



LESSON PLAN

BRAIN PROCESSING OF SENSES GRADES 3-5

SUMMARY

Students explore how the senses and the brain work together to help us, and all animals, survive and thrive in their environments.



4-LS1-2 Use a model to describe that animals receive different types of information through their senses, process the information in their brain, and respond to the information in different ways.

4-LS1-1 Construct an argument that plants and animals have internal and external structures that function to support survival, growth, behavior, and reproduction.

Science & Engineering Practices	Connections to Classroom Activity
<p>Developing and Using Models (4-LS1-2) Engaging in Argument from Evidence (4-LS1-1)</p>	<ul style="list-style-type: none"> • Perform the Ruler Drop Experiment to model how the brain receives information from the senses and responds with an action. • Evaluate the concepts presented in the video and class, and develop explanations through whole class discussion and small group discussions.
Disciplinary Core Ideas	Connections to Classroom Activity
<p>LS1.D Information Processing Different sense receptors are specialized for particular kinds of information, which may be then processed</p>	<ul style="list-style-type: none"> • Experience different sense receptors when they perform the Ruler Drop Experiment with the optional tests.

by the animal's brain. Animals are able to use their perceptions and memories to guide their actions. (4-LS1-2)

LS1.A: Structure and Function

Plants and animals have both internal and external structures that serve various functions in growth, survival, behavior, and reproduction. (4-LS1-1)

- Learn about the various types of sense receptors that animals have (including humans) and how reactions to incoming sensory data cause animals to take action that ensures their growth and survival.

Crosscutting Concepts

Systems and System Models (4-LS1-2) (4-LS1-1)

Connections to Classroom Activity

- Describe the sensory network involved in receiving, transmitting, and responding to input from senses.

DURATION

One 50-minute class period

PRE-ASSESSMENT QUESTIONS

Please see Discussion Questions. These can be discussed as a group or answered individually in student science notebooks.

MATERIALS

- Science notebooks (1 per student)
- Pencils, colored pencils
- Generation Genius Brain Processing of Senses Video

DIY Ruler Drop Experiment – Per team of 2 students:

- A ruler (30 cm/12 inch)
- A flat table or desk to sit at



ENGAGE

Introduce the topic of the body's system of sensory perception.

Ask:

Has anyone here ever caught a ball? (Almost everyone should say yes.)

- Think about the steps involved in catching a ball.
- What is the first step? (Seeing the ball coming at you, or hearing someone call your name to tell you the ball is coming at you—input from your senses.)
- What's the next step? (Deciding to catch the ball—your brain is thinking about your action.)
- Next step? You react. (Your brain tells your body what to do—catch it, run away, duck, hit it back, whatever - nerve impulses travel from your brain to the rest of your body.)
- The last step? Your body performs the task your brain told it to do, and you caught the ball (maybe!).



BEGIN WATCHING THE GENERATION GENIUS BRAIN PROCESSING VIDEO - stop after the introduction of the nervous system pathway of sensory information to the brain, and the reaction of your body to the brain's information. Discuss and recap the video information about the nervous system's function of transmitting information to the brain, and apply it to the scenario of catching a ball.

Stop and discuss each animal in the video to determine what senses the animal has, and create a list on how senses are used to help animals survive.

Ask:

- Do all animals have the same senses? (many do, some don't)
- Do humans use their sense for the same reasons animals do? (Yes - for survival, find food, and so forth.)
- Do you think all animals' bodies process sensory information the same way—through their nervous systems to their brains? (yes)
- What are some of the ways other animals' senses are the same or different from humans? Access students' prior knowledge by discussing the senses of different animals that students may already know about.

Continue watching the video through Izzy's adventures in the graveyard. List and discuss Izzy's reactions in the graveyard as he is poked by a branch while trying to find a lost dog at night. Compare and contrast Izzy's reaction at the stove with his reaction in the graveyard. Discuss how Izzy's reactions help him out in both situations.



EXPLORE



WATCH THE DIY SECTION OF THE GENERATION GENIUS BRAIN PROCESSING VIDEO

so students can observe how to do the experiment they will later perform.

Perform the Ruler Drop Experiment. See the DIY section of the lesson plan for directions.



EXPLAIN

Have students look at their reaction times over their three trials and analyze the changes, if any, between the three times.

Ask:

- Are there differences between the first, second, and third trial times?
- Why do we perform the experiment more than once?
- If your time decreased, became smaller—meaning it took you less time to catch the ruler - what does that mean?
- Why was the ruler caught in the middle (after a lag period) rather than at the end (instantaneously)?
- What causes this delay?
- What had to happen in your body for you to catch the ruler?
- If you performed the ruler grab 10 times, do you think your times would shrink, level off, or start getting larger? Why?
- How can your reaction time be improved?

Have teams review their predictions from the beginning of the experiment and record how well their predictions match what their actual performance numbers show. Using the information learned in the GENERATION GENIUS BRAIN PROCESSING video, have the class work in groups of 4 (two teams) to discuss and create an explanation of what was taking place in their bodies as they tried to catch the ruler. Have each group share their thoughts with the whole class to create a class explanation about how their bodies and brains worked together to catch the ruler. Ask students to record the class explanation in their science notebooks. Identify an outlying result (an extremely quick catch) and explain that we experiment several times and use averages to get more reliable results.



ELABORATE

Have each group of four students brainstorm some common actions they do in their lives that are triggered by information coming in from their senses. Ask each group to come up with at least 10 different actions and identify the sense or senses that received the information. Beside each action and its senses, list how that action helps with survival in their classroom, at home, on the playground, and other places students spend time.



EVALUATE

In their science notebooks, have each student draw the incoming signal from the sense to the brain with one color of pencil, and the outgoing signal from the brain with a different colored pencil on an outline of the human body. Ask each student to label the links in the pathway, starting with the catcher's readiness to grab the ruler and ending with the actual ruler grab.

Students can also be assessed by their contributions in class discussions, and their accuracy, ability to follow directions, and teamwork in conducting the Ruler Drop Experiment.



EXTENSIONS

- Have students create a line graph of their reaction times. If students performed the optional tests, plot each test's data on the graph to compare and contrast.
- Collect the whole class's data and create a series of line graphs of their data. Analyze for trends and make predictions about the performance of the students over time.
- Perform the Ruler Drop Experiment with different-sized and -shaped objects (not breakable), to determine how much the shape or size of the object affects a person's reaction time catching it.
- Hypothesize about the number of times a person should perform the ruler drop to significantly decrease their reaction time. Test out the hypothesis by designing an experiment that will collect enough data to prove or disprove the hypothesis.
- Design an investigation to determine whether a reaction to a sensory input is instinctive or learned. Research the differences between the two types of reaction and justify your investigation design. Perform your investigation.
- Try out different but similar types of sensory inputs and see whether reaction times change in response. For example: use a feather and a paintbrush to see whether one will make a person twitch faster than the other.

