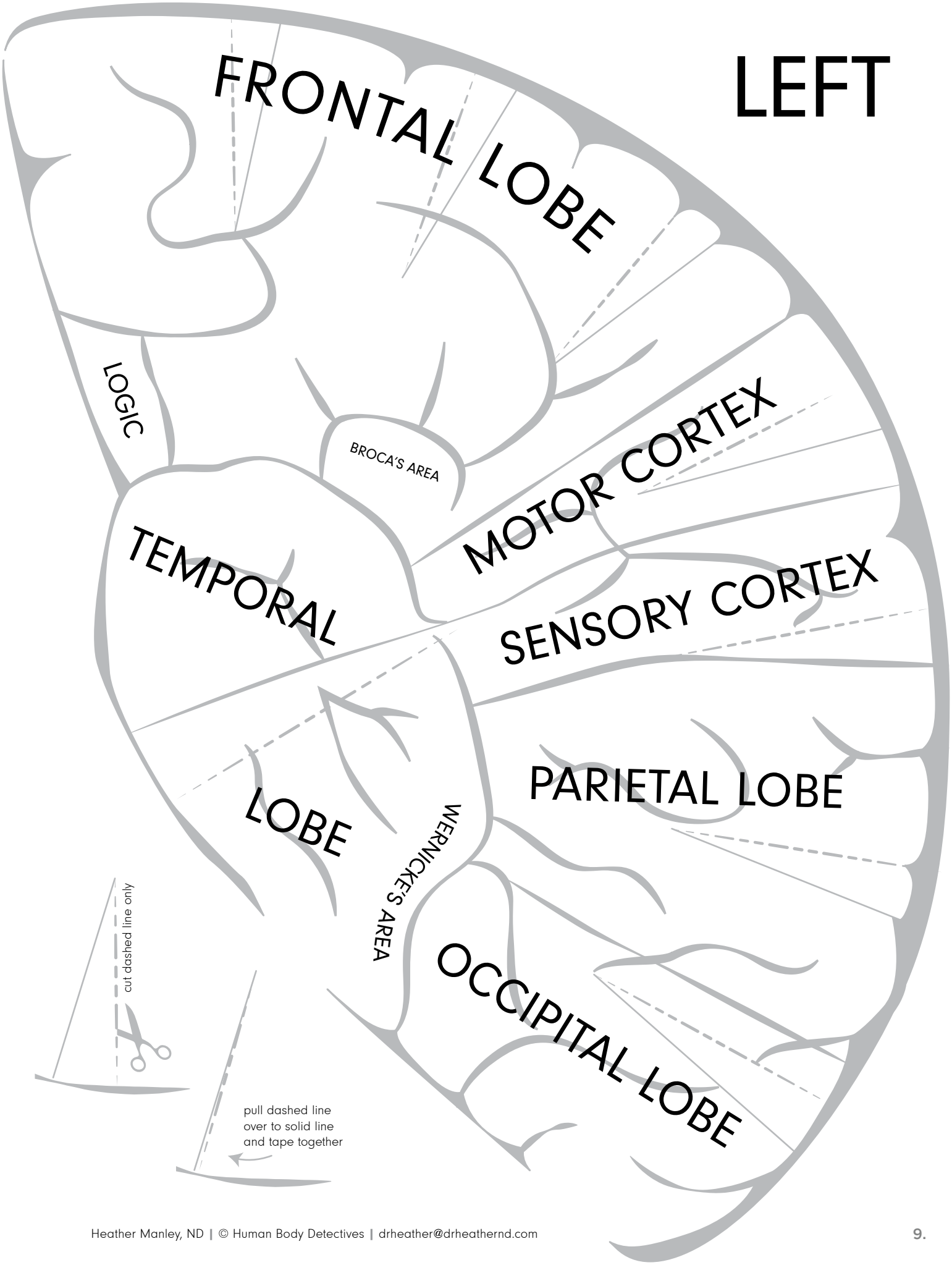
DIRECTIONS

1. Color the hemisphere templates.
2. Cut out both hemispheres.
3. Carefully snip on the "V" dashed lines; just above the solid lines.
4. Pull the "flaps" you have created over to their dashed lines and secure with glue or tape.
5. At this point, you should have created a half-round shape.
6. Assemble the two halves together by choosing one side to overlap just slightly onto the other (1/8" or less) and secure with tape.

