Say "YES" to a Healthy Lifestyle

ask listen learn
Kids and alcohol don't mix.
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Discovery EDUCATION

GRADE RANGE
4–6

A LAB-BASED EXPERIENCE | **EDUCATOR GUIDE**

ASK, LISTEN, LEARN: HOW ALCOHOL AFFECTS THE DEVELOPING BRAIN

Objectives

- Analyze the ways alcohol negatively impacts the developing brain.
- Identify parts of the brain and their function, including the central nervous system, cerebellum, cerebral cortex, and the hippocampus.
- Understand that the brain is a complex organ responsible for controlling all processes of the body, some of which are movement, breathing, reasoning, memories, and emotions.

Introduction

Did you know kids' brains and adults' brains are different? Kids' brains are still developing, which makes them extra important to protect. In fact, a person's brain isn't totally developed until they are in their mid-twenties!

In this Virtual Lab, students take on the role of neurologists studying alcohol and the developing brain. Using a fictional Developing Brain Simulator machine, they will explore how alcohol affects four parts of the developing brain and interferes with important brain functions such as memory, reaction time, coordination, and problem-solving.

NGSS Standards

- MS-LS1-3: Within cells, special structures are responsible for particular functions, and the cell membrane forms the boundary that controls what enters and leaves the cell.
- MS-LS1-8: Gather and synthesize information that sensory receptors respond to stimuli by sending messages to the brain for immediate behavior or storage of memories.
- Disciplinary Core Idea:
    - LS1.D: By the end of grade 8. Each sense receptor responds to different inputs (electromagnetic, mechanical, chemical), transmitting them as signals that travel along nerve cells to the brain. The signals are then processed in the brain, resulting in immediate behaviors or memories.

Changes in the structure and functioning of many millions of interconnected nerve cells allow combined inputs to be stored as memories for long periods of time.

- National Health Education Standards
  Standard 1: Use functional health information to support health and well-being of self and others.
  - 1.8.3 Analyze behaviors that reduce or prevent illnesses and injuries.

Prepare for the Virtual Lab

Discussion

Before launching the Virtual Lab, host a discussion with students to help them engage with the topic. Choose one of these discussion questions or create your own.

Intro Questions

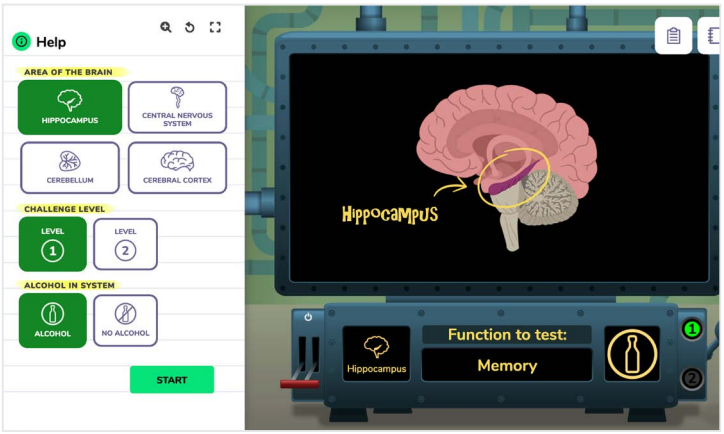
- Should knowing that the brain continues to develop into the mid-20s influence the choices kids make? Why or why not?
- Different parts of the brain are responsible for different functions. What areas of the brain are you already familiar with?
- How may a developing brain impaired by alcohol impact the safety and performance of that person and those around them?
- How do you predict alcohol may affect the developing brain differently than an adult brain?

Student Worksheet

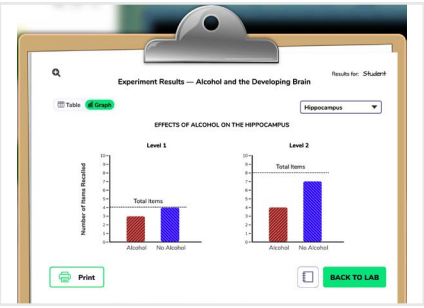
The student worksheet includes questions to check understanding and a section for recording data. Present the student worksheet prior to the activity so that students can focus on the intended learning outcomes and investigate with a purpose. Students can answer the questions during or after the Virtual Lab.

Complete the Experiment

- Whether students complete the lab independently or you present it to them, encourage students to choose variables thoughtfully and to hypothesize the results. To look for patterns, they should run trials with and without alcohol for each part of the brain. You may want to have each student or group choose one part of the brain to run trials on.



In the lab, you can:



- Select variables
- Observe an animation for each trial
- View and analyze results through tables and graphs on the Clipboard
- Gain key understandings and think critically through questions in the Lab Notes
- Read a helpful hint in the Help section.

Troubleshooting

If students need help while performing the lab, try these tips:

- Talk through each variable and what it means.
- Read the Help section.
- Look at a "Results" pop-up together (appears after each trial) and talk about what the results mean.
- Remind students to toggle from table to graph on the Clipboard.
- Ask them to reference the Lab Notes if they get stuck: the questions could help guide them.

After the Experiment

Ask students to share what they discovered about the effects of alcohol on the developing brain.

