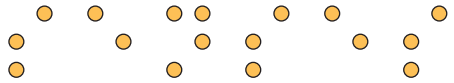
BrainLink®

THE SENSORY SYSTEM

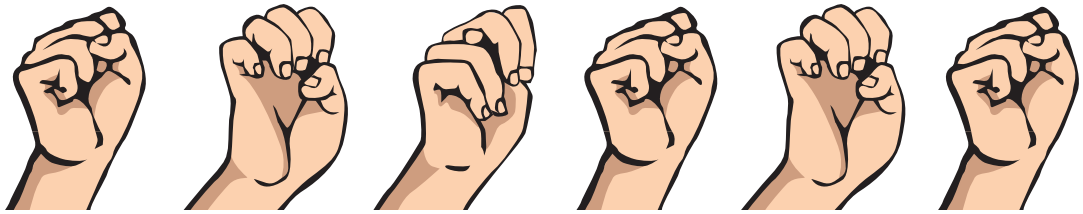
EXPLORATIONS

What do all of these have in common?



Find the dot pattern on page 2 that looks similar to this one. Using a pen, push a hole through each of the dots on page 2. Now, on the bottom of this page, find the bumps you made. **Feel** the bumps with your fingers. Do you know what the bumps mean?

Study the shapes below. Make each shape with your hand. **Look** at the shapes as you make them. Do you know what they mean?



Find the hidden word in the image to the right. Do you know what it means?

BRAIN FLASH

Billions of neurons, or nerve cells, work together each time we feel, smell, taste, see or hear something. Our senses are our "windows to the world."

Look at the pattern below. Say a short "beep" for each dot and a long "be-e-e-e-e-p" for the dash. Do you know what the **sounds** mean?

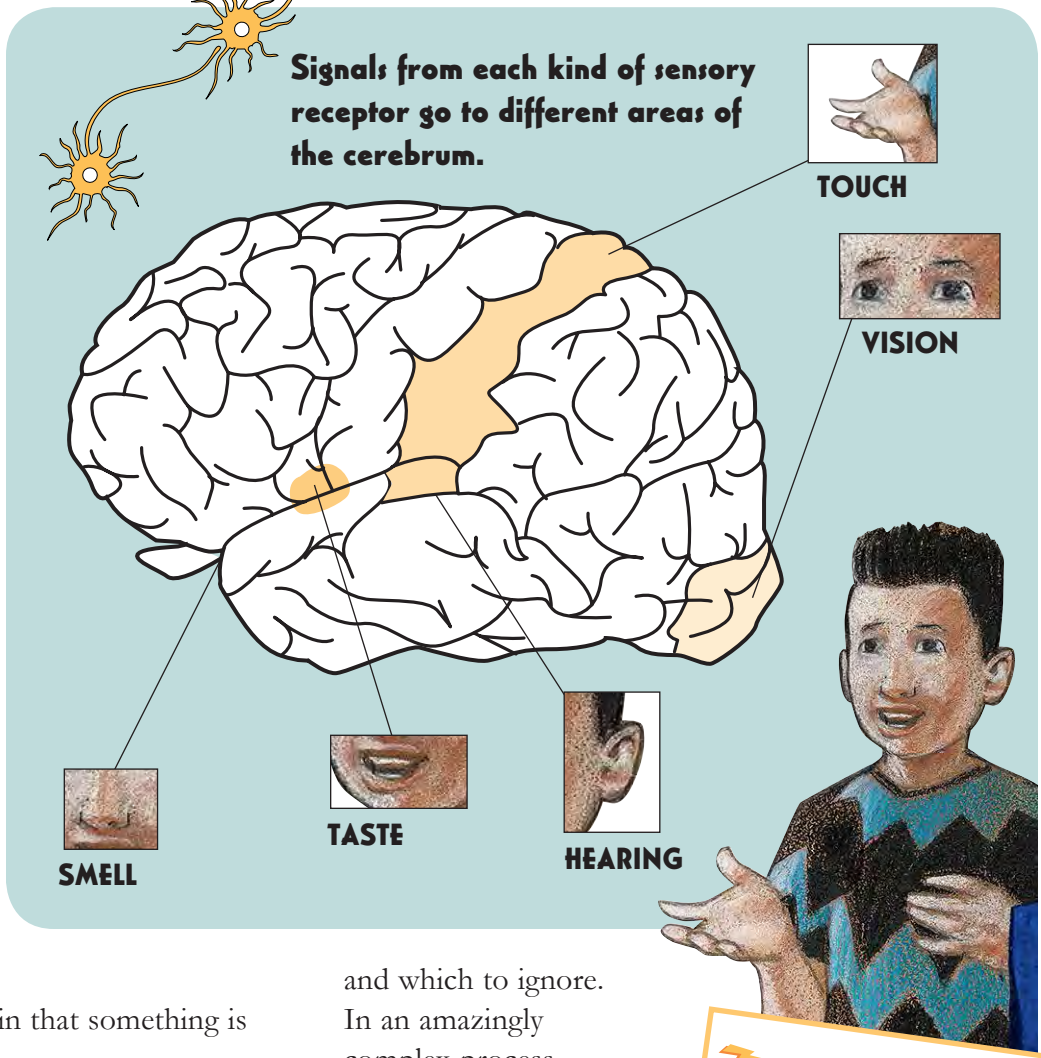
Read "Matter of Fact!" on page 2 to find the answers.

