



HEADS UP
REAL NEWS ABOUT DRUGS AND YOUR BODY

MAPPING THE BRAIN

Structural MRI **fMRI**

How technology is shaping what we know about the brain

Your brain has an estimated 85 billion neurons*...
 *The brain has, and much more, than you know.
 In neuroscience—the study of the nervous system...
 With these technologies, neuroscientists have...
 The future of brain research: The ABCD Study

MAPPING THE BRAIN

The brain is the body's most complex organ, controlling everything from our heartbeat to how we make important decisions. Through research and the use of brain-imaging tools, neuroscientists are learning just how critical the teen years are for brain development. This article explains for students how brain-imaging techniques work, how they apply to their lives, and also highlights some of the things neuroscientists have learned about drug use. It may also inspire them to want to learn more about neuroscience!

Critical-Thinking Questions:

1. How can brain research help explain how teens make decisions? (*Brain imaging can show more brain activity for teens in the area that processes motivation and pleasure than that used for decision making. This indicates that teens may focus more on rewards and less on risks when making decisions.*)
2. Describe how each brain-imaging tool highlighted in the article teaches something different about the relationship between the brain and drug use. (*Structural MRI scans can show changes in a person's brain structure as a result of using drugs. Functional MRIs [fMRI] show that teens may focus more on rewards and less on risks when making decisions—which can increase risks for using drugs. PET scans have shown how using drugs can cause changes in the way brain cells function.*)
3. How might findings from brain research, such as the ABCD study, help doctors in their jobs? (*Doctors can use brain research to better understand who might be at greater risk for disease, or how using drugs changes the brain. This information can give insight into prevention and possible treatments.*)

Writing Prompts:

- What are two ways using drugs may affect the brain?
- Compare and contrast each of these three brain imaging technologies: structural MRI, fMRI, and PET.
- How might changes in the brain caused by using drugs make it more difficult for a person to stop using drugs?

Paired Reading, Writing Prompts:

- “Wiring Your Brain,” [headsup.scholastic.com/students/wiring-your-brain](https://www.headsup.scholastic.com/students/wiring-your-brain)

Writing Prompt: Evaluate the statement: “Using drugs can interfere with brain development.”

- “The Awesomely Evolved Human Brain,” [headsup.scholastic.com/students/awesomely-evolved-human-brain](https://www.headsup.scholastic.com/students/awesomely-evolved-human-brain)

Writing Prompt: Explain the role of dopamine in the brain and how it might affect behavior.

Tiered Vocabulary Tools:

Visit [scholastic.com/headsup/brain-imaging-tools](https://www.scholastic.com/headsup/brain-imaging-tools) for vocabulary printables that support the student article and lesson.

Video Extension:

“The Human Brain: Major Structures and Functions,” <https://teens.drugabuse.gov/videos>

After reading the article, watch this short video with your students and ask them what new information about the brain they learned. Discuss how brain imaging may have helped scientists to learn facts explained in the video. Have students write down at least one question they still have about the brain after reading the article and watching the video. Ask them to conduct additional research, and write a 3–4 paragraph report on their findings.

Student Work Sheet: “Can You Think Like a Neuroscientist?”

The skills sheet on the reverse side has students imagine they are neuroscientists studying the brain.

Answer Key:

- 1) **a.** Structural MRI; structure. **b.** Starting from write-in box, upper right, clockwise: frontal lobe; prefrontal cortex; brain stem; cerebellum; occipital lobe; temporal lobe; parietal lobe
- 2) fMRI; function
- 3) **a.** PET scan; the cellular level **b.** You can conclude that using drugs contributes to a decrease in dopamine activity.
- 4) Structural MRI would be used to track anatomical changes in the prefrontal cortex because this technique produces a detailed map of brain structure.
- 5) fMRI imaging could help determine which areas of the brain are involved in making risky decisions. The technique shows which areas of the brain are most active during certain behaviors and functions.

[Continue to work sheet on next page.]