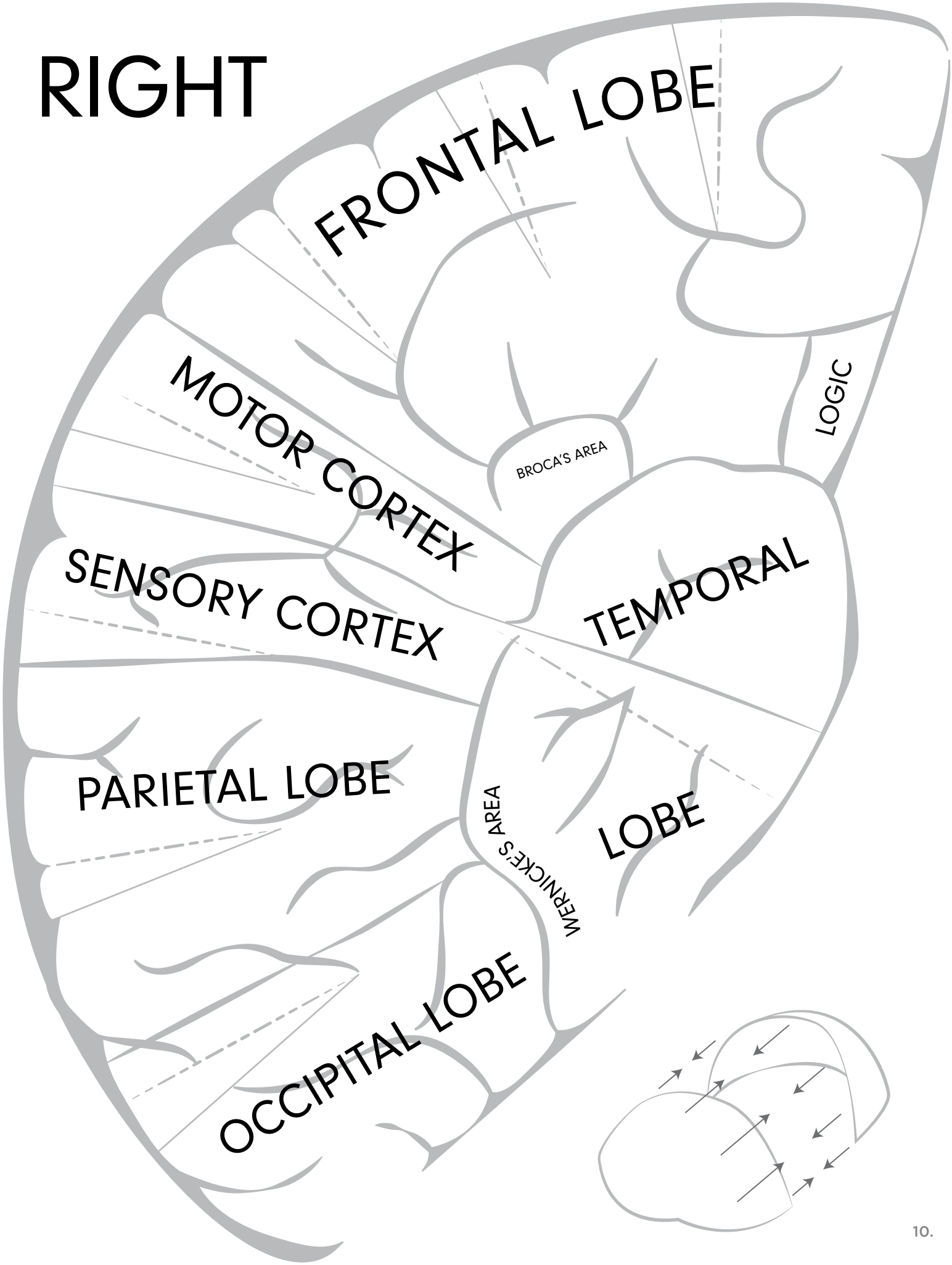
A FEW BRAIN HAT TIPS

- The hat is one size fits all but may need some adjusting.
- Before assembly and while coloring, have the students add their own descriptions on the particular lobes. For example; in the temporal lobe, add smell and speech.
- There are both labeled and unlabeled patterns provided; you can determine which you would prefer the students to do. Have the students do all coloring and labeling before they assemble the hats.
- Write RIGHT and LEFT on the inside of the hat pieces before you cut them out; it will lessen the likelihood of losing track of which one is which when completed.
- White glue is ideal (not school glue sticks) and to secure the joints after gluing, use clothes pins or paper clips.

courtesy of www.ellenjmchenry


LEFT
FRONTAL LOBE
LOGIC
BROCA'S AREA
MOTOR CORTEX
TEMPORAL
SENSORY CORTEX
LOBE
WERNICKE'S AREA
PARIETAL LOBE
OCCIPITAL LOBE
cut dashed line only
pull dashed line
over to solid line
and tape together

RIGHT


FRONTAL LOBE
MOTOR CORTEX
LOGIC
BROCA'S AREA
SENSORY CORTEX
TEMPORAL
PARIETAL LOBE
WERNICKE'S AREA
LOBE
OCCIPITAL LOBE

Cloze Notes:
How Neurons Communicate

Neurons communicate through a chain of sequences, also referred to as an electrochemical process. This process begins when a **sensory receptor** – like a button being pressed to activate- on the body is activated by a stimulus, like light, sound, temperature, pain, etc. With the help of neurons, the message is sent to the brain to get a response on what to do.

The Chain of Sequences

- A sensory **stimulus** occurs (light, pain, heat, cold, sound, temperature) in the periphery nervous system of the body.

- The stimulus is received by the **sensory receptor** in the periphery nervous system of the body when it feels or senses the stimulus. A sensory nerve cell/neuron is alerted (the neuron gets "fired up") and a nerve impulse is generated and begins its quick journey to the brain (periphery nervous system: TOWARDS the brain (central nervous system) via a sensory neuron) to inform the brain about what is happening and to get a reply on what to do.

    - A **dendrite** receives the nerve impulse/message and sends information down the _____, away from the cell body and toward the brain.

    - As the impulse/message travels along the axon, it moves quickly with the aid of the fatty **mylinated sheath** and their **nodes of Ranvier**. The impulse will hop or jump from one node to another, which allows for quick transmission.

    - When an impulse/message reaches the end of a dendrite or **axon terminal** and meets the synapse, it will trigger the release of **neurotransmitters**, which will carry the message to the next neuron's dendrite.

Brain trivia: The mylinated sheath is made of specialized cells called _____ or _____. The glia cells have many jobs: to transport _____ to the neurons, to clean up brain debris (remove unwanted things from the brain), aid in myelin formation, and keep the neurons supported. The glia cells are vital to maintaining a functional nervous system.

Brain trivia: Neurons do not touch each other directly; there is a small gap between neurons called, _____. (see axon terminals above).

The impulse enters the Central Nervous System (brain and spinal cord).

- Review: The impulse is brought to the brain's primary _____ for interpretation and final decision making on what needs to happen next.

- When a decision is determined, the impulse will pass from a **sensory neuron** via an **interneuron**, a _____ in the **primary motor cortex**.

- The **motor neuron** will transmit the message to a _____ where a response will occur (like moving your hand away from a hot stove).

Label Your Neuron

Can you label the neuron below?

