**Health in Our Hands: How can looking for thrills make me miserable?**

**Curriculum storyline**

**Ver. 06/2024**

**Framing the Unit:**

This unit guides students through a journey to figure out thrill seeking, and how thrill seeking evolved as a survival mechanism, but because of environmental changes and modern lifestyle, thrill seeking can sometimes lead to addiction, misery and even death. Throughout the unit, students investigate several sub-driving questions to support them to gradually answer the *big* driving question: “How can looking for thrills make me miserable,” which encompasses these scientific ideas.

Guided by the sub-driving question, the journey unfolds as students figure out:

* In LS1 - What gets us excited by examining the sub-driving question “What do you do for thrills?”
* In LS2 - The basic mechanism of the brain’s reward pathway which is responsible for the feeling of excitement through the sub-driving question “Why do thrills make us feel excited and happy?”
* In LS3 - The importance of thrill seeking to our survival and how the reward pathway evolved through the process of natural selection. Students investigate the sub-driving question “Why do we all look for thrills?”
* In LS4 - The risk for substance use disorders and behavioral addictions is caused, in part, by their environment. Students focus on both national and global trends related to SUD and behavioral addictions to understand the contribution of various environmental factors. and answer the sub-driving question, “What puts us at risk for substance use disorder (SUD) and behavioral addictions?”
* In LS5 - Some genes might cause us to be at risk for substance use disorder (SUD), while others might protect us against it. Alcohol flush is a genetic mutation that causes discomfort following alcohol consumption. Alcohol use disorder is caused by the interaction of an individual’s genes and the environment. Taken together, with Learning Set 4, this information helps students answer the sub-driving question, “What are the environmental and genetic factors that put us at risk or protect us from SUD?”
* In LS6 - What can students do to reduce the risk of addiction by designing and conducting a community action research project focused on making a change in their environment? Students address the sub-driving question “Can we make a change? What can we do to reduce the risk of substance use disorder and behavioral addictions for ourselves and our community?”

**Bundle of PEs selected for this unit**

**From Molecules to Organisms: Structures and Processes:**

* **MS-LS1-4.** Use argument based on empirical evidence and scientific reasoning to support an explanation for how characteristic animal behaviors and specialized plant structures affect the probability of successful reproduction of animals and plants respectively.
* **MS-LS1-5.** Construct a scientific explanation based on evidence for how environmental and genetic factors influence the growth of organisms.
* **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.

**Heredity: Inheritance and variation of Traits:**

* **MS-LS3-1.** 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-LS3-2.** Develop and use a model to describe why asexual reproduction results in offspring with identical genetic information and sexual reproduction results in offspring with genetic variation.

**Biological Evolution: Unity and Diversity**

* **MS-LS4-4.** Construct an explanation based on evidence that describes how genetic variation of traits in a population increases some individuals’ probability of surviving and reproducing in a specific environment

* **MS-LS4-5.** Gather and synthesize information about the technologies that have changed the way humans influence the inheritance of desired traits in organisms.
* **MS-LS4-6.** Use mathematical representations to support explanations of how natural selection may lead to increases and decreases of specific traits in populations over time.

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| **Question(s)** | **Phenomenon** | **Figuring out** | **Scientific Practice(s)** | **(DCI) - (CCC)** | **Learning Goals** |
| **Learning Set 1:**  What do you do for thrills?  (3 days) | Thrill seeking | People like to feel thrilled. It feels good to feel thrilled to a point. People do various things, positive and negative, to get thrills. The effects of thrill seeking can be positive and negative. | Asking questions | LS1.B: Growth and Development of Organisms  LS4.B: Natural Selection  Patterns | * The students generate questions about the search for thrills. * The students develop a model about their thrill-seeking behaviors. |
| **Purpose**  The purpose of the unit is to introduce students to modern concepts in genetics that are highly applicable to their everyday life, and specifically to their health. The phenomenon that students figure out is addiction. In this first learning set, the students will be introduced to the driving question of the unit: ***How can looking for thrills make me miserable?*** The first lesson introduces the anchoring phenomenon for the unit, thrill seeking. After watching videos about roller coasters and teens’ testimonials about vaping, students will share their knowledge and/or experience related to thrill seeking, which will lead them to generate questions about various aspects (positive and negative) of thrill seeking. They will generate an initial model to explain thrill seeking. | | | | | |

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| **Learning Set 2:**  Why do thrills make us feel excited and happy?  (7 days) | Brain reward system. | Each sense receptor responds to different inputs, 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. | Constructing a scientific explanation  Developing and using models | LS1.D: Information Processing  System and system models  Cause and effect | * The students obtain, evaluate, and communicate what it means to be addicted and to construct a definition of addiction/substance use disorders (SUDs) or behavioral addictions. * The students carry out tests to figure out how the effect of dopamine levels in the brain rewards the region of the brain. * The students carry out a lab test to figure out if Floraytryp causes repetitive drug-seeking behavior. * The students obtain, evaluate, and communicate information about the mechanisms, causes, and effects of substance use disorders (SUDs) or behavioral addictions and the brain reward pathway. * The students construct a scientific explanation about whether or not Floratryp is addictive. * The students use physical models of the brain to explain and predict the reward pathway. |
| **Purpose**  In this learning set, the students will discuss the brain’s reward pathway, the biological mechanism that underlies the excitement associated with looking for thrills and its importance. They will figure out how the reward pathway triggers us to initiate, engage, and persist in activities that are crucial for our survival and reproduction and why the feeling of excitement is an adaptive trait. In this learning set, the students will begin to develop a model of the reward pathway that focuses on the sub-driving question of this learning set: Why do thrills make us feel excited and happy? | | | | | |

