

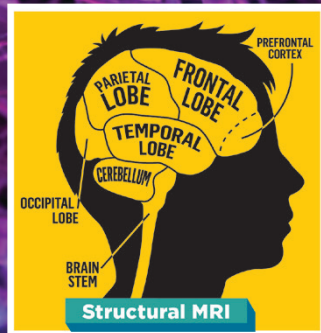
# Heads Up: Real News About Drugs and Your Body

Brought to you by Scholastic and the scientists at the National Institute on Drug Abuse, National Institutes of Health, U.S. Department of Health and Human Services

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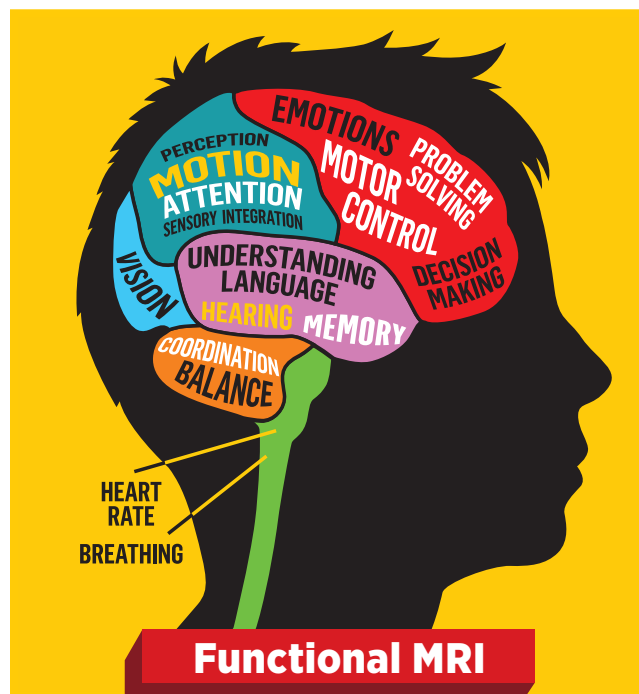
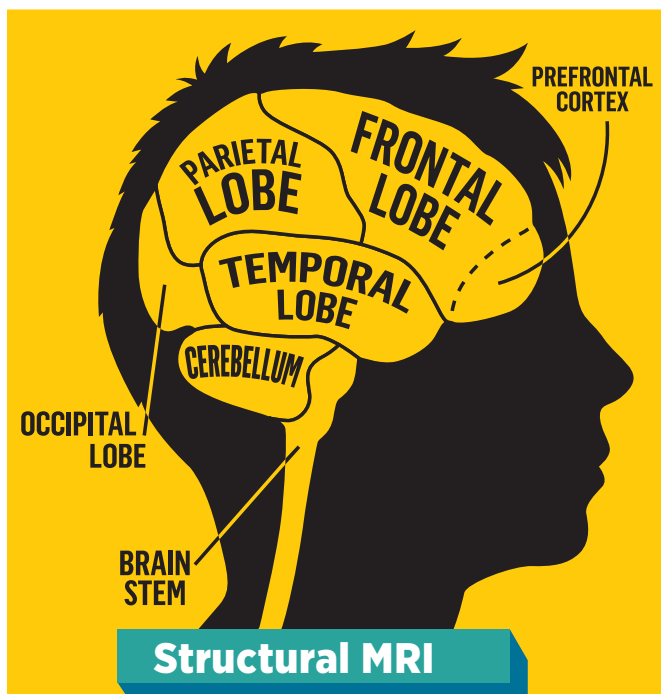
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- For this Heads Up **Student Edition Compilation** refer to **NIH Pub No. 17-DA-8032**.
- For the accompanying Heads Up **Teacher Edition Compilation** refer to **17-DA-8033**.

# MAPPING THE BRAIN



## How technology is shaping what we know about the brain

Your brain has an estimated 85 billion *neurons*\* (nerve cells) that send signals with speeds of up to 270 miles per hour. Through neurons, your brain controls every move you make and every thought you think.

