



# BRAIN GAINS

by: BrainFacts.org

## SYNOPSIS

It's a race down the axon! Students will learn how different behaviors shape the brain as they compete to be the first player to reach the axon terminal.

## OBJECTIVES

At the end of this activity students will:

- Be able to list activities and choices that lead to a healthy brain
- Better understand how certain activities and choices negatively affect the brain

## TEACHER BACKGROUND

The purpose of the Brain Gains board game is to help students understand how the choices they make affect their brain. For example, players will learn that high-fat diets and lack of sleep can negatively affect a person's memory, while regular exercise improves cognition.

No prior knowledge is needed to play this game. Players will follow along with the "Rules of the Road" to learn more about:

- Diet
- Exercise
- Drug and alcohol use
- Sleep
- Traumatic brain injury
- Alzheimer's disease
- Language
- Memory
- Neuron anatomy

## INTEGRATION INTO CURRICULUM

- Health
- Biology, AP Biology
- Anatomy and Physiology

# GETTING STARTED

## MATERIALS NEEDED

- Printed copy of the board game
- Small objects for players to use as game pieces
- Printed copy of the “Rules of the Road”
- Scissors
- Glue or tape
- 1 six-sided die

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## SETUP

\*Two to four players can play the game at once.

1. Print out a copy of the Brain Gains board on 11x17 paper.
  - Cut along the dotted line on side “B.”
  - Paste side “B” onto side “A.”
2. Print out one copy of the “Rules of the Road” for each group playing the game.

# GETTING STARTED



## HOW TO PLAY

1. Divide the students into groups of 2-4 players, and distribute the materials. Have the students agree on which game piece belongs to whom, and have them nominate a leader. The leader of the game will be in charge of reading the “Rules of the Road.”
2. The students will then place all their game pieces on the cell body (“Start”). The students will roll the die to determine the order of the players. The highest roller will go first, then the second highest roller, and so on.
3. Players will roll the die and advance that many spaces across the board. If a player lands on a square with an icon, they must consult the “Rules of the Road” sheet. The “Rules of the Road” will give the players instructions on what to do next. For example:
  - A. Electrical signals mean the player gets another turn
  - B. Plaques mean players lose a turn
  - C. Glial cells mean players advance to another part of the board
  - D. Reverse spaces mean players will have to go back a predetermined number of spaces
4. The first player to make it to the axon terminal (“End”) is the winner.

# RULES OF THE ROAD



**CELL BODY (START)** | The cell body is the part of a neuron that contains the nucleus (with DNA) and the organelles, but not the projections such as the axon or dendrites.

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**ELECTRICAL SIGNAL** | In order for a neuron to pass a message to the next neuron, an electrical signal must travel down the axon. Roll again.

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**PLAQUE** | Plaques are clumps of proteins that build up in the brains of people with Alzheimer's disease. Scientists believe plaques prevent neurons from working properly and likely contribute to the symptoms of the disease. Lose a turn.

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**GLIA** | Glia are the non-signaling cells of the nervous system. They support and nourish neurons and some of them make myelin, the fatty material that wraps around axons to speed up electrical signals. Recently, scientists learned glia also help form and maintain synapses, the points at which neurons communicate with each other. Players who land on these spaces may advance their game piece across the glial cell.



**ABC** | You learned a second language. Bilingualism, or being fluent in two languages, can enhance your ability to concentrate and might also protect against dementia and other types of age-related cognitive decline.



**BICYCLE** | You went for a bike ride. Physical activity does more than build muscle and increase fitness — it can also help the brain make new cells and improve learning and memory.



**TEXTBOOK** | You just finished studying for your science test and you remember all the new facts you just learned. When you learn new things, your brain cells make new connections with each other and strengthen existing connections, a process called neuroplasticity.



**MUSIC** | You learned to play an instrument. Listening to music activates multiple areas of your brain, and playing an instrument is like a full-brain workout.

# RULES OF THE ROAD



**DIET** | A poor diet can not only lead to a host of medical issues like obesity, cardiovascular disease, cancer, and diabetes, but it can also increase the risk for mental disorders and neurodegenerative diseases. Go back two spaces.

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**DRUGS** | If continued long enough, drug abuse can eventually alter the very structure and chemical makeup of the brain, producing a drug addiction. Drug addiction is marked by a pathological desire to use drugs in spite of the harm they cause. Drug use is especially damaging to the developing brain. Go back three spaces.

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**TRAUMATIC BRAIN INJURY (TBI)** | Traumatic brain injury (TBI) is a head injury where the force of an impact causes the brain to slam into the skull, bruising tissue and tearing neurons. Afterward, inflammation in the injured area can disrupt signaling between cells and impair brain function. Go back two spaces.

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**ALCOHOL** | Alcohol, which is easily absorbed into the bloodstream and the brain, affects the brain's chemical messengers, or neurotransmitters. Alcohol can calm anxiety, impair muscle control, and delay reaction time. At higher doses, alcohol can also cloud thinking and potentially lead to coma. Go back three spaces.

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**SLEEP** | Sleep is vital to survival, and it helps the nervous system function properly. Studies reveal that when animals and people don't get enough sleep, concentration, coordination, memory, and mood suffer. Go back two spaces.

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**AXON TERMINAL (END)** | The axon terminal, or nerve terminal, is the tip of the axon where chemical messengers called neurotransmitters are released.