Baylor College of Medicine

Matter of Fact!

Could you figure out that all the symbols on the front page are ways to communicate the word "senses"? Even though you **see** the text and the sign language, you **feel** the braille dots, and you **listen** to the morse code, your brain has the ability to decode each of the different kinds of information as the same word, *senses*!

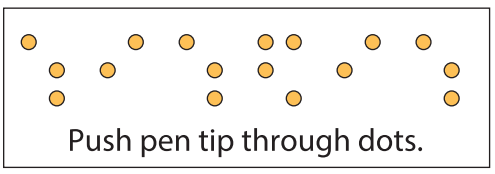
Why do we have senses? Our senses let us know what is going on inside and outside our bodies. Information from our senses helps us to stay safe and healthy. What would it be like without senses? How hard would it be to find food or shelter, or to protect ourselves from danger? Even the ability to feel pain is important! Pain alerts the brain that something is wrong.



What do senses have to do with your brain? Every moment, your brain is bombarded by sensory signals. It receives messages from sensory receptors in your eyes, ears, nose, mouth and skin, and from inside your body. All the messages travel along neurons to the brain. Signals from each kind of sensory receptor go to different areas of the cerebrum.

Thousands of messages come in to the brain all the time. Incredibly, your brain can sort out the signals, knowing which ones to pay attention to and which to ignore. In an amazingly complex process, the brain combines information from different senses and memories of past experiences to reach conclusions and begin actions.

The senses give the brain information from inside and outside the body. They are our windows to the world!



BRAIN FLASH

Believe it or not, we have other senses besides hearing, seeing, touching, tasting and smelling. We have senses of balance, and some scientists believe that we can sense magnetism. We also have senses inside our bodies that tell us when we are hungry or thirsty. Can you think of any other senses we might have?

Is Seeing Believing?

Most of the time, the eyes and brain work together to tell us what is around us. Sometimes, though, the brain can be fooled or confused by what the eyes take in.

What do you see in the picture to the right? What you see depends upon which part of the picture you look at. Do you see the twin faces or do you see a vase? You may notice that you cannot focus on both faces and the vase at the same time. The brain is selecting only part of the information available to it in order to make sense of what you are seeing. We do this all the time without being aware of it. It may be one reason why different people will describe the same scene or occurrence in very different ways.

RED LAVENDER BLUE

GREEN YELLOW PINK

RED BLUE BLACK GREEN

YELLOW RED ORANGE

BLUE GREEN YELLOW

RED BLUE PURPLE PINK

YELLOW RED ORANGE

LAVENDER BLUE GREEN

YELLOW RED BLACK

BLUE ORANGE GREEN

SEE and SAY

Read the names of the colors. Is it easy or hard? Now try saying the colors instead of reading the words. Do you find that you have to go slowly to get the colors right? Seeing the words, the brain expects the colors and names to match. They do not match, so the brain has to rethink and decide which information to use and which to ignore. Often we will be fooled into thinking we see something that is not present (or do not see something that is) because of what we expect to see.

BRAIN FLASH

The human eye has 125 million receptors, rods and cones, which turn light into electrical signals.

This is called the Stroop Test.

The Eyes Have It!

Have you ever had your eyes checked by a doctor or by the school nurse? How many lines of letters could you read? Having your eyes checked regularly is very important for protecting one of your most important senses, your vision. Follow the instructions below to make an eye chart and test your vision, or that of your friends.

1. Cut a sheet of poster board (or paper) approximately 25 cm by 75 cm.
2. Using a pencil, draw a line for the first row 12 cm from the top of the poster board. Start from this line and draw 10 more lines, 6 cm apart.
3. Measure (in millimeters) and draw a "dashed" line above each "row" line, using the measurements shown on the "Eye Chart Guide" to the right.
4. With a black pen or fine point marker, draw the letters on each row. Erase the pencil lines.