We know this, and much more, from advancements in *neuroscience*—the study of the nervous system, including the brain. Neuroscientists use brain-imaging tools—**MRI**, **fMRI**, and **PET**—to study the brain's structures and functions.

With these technologies, neuroscientists have

mapped out which brain regions control different bodily functions. They've identified the brain areas that control critical thinking, movement, and breathing, as well as feelings like pleasure, sadness, and fear. They've also learned what happens to the brain as we age, as well as the effects of injury and of using drugs.

But there is still a lot to figure out. Read on to learn how these technologies work and how they are helping to teach us about ourselves, now and in the future.

\*The prefix *neuro-* signals a word related to the brain, nerves, or the nervous system—such as *neuron* (a nerve cell).

## The Future of Brain Research: The ABCD Study<sup>1</sup>

**We know the brain changes a lot during adolescence. But does sleeplessness or stress affect brain development? Does playing sports? Are there lasting changes to the brain that result from vaping e-cigarettes?**

To answer these questions and many more, neuroscientists will begin a study in 2016 that researches 10,000 9- to 10-year-olds for a period of 10 years. The researchers will use MRI and fMRI to track brain structure and function in the participants, as well as surveys

and games to track the participants' behaviors. In the largest study of its kind, scientists will be able to look for patterns in how teens' lives affect their brains, and how teens' brains affect their lives. This information can be used to help future generations live better, healthier lives.

<sup>1</sup> Adolescent Brain and Cognitive Development Study

## Structural MRI

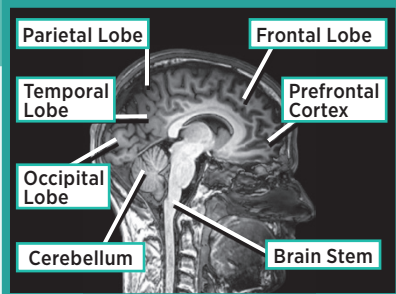
Structural Magnetic Resonance Imaging

### WHAT IT SHOWS

A detailed image of the structure (size and shape) of tissues, organs, and bones. Also shows the presence of disease.

### HOW IT WORKS

A person lies still in an MRI machine, which surrounds the body with a magnetic field and emits radio



waves. Hydrogen atoms in the water of tissues and bones absorb and then release the energy from the radio waves. A computer maps and measures these changes to create an image. Changes in the size of tissues (such as from diseases like cancer that cause tumors) can increase the amount of water in different parts of the body, which can be detected by MRI scans.

### SOMETHING WE'VE LEARNED

MRI scans of the brain have shown that people who have been using drugs for a long time have a smaller prefrontal cortex than people who have not been using drugs. The prefrontal cortex is the area where decision making occurs.

## Functional MRI (fMRI)

Functional Magnetic Resonance Imaging

### WHAT IT SHOWS

Areas of the brain that are active during a task.

### HOW IT WORKS

A person lies in an MRI machine while doing an activity such as looking at an image, hearing a sound, laughing at something funny, or completing a puzzle.

The areas of the brain that are active during the behavior have increases in blood flow and blood oxygen levels. A computer analyzes these changes to map brain function.



### SOMETHING WE'VE LEARNED

In studies where adolescents played a game to earn rewards, their brain scans showed higher activity in the area of the brain that processes motivation and pleasure (the nucleus accumbens<sup>2</sup>) compared with the area of the brain that guides thoughtful decision making (the prefrontal cortex). Scientists think this imbalance in activated brain regions may lead teens to focus more on the possible rewards of a decision than on any drawbacks. This could increase a person's risk for using drugs.

## PET Positron Emission Tomography

### WHAT IT SHOWS

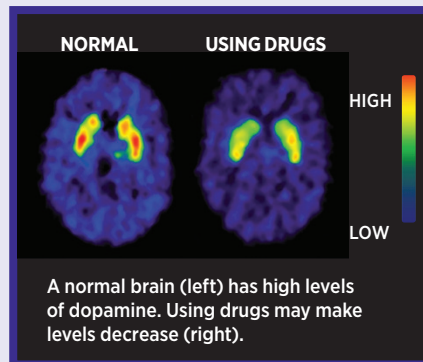
The brain and body at the cellular level.

