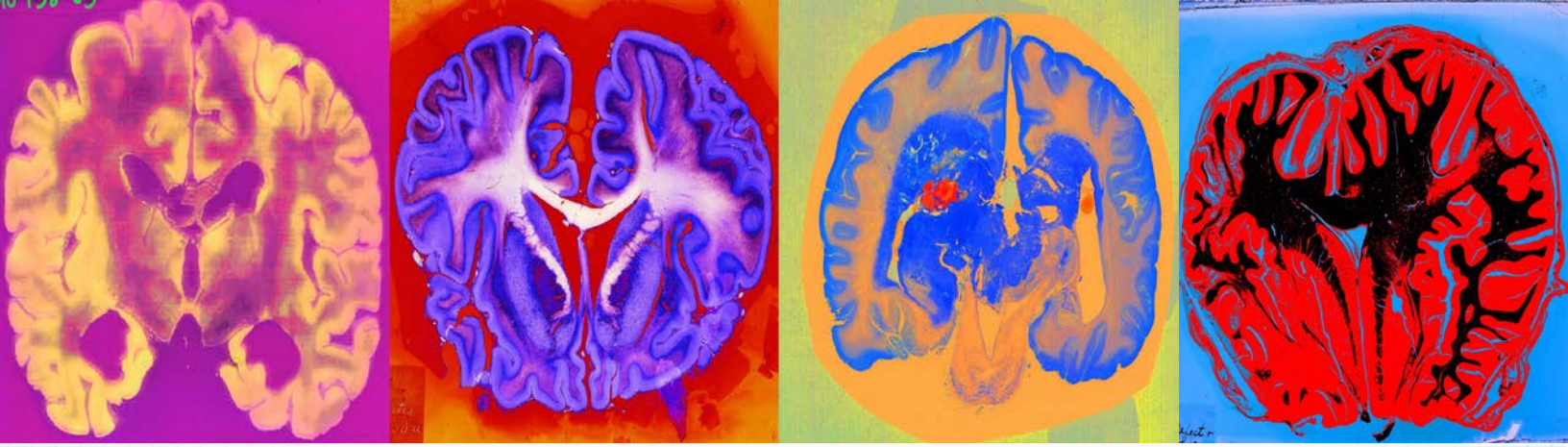
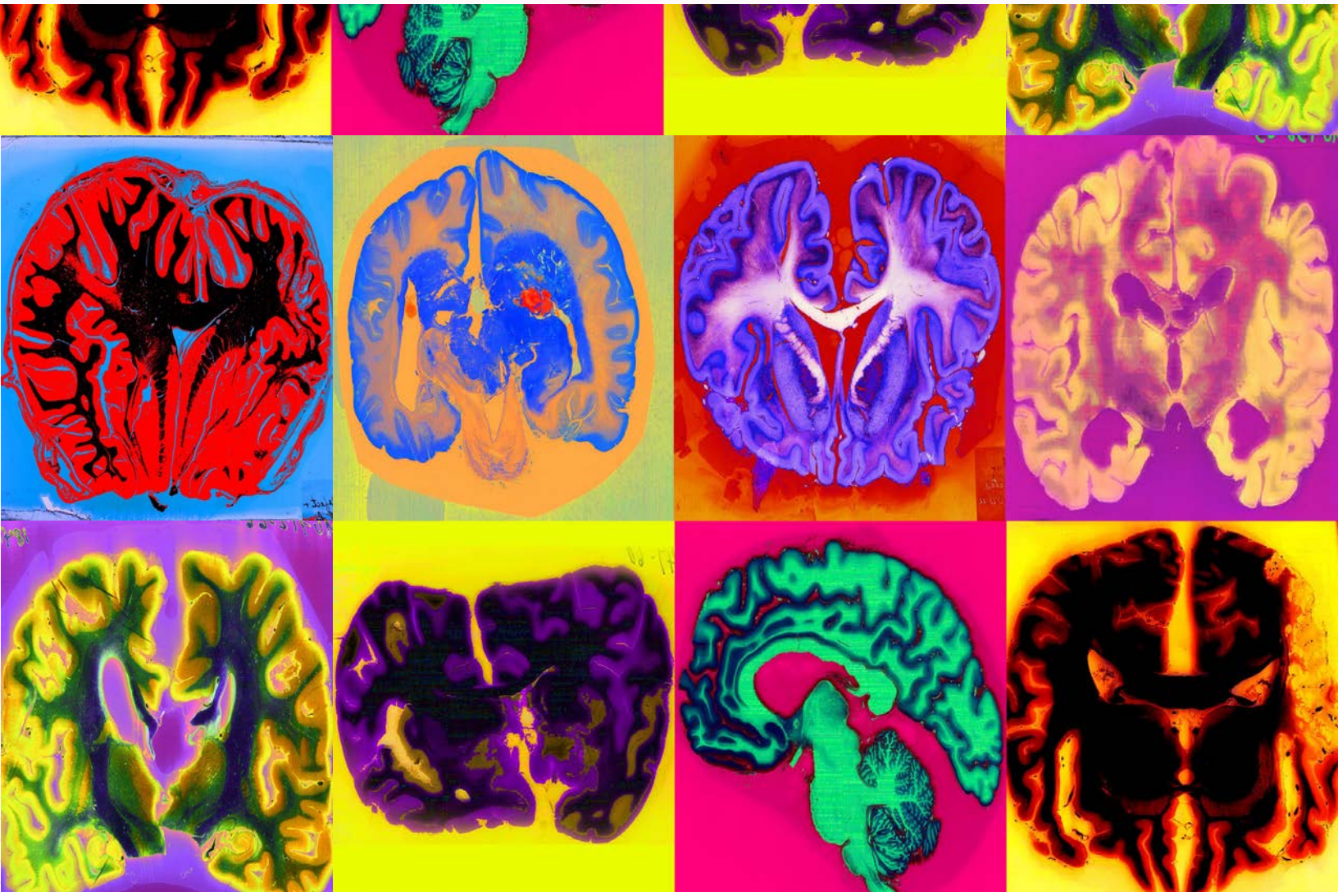