BRAIN FLASH

Barn owls and bats both use sound to hunt at night. Bats hunt by making sounds and listening to the echoes made when the sound bounces off their prey. Barn owls hunt by listening to the sounds made by their prey. By turning their heads, owls can use the differences between sounds coming to their ears to find prey, even in total darkness.

To use your eye chart, place it on the wall at eye level. Stand 3 meters (10 feet) away from the chart. Cover one eye at a time and read the letters on the chart, starting at the top. Have a friend compare your answers to the letters on the chart. How did you do? Can one eye see the letters better than the other eye? If you are able to read all of the letters on row 8, your vision is about average. If you wear glasses, test your eyesight with and without them.

Now you are ready to test friends and family. If you think you have uncovered any vision problems, you may want to suggest a visit to the school nurse, optometrist or family doctor.

Eye Chart Guide

1	E	90 mm
2	F P	45 mm
3	T O Z	30 mm
4	L E P D	25 mm
5	P E C F D	20 mm
6	E D F C Z I	15 mm
7	F E L O P Z D	11 mm
8	D E F P O T E C	9 mm
9	L E F O D P C T	7 mm
10	F D P L T C E O	5 mm
11	P E Z O I C E T D	4 mm

Sensible Games

We often use information from just one sense to figure out what is going on around us. What happens when we use other senses to explore the world? Try these games to find out!

Focusing In!

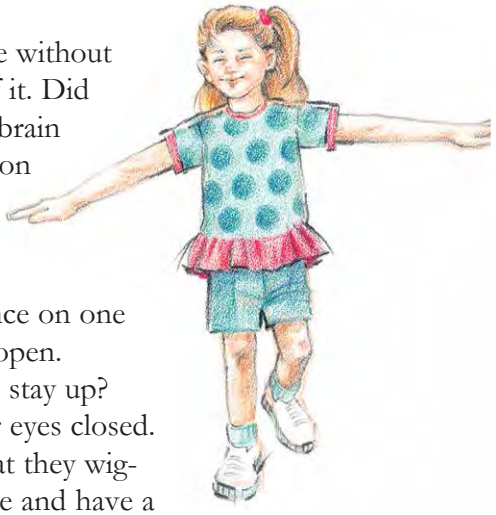
Sit outside with your eyes open and list all the sounds you can hear. Now close your eyes. Can you hear any new sounds? Often you will find there are softer sounds you hadn't noticed before. Why do you think it is easier to hear faint sounds if you close your eyes? Sit in a room with which you are very familiar. Put on a blindfold. Walk around the room. How well can you remember where the furniture is? Practice until you feel comfortable getting around the room. Take the blindfold off and place an unbreakable object on a table. With the blindfold on, walk around the room again and then try to find the object. How hard was it to find the object? What senses did you use as you learned to walk around the room without your sight? What would it be like if you were unable to see? How would it change what you can do?

Who's Talking?

This is a good one to do with a few friends. Put in earplugs. Have several people talk softly or pretend to talk to you. Can you tell who really is making sounds and who is pretending? How might you be able to tell? What sense or senses could you use? Can you figure out what they are saying by watching their lips or by touching their throats?

Unbalanced!

Often we use a sense without really being aware of it. Did you know that your brain uses visual information as one of the ways to help you keep your balance? Check it out yourself. Balance on one foot with your eyes open. How long could you stay up? Now try it with your eyes closed. Most people find that they wiggle around a lot more and have a much harder time balancing when their eyes are closed!



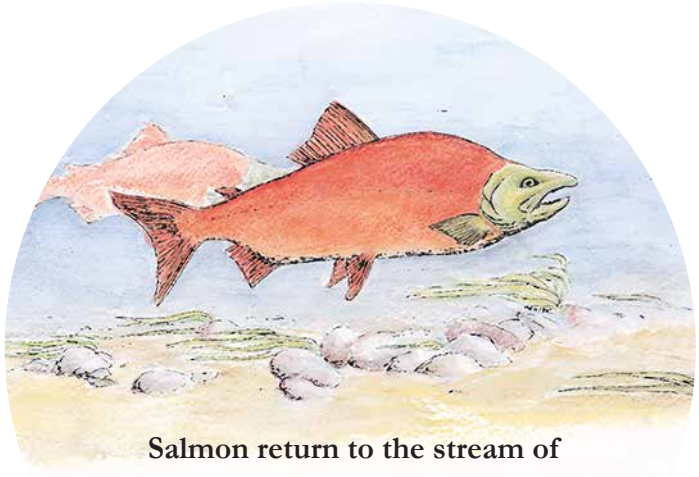
(continued on page 6)

Did You Know?

