## Brainpower

It is said that the mind is separate, yet inseparable from, the brain. This issue of MUSE explores the brain as the organ inside the skull and the mind as the abstract mechanism responsible for cognition and consciousness. Engaging articles introduce readers to a variety of concepts, from neurons to daydreams.

CONVERSATION QUESTION

How does the brain function?

TEACHING OBJECTIVES

- **Students will learn how recent developments in neuroscience are working to interpret brain scan patterns.**
- **Students will learn how different parts of the brain are responsible for making, storing, and recalling memories.**
- **Students will learn the science behind daydreaming.**
- **Students will use data to draw logical conclusions.**
- **Students will classify information.**
- **Students will collect evidence to support a claim.**
- **Students will write an opinion essay.**
- **Students will represent large numbers in different forms.**
- **Students will identify idioms and provide their intended meanings.**
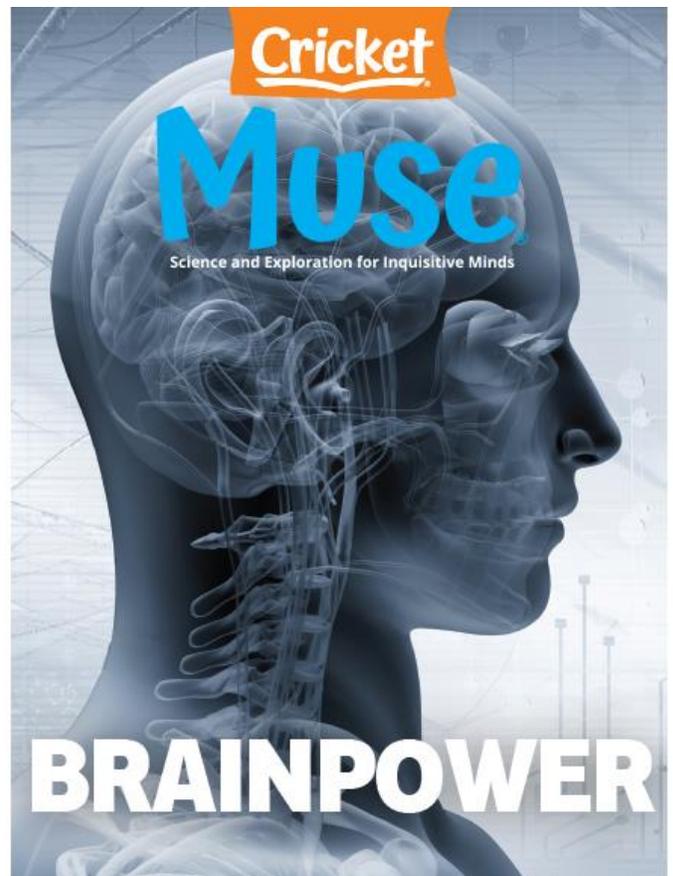
In addition to supplemental materials focused on core STEM skills, this flexible teaching tool offers vocabulary-building activities, questions for discussion, and cross-curricular activities.

SELECTIONS

- **Is Mind Reading Possible?**
  Expository Nonfiction
- **Remember…and Forget**
  Expository Nonfiction
- **Quit Paying Attention!**
  Expository Nonfiction

http://www.cricketmedia.com/teacher-guides

Is Mind Reading Possible?

pp. 10–15, Expository Nonfiction

A prominent storyline in many science fiction books and movies is the ability to read minds. This article will introduce readers to the technological advances that are helping scientists unlock such potential.
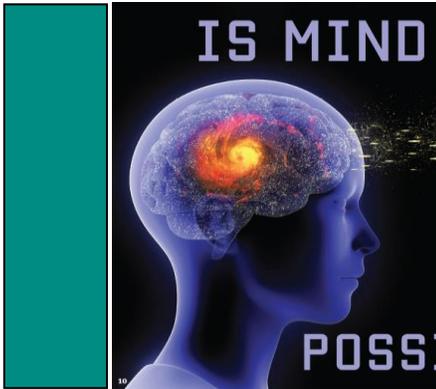
RESOURCES

- Drawing Conclusions: Masterminds

OBJECTIVES

- Students will learn how recent developments in neuroscience are working to interpret brain scan patterns.
- Students will use data to draw logical conclusions.
- Students will write an opinion essay.

KEY VOCABULARY

- *neuroscientist* **(p. 14)** a scientist who studies the nervous system and the brain

ENGAGE

Conversation Question: How does the brain function?