Lab Notebook

BACK TO BASICS: THE BRAIN
BRAIN AWARENESS DAY



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Egg Drop Challenge

Organization: Traumatic Brain Injury Center of Excellence (TBICoE)

Learn about some of the signs and symptoms of a mild traumatic brain injury (mTBI) and how to properly wear a helmet during sports or cycling. This activity will demonstrate the impact of head trauma on the brain with and without a helmet.

Supplies:

- 2 eggs (one raw, one hard-boiled)
- 4 sandwich bags (2 per egg)
- Tape
- Bubble wrap
- Plastic or paper towels

Procedure:

1. Find a 3x3 foot area to perform the egg drop. Tape some plastic or paper towels down on the floor in this area. This will keep the floor clean.
2. Place the raw egg in two sandwich bags (double-bagged). Make sure the bags are sealed/closed. This egg represents a head that is not wearing a helmet.
3. Drop the bag with the raw egg from standing height. If you want to drop from a greater distance, you may ask an adult to drop the egg for you.

   Record your findings:

4. Using the bubble wrap and tape, wrap the hard-boiled egg in the bubble wrap. Make sure the bubble wrap is secure with the tape.

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5. Place the hard-boiled egg, with the bubble wrap, in two sandwich bags (double-bagged). Make sure the bags are sealed/closed. This egg will represent a head wearing a helmet.
6. Drop the hard-boiled egg from standing height. You may ask an adult to drop the egg for you.

   Record your findings:

Analysis Questions:

1. What differences did you observe between the raw egg (head without a helmet) and the hard-boiled egg (head with a helmet) after you dropped them?

2. What is a mild traumatic brain injury (mTBI)?

3. List three signs or symptoms of a mTBI.
   -
   -
   -

4. What are the steps to make sure you are wearing a helmet correctly?

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Feeling Just Right: Balancing Brain Chemicals

Organization: Psychological Health Center of Excellence (PHCoE)

Learn how to help take care of your brain, an organ in your body that contains different chemicals that can influence how you feel, act, and think. PHCoE will provide psychoeducation to viewers about the four main chemicals, what they do, and how to experience their benefits in your everyday life!

Supplies:

- Blank sheet of paper
- Writing utensils

Procedure:

1. Draw one large square/box to fill the page (vertical or horizontal).
2. Divide the large square into four quadrants by drawing a horizontal and vertical line through the center of the large square. Label each square with one of the four chemical messengers (or neurotransmitters) mentioned in the video with the following descriptors:
   - Dopamine: When I am feeling unmotivated, low energy, and/or finding it hard to focus...
   - Oxytocin: When I am feeling lonely, tired, and/or disconnected from others...
   - Serotonin: When I am feeling bad about myself, anxious, and/or in a grumpy mood...
   - Endorphins: When I am feeling hurt, in a low mood, stressed...
3. Now, within each square brainstorm ideas that you can use to make decisions on how to create the feel-good chemicals in your body.