Although we take glasses, contact lenses and hearing aids for granted now, they have been important inventions to improve our vision and hearing. Scientists are discovering new ways to help people who have become deaf or blind by illness or accidents. A tiny device called a cochlear (KOK-lee-er) implant can be placed within the inner ear by a surgeon. It directly stimulates neurons that lead from the ear to the brain, sending messages about sound.

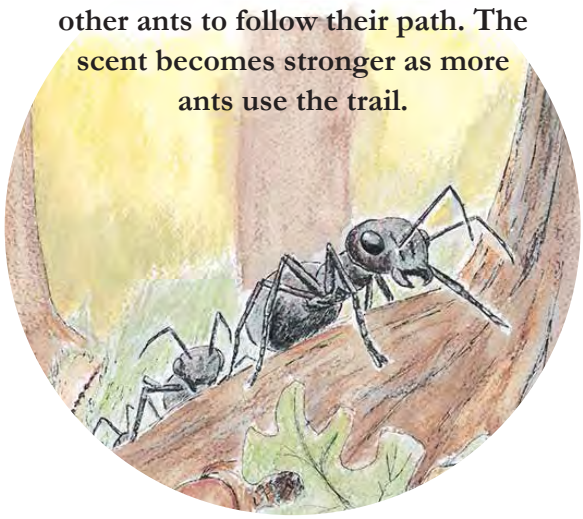
Scientists have made great strides in creating implants to restore vision. One such device is the retinal implant. The retinal implant is placed in a patient's eye and converts light into electrical signals that are sent to the parts of the brain that respond to vision. This is still experimental and is being tested in humans, but the initial results are promising. There are other devices in development, including the BrainPort, that uses a camera to send visual signals through the tongue to the brain.

Sensational Animals



Salmon return to the stream of their birth by "tasting" their way up miles of rivers and streams until they come back to the location that tastes exactly right!

Ants lay a scent trail that enables other ants to follow their path. The scent becomes stronger as more ants use the trail.



Some birds are able to sense the magnetic field of the Earth, and use this information to know exactly where they are in the world!

BRAIN FLASH

Did you know that boat captains used to navigate in the fog by using echoes? They would blow a short whistle and listen for the returning echo. They could estimate distances and even recognize different types of shorelines by the timing and sound of the echo that they heard back. Now blind people are taught to use the same strategy by making sounds with a cane or clicker and listening for the echoes.

What other kinds of animals use sound to navigate?

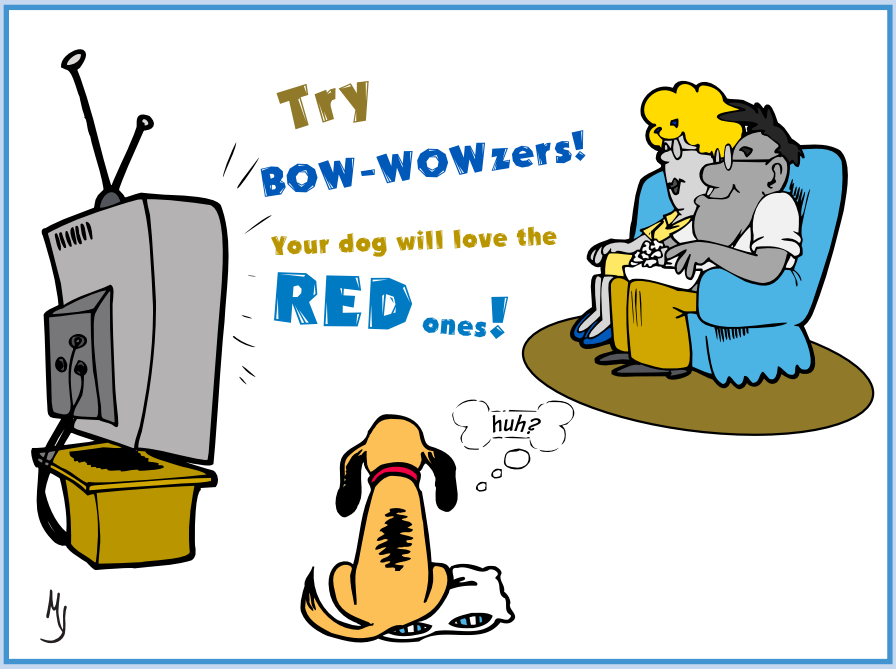
Sensible Games

(continued from page 5)

Tasteless . . .