_____ Axon

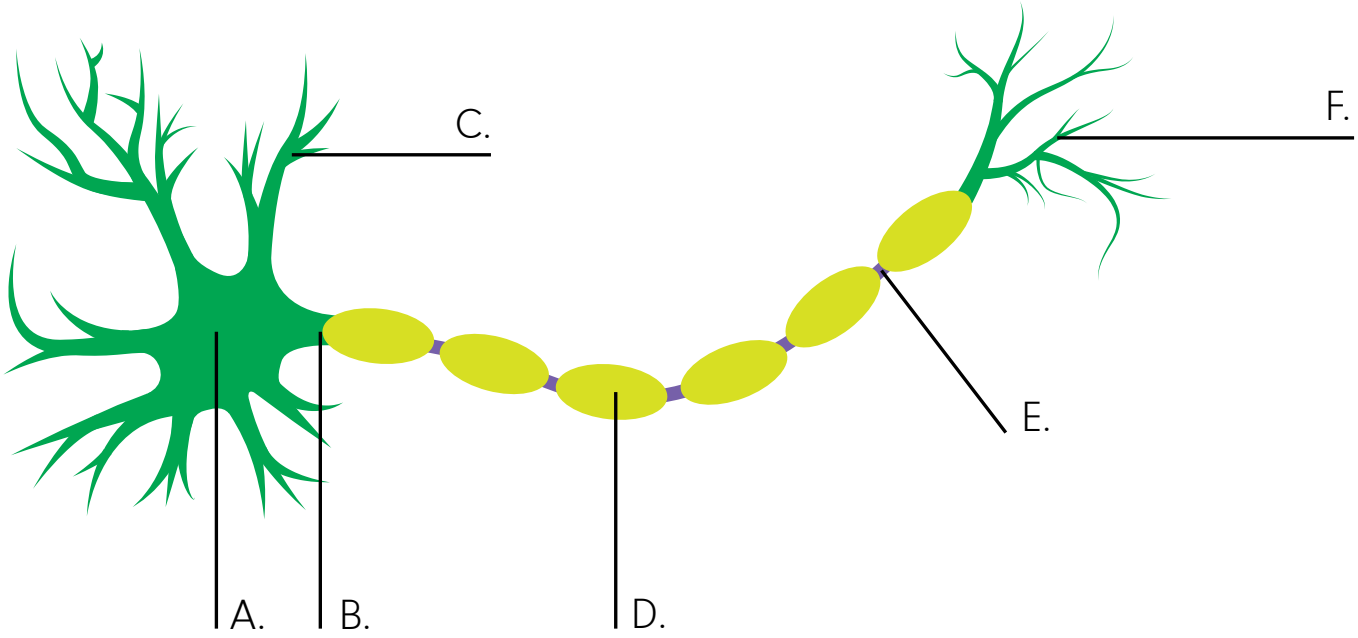
_____ Axon terminal

_____ Cell body

_____ Dendrite

_____ Node of Ranvier

_____ Myelin sheath

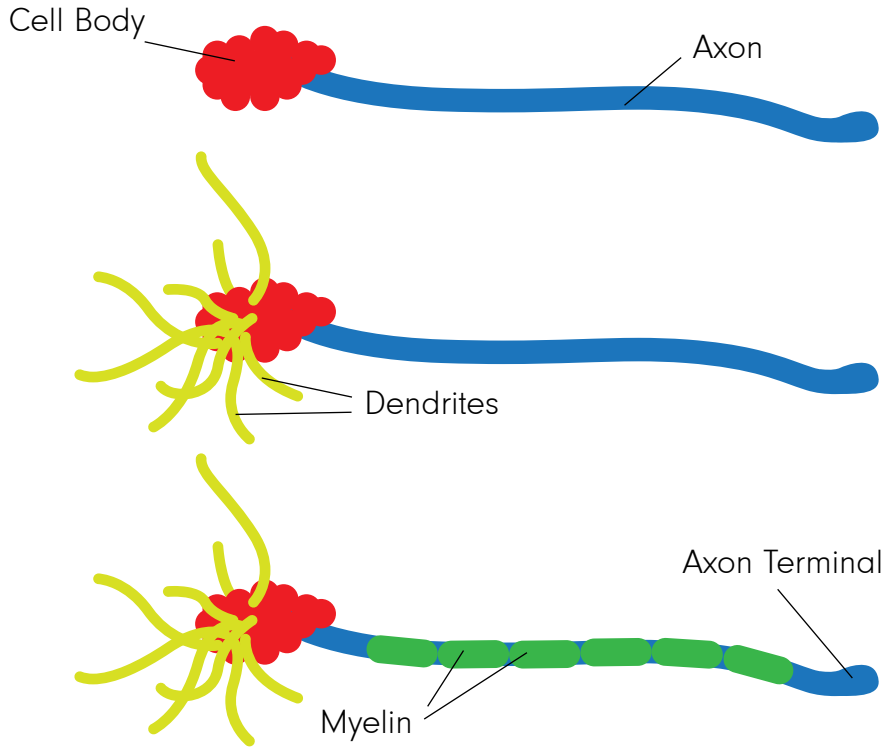


Build a Neuron

OBJECTIVE
To build a neuron

MATERIALS
5 different color pipe cleaners: one color for dendrite(s), one color for cell body, one color for axon, white for the myelin sheath and one color for the axon terminal (if you decide to do this).

DIRECTIONS
1. **Cell body**: Take one pipe cleaner and roll it into a ball.
2. **Axon**: Take another pipe cleaner and attach it to the "cell body" by pushing it through the ball so there are two halves sticking out. Take the two halves and twist them together into a single extension.
3. **Dendrites**: Take (as many as needed) other pipe cleaners and push them through the cell body to create the dendrite branches. Make different lengths.
4. **Myelin sheath**: Wrap and twist another pipe cleaner along the length of the axon.
5. **Axon terminal**: Wrap another pipe cleaner on the end of the axon.



Flow Chart for Neuron Communication

Periphery Nervous System

↓

Hand

↓

Cold ice cube

↓

Sensory receptor received
Sensory nerve cell is alerted
(message begins to be sent to the brain for a response)

↓

Message/impulse travels up to 400 feet per second
with the help of myleinated sheaths and nodes of Ranvier on the axons

↓

Central Nervous System

↓

Spinal cord and then Brain
(makes a decision on what needs to be done)

↓

(primary sensory cortex)

↓

Interneuron

↓

Primary motor cortex

↓

Motor/muscle nerve cell/motor neurons
transmits message to move hand away with the help of muscles

↓

Move hand away from the cold ice

Afferent and Efferent Nerve Pathway

Can you label the diagram below?

