In this lesson, students will examine misconceptions and facts about opioids. Through a series of investigations, they then will learn the science behind prescription opioid misuse and heroin use, overdose, and withdrawal. Students will discover that opioid use may start off as a choice, but it can become a chemical dependency.

The accompanying presentation was created with PowerPoint so that it can be used in a variety of classrooms. If you are using a laptop with an LCD projector, simply progress through the PowerPoint by clicking to advance. All of the interactive aspects of the presentation are set to occur on click. This includes images, animations, videos, answer keys, and text boxes. The corresponding videos are embedded in the slide. Hover over the video window to reveal the “play arrow” at the bottom. If you are using an interactive whiteboard, tap on each slide with your finger or stylus to activate the interactive aspects of the presentation. It does not matter where you tap, but you can make it appear as if you are making certain things happen by tapping them. In the notes for each slide, there will be instruction on how to proceed and information to support facilitating graphics and statistics.

Content Areas
Life Science, Anatomy and Physiology, Biology, Health and PE, Sports, Exercise, and Health Science

Activity Duration
1 class session (45 minutes)

Grade Level
Grades 9–12

Essential Questions
- What are opioids, and how do they impact the human body?
- What are neurons and neurotransmitters, and what part do they play when opioids enter the body?
- What are the effects of opioid use on the brain?

Materials
- Chart paper and markers
- Access to the Internet
- Student Activity Sheet: Types of Opioids (one per student)
- Student Activity Sheet: Parts of a Neuron (one per student)
- Student Activity Sheet: Brain Basics (one per student)

Objectives
- Analyze the misuse of opioids and suggest factors responsible for the progression from misuse to physical dependency.
- Explain how opioid misuse affects the brain and other body systems.
- Explain information processing by following sensory information through neural transmission.
The misuse of opioids such as heroin, morphine, and prescription medications is a serious national problem that affects the health, social, and economic welfare of communities. There are approximately 144 drug overdose deaths per day in the United States with 63% of those deaths related to pharmaceutical opioids or heroin. About 15 million people indicated misusing or abusing prescription painkillers in 2014 while nearly one in five teens say they have used prescription medicine at least once in their lifetimes to get high. To address this complex problem, federal agencies are working to inform patients, parents, teens, pharmacists, and educators about the dangers of opioid misuse. This guide was created to give educators ideas and strategies for presenting the content in the digital lesson. It provides slide-by-slide details for educators to be prepared to engage, explain, discuss, and effectively facilitate the content in the presentation. The presentation is designed to cover one 45-minute class session, but it is flexible, depending on the student's needs and time available.

During the lesson, students will learn that opioids are drugs that are derived from the opium poppy plant or are synthetic equivalents, such as methadone and fentanyl. Heroin is an illegal opioid, but many opioids are legal. Opioids are commonly prescribed in forms of medications that relieve pain and reduce the intensity of pain signals reaching the brain. Prescription opioid misuse is the use of a medication without a prescription. This may mean taking more than prescribed or for the feeling of being high. Prescription medications that are examples of opioids include hydrocodone (e.g., Vicodin®), oxycodone (e.g., OxyContin®, Percocet®), morphine (e.g., Kadian®, Avinza®), and codeine. Opioids act by attaching to specific opioid receptors. Endorphins are naturally produced in our bodies to help manage pain. When opioid drugs attach to these receptors, they also reduce the awareness of pain.

After considering several facts vs. misconceptions, students will examine the adverse effects of opioids on the nervous system. They will learn that opioids act upon the opioid receptors in our nervous system, and many parts of our nervous system are affected by opioid misuse. Different messages are communicated through our bodies using neurotransmitters. A person's experiences when misusing a drug match to a specific neurotransmitter whose activity it disrupts.

Simply put, when opioids enter the body, they make us feel extremely happy. That positive feeling may make someone want to take the substance again. What is not obvious, is how opioids are hijacking the pleasure center of the brain. This region is normally activated by healthy activities, like eating and sleeping, but it is also activated during the misuse of opioids. Opioids target this part of the brain by flooding it with dopamine, a type of chemical signal that makes people feel good. Long-term misuse can lead the body to produce less dopamine over time, causing cravings.

