

Making Neuroscience Fun

A Brain Awareness Program for All Ages



Brain Health: It's SPECTacular

What to do TODAY Grade 4 (🧠 A Cognitive Health Story)

All animals get information about the world around them and they use this information to modify their behaviors in a way that allows them to survive.

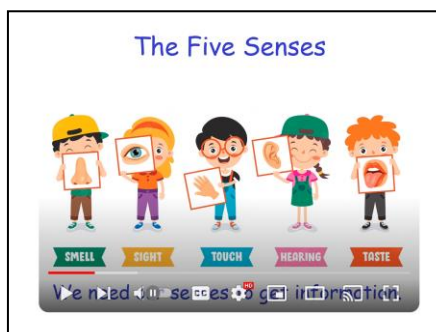
- The world as we know it is dependent on our sensory receptors.
 - Humans are the only animals that are able to enhance their sensory systems to detect stimuli that they would not normally be able to detect. That gives humans a definite advantage as to what they can learn about the world.
 - How our brains perceive the information that is obtained from our sensory systems depends on a number of factors. We need to understand that not only is the world around us constantly changing, but that our perception of the world also changes. What we know about the world allows us to choose behaviors that will allow us to not only survive – but, to thrive.
- 🧠 For this presentation, you need to have the “The World As We Know It ” Story Video. You will need to load the <https://www.nhm.ac.uk/discover/how-do-other-animals-see-the-world.html> website and practice moving the line all the way to the right to see how humans see the picture and to the left to see how the animal sees the picture. You will also need a copy of the G4 Activity Powerpoint. Finally, you will need the <https://www.youtube.com/watch?v=G-IN8vWm3m0> auditory illusion.
- 🧠 Start the story video and stop after the title slide.



The story today, “The World as We Know It!!!” is going to OPEN your eyes to how much our brain REALLY does to help us survive in this world.

Let's SEE...

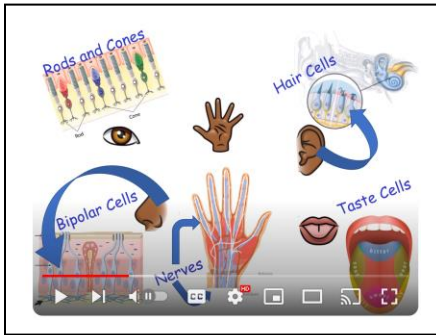
- 🧠 Continue playing the Story Video and stop after this screen.



Ok...so our senses give us INFORMATION about the world around us so that we can survive.

So, when you get up in the morning...HOW do you senses tell you how to dress so you won't be too hot or too cold – so you don't sweat or freeze to death? (Discuss – EYES may SEE snow, TOUCH (skin) can FEEL temperature, Listen to the weather report)

Continue playing the Story Video and stop after this screen.



WHOA!!! That was a LOT of information!!!

Basically, what that all means is that your body – eyes, nose, mouth, ears and skin, **CATCHES** all kinds of things that are out in the world with special **RECEPTORS**.

We only know about the world around us because once those **receptors** **CATCH** the information, they **SEND** the information to our brains.

So, let's learn more about **what** the receptors in each one of our sensory systems **catches** AND what information that it is sending to our brains so that we can learn about the world around us.

Continue playing the Story Video and stop after this slide.

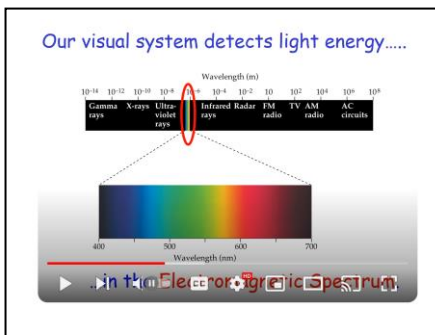


All animals need to learn information about the world, so that they can do behaviors that keep them alive.

Ask...What is a behavior that all animals need to do to survive? (Get a response and then discuss the difference between how humans do that behavior and how animals do.

Explain how all animals have to learn **different** things about the world around them, because the world we “know” and the world that other animals “know” may be totally different. It all depends on the type of **sensory receptors**.

Continue playing the Story Video and stop after this slide.



Ok..so our **RECEPTORS** in our eyes – called **RODS** and **CONES** – **catch** the **wavelengths** that let our see all the colors of the rainbow.

There are other wavelengths – along the **electromagnetic spectrum** (point to the line), the receptors in our eyes cannot catch them.

Think about it you tried to **catch** a football with a baseball glove...it doesn't work that well.

Continue playing the Story Video and stop after this slide.



So, animals **SEE** the world differently based on the kind of **receptors** they have in their eyes. And, this is based on the kind of information their brains need to be able to **SEE** in order for them to survive.