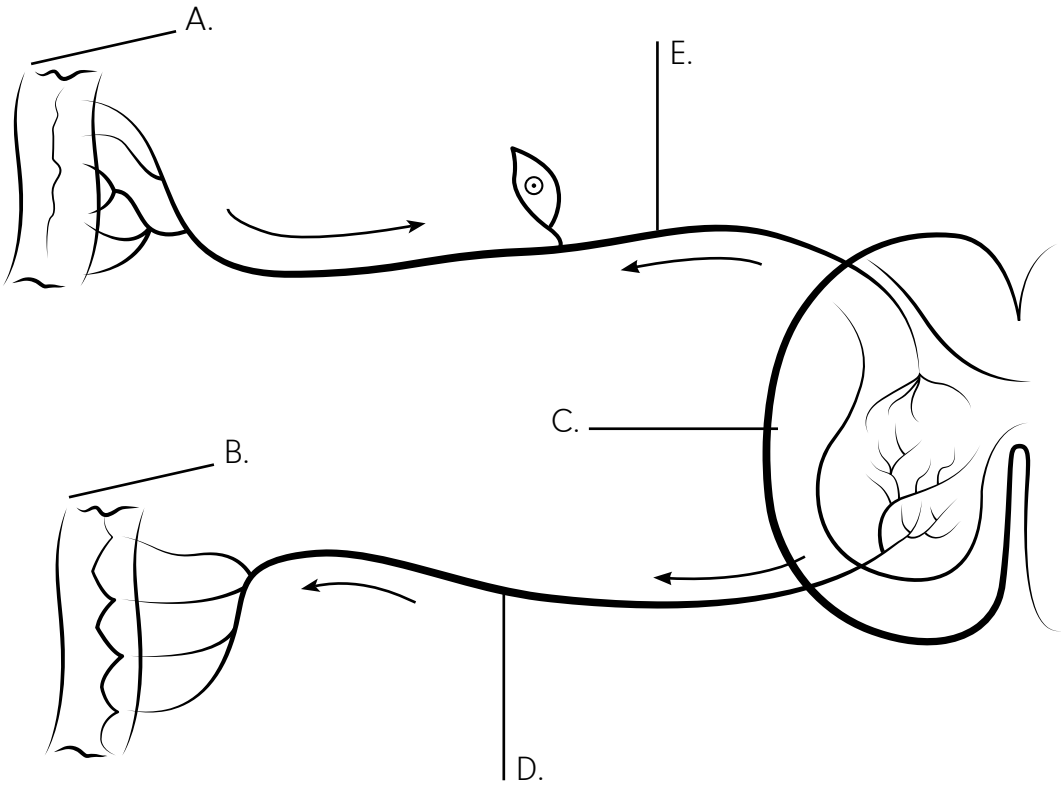
_____ Skin

_____ Muscle

_____ Spinal Cord

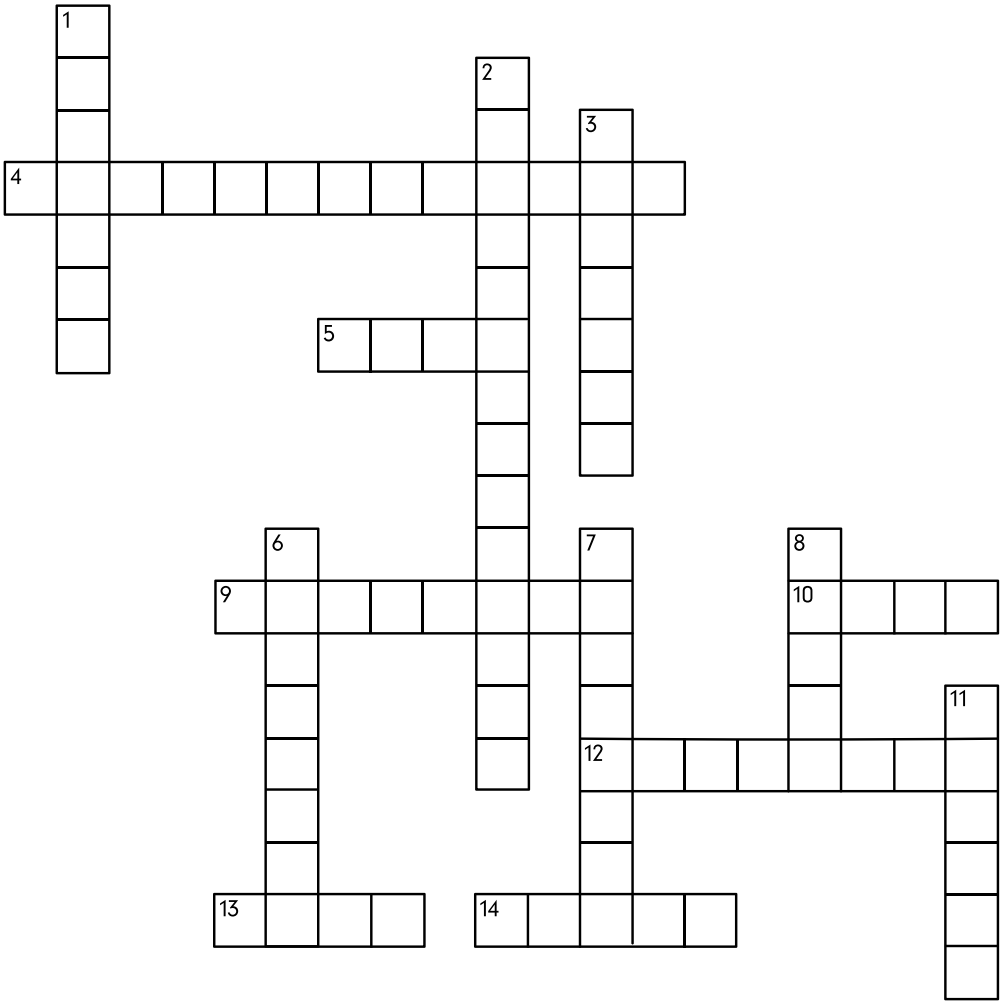
_____ Afferent Nerve

_____ Efferent Nerve



A Brainy Crossword

The Human Body Detectives know you can do this...



ACROSS

4 The main source of energy for the brain are _____.

5 Another name for the cell body of a neuron is _____.

9 I am the biggest part of the brain.

10 A motor efferent neuron transmits signals _____ from the brain and spinal cord (central nervous system).

12 The part of the neuron that resembles branches of a tree is called a _____.

13 I am a specialized cell on the axon and has many jobs: feeding the neurons and cleaning up brain debris.

14 I am the size of a grapefruit and weigh about 3 pounds.

DOWN

1 I am the gap between neurons.

2 There are 12 pairs of me.

3 The brain is made up of approximately 100 billion of these.

6 I am the lobe that controls language, hearing, memory and emotions.

7 This structure in the limbic system determines what and where memories are stored in the brain.

8 I help the brain from overheating.

11 The best way to protect your brain when riding a bike is to wear a _____.

Your Cranial Nerves

The cranial nerves are 12 pairs of nerves that extend from the bottom or inferior past of the brain. These nerves vary in function; some bring information from the sense organs to the brain, others control muscles and lastly, a few cranial nerves are connected to glands and organs like the lungs and heart.

Cranial nerves are identified by roman numerals 1 through 12.

Roman Numeral	Name	Function
I	Olfactory nerve	Smell
II	Optic nerve	Vision
III	Oculomotor nerve	Eye movement
IV	Trochlear nerve	Eye movement
V	Trigeminal nerve	Touch, pain
VI	Abducens nerve	Eye movement
VII	Facial nerve	Taste (front 2/3 of tongue)
VIII	Vestibulocochlear nerve	Hearing and balance
IX	Glossopharyngeal nerve	Taste (front 1/3 of tongue)
X	Vagus nerve	sensory, motor and autonomic functions
XI	Spinal accessory nerve	Controls muscles in head movement
XII	Hypoglossal nerve	Controls muscles of the tongue

Cranial nerve trivia mnemonic:
Oh **O**nce **O**ne **T**akes **T**he **A**natomy **F**inal **A** **G**ood **V**acation **S**eems **H**eavenly

The bold letters stand for:
olfactory, optic, oculomotor, trochlear, trigeminal, abducens, facial, vestibulocochlear, glossopharyngeal, vagus, spinal accessory, hypoglossal.

HBD Lab:
Test Your Cranial Nerves

Since you now know the names and functions of the cranial nerves, it's time to have some fun and test them to help you understand how the cranial nerves work and why they are important.

Find a partner and determine who will go first and be the tester and who will be the subject, use the handout to record your observation.

CRANIAL NERVE	TEST	MATERIAL	RESULT/OBSERVATION
Olfactory Nerve (I)	Gather some items with distinctive smells; use different smells for each partner	Orange, Coffee Cinnamon and Lavender	
Optic Nerve (II)	Using the Snellen Eye chart, have your partner read the letters from various distances	Snellen Eye Chart	
Oculomotor Nerve (III) Trochlear Nerve (IV) Abducens Nerve (VI)	These 3 nerves control eye movement and pupil dilation (pupil getting big and small) Ask your partner to hold their head still while you hold a finger in front of their eyes. Ask your partner to follow your finger as you move it right and left and up and down.		
Oculomotor Nerve (III)	Check the pupillary response. Observe the diameter of your partner's eyes/pupils in dim light and also in bright light. Note the differences in the sizes of the right and left pupils.	Flashlight	
Trigeminal Nerve (V)	The trigeminal nerve has both sensory and motor functions. To test the motor part of the nerve, ask your partner to close their jaw as if they was biting down on a piece of food. To test the sensory part of the trigeminal nerve, lightly touch various parts of your partner's face with piece of cotton or a blunt object (tooth pick). Be careful not to touch your partner's eyes.	Cotton ball and toothpick	

HBD Lab: Test Your Cranial Nerves continued...