Students will begin to uncover that, with all these changes in the human nervous system, drug misuse is no longer a choice. When opioids are misused for pleasure they can lead to physical and chemical changes in our bodies. These changes can prevent us from controlling the impulse to continue misusing opioids. The initial decision is typically voluntary but can lead to tolerance and dependence.
Embedded within this lesson is a clip from the video “Chasing the Dragon: The Life of an Opiate Addict,” a documentary aimed at educating students and young adults about the dangers of addiction. This video was released by the FBI and DEA in an effort to combat the growing epidemic of prescription drug misuse and heroin use. There are graphic descriptions of the impact opioid misuse can have on the body including bodily fluid (vomiting, blood, open wounds) and violence, as well as strong language. Instructors should watch this clip prior to sharing with students to determine if it is appropriate for the audience.

At different points in the lesson, students may be tempted to share personal information about opioid misuse by themselves or others. As always, be sure to follow school or district policies about the sharing of personal information about minors.
ENGAGE

Overview: Students will identify and justify their beliefs about a series of facts and misconceptions related to opioid misuse.

Students will be introduced to what an opioid is, the different types of drugs that are classified as opioids, and common reasons why they are taken.

SLIDE 1

Arrange students in small groups, and hang a blank sheet of chart paper for each group in different areas of the room. Ask: "What do you know about opioids?" and instruct student groups to list everything they know or think they know about opioids, using the chart paper to capture their ideas. At set intervals, ask students to rotate and annotate the other groups’ chart paper to identify which statements they agree or disagree with.

Introduce the concept of a misconception. A misconception is an idea or opinion that is incorrect because it is based on a mistaken thought or understanding. Invite students to revisit their chart papers and identify what they think the biggest misconceptions are about opioids.

Click on the slide to reveal statistics about America’s opioid epidemic. Explain to students that opioids are drugs that influence the nervous system to reduce feelings of pain. Heroin is an illegal opioid, but many opioids are legal. Opioids are commonly prescribed in forms of medications. Students might have heard of Vicodin®, OxyContin®, Percocet®, morphine, and codeine. These are all types of prescription opioids.

SLIDES 2-3

Combine the small groups to form two large groups of students.

Explain that there are many misconceptions about opioid misuse. It is important to be able to separate truth from misconception. Distribute two index cards to each group: one with “Fact” written and one with “Misconception”.

Read aloud the first statement on slide 2 and invite students to discuss their response as a group. Invite each group to hold up the card they think is correct. Reveal the correct answer and explain using slide notes. Repeat these directions for all statements.

After all of the statements have been reviewed, lead a discussion around the following guiding questions:

- Which fact or misconception statement is most surprising?
- What misconception do you think is most common with teens your age, and why?
- Which misconception do you think is most important for teens your age to understand, and why?

SLIDE 4

Invite students to use the information from their chart papers, and information they obtained from reviewing the statements on slides 2-3, to develop a definition of what an opioid is. Students can capture this information on an index card or on the same chart paper.

Next, showcase some of these ideas on chart paper. Invite students to vote and pick the three answers that best describe what opioids are and where they came from.

Then, click to display the definition of opioids. Compare the definition on the slide to student answers. Ask about potential discrepancies between their definitions and the one provided. Could any of these stem from misconceptions? Have students discuss in what cases someone their age might be prescribed an opioid.
It's important for students to know that synthetic and natural opioids work in our bodies the same way.

The table shows the different types of opioids, how they are derived, and examples. But some of the information is missing. Ask students to fill in the chart on the slide using the word bank provided. Students can use the slide or the Types of Opioids student activity sheet to complete the chart.

Then, reveal the correct answers by clicking on the slide. Discuss why opioids that are synthetic can be a problem – they are made much stronger than natural opioids, and street manufacturers can put dangerous ingredients into them.
Overview: Students will compare and contrast models of a healthy nervous system with the natural release of endorphins to prescription opioid misuse and heroin use. Students will be able to explain the chemical imbalances in each to describe why opioids are prescribed. The neuroscience concepts in this section will be discussed specifically in terms of the effects of opioids on the brain and body.