### HOW IT WORKS

PET scans use radioactive chemicals, called radiotracers, that are injected into the body. The radiotracers go to different areas depending on the chemical that is used. The PET machine detects the radiotracers and computer programs use colors to show their location.

### SOMETHING WE'VE LEARNED

Dopamine is the brain chemical that helps us feel pleasure. By following radiotracers for dopamine receptors, PET scans have shown that using drugs heavily reduces the number of these receptors. Fewer receptors indicates less dopamine activity in the brain. This finding helps explain why people addicted to drugs experience less pleasure from everyday activities. They begin

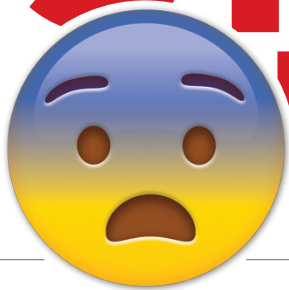


A normal brain (left) has high levels of dopamine. Using drugs may make levels decrease (right).

to crave the drug to get their dopamine activity back up to normal.

<sup>2</sup> The nucleus accumbens is a brain structure located at the base of the frontal lobe deep inside the brain. It does not appear on the MRI scan shown on this page.

# STRESSED OUT?



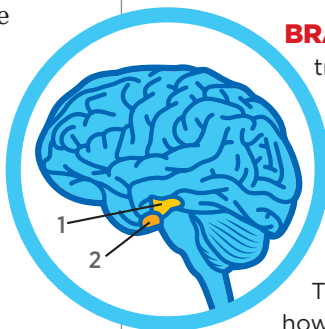
Learn how the body responds to stress—and healthy ways to cope

## Your Body Under Pressure

Think of a time you were stressed. You may remember your heart racing, palms sweating, shoulders tensing up.

These reactions are part of the body's natural stress response. When the brain perceives a situation to be threatening, it triggers a surge of hormones that prepare the body for the challenge.

Known as “fight or flight,” the stress response evolved to help us survive. But it is also triggered by events that aren't life-threatening. This can include academic and relationship pressures, or even stress from being over-connected to technology and social media. Some stress is helpful, like keeping you energized to study for a test. But constant stress can take a toll on a person's emotions and body, which can lead to serious health problems.

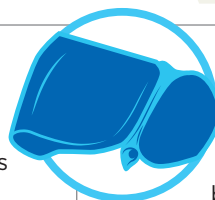


**BRAIN:** The body's stress response is triggered when the brain's hypothalamus (1) sends a signal to the pituitary gland, located at the base of the brain (2). This gland then signals the adrenal glands (located above the kidneys) to release stress hormones. These hormones change how organs and systems act to prepare the body to fight or take flight.

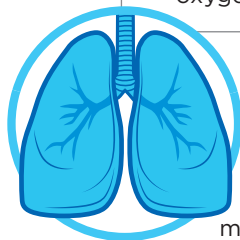
**Fast Fact:** Adrenaline, norepinephrine, and cortisol are the body's major stress hormones.



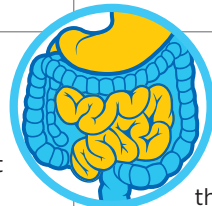
**HEART:** Heart rate and blood pressure increase so that blood travels through the body faster. This helps deliver oxygen to power muscles.



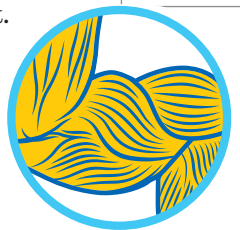
**LIVER:** The liver causes more glucose (blood sugar) to be released into the bloodstream. This powers cells in the body.



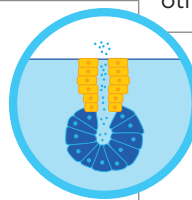
**LUNGS:** Breathing rate increases to deliver more oxygen throughout the body to power muscles and tissues.