CRANIAL NERVE	TEST	MATERIAL	RESULT/OBSERVATION
Facial Nerve (VII)	The facial nerve has both sensory and motor functions. To test the motor part of the facial nerve, ask your partner to smile or frown or make funny faces. To test the sensory part of the facial nerve, responsible for taste on the front part of the tongue, place a few drops of sweet or salty water on front part of the tongue and see if your partner can taste it.		
Vestibulocochlear Nerve (VIII)	The vestibulocochlear nerve is responsible for hearing and balance; however, test only the hearing portion of the nerve. Have your partner close their eyes and determine the distance at they can hear snapping of your fingers.		
Glossopharyngeal Nerve (IX) Vagus Nerve (X)	Have your partner drink some water and observe the swallowing reflex. To test the strength of the muscles used in head movement, put your hands on the sides of your partner's head.		
Spinal Accessory Nerve (XI)	Tell your partner to move his or her head from side to side. Apply only light pressure when the head is moved.		
Hypoglossal Nerve (XII)	Have your partner stick out his or her tongue and move it side to side.		

HBD Brainiacs Word Search

Q	T	B	A	X	O	N	F	I	I	H	K	M	U	M	V	S	M	D	E
K	E	D	R	Z	C	J	C	I	P	R	O	T	E	I	N	H	W	T	R
I	J	T	R	A	C	N	V	L	H	T	N	X	N	D	C	M	I	N	T
D	I	C	O	H	I	F	S	C	M	N	E	T	K	F	S	R	G	S	C
Y	H	E	I	Z	P	N	O	D	A	B	U	Z	K	K	D	K	X	Z	S
C	I	R	A	Y	I	Y	E	J	M	D	R	I	O	N	Q	H	S	J	Y
E	P	E	J	N	T	H	E	M	R	T	O	G	E	X	H	N	O	E	N
R	P	B	B	E	A	P	X	O	T	W	T	D	W	G	J	O	U	M	A
E	O	R	V	U	L	V	C	S	L	A	R	C	R	P	P	D	O	R	P
B	C	U	S	R	R	L	E	F	Q	K	A	A	C	X	Q	E	D	J	S
E	A	M	P	O	A	H	J	Z	G	T	N	L	V	F	P	S	H	Q	E
L	M	P	Y	N	T	W	S	V	K	I	S	C	R	N	G	O	O	Z	V
L	P	C	I	A	N	J	W	U	A	L	M	I	P	Q	L	F	X	L	N
U	U	P	C	P	E	I	U	C	K	J	I	U	D	X	O	R	Y	C	V
M	S	E	E	R	D	L	J	L	M	D	T	M	G	I	B	A	I	N	R
X	R	T	X	Q	A	I	P	X	K	I	T	A	D	A	E	N	E	E	S
H	G	Z	K	U	S	N	S	Z	A	N	E	I	M	W	S	V	F	R	Y
W	Y	K	U	U	K	L	I	F	A	F	R	O	Q	L	J	I	E	V	Z
W	P	S	H	D	D	B	R	A	I	N	S	T	E	M	E	E	L	E	H
R	P	Y	W	E	E	J	V	K	L	I	T	B	R	X	K	R	K	S	L

BRAIN
SOMA
BRAINSTEM
NEURON
NODES OF RANVIER
CRANIAL
CEREBRUM

CREEBELLUM
SPINAL CORD
AXON
SYNAPSE
PROTEIN
LOBES
OCCIPITAL

HIPPOCAMPUS
NERVES
DENDRITE
NEURO TRANSMITTER
ZINC

Brain Lab:
Using One Hand to Dress

OBJECTIVE

To understand the importance of protecting their brains, avoiding brain injury, by becoming aware of the importance of needing both sides of the brain.

MATERIALS

- Button – up shirt
- 2 to 3 # weight

INSTRUCTIONS

1. Have the students determine their dominant hand.
2. Instruct the students to place the weight in this hand.
3. Next, have the students to put on the shirt with their non-dominant hand without using any help from the dominant hand/arm.

! **Teacher's note:** You may want to pair the students up and have one student to the exercise while the other takes notes.

After the experiment, ask the students to discuss their results. Discuss what it would be like to only use the muscles and nerves on one side of the body and how that would affect everything they do on a daily basis. At the end, tie in the importance of wearing a helmet and protecting the brain the best they can.