SLIDE 6

Ask students: Do you know which system of the body helps you learn? Or which system your dreams come from? It is anticipated students will be able to identify the nervous system or the brain.

Invite students to make observations of the two brain scans on the slide. At least one of which has been influenced by drugs. Instruct students to note the differences between the brains in the image. Then, challenge them to answer the three questions that appear on the slide:

- What do you notice about the two brains?
- How are they different?
- How do you think these differences might be impacting the human body?

Invite students to share their observations, and discuss as a class.

Next, play the video “The Reward Circuit: How the Brain Responds”:

Ask students: What role did the nervous system likely play in drug addiction in this video? It is anticipated students will identify the brain as part of the nervous system. Clarify with students that when opioids enter the body, they make us feel extremely happy. That positive feeling may make someone want to take the substance again.
This slide introduces the biological messages, sent through the nervous system, that can cause a person to misuse prescription drugs.

Begin by asking students: “How do you think disruptions or changes in the nervous system might impact our behavior?” Students may want to revisit slide 7. Discuss their responses as a class.

Click the embedded link in the slide to watch part of the “Chasing the Dragon” documentary, from 29:00 to 31:53. The video discusses how many individuals begin with prescription drugs prescribed by doctors, only to find they cannot stop using the drugs. This begins the discussion on the biological processes that cause opioid misuse.

NOTE: There are graphic descriptions of the impact opioid misuse can have on the body including bodily fluid and violence. Instructors should watch this clip prior to sharing with students to determine if it is appropriate for the audience.

When students finish watching, ask: “How do you think what we learned about the nervous system can help explain the challenges faced by the people in this video?” When opioids enter the body, they hijack the pleasure center of the brain. This region is normally activated by healthy activities, like eating and sleeping, but it is also activated during the misuse of opioids.
EXPLORE

SLIDE 8

Invite students to take a look deeper inside the nervous system to learn how pain and pleasure messages travel to and from the brain. Remind students that the brain is impacted by opioid misuse and that our brain is part of a larger system in our bodies: the nervous system. We also know the nervous system helps us communicate information throughout our bodies.

- Ask students: “How are messages sent throughout our bodies?” and invite students to share out their ideas. The slide shows a diagram of two neurons. Remind students there are millions of neurons in our bodies communicating information through a vast network.

- Distribute the Parts of a Neuron student activity sheet. Explain that each term in the word bank completes one of the blanks in the diagram. Challenge students to identify where in the diagram to place the corresponding labels. Answers will be revealed with click of slide.

- Point out that the two neurons are not touching each other in the image. But, messages (like pain or pleasure messages) still have to get from one neuron to another to be able to travel to and from the brain. Ask: How do you think that happens?

- The answer? The synaptic gap (synapse). This is the small space between neurons, which the message must cross as it makes its way to and from the brain. The synaptic gap is where our body has receptors to transfer the messages of pain and pleasure throughout our bodies.

SLIDE 9

Ask students to compare and contrast the diagram of the people talking with how neurons are communicating. Point out that neurotransmitters are like the words we use to talk to another person and give them instructions. The neurotransmitter that moves from one neuron to the next is specific to certain messages, the strength of these messages, and how long these messages continue to be conveyed.

Ask: “Based on what you have learned; how do you think drugs affect this process of messaging in the brain?”

The messages that are sent from one neuron to the next are altered by the actions of the drugs on the neurotransmitters. The drugs act on the messengers to change the message. Students learned earlier that opioids could attach to the same receptors as endorphins.
The messages that travel across a synaptic gap are called neurotransmitters. Different neurotransmitters are specific to different types of messages. Explain to students that opioids mimic neurotransmitters and either excite or inhibit a response like euphoria or moodiness in the body.

This slide displays a chart that identifies and describes the neurotransmitters most often affected by prescription opioids, which functions they normally affect, and how they are affected by opioids.