So, the world that we **SEE** is **different** than the world other animals **SEE**. Let's **see** what that would look like.

🌈 Do the “Do You See What I See” demonstration. (There is still about 12 more minutes of the video – so watch your time.)

Remind the students that all animals **see** the world differently because of the kinds (and number) of rods and cones – **receptors** – they have in their eyes.

Example #1 - Dogs

- Humans have 1 kind of rod and 3 kinds of cones (red, green and blue). These **receptors** let us see our world.
- Dogs – have one kind of rod and 2 kinds of cones (yellow and blue). So...dogs can't see the **red** ball in the picture. BUT, they CAN see yellow...maybe that is why they LOVE tennis balls.
- Oh...for those cat lovers...cats have 3 kinds of cones – so they see more color than dogs...but, their vision is blurrier.

Example #2 – Gecko

- Humans cannot see very well at night. They especially can't see color in the dark. This is because of the way their eyes are – NOT because of **receptors**.
- Geckos CAN see color in the dark and they have 3 types of cones just like humans – but geckos have color receptors that CAN see in the dark - unlike humans.

Example #3 – Garden Snail

- Garden snails mainly see in black and white and their eyes do not focus very well – which is why things are fuzzy.
- Some snails may have blue cones – but, most snail go towards the dark.

Example#4 – Giant Clam

- Clams CAN see colors – but, they don't have eyes that can focus to tell their brains about shape.
- Clam “eyes” are just lots of “pin pricks” along their body.
- Their see movement and then they either squirt water or close their shell.

Example #5 – Spiders

- We know that most spiders have more than 2 eyes and lots of spiders actually have more cones than humans. Some can even see ultraviolet light.
- So humans see a yellow flower – but the spider sees a flower with yellow, pink, brown, etc colors.

So, you SEE (pun intended), how we see the world depends on the **receptors** we have in our eyes. Different animals **see** the world differently because they have different receptors. (If you get a color blind questions – tell the students that some people cannot see all the colors of the rainbow – this is due to differences in their **cone receptors**.)

Now, let's see about the receptors for the other senses.

🌈 Continue playing the Story Video and stop after this slide.



The taste sense – or GUSTATORY system if you like big words – is a lot of fun. Mainly because you can actually see where the **taste receptors** are in your mouth.

We are going to do a quick experiment....

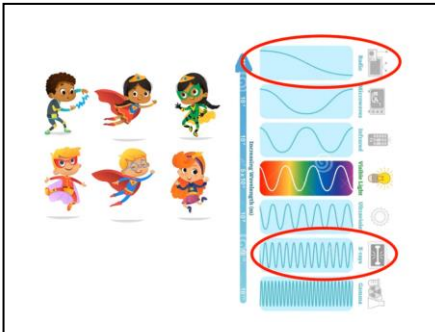
(Pair up the students, in groups of 2 or 3 if you have an odd number.)

Ok...I am going to tell you something that you don't hear a lot...**STICK OUT YOUR TONGUE** at your fellow student(s). Now, look at your friends tongue.

Do you see all those bumps, well those are **papilla** (another hard word) and on the papilla are the taste cells that allow you to taste all the yummy foods in the world.

- Now, different people have different amounts of papilla on their tongues and those papilla can have different numbers and kinds of taste cells.
- This is why different people like or dislike different foods. Depending on their taste buds – foods taste different to different people.

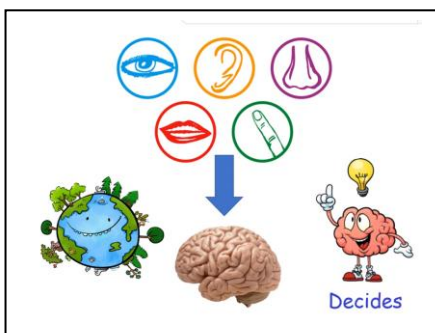
🌈 Continue playing the Story Video and stop after this slide.



Because humans are creative and can use their brains to make new things, we can learn **MORE** about the world around us than our sensory receptors can tell us.

Ask...What are some other inventions that let us learn more about the world? (Get responses and discuss. Ex. Telescopes (see planets and stars), microscopes (see very small cells in and out of our body), GPS (get directions & track people), cell phones (hear and see people far away), etc.)

🌈 Continue playing the Story Video and stop at the end of the slide.

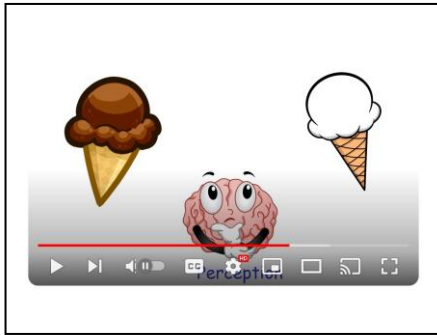


So, depending on what is going on in the world around you and what your sensory systems tell you - your brain then **decides** what behavior to do.