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| **Learning Set 3:**  Why do we all look for thrills?  (4 days) | Natural Selection | Adaptation by natural selection acting over generations is one important process by which species change over time in response to changes in environmental conditions. Traits that support successful survival and reproduction in the new environment become more common; those that do not, become less common. Thus, the distribution of traits in a population changes. | Planning and carrying out investigations  Analyzing and interpreting data | LS4.B: Natural Selection LS4.C: Adaptation Patterns  Cause and effect | * The students will plan and carry out investigations to explain how variation of traits and natural selection affects survival of a population over time. * The students construct a scientific explanation about whether or not moth color and environmentaffects survival of a moth population over time. |
| **Purpose**  In this learning set, students will focus on the sub-driving question of this learning set: Why do we all look for thrills? They will figure out why the reward system evolved from an evolutionary perspective. The students will be introduced to concepts of adaptation and natural selection, and then apply these concepts to the reward pathway. Students will continue to develop their models to demonstrate their understanding. | | | | | |

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| **Learning Set 4:**  What puts us at risk for Substance Use Disorder and behavioral addictions? (Part 1)  (4 days) | Substance use disorder and behavioral addictions: Smoking , Opioid, Cell phone use,  Gaming, and Alcohol consumption, Alcohol use disorder | Substance use disorder and behavioral addictions are affected by the environment. | Analyze and interpret data | LS3.A Inheritance of Trait  Cause and effect | * The students obtain, evaluate, and communicate information about the pattern of addiction in various populations. * The students analyze and interpret data to explain potential factors that might affect Substance Use Disorder (SUD) behavior trends. * The students construct a scientific explanation about pattern of alcohol use and deaths around the world? |
| **Purpose**  In this learning set, the students will continue to examine how some environments might cause us to be at risk for SUDs, while others might protect us against it. Students will analyze various data sets (maps, graphs, infographics) to identify patterns related to various addictive behaviors and then explain patterns they identify in those sources of data. Students discuss what is valid and reliable data and data sources as well as the difference between causation and correlation related to environmental factors that affect addictive behaviors. This learning set begins to help them answer the sub-driving question, “What puts us at risk for substance use disorder (SUD) and behavioral addictions?” | | | | | |

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| **Learning Set 5:**  “What are the environmental and genetic factors that put us at risk or protect us from SUD?”  (Part 2)  (4 days) | Alcohol flush | Genetic and environmental factors affect substance use disorder and behavioral addictions | Asking questions | LS1.B: Growth and Development of Organisms  LS4.B: Natural Selection  Patterns | * The students obtain, evaluate, and communicate information to explain the cause and effects of alcohol flush. * The students analyze and interpret data to explain the cause and effects of alcohol flush. |
| In this learning set, the students will examine how some genes might cause us to be at risk for SUDs, while others might protect us against it. This learning set will focus on one phenomenon associated with addictive behavior called alcohol flush, a mutation that causes discomfort following alcohol consumption, thereby reducing the risk for alcohol addiction. Students will analyze various data sets to identify patterns related to alcohol use and then explain that alcohol addiction can be caused by the interaction of their genes and the environment, i.e. the environment has a different effect on individuals based on their genetic makeup. This helps them answer the sub-driving question, “What puts us at risk for substance use disorder (SUD) and behavioral addictions?” | | | | | |

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| **Learning Set 6:**  Can we make a change: What can we do to reduce the risk of substance use disorders (SUD) for ourselves and our  community?    (2-3 weeks) | Improving society through science | Tying science and society - how can we improve our society through science? | Planning and carrying out investigations  Analyzing and interpreting data  Developing and using model | LS1.B: Growth and Development of Organisms  LS3.B: Variation of Traits  LS4.B: Natural Selection  LS4.C: Adaptation  Cause and effect | * Students plan and carry out an investigation about environmental issues that may increase their risk for Substance Use Disorders (SUD). * Students analyze data and communicate findings with peers to explain environmental factors in their neighborhoods that can be changed to reduce their risk for Substance Use Disorders (SUD). |
| **Purpose**  Our environment can greatly affect our risk for substance use disorders (SUD). The purpose of this lesson is to support students’ understanding that there are risks in their community that can increase their chances for substance use disorders (SUD), and that they have some power in reducing their risk and that of their community. In this lesson, students will conduct community action projects, discuss the data they have gathered, and develop ways to improve their neighborhood and reduce the risk for substance use disorders (SUD). | | | | | |