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Feel-Good Foursquare

Dopamine: When I am feeling unmotivated, low energy, and/or finding it hard to focus... I can... • • • • •	**Serotonin:** When I am feeling bad about myself, anxious, and/or in a grumpy mood... I can... • • • • •
Oxytocin: When I am feeling lonely, tired, and/or disconnected from others... I can... • • • • •	**Endorphins:** When I am feeling hurt, in a low mood, stressed... I can... • • • • •

Analysis Questions:

1. What is a chemical messenger (or neurotransmitter)?

2. Why are chemical messengers important to mental health?

3. How do chemical messengers impact mood or stress?

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Perfect Protection:

How to Protect Your Ears from Hearing Loss

Organization: Hearing Center of Excellence (HCE)

Learn how to protect your ears from hearing loss! A presenter from HCE will demonstrate the do's and don'ts of wearing earplugs, how to fully protect your hearing, and why it is important to prevent hearing loss.

Supplies:

- 2 foam earplugs
- 1 glass or jar
- 1 small funnel
- 1 cup of liquid

Procedure:

This activity will take place in two parts. Part 1 will demonstrate improper use of a foam earplug, while Part 2 will show how to properly use a foam earplug.

Part 1:

1. Take one foam earplug and insert the earplug into the funnel. The earplug should reach the end of the funnel.
2. Place the funnel with the inserted earplug over the glass.
3. Slowly pour the liquid into the funnel.
4. Record your observations.

Part 2:

1. Take a dry foam earplug and place it between two fingers.
2. Begin by gently rolling the earplug between your fingers.
3. Continue to roll the earplug with more force until it becomes stiff.
4. With the earplug still between your fingers, insert the earplug into the funnel until it reaches the end of the funnel.
5. Hold the earplug in place for a few seconds until it expands in place.

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6. Place the funnel with the inserted earplug over the glass.
7. Slowly pour the liquid into the funnel.
8. Record your observations.

Analysis Questions:

1. List two causes of hearing loss.

2. Why do you need to protect your hearing?

3. What are some examples of hearing protection?

4. What is one thing you learned from the experiment?

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Build-a-Neuron

Organization: Uniformed Services University of the Health Sciences (USUHS)

Neurons are a very important type of cell in our brains. They are also located throughout our bodies; you may have heard of a group of neurons in your body referred to as a nerve. Neurons are important for everything we do. They're the reason we can see, feel, smell, move, and think. They help our hearts beat and our stomachs digest food. Neuroscience graduate students from USUHS are going to help you learn about the different parts of a neuron and what each part does. Then, they will show you an example of how these neurons all work together to help you make sense of what is happening around you.

Supplies:

- 1 foam ball
- 3-5 short pipe cleaners (about 2 inches long)
- 1 long pipe cleaner (about 4 inches long)
- 3-5 beads that will fit onto your pipe cleaner

Procedure:

1. Pick up your foam ball. This will represent the cell body of your neuron. The cell body contains the nucleus, where our DNA is stored.
2. Take some short pipe cleaners, and stick 3-5 of them into different spots on your foam ball. These represent dendrites. Dendrites communicate with other cells and bring information into the neuron.
3. Find an open space on the foam ball. Stick a long pipe cleaner into this space. This is your axon. An axon is like an electrical wire. Electrical signals travel down the axon to be passed along to other cells.
4. String some beads onto your axon. Leave space between each bead. This is the myelin. If your axon is like a wire, then your myelin is like the rubber that wraps around the wire to insulate it. Myelin helps signals travel faster down the axon.
5. Fold a pipe cleaner in half, and wrap it around the end of your axon. This is your synaptic terminal. The synaptic terminal is where neurons meet up with other neurons to communicate and pass signals along.

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Analysis Questions:

1. What are three things that neurons help you do every day?

   -
   -
   -

2. List all the parts of the neuron. What does each part do?

3. Which parts of a neuron communicate with other neurons?

4. Name three things that happen in your brain when you smell a cookie.

   -
   -
   -

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Concussion Simulation

Organization: U.S. Army Medical Research and Development Command (USAMRDC)

Concussions are a mild form of a traumatic brain injury or TBI. Take part in this quick activity to feel and see what it is like to have a concussion and how it impacts your vision and capabilities by running an obstacle course.

Supplies:

- Sunglasses, goggles, or old eyewear
- Petroleum jelly
- Open area outside where an obstacle course can be set up
- Timer

Procedure:

1. Obtain materials for the concussion simulation (see materials list above).
2. Set up an obstacle course. Be sure that the obstacle course is in a safe location (not near a busy street, cliff etc.). The obstacle course can be complex or simple.
3. Stand at the starting line of your obstacle course.
4. Push start on your timer or have a friend or relative time you.
5. Run through your obstacle course as fast as possible.
6. Push stop on the timer when you reach the finish line and note the time.
7. Smear petroleum jelly onto sunglasses or goggles to simulate a concussion.
8. Put the eyewear on your face.
9. Repeat steps 3-6.
10. Answer the analysis questions.