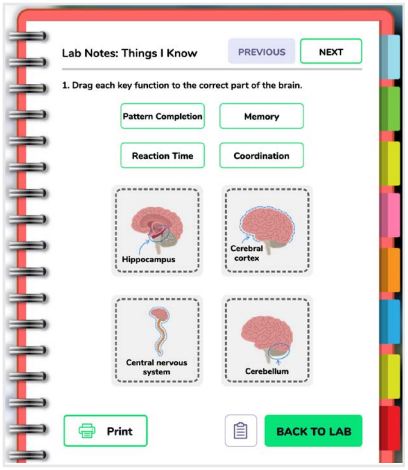
Results

Students will discover:

- Alcohol consumption reduces memory.
- Alcohol consumption slows reaction time.
- Alcohol consumption reduces the brain's ability to solve problems.
- Alcohol consumption reduces the brain's ability to coordinate movements.

Lab Notes

- The Things I Know questions nudge students toward key takeaways of the lab. The My Thoughts section promotes critical thinking. Consider discussing the questions from the Lab Notes as a class or in small groups. Expand the conversation using the facts and prompts below.



Things I Know

1. Drag each key function to the correct part of the brain.

Correct answers:
Pattern Completion: Cerebral Cortex
Reaction Time: Central Nervous System
Memory: Hippocampus
Coordination: Cerebellum

Facts:

- These brain areas mature at different speeds, and regions involved in thinking and decision-making develop later than areas that control basic movement and reactions.
- Different parts of the brain communicate by sending signals to each other, so a change or delay in one area can affect other areas as well.

2. Use your data to identify the impacts of alcohol on the developing brain. Select all that apply. Alcohol consumption:

   A. improves memory

   B. slows reaction time

   C. reduces the brain's ability to solve problems

   D. improves the brain's ability to coordinate movements

Correct answers:
B. slows reaction time
C. reduces the brain's ability to solve problems

Facts:

- Alcohol increases reaction time because it slows signals in the central nervous system.
- Alcohol reduces the brain's ability to solve problems because it interferes with how the cerebral cortex thinks, plans, and makes decisions.

3. Based on your data, which images below show possible impacts of an impaired cerebellum? Select all that apply.

Correct answers:
A. image of a person falling down the stairs
C. image of a baseball hitting a baseball player on the head

Facts:

- The cerebellum helps control balance and coordination, so impairment could make it harder to stay steady and increase the risk of falling.
- An impaired cerebellum can make movements slower and less precise, which could cause a person to misjudge their timing or position, leading to accidents like being hit by a ball.

Learn about the cerebral cortex to answer questions 4 and 5.

The cerebral cortex is the largest part of the brain. It is made up of four sections called lobes, each responsible for different functions. Drag the correct labels to answer questions 4 and 5.

4. This part of the brain helps with language and speech and may cause slurred words after drinking alcohol.

Correct answer: Temporal Lobe

Facts:

- The temporal lobe processes sounds, including spoken language, from others and yourself. This is important for clear speech and communication.
- Alcohol can interfere with how the temporal lobe processes sounds and words, which can make speech slower or slurred.

5. A teen who drinks alcohol might make poor decisions because alcohol affects this lobe.

Correct answer: Frontal Lobe

Facts:

- The frontal lobe is responsible for decision-making, problem-solving, reasoning, planning, and self-control.
- Alcohol interferes with how the frontal lobe works. This makes it harder to think clearly and weigh the consequences, which can lead to poor decisions.

My Thoughts

6. A friend had alcohol at a party, then fell and hurt her ankle. Using your data, explain why drinking alcohol may have caused the fall.

Possible answer: The Youth Brain Simulator results show that without alcohol in their system, Sim caught five balls in Challenge Level 1 and four balls in Challenge Level 2. When Sim had alcohol in their system, they caught three balls in Challenge Level 1 and two balls in Challenge Level 2. This shows that alcohol can affect the body's coordination, which can make it more likely for someone to fall.

Extension: Which part of the brain helps with balance and coordination and was likely affected by the alcohol?

7. How do you think drinking alcohol affects a developing brain differently than an adult brain? Make a claim and support it with evidence from the Youth Brain Simulator results.

> **Possible answer:** Alcohol can affect a young, developing brain more than an adult brain because it can interfere with brain growth and important skills like memory, decision-making, and self-control.
>
> **Extension:** How might knowing that the brain is still developing influence a kid's choices about alcohol?

Student Worksheet Answers

1. What does it mean when adults say that a kid's brain is "still developing?"

   Answer: It means that a kid's brain is still changing and growing. This continues until the kid is in their mid-twenties!

2. Why do you think it is extra-important to protect a developing brain?

   Answer: It's extra-important to protect a developing brain because it is still growing! Harm during this time can affect how someone thinks, learns, and makes decisions later in life.

3. The cerebral cortex is the brain's outermost layer. It is made up of four different lobes. What are some of the different functions that these lobes are responsible for?

   Answer: The functions of the cerebral cortex include problem solving, reasoning, decision-making, movement, recognition, speech, memory, perception, and vision.

4. In this Virtual Lab, you used Sim to see how alcohol affects a developing brain. What changes did you notice in thinking and behavior when alcohol was involved?

   Answer: Alcohol can slow down a person's reaction time. It can also reduce someone's ability to coordinate movement, solve problems, and remember things.

5. Based on your results, how could an impaired youth brain impact the safety and performance of both the kid and those around them?

   Answer: An impaired youth brain can make it harder to react quickly, think clearly, and move safely. This can increase the risk of accidents or mistakes, which can put both the kid and others around them in danger.

Additional Resources

For more resources that teach students the impact of alcohol on the developing brain—all while building kids' confidence in their knowledge and providing them with tools to say "YES" to a healthy lifestyle and "NO" to underage drinking—visit https://asklistenlearn.org/teachers/discovery-ed/.