You need a piece of peeled apple, a piece of peeled, raw potato and a friend to do this one. Close your eyes and hold your nose, and have your friend place a piece of apple or potato in your mouth. Can you tell which one it is? Now, try the other one. Once the second piece is in your mouth, unplug your nose. Can you tell them apart now? How do the senses of taste and smell work together?

Brain Busters!



It was once commonly thought that dogs and other animals could only see in black and white. More recent studies have shown that dogs see the world in shades of yellow and blue—but cannot see reds or greens. Still, dogs have sharper senses than humans do when it comes to smelling and hearing. Odors that we can't detect are easy for dogs to smell. They can sniff objects and tell which ones were touched by a particular person. Dogs also hear sounds far beyond the range of human ears.

Why do you think that humans can see more colors than dogs? What other animals see color? Why do some animals have sharper senses of smell or hearing than we do? Think about it and check it out.

Careers for NeuroExplorers:

Nurse Anesthetist

Have you or anyone you know ever had an operation? Operations would be very painful if it were not for special pain-killing medicines called anesthetics (an-is-THET-icks). Normally, pain sensors in your skin and throughout your body give your brain important signals when something is hurting you. Meet a person who is responsible for easing pain, a nurse anesthetist (uh-NES-thuh-tist).

Neuro-Explorer: Ismay Wilson, CRNA
Certified Registered Nurse Anesthetist
The Methodist Hospital
Houston, Texas

Ms. Wilson, what do you do?

I give people in the hospital who are having an operation special medication that stops signals from their pain sensors from getting to their brains.

What do you find the most fun or most interesting about your work?

I use my nursing skills to the maximum, which I find to be satisfying. It is rewarding to know that I am helping people to feel comfortable instead of feeling pain, and I like working with lots of different kinds of people.

What advice do you have for future nurse anesthetists?

You need to set your goal to become the best possible nurse. Getting good grades in science and mathematics also helps. You also have to be very calm under pressure because you are part of a team responsible for someone's life.

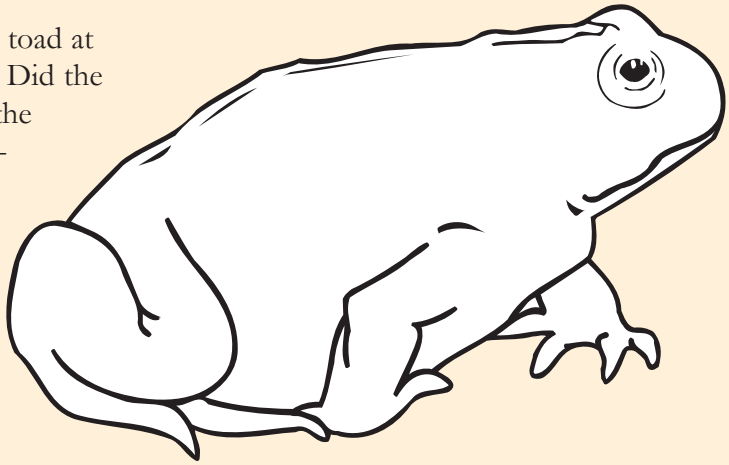
Camouflage!

Some animals avoid being eaten by tricking their predators. They are able to hide by fooling the predator's sense of vision. Many different kinds of animals use camouflage. Imagine that you are a toad in the forest. What type of protective coloration would help you most to hide from your predators? Here is a fun game to try with some friends or family members. It illustrates how toads are almost able to disappear from sight.

1. Make enough copies of the toad below by tracing it onto another piece of paper.
2. Look around and decide where you are going to put your toad so that it blends into the background when colored.

3. Secretly color the toad with crayons or markers and cut it out. When no one else is in the room, tape your toad onto a surface so it blends into the background.
4. Now, ask your partner to **hunt** for the hiding toad.

How successful was your toad at escaping the "predator"? Did the toad fool the **vision** of the "predator" with its camouflage? Can you think of any other sensory tricks that prey might use to escape being eaten by predators?



BRAIN FLASH

Did you know that each person senses the world differently? Some people can't tell the difference between red and green. This is called color blindness. Most people are "blind" to a few kinds of odor. The inability to smell certain odors is called anosmia.

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Activities described here are intended for school-age children under direct supervision of adults. The publisher, Baylor College of Medicine and the authors cannot be responsible for accidents or injuries that may result from the conduct of the activities.

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