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Analysis Questions:

1. What happened to your time when wearing the concussion simulation glasses? Did it increase, decrease, or stay the same?

2. How was wearing the glasses similar to having a concussion?

3. What is one easy way to avoid a concussion?

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How Do Our Own Bodies Protect Our Brains?

Organization: Walter Reed Army Institute of Research (WRAIR)

Do you know how your body protects your brain from injury? There may be more to it than you expect! Participate in an activity that demonstrates the importance of how our bodies protect our brains!

Supplies:

- Large container
- Water (enough to fill the container about two thirds of the way up)
- 2+ eggs (can be hardboiled so that they can be eaten after the experiment)
- Sandwich bags (not required, but helpful to contain mess if raw eggs are used)
- Permanent marker

Procedure:

1. Sketch a brain with the four lobes mentioned in the video.

2. Then, sketch a neuron. Label the neurotransmitters and receptors.

3. With a permanent marker, label two eggs with the four lobes mentioned in the video.

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4. With an empty container representing a skull, predict what would happen if an egg fell into the container from shoulder height. This represents a brain bumping against the inside of a skull after being hit in the head.

   Prediction:

   Then, drop the egg. Was your prediction correct?

5. Sketch your experimental set-up. Label the items that represent the skull, and the brain. Draw what the egg looks like after the drop.

6. Fill the container about two thirds of the way up with water. The water represents cerebrospinal fluid inside of the skull. Predict what would happen if an egg fell from sholder height into a fluid-filled container.

   Prediction:

   Then, drop the egg. Was your prediction correct?

7. Sketch your second experimental set-up. Label the items that represent the skull, the cerebrospinal fluid, and the brain. Draw what the egg looks like after the second drop.

Analysis Questions:

1. Was the outcome in the two parts of the experiment the same or different? Why do you think that is?

2. Even though your body has its own way of protecting your brain, what else can you do to protect your brain?

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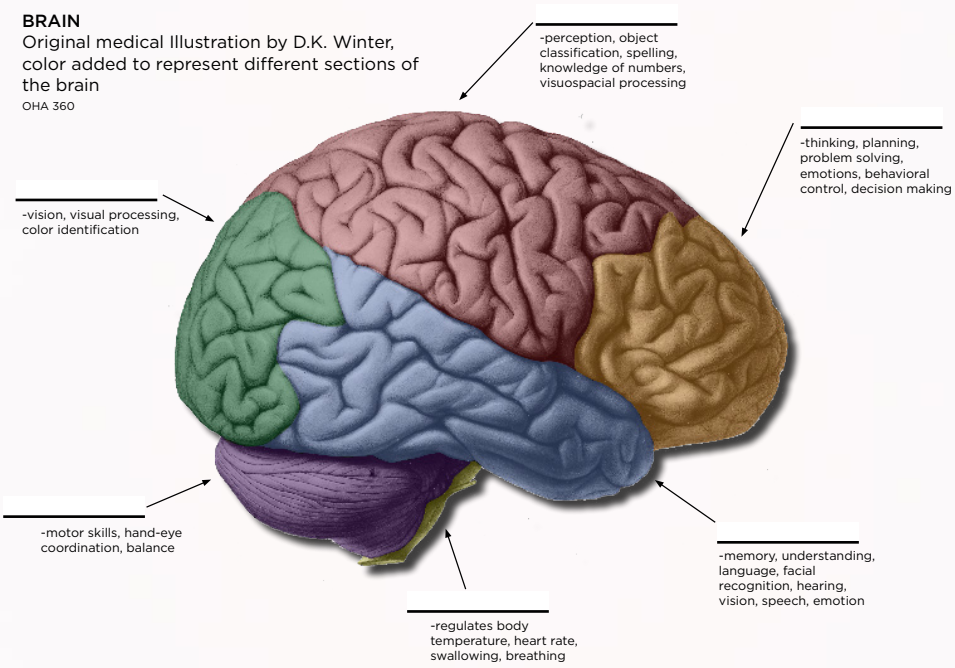
Brain Functions: Back to Basics

Organization: National Museum of Health and Medicine (NMHM), Neuroanatomical Collections

Learn about the different parts of the brain, their function, and how you use your brain in daily activities.

Procedure:

1. Watch the Brain Functions: Back to Basics video on Facebook.
2. Label the structures of the brain below.



Analysis:

List the five main lobes of the brain, their functions, and one activity associated with each structure.

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More Than Meets the Eye

Organization: National Eye Institute (NEI)

"More Than Meets the Eye" is a series of fun, hands-on activities to help students understand how the brain and eyes work together during visual processing. Presenters will reveal how these complicated processes may at times cause optical illusions and affect perception.