Foods for Your Brain

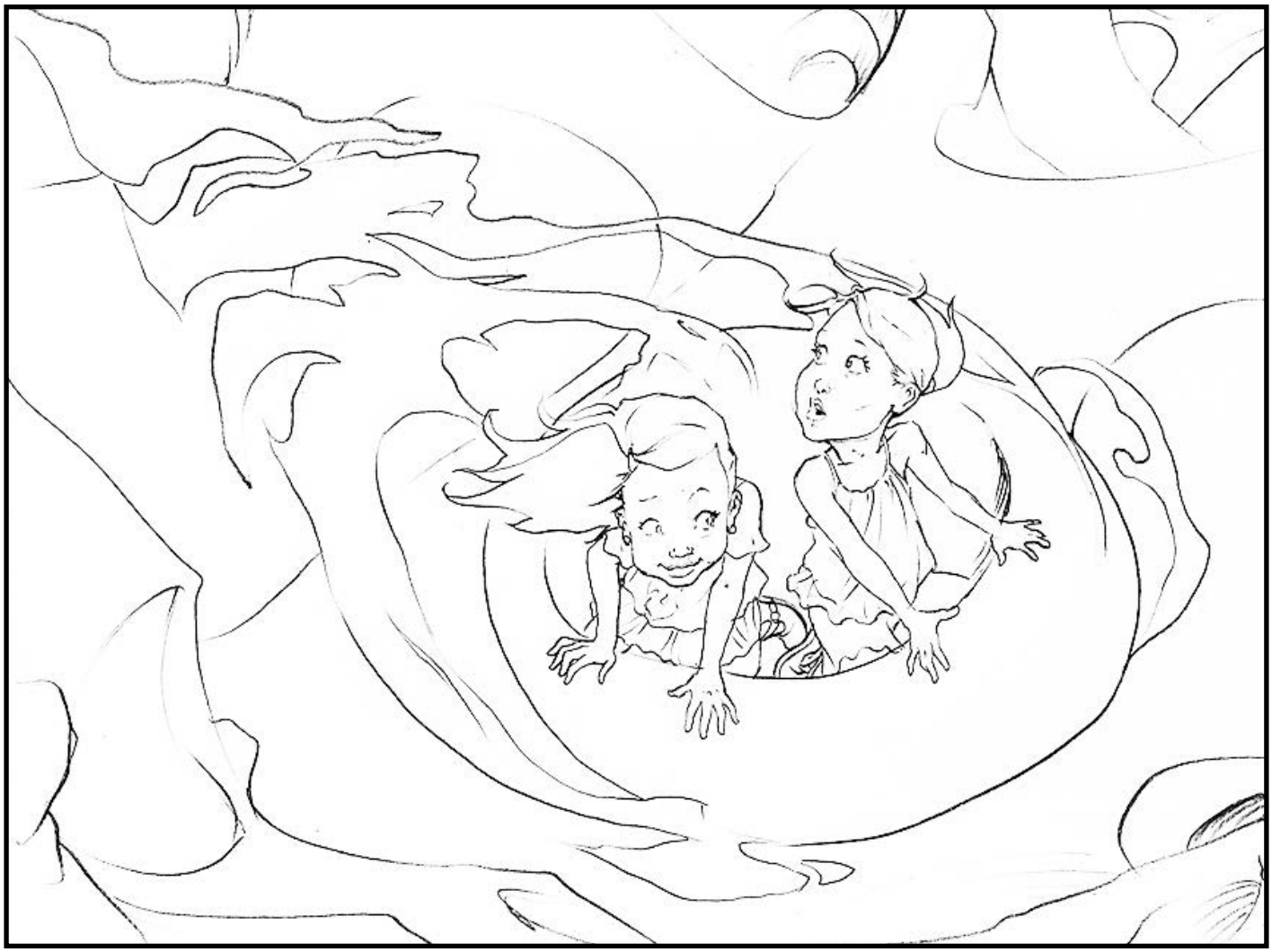
FOOD	WHAT IT DOES	HOW DO YOU EAT THEM?
Almonds	Increase blood flow to the brain	
Walnuts	A good fat essential for the myelin sheath	
Blueberries	Improves learning and motor skills	
Brussel Sprouts	Nourish the brain with its' array of B vitamins.	
Cinnamon	Keeps brains cells alive	
Eggs	Helps the neurotransmitters do their jobs well	
Pine nuts	Stimulates brain activity	
Ginger	Helps protect the brain from brain disease	
Apples	Helps protect your brain cells	
Salmon	Keeps gray matter strong and alert	
Cabbage	Increases blood flow to the brain	
Celery	Prevents the brain doesn't get inflamed	
Broccoli	Super charges the brain to help you learn and remember	
Spinach	Improves mental focus	

extra activities

Human Body Detective
Spot the Differences

Can you find 10 differences?

Human Body Detectives Color



Word Scramble

The Human Body Detectives need your help! Be a super HBD and unscramble these words.

EBMUCERR

TEDIRNED

ASEPYNS

MUSHOPIPPCA

TWREA

The Human Body Detectives Search for the Truth

Help Merrin and Pearl decide if the following statements are true or false. Label each statement with a T if the statement is true or F if the statement is false.

_____ 1. The nervous system is made up of the nerves, spinal cord and the brain.

_____ 2. The right hemisphere controls movements on the right side of the body, and the left hemisphere controls movements on the left side of the body.

_____ 3. The cerebrum not only has two hemispheres, but it also has four distinct areas, called sections.

_____ 4. The sciatic nerve is the longest and widest nerve in the body.

_____ 5. A neuron is a bundle of nerves that will receive messages in the body, help deliver the message to the brain, and then the brain will make actions happen.

_____ 6. The central nervous system consists of just the spinal cord.

_____ 7. The branch- or finger-like things on the neuron are called dendrites.

_____ 8. There are over 1 billion neurons in the brain.

_____ 9. The junction between neurons is called a synapse.

_____ 10. Motor neurons are in the skeletal system.

More About Your Nervous System

Your brain may look like a squishy coiled soft mesh of nothing that is protected by your skull bones, but it is truly the boss of your body; it controls just about everything you do, even when you're snoring away. Your brain is actually works faster than your computer!

There are three major parts of the brain: cerebrum, cerebellum, and the brain stem.

The biggest part of the brain is the **cerebrum**—it's the brains of the brains! The cerebrum looks like a walnut and is located on the outer part of the brain. The cerebrum is not only the thinking part of the brain, it is also responsible for memories, emotions, understanding language, regulating body temperature, eating, and sleeping.

The cerebrum is divided into two equal halves: the right and left hemispheres. The right hemisphere controls the left side of the body and the left hemisphere controls the right side. Nerves through the **corpus collosum** connect these two hemispheres. Each hemisphere has an inside layer called white matter, and an outside layer of gray matter. Research has indicated that the right half helps us think about music, colors, and shapes, and the left half helps us with math, logic, and speech.

The outermost layer of the cerebrum is the **cerebral cortex**. It is divided into four main lobes: frontal, occipital, parietal, and temporal. These lobes have specific functions: **frontal** controls motor functions and memory; **occipital** controls vision and color recognition; **parietal** controls speech and information processing; and **temporal** controls hearing, memory, and emotions.

The **cerebellum** is at the back of the brain below the cerebrum and is about the size of a pear. It may be a lot smaller than the cerebrum, but it has many important jobs, like controlling balance, movement, and coordination. Next time you are riding your bike, give thanks to your cerebellum!

The **brain stem** sits beneath the bottom of the brain just above the neck and connects the brain to the **spinal cord**. Our bodies have voluntary muscles and involuntary muscles. Our voluntary muscles work when we ask them to, like when we want to ride our bikes or move our hand away from a hot stove. Our involuntary muscles, like the heart, lungs, and stomach muscles, are working all the time, automatically. The brain stem is in charge of all the functions

of these involuntary muscles to help us circulate our blood, breathe, and digest food. The brain stem is also known as the body's secretary as it sorts through millions of messages that the body and brain send back and forth.

The big questions are: How is the body connected to the brain? And how does the brain know what to tell the body to do? The **spinal cord** and its nerves put it all together. The spinal cord is an extension of the brain. It runs down our backs and is protected by spinal bones (vertebrae). Inside the spinal cord are long bundles of **nerves** that allow messages to be safely communicated between the brain and body.

The brain and the spinal cord make up the **central nervous system (CNS)**, which is the command center, thus leaving the **periphery nervous system (PNS)** consisting of everything outside the CNS. **Neurons** are nerve cells that help transmit information throughout the body. There are three basic parts of a neuron: the **dendrites**, the **cell body**, and the **axon**. Let's say, similar to what happened in the story, you burn yourself, or you are about to burn your hand. Dendrites in your hand will sense heat and will transmit this information down to the cell body and then to the axon. This transmission will continue from neuron to neuron—via **synapses**—until it reaches the brain. The brain will then send a message through neurons to your muscles telling you to take your hand away from the heat. This action may happen at a speed of up to 200 miles per hour!