**STOMACH/INTESTINES:** Digestion decreases. This redirects energy that would be used to break down food to power other parts of the body.



**MUSCLES:** Muscles tense up to prepare the body for action.



**SWEAT GLANDS:** Stress-triggered sweat is chemically different from sweat that cools the body. Stress sweat interacts with bacteria on the skin to cause body odor. Researchers aren't exactly sure why we sweat when stressed.

► **More Info:** For additional facts about health, visit [scholastic.com/headsup](http://scholastic.com/headsup) and [teens.drugabuse.gov](http://teens.drugabuse.gov).



## ⚠️ Chronic Stress

Ongoing, or chronic, stress does not allow the body's stress hormones to return to normal levels. This can lead to health problems. Chronic stress can:

- \* Increase the risk of getting sick because stress can weaken your immune system
- \* Cause sleep problems because of the energy surge brought on by stress hormones
- \* Lead to injuries or migraine headaches from constant muscle tension
- \* Increase the risk of certain mental health problems, such as anxiety and depression
- \* Lead to problems with learning and memory
- \* Increase the risk for chronic health problems such as heart disease, obesity, and diabetes

## Stress and Misusing Drugs: Not a Good Mix




Some people may think that drugs can help them deal with stress. But drugs can actually make it harder to cope by causing the body's stress response to be hyperactive. Here are some examples:

- \* Some drugs, such as stimulants, have similar effects to stress. These effects include increased heart rate, blood pressure, and feelings of anxiety. This can cause a stronger reaction to stressful events.
- \* Some drugs such as alcohol may be calming at first, but frequent use can raise stress hormone levels. This increases irritability and anxiety. Short-term withdrawal, such as a hangover, can have the same effect.
- \* Both stress and drug use can make a person more impulsive and impair decision making. They can also change how the brain perceives pleasure. These effects increase the risk for drug use and for developing an addiction.

## Tips to Help You Cope




### MOVE YOUR BODY:




Regular aerobic exercise activates the body's stress response. But this is actually "good stress" and helps the body cope with psychological stress.

### MEDITATE:




Meditation and deep breathing exercises can decrease blood pressure and improve symptoms of anxiety and depression.

### TAKE A TIME-OUT:



Stepping away from distractions, such as social media and texting, may be stressful at first, but with practice can help you relax.

### DO ONE THING AT A TIME:



If you feel overwhelmed with multitasking, try to tackle one challenge at a time.

### GET SUPPORT:

If you are stressed, ask for help from your family, friends, or a professional, such as a doctor or school counselor.

**DID YOU KNOW?** If you experience stress during a test, you may feel your mind "go blank." This happens because norepinephrine—a stress hormone—may temporarily disrupt brain circuits that are used to recall memories.

Tip: If you experience your mind going blank, pause for a moment, take a deep breath, and try to relax to help the hormone surge ease off. *You've got this.*