Supplies:

- Piece of paper
- Pencil or pen
- Ruler
- Optional: Google cardboard for cell-phone based virtual reality

Procedure:

1. Hold up a pencil in front of you with both eyes open; touch the pencil end with your free hand. Repeat with one eye closed. Which is easier?

2. Roll up a piece of paper to make a tube that you can look through. Hold the tube up to one eye so you're looking through it. Place your free hand next to the tube, palm facing the other eye. What do you see?

3. Following the video, does the hat look taller or wider? Measure it with your ruler.

4. Following the video, which frog has a bigger mouth? Check with your ruler.

5. Following the video, are the vertical lines in this image straight or bent? Check with your ruler.

6. Following the video, when you look at this image, what do you see?

7. For the Stroop test, say the color of each word (don't try and read the words) on screen one. On screen two, repeat. Which was harder?

8. Look at the picture in the video. Try moving your eyes from the top left corner towards the bottom. What happens?

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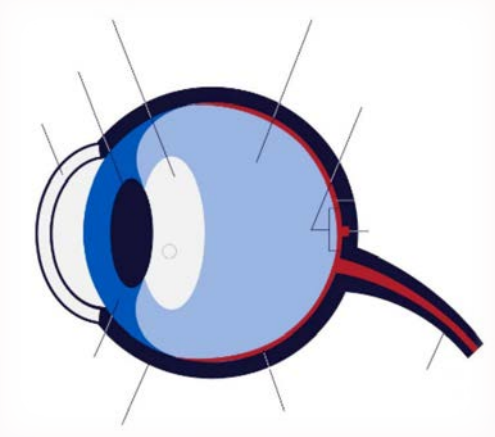
Analysis Questions:

1. What is an optical illusion?

2. Label the parts of the eye: Cornea, Fovea, Iris, Lens, Macula, Optic Nerve, Pupil, Retina, Sclera, Vitreous Humor.



3. What part of the brain processes sight?

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How Hot Is It?

Organization: National Institute of Neurological Disorders and Stroke (NINDS)

Follow along with NINDS, as they use bowls of water to learn how the body senses changes in temperature. Viewers will see that there is variation in how hot or cold we perceive water to be, based on previous experience, even though we all sense the same water.

Supplies:

- 3 bowls
- 1 cup of warm water
- 1 cup of cold water
- 1 cup of room temperature water
- 1/2 cup ice

Procedure:

Set-up:

1. Place three bowls on a flat surface or table.
2. Place warm/hot water (bath water temperature, not painful to the touch) in one bowl.
3. Place room temperature water in one bowl.
4. Place cold water in one bowl (add ice as needed).

Experiment:

1. At the same time, place both hands in the bowl containing room temperature water. Record your observations in the Data Table.
2. Place one hand in the bowl with hot water and one hand in the bowl with cold water. Record your observations in the Data Table.
3. Keep the hands in each bowl for one minute. Record your observations in the Data Table.
4. Return both hands, at the same time, to the bowl with room temperature water. Record your observations in the Data Table.

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Data Table:

	Left Hand	Right Hand
Room Temperature Bowl (Step 1)		
Hot and Cold Bowls		
Hot and Cold Bowls for 1 minute		
Room Temperature Bowl (Step 4)		

Analysis Questions:

1. List the five senses.

   -
   -
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2. What sense or senses did you use for the experiment?

3. When you placed your hands in the hot and cold bowls, why did the water feel cooler/hotter after a minute even though the temperature stayed the same?

4. When you placed your hands back in the room temperature bowl, why did each hand feel like the water was a different temperature?

5. What is sensory adaptation?

6. List one example of our senses adapting with time.

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Getting to Know Your Brain: Dealing with Stress

Organization: National Institute of Mental Health (NIMH)

This video from NIMH will test your knowledge about stress and the brain. You will also learn how to create and use a "stress catcher" to practice strategies to cope with stress.

Supplies:

- "Stress catcher" template (available from NIMH website: www.nimh.nih.gov/stresscatcher)
- Printer and paper to print 1 page
- Scissors
- Markers, crayons, or colored pencils

Procedure:

This activity includes three parts:

1. Test your knowledge about stress and the brain.
2. Learn how to create a "stress catcher."
3. Practice using a stress catcher to discover activities that can help you cope with and manage stress.

Part 1: Test Your Knowledge about Stress and the Brain

Watch the video to learn what stress is, signs of stress, and ways to cope with stress. Also, find out the benefits of practicing new ways to cope with stress while your brain is still developing.