Invite students to consider how each of the neurotransmitters, affected by opioids, could impact the human body by reviewing the chart and answering the following guiding questions:

Answers are in red:

- Which neurotransmitter could cause dry mouth or an irritable mood? endogenous opioids
- Which neurotransmitter is responsible for overstimulating the nervous system creating a euphoric effect? dopamine
- Which neurotransmitter could cause sleepiness? gamma-aminobutyric acid
**Overview:** Students will analyze images produced by brain mapping to explain how opioid misuse can cause changes in areas of the brain related to judgment, decision making, learning and memory, and behavior control. Students will construct an explanation of how this is evidence of a brain disease. Students will learn and be able to explain how brain development during adolescence leads to additional risks on their bodies.

**SLIDE 11**

Ask students to consider how addiction is a disease by comparing the brain and heart images.

As students view the images on the slide, ask: “How are the diseased heart and the diseased brain similar?”

(In each case, disease reduces the ability of the organ to use energy, making it less effective in the body.)

**SLIDE 12**

Distribute the **Brain Basics** student activity sheet to provide students with information about the different parts of the brain.

Invite students to use this information to review the diagram in the slide and identify which parts of the brain are responsible for the highlighted processes. (For example, the highlighted parts labeled “judgment” and “sensations” are both controlled by the frontal lobe.)
**SLIDE 13**

Divide the class into pairs of students.

Invite students to use their completed **Brain Basics** student activity sheet as a reference and have each pair look at the information on the slide. Guide students to come up with as many factors that might influence risk based on adolescent brain development. Anticipated responses include difficulty controlling emotions, poor planning and judgment, and risky, impulsive behavior.

Ask students to share their lists with the whole class. Capture student ideas using chart paper or the provided space on the slide. Have students rank them in order from “most influential” to “least influential,” giving reasons for their rankings.

**SLIDE 14**

Share with students that we have learned opioids can have many different impacts to our bodies. When opioids are misused they can lead to physical and chemical changes in our bodies. These changes can lead to a lack of impulse control resulting in the continued misuse of opioids. The initial decision is typically voluntary but can lead to tolerance and dependence.

Invite students to use the text and image on the slide to identify similarities and differences in a person that has developed a tolerance to one that is dependent on the misuse of opioids. It is anticipated students will identify that when the body adapts to the drug, and requires more of it to achieve a certain feeling, an individual has developed a tolerance. A person that is dependent on a drug will experience withdrawal symptoms when use of the drug is suddenly reduced or stopped.

Revisit the people that shared their stories in Chasing the Dragon. Ask students: “How could you now explain their challenges with withdrawal?” Remind students that opioids flood the brain with dopamine, a type of signal that makes people feel good. Long-term misuse can lead the body to produce less dopamine over time, causing cravings that can lead to tolerance or physical dependency.
**TYPES OF OPIOIDS**

**Directions:**
The table below shows the different types of opioids, how they are derived, and examples. But some of the information is missing. Using the word bank, complete the chart with the correct answers.

<table>
<thead>
<tr>
<th>Type of opioid</th>
<th>Where they come from</th>
<th>Examples</th>
</tr>
</thead>
<tbody>
<tr>
<td>Natural opioids</td>
<td>Alkaloids, that occur in plants such as the opium</td>
<td>codeine</td>
</tr>
<tr>
<td>(made from the plant)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Semi-synthetic, man-made</td>
<td>Created in labs from natural opioids</td>
<td>Hydrocodone, oxycodone,</td>
</tr>
<tr>
<td>man-made</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Word bank:**
- poppy
- Morphine
- opioids
- heroin
- fully synthetic
- man-made
- fentanyl
**Directions:**
Each term in the word bank completes one of the blanks in the diagram on the slide. Using the following definitions, identify where in the diagram to place the corresponding labels.

**Word bank:**
- Axon
- Branches of axon
- Cell body
- Dendrites
- Nucleus
- Terminal bulbs
- Synaptic gap

**Definitions:**
- The cell body contains the nucleus, which determines whether the message will continue down the axon to be sent to another neuron.
- Dendrites receive the impulse, or message, from another neuron and send it to the cell body.
- The axon is the long part of the neuron that takes the message from the cell body to the terminal bulbs.
- The terminal bulbs are at the sending end of the neuron. They release the neurotransmitters into the synaptic gap.
Directions:
Listed below are descriptions of different parts of the brain. Using this information and the image on the slide, identify which parts of the brain are impacted by opioid misuse.