There is a lot more to learn about the brain, and scientists are working every day to learn more about this complex organ. Maybe you can grow up and be a scientist who studies the brain! In the meantime, take good care of your brain by protecting it by wearing helmets when on a bike, scooter, or skateboard, and feed it healthy foods like fish, nuts, and seeds!

Human Body Detectives Riddles

- I am the outermost are of the cerebrum and I am divided into four main lobes. What am I?
- I am the white fatty part of the neuron that helps protect the axon. What am I?
- I am the gap between neurons. What am I?
- There are twelve pairs of me. What am I?
- In Latin, my name translates into "little brain." What am I?
- We are nutrients that help make neurotransmitters. What am I?
- I am found everything but in the brain and spinal cord. What am I?
- There are thirty-one pairs of me. What am I?
- I am approximately three inches long and as thick as your thumb. What am I?
- My main job is to receive and pass messages from/to other nerve cells. What am I?

Word Bank:

Cerebral Cortex

Cerebellum

Spinal Nerves

Brain Stem

Peripheral Nervous System

Myelin Sheath

Dendrite

Synapse

Cranial Nerves

B Vitamins

Human Body Detectives Ask You

Both Merrin and Pearl are fascinated by the brain. They learned some interesting and intriguing facts that they wanted to share with you.

did you know that...

- ★ the brain is always working, even while you sleep?
- ★ more than 90% of the world is right-handed?
- ★ your brain is about 2% of your total body?
- ★ there are about 100 billion neurons in the human brain, the same number of stars in our galaxy?
- ★ the average human dream lasts only 2 to 3 seconds?
- ★ your brain can go without oxygen for 3 to 5 minutes before injury will occur?
- ★ your brain consumes as much as a fifth of all the energy you get from food?
- ★ the word "dendrite" (the part of a neuron that brings information toward the cell body) comes from the Greek word meaning "tree"?
- ★ information travels in the nerves at speeds of more than 200 miles per hour or 429 kilometers/hour?
- ★ a jellyfish doesn't have a brain?
- ★ the average human brain weighs about 3 pounds (1.4 kilograms)?
- ★ the part of the brain called the "amygdala" gets its name from the Greek word for "almond" because the shapes are similar?
- ★ the length of myelinated fatty nerve fibers in the brain is 241,000 to 289,000 miles or 150,000 to180,000 kilometers?
- ★ sixty percent of an octopus's nerve cells are located in its arms?
- ★ a doctor who studies nerves is called a neurologist?
- ★ the Swahili word for brain is "ubongo"?
- ★ though the brain may process pain messages, it doesn't feel pain.

Brain Sudoku Puzzles

Fill in the grid with digits in such a manner that every row, every column and every 3 x 3 box accomodates the digits 1 through 9, without repeating any.

	5		8		7	6		2
		1	9		2	3		
8		3						9
	9	8			5			6
		4		7			2	
	7		1		3		5	4
		6		5		4		
	3		7	9		2	6	
2		7			8		9	1

		3		8		4	7	6
	5	7	4	2			1	
1			3					
	8	9			1	6		9
	6	4	9	3		8		
			6					7
								5
	3		8		7	1	2	
8	1	2	5	9		7		

		3			8			1
4	9	8	1		5			3
			7				6	9
	4		5			9		
8		5		7	9	3		4
		2			3		5	
	5				7			
7			9		1	4	3	5
2		9			6	7		

		1		9		4		7
	6	2	4		5			
3				2		6	5	
	9				3			5
		4		1		9		
1		3	7		9		4	2
	2		8		1			6
6					2	3	8	
9		8		5		2		

Brain Metaphors

Merrin and Pearl love to use their brains. One of the ways they do that is through metaphors, which compares two things that seem unlikely to be similar.

The following table lists some of the things that the brain has been compared to and describes why they are similar the brain.

The Brain is...

A spider web because it is delicate and connects to many things.

A tree because it has branches that go this way and that way.

A symphony because it creates movement, ideas, and emotions.

Can you think of more?

Brain Teasers and more!

We all love a good joke and the Human Body Detectives have found a few that will make you laugh out loud!

What did the right hemisphere say to the left hemisphere when they could not agree on anything?

Let's split.

What street does the hippocampus live on?

Memory Lane.

What did parietal say to frontal?

I lobe you.

When does a brain get afraid?

When it loses its nerves.

Why was the neuron sent to the principal's office?

It had trouble controlling its impulses.

What do you get when you cross a thought with a light bulb?

A bright idea.

What does a brain do when it sees a friend across the street?

Gives her a brain wave.

What works even after it is fired?

A neuron.

ha!
ha!

ha!

Merrin and Pearl Had to Know...

Why does your head pound immediately after eating something really cold too quickly?

Great question! Here's the deal:

When you eat something really cold and too quickly, the blood vessels on the roof of your mouth begin to swell (or get big); this rapid swelling causes the pounding sensation. This "brain freeze" will last until your mouth warms up—usually in less than a minute.

Luckily, brain freeze is not dangerous and will go away on its own. There are ways to prevent this from happening; the most important being to eat or drink cold foods slowly, however, if that is too hard and if you feel a brain freeze coming on, take a break from the cold food or drink. It also might be helpful to press your tongue to the top of your mouth and tilt your head back for approximately 10 seconds.

Below is the fancy medical term for brain freeze. Can you say it out loud?

sphenopalatine ganglioneuralgia

sfee-noh-pal-uh-teen gan-glee-oh-new-ral-juh

word game

See how many words you can make using the letters in

sphenopalatine ganglioneuralgia

plate

one

spin

Glossary

Axon (ak-son): Part of the neuron that transmits impulses.

Brain matter (breyn mat-er): There is white and gray matter in the brain that make up the brain matter. The white matter is mostly made up of axons, whereas the grey matter contains the cell bodies and dendrites.

Brain stem (breyn stem): The brain stem connects the brain to the spinal cord and controls the muscles in your body that work automatically, all the time: muscles that help with breathing, digesting food, and circulating blood.

Cell body (sel bod-ee): The cell body is the body of neuron.
Central nervous system (CNS) (sen-trul nur-vuh s- sis-tuh m): The CNS is part of the nervous system consisting of the brain and spinal cord.

Cerebrum (suh-REE-brum): The cerebrum is the biggest part of the brain and it controls the voluntary muscles that you choose to use (like when you use your leg muscles to kick a soccer ball).

Cerebellum (sair-uh-BELL-um): The cerebellum is at the back of the brain and controls balance, movement, and coordination.

Dendrite (den-drahyt): Dendrites are the branching parts that extend from the axon and aid in the transmission of nerve impulses.

Myelin sheath (my-e-lin sheth): Myelin sheaths wrap around axons to protect and speed up nerve impulses.

Nerve (nurv): A nerve conducts impulses between the brain or spinal cord and the other parts of the body.