Part 2: Learn How to Create a "Stress Catcher"

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Create your own stress catcher. Watch the video for instructions or follow the steps below:

1. Download and print the PDF template of the stress catcher from the NIMH website at www.nimh.nih.gov/stresscatcher.
2. Color the stress catcher and cut out the square.
3. Place the stress catcher face down. Fold each corner to the opposite corner and then unfold to create two diagonal creases in the square.
4. Fold each corner toward the center of the square so that the numbers and colors are facing you. Turn over the square, and again fold each corner into the center so that the color names are visible.
5. Fold the square in half so that the color names are touching, and the numbers are on the outside. Now open it and fold it in half the other way.
6. Insert your thumb and first finger of each hand (pinching motion) under the number flaps.
7. Close the stress catcher so only the numbers show.

Part 3: Practice Using a Stress Catcher

Use your stress catcher to practice ways of coping with stress. To get started:

1. Pick a number and open and close the stress catcher that number of times.
2. Pick a color and spell out the color name, opening and closing the stress catcher for each letter.
3. Pick a color on the stress catcher and open that flap.
4. Read what it says and practice the coping strategy. This game can be played with one or two players and is a way to practice coping strategies.

Analysis Questions:

1. When have you felt some of the signs of stress?

2. What types of activities do you do when you are feeling stressed?

3. Did you learn any new coping strategies to try in the future?

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Dealing with Stress: Guided Visualization

Organization: National Institute of Mental Health (NIMH)

Dr. Krystal Lewis, a licensed clinical psychologist at NIMH, explains what stress is and describes the parts of the brain that handle the "flight-fight-freeze" response. Dr. Lewis will also lead a guided visualization activity, which may help you relax when you feel stressed out.

Supplies:

- Pen, pencils, or crayons
- A quiet place

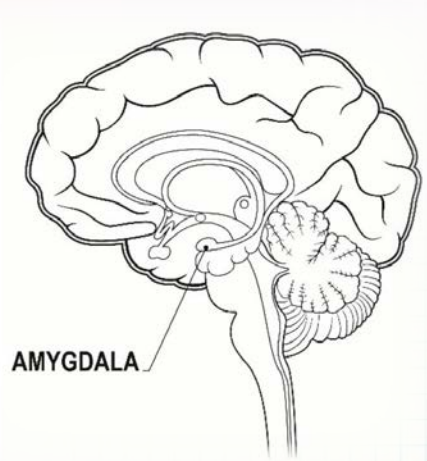
Procedure:

This activity will take place in three parts:

1. Learn about the parts of the brain that process fear and stress.
2. Reflect on when you might be feeling stressed.
3. Practice a guided visualization activity.

Part 1:

Watch the video to learn about stress and how the brain processes stress. Take a moment to color in the parts of the brain below that were discussed in the video. You can use a pinkish-grey color like that of a real brain, or be creative with your own take on the colors.



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Part 2:

Think about when you might need to take a moment to calm down. Write out what might make you feel stressed or overwhelmed:

Part 3:

Continue watching the video to practice a guided visualization activity. Many people use visualization to relax and create a sense of calm. You can use this activity when feeling anxious and stressed about school, before a performance or presentation, when feeling upset at home, or any other time you feel that you need to calm your mind and body. To get started:

- Think about a favorite, peaceful place.
- You can look at a photo of a peaceful place or use the photos below to inspire you.
- Breathe deeply in and out.
- Engage your senses during your relaxation activity.
- Focus on the things you can see, hear, feel, touch, and taste during your visualization.

(Image courtesy of NIMH)

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(Image courtesy of NIMH)

Analysis Questions:

1. How did you feel before the guided visualization?

2. Did you notice any changes in your body or feelings during the guided visualization?

3. Can you think of situations when it may be useful to try a visualization activity?

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Walk the Line

Organization: National Institute on Alcohol Abuse and Alcoholism (NIAAA)

Families will learn how alcohol interferes with the brain, as well as sensory perception, movement, and balance. First, a video will provide true and false answers about alcohol and its effects on the brain. Families will then have the opportunity to try their balance by placing a piece of tape on the ground about five feet long and spinning 5-10 times prior to walking to simulate being under the influence of alcohol.

Supplies:

- Painter's tape or tape that can be visually seen on the ground
- 10 feet of space either inside or outside

Procedure:

1. Place a piece of tape about five feet long down on the ground in a straight line.
2. First, attempt to walk on the straight line.
3. Next, spin around 5-10 times rapidly.
4. Immediately after spinning, attempt to walk on the straight line and see how you do!

Analysis Questions:

1. What region of the brain controls motor control, balance, and speech?

2. What are five warning signs of underage drinking?
   -
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   -
   -
3. What is the decision-making center of the brain?

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Let's Talk About Conditioning!