SUBJECT

- Science Literacy
- English/Language Arts
- Health/Life Skills

COMMON CORE STATE STANDARDS

- RST.9 Analyze structure of relationships among concepts in a text
- W.9 Draw evidence to support analysis and reflection

NEXT GENERATION SCIENCE STANDARDS

- LS1.A Structure and Function
- LS1.D Information Processing

NATIONAL SCIENCE EDUCATION STANDARDS

- Structure and Function in Living Things
- Personal and Community Health

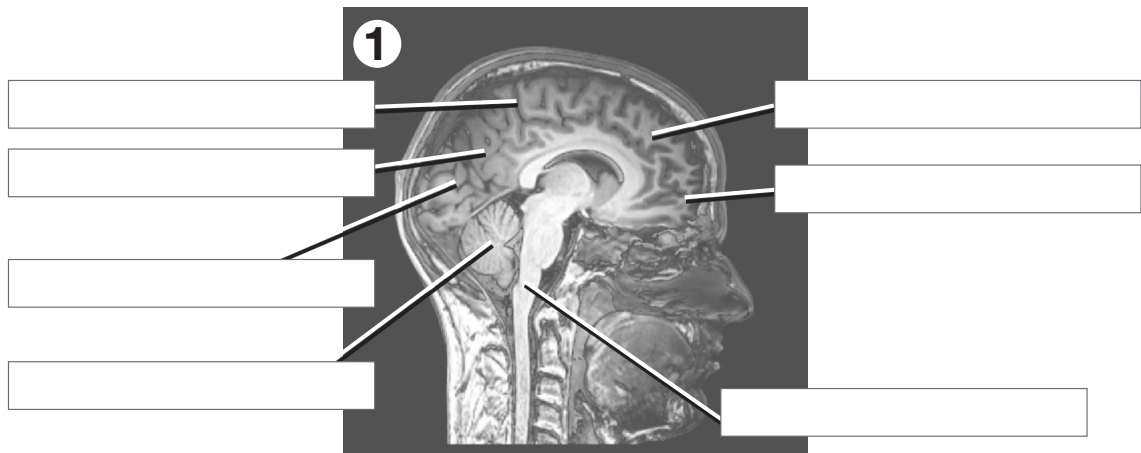
Additional Teaching Resources:

- [headsup.scholastic.com/teachers](https://www.headsup.scholastic.com/teachers)
- [teens.drugabuse.gov](https://www.teens.drugabuse.gov)

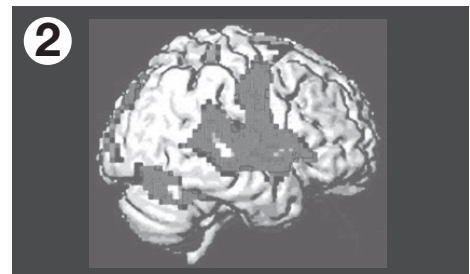
Can You Think Like a Neuroscientist?

Use the information from "Mapping the Brain" to answer the questions below and analyze real images of the brain. Record your responses on a separate sheet of paper as necessary.

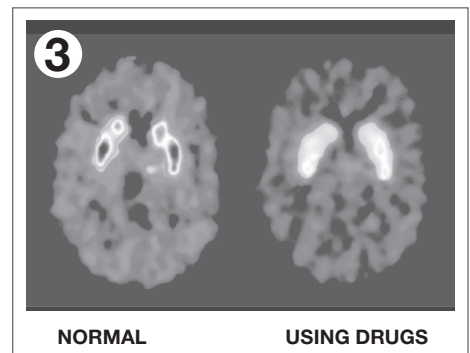
1. **a.** The image below shows regions of the brain. What type of scan is shown?
What kind of information about the brain does it provide (structure, function, or cellular)?
- b.** Label the highlighted regions of the brain.



2. The image at right shows brain activity levels while a person is laughing. What type of scan is shown?
What kind of information does it provide?



3. **a.** These images (below right) were created using radiotracers that attached to dopamine receptors in the brain. What type of scan is shown? What kind of information does it provide?



- b.** Dopamine is the brain chemical that helps us feel pleasure. Dopamine levels are higher in the brain on the left. What can you conclude about how using drugs affects the brain?
4. What type of imaging technique would you use to learn about how the size of the prefrontal cortex changes as kids grow into adulthood? Explain your answer.
5. What type of imaging technique would you use to find out which areas of the brain are active when a person considers making a risky decision? Explain your answer.