

Document Overview

DOPE...I Mean Dopamine: The Impact of the Enriched Environment on Dopamine Levels and Addiction

Does an enriched environment impact dopamine levels and therefore lessen addiction?

Standards

Minnesota State Academic Science Standards

- 7.4.1.1.1 Recognize that all cells do not look alike and that specialized cells in multicellular organisms are organized into tissues and organs that perform specialized functions.
- 9.1.3.1.1 Describe a system, including specifications of boundaries and subsystems, relationships to other systems, and identification of inputs and expected outputs.
- 9.1.3.1.2 Identify properties of a system that are different from those of its parts but appear because of the interaction of those parts.
- 9.1.3.4.3 Select and use appropriate numeric, symbolic, pictorial, or graphical representation to communicate scientific ideas, procedures and experimental results.
- Understand that science is a way of knowing about the natural world and is characterized by empirical criteria, logical argument and skeptical review.
- 7.1.1.2.3 Generate a scientific conclusion from an investigation, clearly distinguishing between results (evidence) and conclusions (explanation).
- 7.1.1.2.4 Evaluate explanations proposed by others by examining and comparing evidence, identifying faulty reasoning, and suggesting alternative explanations.
- 9.4.4.2.1, 9.4.4.2.4 Personal and community health can be affected by the environment, body functions and human behavior.

Next Generation Science Standards

- MS-LS1-2. Develop and use a model to describe the function of a cell as a whole and ways parts of cells contribute to the function.
- MS-LS1-3. Use argument supported by evidence for how the body is a system of interacting subsystems composed of groups of cells.
- MS-LS1-8. Gather and synthesize information that sensory receptors respond to stimuli by sending messages to the brain for immediate behavior or storage as memories.
- HS-LS3-2. Make and defend a claim based on evidence that inheritable genetic variations may result from: (1) new genetic combinations through meiosis, (2) viable errors occurring during replication, and/or (3) mutations caused by environmental factors.
- HS-LS3-3. Apply concepts of statistics and probability to explain the variation and distribution of expressed traits in a population.

Other Standards: AP Psychology Standards

- Identify basic processes and systems in the biological bases of behavior, including parts of the neuron and the process of transmission of a signal between neurons.

- Discuss the influence of drugs on neurotransmitters (e.g., reuptake mechanisms, agonists, antagonists).
- Discuss psychology's abiding interest in how heredity, environment, and evolution work together to shape behavior.
- Discuss drug dependence, addiction, tolerance, and withdrawal.

Objective

- 1) Students will develop an understanding of the impact of an enriched environment or the lack of and how it relates to the development of addictions.
- 2) Students will analyze scientific research on how dopamine works and how its level can change and impact behavior.

Type of Activity

- 1) Reading with class discussion.
- 2) Video viewing and discussion.
- 3) Webquest

Suggested Duration

80-90 Minutes of class time.

Connection to Nobel Speakers

Carl Hart's theories on the causes of addiction.

Concepts/Keywords/Appropriate Classes

Appropriate Classes:

Lesson plan could be used for a high school biology class, a high school anatomy class, and a psychology class.

Concepts:

Social Neuroscience

Importance of an Enriched Environment

Dopamine in the Brain

The Science Behind Addictions

Keywords:

Addiction, Dopamine, Serotonin, Social Neuroscience, Neuron, Neurotransmitter, Synapse, Reward Pathway, Evidence Based Decision Making, Interpretation of Data, Evaluation, Data Analysis, Enriched Environment, Brain

Description of Activity

- 1) First, students will read a brief article found on page 12 of the following document: <http://www.scholastic.com/nida/nida/headsup-teacher-yr4.pdf>. The article overviews an experiment done with monkeys where they were given either an enriching or an isolated environment for 3 months and then given access to cocaine. Monkeys with the enriched environments had 20% more dopamine and only tried small amounts of cocaine whereas the isolated monkeys used larger portions of cocaine and were more prone to becoming addicts.
- 2) Students will then be divided into groups and asked to answer the questions at the end of the article. The class will then discuss their responses, in particular, their responses to questions 3 and 4 which asks them to propose how this kind of experiment could be done with humans, what environments would be considered enriching, and which would not, and what possible things could be done to help humans avoid addictions based on this research.
- 3) Students will then be introduced to Carl Hart's experiments with cocaine addicts, methamphetamine addicts, and rats. This could be done with either having students watch his Ted Talk found at <http://www.tedmed.com/speakers/show?id=308946> (19 min) or by reading the transcript, also available at the same site. Students will be asked to look for what Hart's research suggests and what implications his research has in understanding drug addictions in humans.
- 4) Students could also watch <https://www.youtube.com/watch?v=K3gfzfqEre> (5 min) to gain a scientific understanding of how dopamine and serotonin play a part in addictions.
- 5) Extension- Students will then go to <http://learn.genetics.utah.edu/content/addiction/> to explore the neuroscience behind addictions. Teachers could use the following provided webquest for using the above website: <http://teach.genetics.utah.edu/content/addiction/webquest/Exploring%20The%20New%20Science%20of%20Addiction.pdf>. If time is limited, assign different parts of the webquest to different groups and have them teach the class on the parts they were assigned.

Materials

- 1) Computer Access
- 2) Internet Access
- 3) Student handouts linked to above.

Teacher Tips

Pre-watch the video clips and make sure links are still active. Adjust activities to fit student ability.

Activity

See description of activity.

Extension and Follow-up Activity

Students could explore Carl Hart's website found at <http://www.drcahlhart.com/>. Each student could watch one of his clips or read one of his articles and report their findings or their opinion. Teacher may want to assign clips that they have previously watched due to mature subject matter.

Students could also discuss or describe what factors they have in their own lives or in their own community that could help create an enriched environment or increase the likelihood of addiction.

Sources/Bibliography

<http://www.scholastic.com/nida/nida/headsup-teacher-yr4.pdf>

<http://www.tedmed.com/speakers/show?id=308946>

<https://www.youtube.com/watch?v=K3gfzfqEre>

<http://learn.genetics.utah.edu/content/addiction/>

<http://teach.genetics.utah.edu/content/addiction/webquest/Exploring%20The%20New%20Science%20of%20Addiction.pdf>

<http://www.drcahlhart.com/>