Say you are sitting in the classroom and you see and smell smoke – what do you do? (Get responses.)

What if you are sitting around a campfire and you see and smell smoke – what do you do? (Get responses – my favorite would be **smores**).

- Continue playing the Story Video and stop after this point in the slide after the choc vs vanilla discussion.



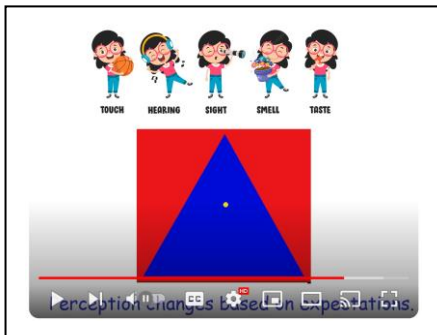
OK...Raise your hand if you like chocolate. (Don't forget to raise your hand too.)

Raise your hand if you like vanilla.

Raise your hand if you like both.

Why do you think some of us like chocolate, some of us like vanilla, and so of us like both? (Discuss, lots of reasons...number of taste cells, some people think chocolate is grittier, etc.)

- Continue playing the Story Video and stop at this point in slide after the question "What would you say?".



Ask...do you think the dot is closer to the top or the bottom?
(you can get the students to raise their hands...top? Or bottom)

Then say...if you said top – you are wrong...and if you said bottom – you are wrong. The dot is directly in the middle of the triangle.

When Dr. Gorman asks you if you think it is top or bottom – you are then expecting it to be in the top or bottom. Your expectations can change how you are seeing the dot.

There are lots of things that can change your **perception** of the world, some has to do with sensory receptors and how those receptors get the information to the parts of the brain that make the **decision** about what the world is actually like.

Other things like **paying attention**, your **emotional state**, and your **expectations** can change the way you **perceive** the world. All of these things can trick your brain into thinking things are different from the way they really are in the world. These are known as **illusions**.


- At this point, there is about 3 minutes of summary. So, at this point you can talk more about **illusions**.

There are ways to “trick” your brain for all of the sensory systems that we use to learn about the world around us.


Let's try some....


- The "Jumping Pencil" (Depth Perception Illusion):**

1. Have students hold a pencil at arm's length.
2. Ask them to close one eye and align the pencil with a distant object. When they switch eyes without moving, the pencil will appear to "jump" to the side.
3. This shows how each eye sees from a slightly different angle. The pencil is NOT really jumping.


 Put up the powerpoint of the **Color Illusion**.

1. Tell the students to stare at the yellow cross. Leave it up for a minute or so, continuously reminding the students to stare at the yellow cross.
2. Then advance the powerpoint to the blank slide and ask the students what they see...there is NOTHING there.
3. Explain that when they continuously stare at the yellow – the cone receptors in their eyes that help them see yellow get “bleached” out – and all they have in that area are the cones that see blue. The same is true for the blue outline.
4. Be sure to tell the students that the cones will all get “unbleached” so they will be able to see correctly again.
 5. The Setup: A participant is blindfolded and instructed to hold their nose while eating bite-sized pieces of raw apple, potato, and sometimes onion.
 6. The Effect: Because these foods have a similar firm and crunchy texture, many people find it nearly impossible to distinguish between them without their sense of smell.
 7. The Science: Researchers suggest that roughly 80% of what we perceive as taste is actually processed through our olfactory system (smell). When the nose is plugged, the tongue can only detect basic tastes—sweet, sour, salty, bitter, and umami—making the subtle flavor profiles of an apple and a potato indistinguishable.

 Put up the **Auditory Illusion** video and watch. The video is 3 minutes – but, you do not have to watch it all.





 If time permits, you can explain about the **Smell and Taste Illusion**.

1. The Setup: A participant is blindfolded and instructed to hold their nose while eating bite-sized pieces of raw apple and a potato.
2. The Effect: Because these foods have a similar firm and crunchy texture, many people find it nearly impossible to distinguish between them without their sense of smell.
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 Continue playing the video until the end.

Tell the students that you had fun talking with them about how they actually learn about the world around them.

Remind the students that...

-  Our sensory systems help us to learn about the world by using **receptors** to send information about the world to our brain.
-  Because humans are more advanced in their thinking than other animals, we are able to enhance our sensory systems to get even more information.
-  Based on a lot of different factors, we then perceive that information and make decisions on how to behave.
-  Using your brain to do all this, helps your brain stay healthy and that is SPECTacular.

Be sure to thank them for listening and the Brain Health Team of JHU students will see them soon.