<table>
<thead>
<tr>
<th>Description</th>
<th>Does this system appear to be impacted by opioid misuse? Why or why not? Use evidence from the brain scan in your response.</th>
</tr>
</thead>
<tbody>
<tr>
<td>The brainstem controls basic functions that humans need to survive. These include breathing, sleeping, and maintaining a heart rate. These functions are involuntary, which means they happen without our thinking about them.</td>
<td></td>
</tr>
<tr>
<td>The cerebral cortex is divided into several areas. Different areas control different functions. For example:</td>
<td></td>
</tr>
<tr>
<td>- Thinking happens in the front part of the cortex (also called the prefrontal cortex, or forebrain). Processes in the frontal cortex allow us to plan, make decisions, and solve problems.</td>
<td></td>
</tr>
<tr>
<td>- Other areas in the cerebral cortex process sensory information. These processes allow us to see, feel, hear, taste, and touch.</td>
<td></td>
</tr>
<tr>
<td>The limbic system consists of many different brain structures. Together, they control and regulate how we experience pleasure. When a behavior causes us to feel pleasure, we are likely to repeat that behavior. This “reward circuit” in the brain reinforces behaviors that are necessary to our survival. Processes in the limbic system also shape how we experience positive and negative emotions.</td>
<td></td>
</tr>
<tr>
<td>- Eating, socializing, and other healthy behaviors activate the limbic system and give us pleasure. However, misusing and abusing drugs also activate the limbic system.</td>
<td></td>
</tr>
<tr>
<td>- Using drugs can also affect our moods by changing processes in the limbic system that shape emotions.</td>
<td></td>
</tr>
</tbody>
</table>
**Next Generation Science Standards**

**LS1.A: Structure and Function**
Feedback mechanisms maintain a living system’s internal conditions within certain limits and mediate behaviors, allowing it to remain alive and functional even as external conditions change within some range. Feedback mechanisms can encourage (through positive feedback) or discourage (negative feedback) what is going on inside the living system. (HS-LS1-3)

**PS1.B: Chemical Reactions**
Chemical processes, their rates, and whether or not energy is stored or released can be understood in terms of the collisions of molecules and the rearrangements of atoms into new molecules, with consequent changes in the sum of all bond energies in the set of molecules that are matched by changes in kinetic energy. (HS-PS1-4),(HS-PS1-5)

**LS1.D: Information Processing, Grade Band Endpoints**
By the end of grade 12: In complex animals, the brain is divided into several distinct regions and circuits, each of which primarily serves dedicated functions, such as visual perception, auditory perception, interpretation of perceptual information, guidance of motor movement, and decision making about actions to take in the event of certain inputs. In addition, some circuits give rise to emotions and memories that motivate organisms to seek rewards, avoid punishments, develop fears, or form attachments to members of their own species and, in some cases, to individuals of other species (e.g., mixed herds of mammals, mixed flocks of birds). The integrated functioning of all parts of the brain is important for successful interpretation of inputs and generation of behaviors in response to them.

**National Health Education Standards Addressed**
1.12.9 Analyze the potential severity of injury or illness if engaging in unhealthy behaviors.

**CCSS.ELA-LITERACY**

CCSS.ELA-LITERACY.RST.11-12.1
Cite specific textual evidence to support analysis of science and technical texts, attending to important distinctions the author makes and to any gaps or inconsistencies in the account.

CCSS.ELA-LITERACY.RST.11-12.7
Integrate and evaluate multiple sources of information presented in diverse formats and media (e.g., quantitative data, video, multimedia) in order to address a question or solve a problem.

CCSS.ELA-LITERACY.RST.11-12.9
Synthesize information from a range of sources (e.g., texts, experiments, simulations) into a coherent understanding of a process, phenomenon, or concept, resolving conflicting information when possible.