Organization: Society for Neuroscience, D.C. Metro Area Chapter (SfN DCMA)

Learn about conditioning and behavior. Presenters from SfN DCMA will talk about different types of conditioning and demonstrate how to use conditioning to train certain behaviors.

Supplies:

- Pet(s) with parent/guardian/pet owner's permission
- Pet treats
- Notebook

Procedure:

1. Identify a desired response/behavior (i.e. sit, lie down, shake). What is the behavior?
2. Identify a reward to use to increase the behavior (i.e. pet treat). What is the reward?
3. Practice pairing a response with a reward (i.e. when the pet sits, or gets a treat).
4. Record observations.

Analysis Questions:

1. List two examples of classical conditioning in your own life.
   -
   -
2. List two examples of operant conditioning in your own life.
   -
   -
3. Did the conditioning work? Why or why not?

4. What would you do differently to change or improve the behavior?

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Glossary

Amygdala: part of the limbic system, this group of nuclei are located within the temporal lobes of the brain and are shown to play a primary role in the processing of memory, decision-making, and emotional reactions.

Axon: the long, fiber-like structure of a nerve cell that conducts impulses to or from the cell body; bundles of axons form nerves.

Brain Stem: the lower part of the brain; houses the centers that control vital functions, such as breathing and the heartbeat.

Cerebellum: the region of the brain located behind the brain stem. It is concerned with balance and the control of movement.

Cerebrum: the largest part of the brain; made up of two cerebral hemispheres. It contains the nerve centers for thoughts, personality, the senses, and voluntary movement.

Circuits: the neural pathways of the brain.

Classical Conditioning: conditioning in which the conditioned stimulus (such as the sound of a bell) is paired with and precedes the unconditioned stimulus (such as the sight of food) until the conditioned stimulus alone is sufficient to elicit the response (such as salivation in a dog).

Concussion: a type of traumatic brain injury caused by a bump, blow, or jolt to the head or by a hit to the body that causes the head and brain to move rapidly back and forth. Also called a mild traumatic brain injury.

Corpus Callosum: the wide, curved band of about 20 million nerve fibers that connect the two hemispheres of the cerebrum.

Cranial Nerves: 12 pairs of nerves that can be seen on the ventral (bottom) surface of the brain and passes through openings in the skull to the periphery of the body.

Dendrite: a short, branched extension of a nerve cell where impulses are received from other cells at synapses and are transmitted to the cell body.

Dopamine: a chemical messenger, or neurotransmitter, thought of as the "reward" chemical. Helps with feeling motivated and determined, ready to learn, and is released during enjoyable situations/activities (completing a task, eating your favorite food, or experiencing good news). Also controls movement.

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Dura Mater: a tough membrane which covers the brain and the spinal cord. It lies over the arachnoid and pia mater and adheres closely to the inside of the skull.
Endorphins: a peptide (small protein) that binds to opioid receptors in the central nervous system. Can be thought of as a "pain killer" chemical. Helps respond to feelings of pain or stress to bring a feeling of euphoria and/or joy. Released after exercise or physical movement, laughing, or even eating dark chocolate!
Frontal Lobe: located at the front of the brain behind the forehead, this lobe is concerned with behavior, learning, personality, and voluntary movement.
Glial Tissue: a nerve cell that provides support for neurons.
Hematoma: an accumulation of blood within any part of the body, caused by a torn blood vessel.
Hemorrhage: the escape of blood from a blood vessel, usually as a result of an injury.
Hippocampus: a structure in the brain concerned with learning and long-term memory.
Myelin Sheath: the insulating covering that surrounds the axon, which increases the speed at which nerve impulses can travel along the axon.
Neural Tube: in an embryo, a hollow structure from which the brain and spinal cord form.
Neuron: a single nerve cell, the function of which is to transmit electrical impulses.
Neurotransmitter: chemical messengers that transmit messages from a nerve cell to another cell, such as a muscle or gland cell.
Nervous System: the network of nerve cells and fibers that transmit nerve impulses between parts of the body.
Occipital Lobe: the lobe in the rear of the brain that is concerned with vision.
Operant Conditioning: conditioning in which the desired behavior, or increasingly closer approximations to it, are followed by a rewarding or reinforcing stimulus.
Oxytocin: a hormone that acts as a neurotransmitter in the brain. Oxytocin can be thought of as the "bonding" or "love" chemical. Helps with experiencing feelings of trust, engaging in friendships and relationships, and is released when we are feeling connected with others (playing with a dog, holding hands, hugging a family member, giving a compliment).
Parietal Lobe: the pair of lobes located at the top of the head concerned with processing sensory information.

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Peripheral Nervous System: all of the nerves with their coverings that fan out from the brain and spinal cord, linking them with the rest of the body. The system consists of cranial nerves and spinal nerves.