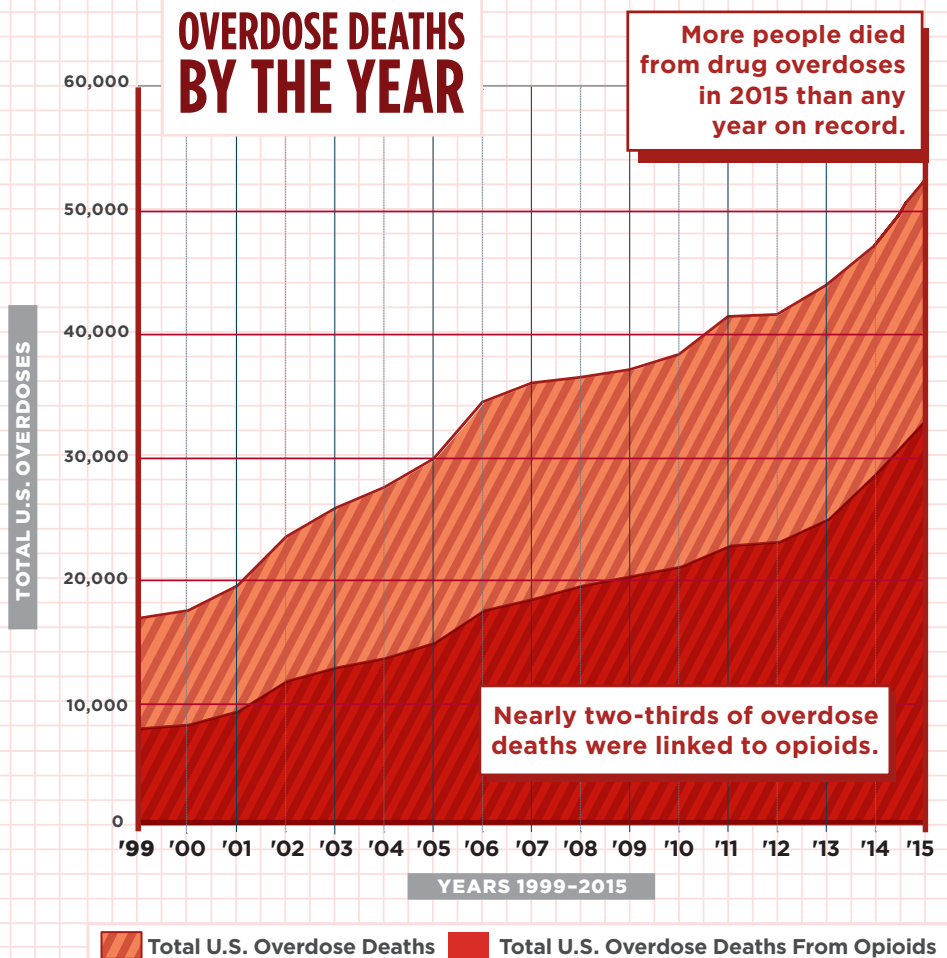
# OPIOIDS AND THE OVERDOSE EPIDEMIC

**America is facing a national health crisis. More people died from drug overdoses in 2015 than any other year on record. In fact, more people died from drug overdoses than from either car crashes or guns. Nearly two-thirds of overdose deaths were linked to opioids.**

Opioids (*OH-pee-oyds*) are a group of chemicals that reduce pain, increase pleasure, and slow breathing. Prescription opioid medications include OxyContin® (oxycodone), Vicodin® (hydrocodone), codeine, morphine, methadone, and fentanyl. Heroin is also an opioid, but it is illegal.

Doctors prescribe opioids to treat severe pain. But these drugs, like heroin, can be addictive and potentially deadly due to overdoses. Opioid overdoses cause breathing to slow or even stop. Without medical help, this can cause death.

In recent years, overdoses and deaths related to opioids have dramatically increased. Health officials call it an *epidemic* because the number of overdoses has increased dramatically throughout the population. Read on to learn more about the crisis and how to stay safe.