Neuron (noo -ron): A neuron is a bundle of nerves that has a cell body, dendrites, and an axon.

Node of Ranvier (nohd - ov - Ran·vier): Nodes of Ranvier are gaps located on the myelin sheaths of the axon that help with the transmission of nerve impulses.

Periphery nervous system (PNS) (puh-rif-uh-ree -nur-vuh s- sis-tuh m): The PNS consists of nerves outside the spinal cord and brain.

Synapse (sin-aps): A synapse occurs between dendrites and helps nerve impulses pass from one neuron to another.

Answers

Word Scramble

Cerebrum

Dendrite

Synapse

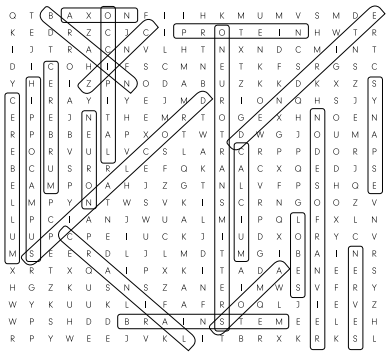
Hippocampus

Water

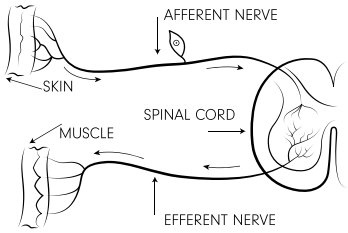
Search for the Truth

1. **T**
2. **F**
   The right hemisphere controls movements on the left side of the body, and the left hemisphere controls movements on the right side of the body.
3. **F**
   They are called lobes not sections.
4. **T**
5. **T**
6. **F**
   The central nervous system consists of the spinal cord and brain.
7. **T**
8. **F**
   There are over 100 billion neurons in the brain.
9. **T**
10. **F**
    Motor neurons are in muscles.

Brainiac Word Search



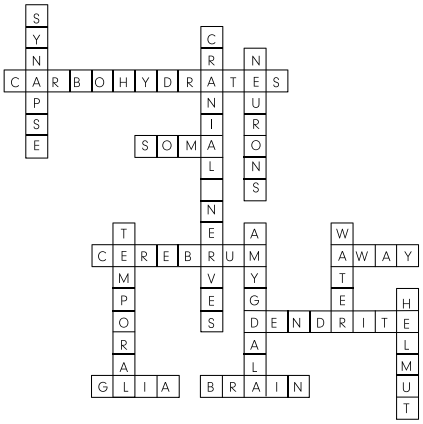
Afferent and Efferent Nerves



Human Body Detectives Riddles

1. Cerebral cortex
2. Myelin Sheath
3. Synapse
4. Cranial Nerves
5. Cerebellum
6. B Vitamins
7. Peripheral Nervous System
8. Spinal Nerves
9. Brain stem
10. Dendrite

Crossword



Sudoku

4	5	9	8	3	7	6	1	2
7	6	1	9	4	2	3	8	5
8	2	3	5	1	6	7	4	9
3	9	8	4	2	5	1	7	6
5	1	4	6	7	9	8	2	3
6	7	2	1	8	3	9	5	4
9	8	6	2	5	1	4	3	7
1	3	5	7	9	4	2	6	8
2	4	7	3	6	8	5	9	1

9	2	3	1	8	5	4	7	6
6	5	7	4	2	9	3	1	8
1	4	8	3	7	6	5	9	2
2	8	5	7	4	1	6	3	9
7	6	4	9	3	2	8	5	1
3	9	1	6	5	8	2	4	7
4	7	6	2	1	3	9	8	5
5	3	9	8	6	7	1	2	4
8	1	2	5	9	4	7	6	3

6	7	3	2	9	8	5	4	1
4	9	8	1	6	5	2	7	3
5	2	1	7	3	4	8	6	9
3	4	7	5	1	2	9	8	6
8	1	5	6	7	9	3	2	4
9	6	2	8	4	3	1	5	7
1	5	4	3	8	7	6	9	2
7	8	6	9	2	1	4	3	5
2	3	9	4	5	6	7	1	8

5	8	1	3	9	6	4	2	7
7	6	2	4	8	5	1	3	9
3	4	9	1	2	7	6	5	8
8	9	6	2	4	3	7	1	5
2	7	4	5	1	8	9	6	3
1	5	3	7	6	9	8	4	2
4	2	7	8	3	1	5	9	6
6	1	5	9	7	2	3	8	4
9	3	8	6	5	4	2	7	1

Label Your Neuron

A. Cell body

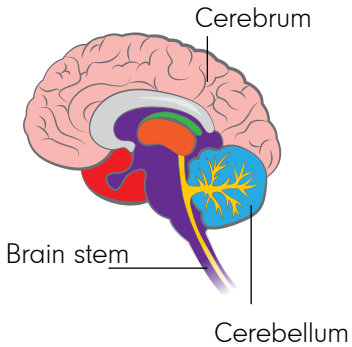
B. Axon

C. Dendrite

D. Myelin sheath

E. Axon Terminal

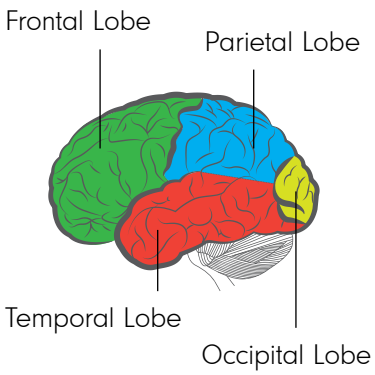
Label Your Brain



Spot the Difference

1. clock
2. #4 on computer
3. plant
4. eyebrow
5. kettle
6. curtains
7. apple
8. jar moved
9. drawer pull
10. jar empty

Label Your Brain Lobes



go to school

Dr. Heather Manley, ND, is a practicing physician who received her medical degree in 2001 from National College of Naturopathic Medicine in Portland, Oregon. She is also the award-winning author of the **Human Body Detectives** book and curriculum series.

A contributing writer to Dandelion Moms, Organic Eats magazine, Parents Canada, and KIWI magazine, Dr. Heather was inspired to write the **Human Body Detectives** stories when she went on a search for books about healthy eating tips for parents and kids and couldn't find what she was looking for. She wanted to provide a fun and engaging resource that would teach kids about how their bodies work and what foods best feed them. And the HBDs were born.

The **Human Body Detectives** series won Moms' Choice Award and is also a Parent Tested, Parent Approved winner. Dr. Heather has been named to the Top 50 Mompreneurs Bloggers List on both **Babble**, **VoiceBoks** and **blogtrepreneur**.

Dr. Heather lives and practices on the Big Island of Hawaii, where her focus is on preventative healthcare for families and providing a resource for families to learn more about preventative health care so that they can be confident and proactive in their everyday health. She lives with her husband and her two daughters, with whom she based her stories' characters, Merrin and Pearl.

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