Sensory Adaptation: sensory receptors that become more or less sensitive in the presence of stimuli such as heat, noise, or smells.

Serotonin: a hormone that can be found in the brain, platelets, digestive tracts, and pineal gland. It acts as both a neurotransmitter and a vasoconstrictor and can be thought of as the "mood balancing" chemical. Helps with calming your mood, feeling confident and good about yourself, and also with relaxing and getting better sleep. It's released when engaging in activities like meditating, running, being outside in the sun, walking in nature, and other kinds of body movement.

Spinal Nerves: the 31 pairs of combined motor and sensory nerves that emerge from and enter the spinal cord.

Stimuli: a thing or event that evokes a specific functional reaction in an organ or tissue.

Stroke: damage to the brain by deprivation of its full blood supply or leakage of blood from a ruptured vessel; may impair movement, sensation, vision, speech, or intellect.

Synapse: the junction between two nerve cells, or between a nerve cell and a muscle fiber or a gland. Chemical messengers are passed across a synapse to produce a response in a target cell.

Temporal Lobe: each of the paired lobes of the brain lying beneath the temple concerned with the understanding of speech/language.

Traumatic Brain Injury: an injury to the brain as a result of an outside force, usually a blow to the head.

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Resources

The appearance of hyperlinks does not constitute endorsement by NMHM or any other agency of the U.S. Government of the destination website or the information, products or services contained therein.

Websites:

Brain Facts: http://www.brainfacts.org

Brainline: http://www.brainline.org

Dana Alliance for Brain Initiatives: http://www.dana.org

Hearing Center of Excellence: https://hearing.health.mil/

National Institute on Alcohol Abuse and Alcoholism: www.niaaa.nih.gov

National Eye Institute: https://www.nei.nih.gov

National Institute of Mental Health: https://www.nimh.nih.gov

National Institute of Neurological Disorders and Stroke, Brain Basics:
https://www.ninds.nih.gov/Disorders/Patient-Caregiver-Education/Know-Your-Brain

Neuroscience for Kids: http://faculty.washington.edu/chudler/neurok.html

Psychological Health Center of Excellence: https://pdhealth.mil

Society for Neuroscience: http://www.sfn.org

Traumatic Brain Injury Center of Excellence:
https://www.health.mil/About-MHS/OASDHA/Defense-Health-Agency/Research-and-Development/Traumatic-Brain-Injury-Center-of-Excellence/Research

Publications:

Human Body by Kirsteen Rogers and Corinne Henderson. Usborne Publishing Ltd. 2001.

Understanding Your Brain by Rebecca Treays. Usborne Publishing Ltd. 2004.

Understanding Your Sense by Rebecca Treays. Usborne Publishing Ltd. 1997.

The Human Body Book by Steve Parker. DK Publishing. 2007.

The Magic School Bus Explores the Senses by Joanna Cole and Bruce Degen. Scholastic. 1999.

Neurocomic by Matteo Farinella and Hanna Ros. London: Nobrow Ltd. 2013.

The Brain: Our Nervous System by Seymour Simon. New York: William Morrow. 1997.

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Standards:

National Science Standards

• Conduct an investigation to provide evidence that living things are made of cells; either one cell or many different numbers and types of cells (MS-LS1-1, Structure and Functions, LS1.A).

• Develop and use a model to describe the function of a cell as whole and the ways parts of cells contribute to the function (MS-LS1-2, Structure and Function, LS1.A).

• Gather and synthesize information that sensory receptors respond to stimuli by sending messages to the brain for immediate behavior or storage as memories (MS-LS1-8, Information Processing, LS1.D).

• Develop and use a model to describe why structural changes to genes (mutations) located on chromosomes may affect proteins and may result in harmful, beneficial, or neutral effects to the structure and function of the organism (MS-LS3-1, Variation of Traits, LS3.B).

• Use a model to describe the way animals receive different types of information through their senses, process the information in the brain, and respond to the information in different ways (4-LS1-2, From Molecules to Organism: Structures and Processes).

Common Core:

• Follow precisely a multistep procedure when carrying out experiments, taking measurements, or performing technical tasks (RST.6-8.3).

• Determine the meaning of symbols, key terms, and other domain-specific words and phrases as they are used in a specific scientific or technical context relevant to grades 6-8 texts and topics (RST.6-8.4).

• Engage effectively in a range of collaborative discussions (one-on-one, in groups, and teacher-led) with diverse partners on grades 6-8 topics, texts, and issues, building on other's ideas and expressing their own clearly (SL.7.1).

• Acquire and use accurately grade-appropriate general academic and domain-specific words and phrases; gather vocabulary knowledge when considering a word or phrase important to comprehension or expression (L.7. 6).

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