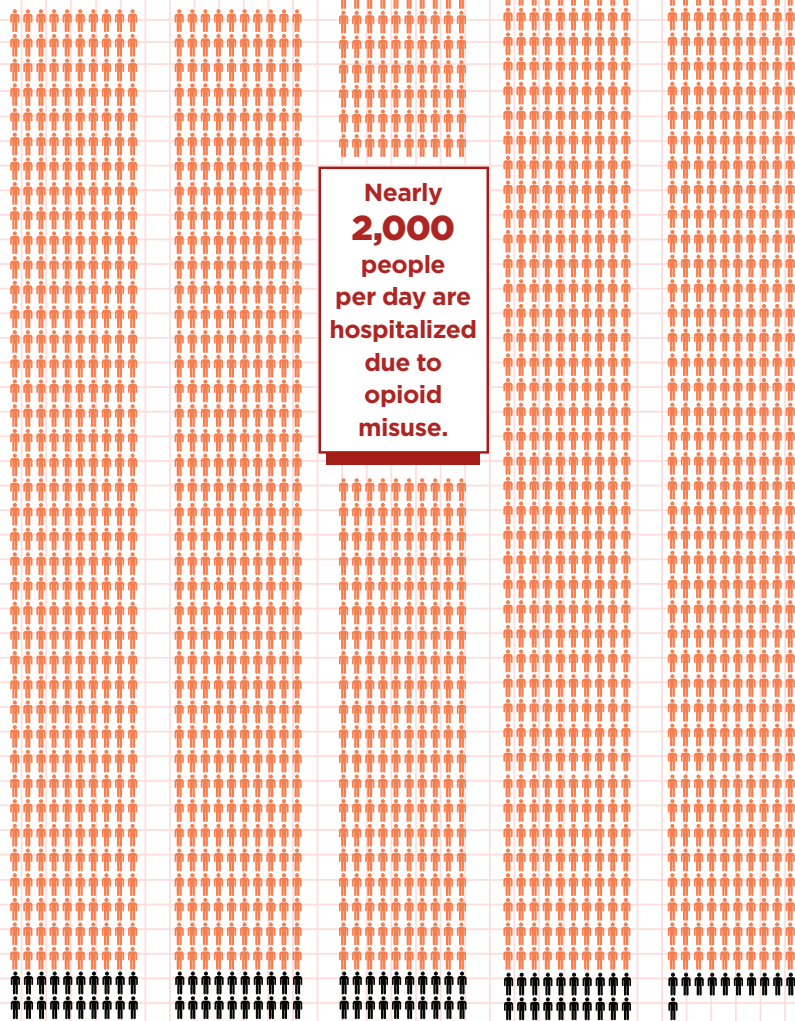
Overdose Data: CDC Wonder, 1999–2015. <https://wonder.cdc.gov>.



**When opioids are prescribed by a doctor and used as directed, most people don't become addicted, overdose, or die—but some do. Opioids are very powerful painkillers that should be handled with extreme care. The following safety precautions are very important.**

- ✓ Never take any drug not directly supplied by a doctor or a pharmacy. Prescription painkillers that are made or sold illegally can be deadly.
- ✓ If a doctor prescribes an opioid painkiller, discuss with him or her whether there are less addictive options.
- ✓ Medications should be taken exactly as prescribed.

## OPIOID MISUSE BY THE DAY



Roughly 91 people die every day from opioid overdose.

## + A LIFESAVING DRUG

**Naloxone** is a medication that can reverse opioid overdose and restore breathing. It can save a victim's life if administered quickly enough. Naloxone is used by medical personnel, but programs are underway to also make it available to opioid users, their friends, and other potential bystanders.

► **More Info:** For additional facts about opioids and health, visit [scholastic.com/headsup](http://scholastic.com/headsup) and [teens.drugabuse.gov](http://teens.drugabuse.gov).

## WHY IS THIS HAPPENING?

### ↑ An increase in prescriptions:

Between 1999 and 2013, the number of opioid prescriptions in the United States quadrupled. New guidelines are now helping decrease the number of prescriptions.

### ↑ A rise in heroin use:

People addicted to prescription opioids sometimes end up using heroin, which is cheaper. As a result, the use of heroin has been increasing across most age groups and populations. Heroin today is



THREE OUT OF FOUR HEROIN USERS STARTED BY MISUSING PRESCRIPTION OPIOID MEDICATIONS.

much more pure and powerful than it was 30 years ago—which increases the risk of overdose.

### ↑ A rise in fentanyl deaths:

Fentanyl is an opioid that is 50 to 100 times more powerful than other opioids—increasing the risk of overdose. Normally, fentanyl is prescribed only for extreme pain. But now it is being illegally made and is sometimes mixed with heroin and other drugs without the users' knowledge. Recently, people have died when they took this powerful drug without knowing it.

- ✓ Opioids should never be mixed with alcohol or with any other drug (except as prescribed by a doctor) because this greatly increases the risk of overdose.
- ✓ Prescription drugs should never be shared with anyone else. This is both illegal and dangerous.

CHECK OUT THIS POSTER:

# How to Recognize and Respond to Bullying

[scholastic.com/headsup/standupagainstabullying](http://scholastic.com/headsup/standupagainstabullying)

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