Entice students into a game of "20 questions" in which they will try to guess the topic of the article (brain). In this game, the players are allowed to ask yes/no questions, one by one, in order to unravel the mystery. Instead of calling out the answer, have students write their guess on a piece of paper after each question. At the end of the questions, did all students write the word *brain*? Congratulate the students on being able to "read your mind"! Ask: *Is mind reading actually possible?* Discuss ideas and then distribute the article.

INTRODUCE VOCABULARY

As most words are defined within the article, post and read aloud the single key word. Tell students that many new vocabulary words will have Greek and Latin roots, as well as prefixes and suffixes. This knowledge can help us determine the meaning of an unfamiliar word. Break apart the terms and show the root meanings, then compare to actual definitions. **neuro**=nerves / **scientist**=person who is trained in science (knowledge). Ask: *How does knowing the meaning of roots, prefixes, and suffixes help to give meaning to unfamiliar words?*

READ & DISCUSS

Read the article aloud with the class. Have students reread the article in small groups to answer the questions below. Share responses.

1. How is brain activity measured?
2. What is the purpose of an fMRI machine?
3. What does a specific pattern of voxels represent?
4. Summarize the findings of the study conducted at Princeton University in 2017.
5. List and explain two obstacles to creating more accurate computer models of voxel patterns.

SKILL FOCUS: Drawing Conclusions

INSTRUCT: The article presents readers with information regarding the possible applications for mind reading in the future. Have students work independently to supply details and draw logical conclusions to complete the *Drawing Conclusions: Masterminds* worksheet.

ASSESS: Review the completed worksheet with the class. Collect papers to evaluate students' responses to the THINK TANK question.

EXTEND

Language Arts: Read aloud this excerpt from the final paragraph on page 15: "We have ample time to consider how exactly we want such a powerful technology to be used. How accurate is accurate enough? Who can it help, and who is at risk if it's wrong?" Then instruct students to choose one of the questions and write an opinion essay that includes: introduction/hook, two body paragraphs with reasons/ evidence/ examples, and a conclusion. Invite volunteers to read their essays aloud.

Masterminds

Drawing Conclusions Use detailed information from the article to complete the first column. In the second column, use methods from the text and your own critical thinking skills to arrive at a logical conclusion based on the brain scan evidence.

Accused of: Robbing a jewelry store	**Accused of:** Vandalizing a classmate's bicycle
Claim: INNOCENT	**Claim:**
Brain Scan Procedure:	**Brain Scan Procedure:**
Brain Scan Findings:	**Brain Scan Findings:**
Conclusion: GUILTY	**Conclusion:**

THINK TANK Do you think that this technology can be fairly used to help convict criminals in the future? Why or why not? Use the back of this paper to answer in paragraph form. Support your answer with reasons and examples.

Remember...and Forget

pp. 28–31, Expository Nonfiction

Students will explore the science of memory in this high-interest article. Relatable examples of how each part of the brain helps a person function and remember are provided.
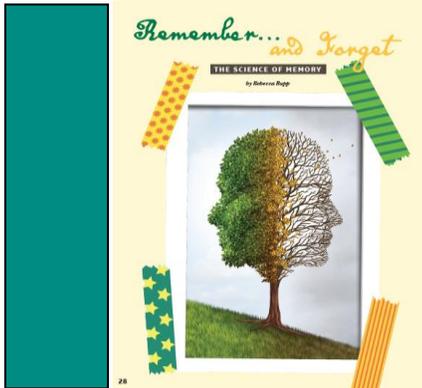
RESOURCES

- Memory Matching Cards
- Classifying Information: The Marvel of Memory

OBJECTIVES

- Students will learn how different parts of the brain are responsible for making, storing, and recalling memories.
- Students will classify information.
- Students will represent a large number in different forms.

KEY VOCABULARY

- *amygdalae* **(p. 29)** two small almond-shaped parts of the brain that are responsible for processing and expressing emotions
- *striatum* **(p. 29)** the part of the brain that is involved in decision-making
- *hippocampus* **(p. 29)** the part of the brain that is responsible for memory and learning

ENGAGE

Conversation Question: How does the brain function?

Motivate students to learn about memory by having pairs of students play a card-matching game. Use the *Memory Matching Cards* included in this guide or distribute playing cards. Ask students to discuss the game. Then explain that short-term memory is what makes it possible to remember where the cards are. Tell students they will learn about several functional memory types in this article.

INTRODUCE VOCABULARY

Post the three key terms and definitions. Distribute the article and have students turn to page 29 and study the brain diagram at the bottom of the page. Have them locate the brain structures (amygdalae, striatum, hippocampus) and read the descriptions. As a post-reading activity, have students use information from the article and online resources to accurately label other brain structures on the diagram.

READ & DISCUSS

Pose the following questions to prompt meaningful discussion. Students should use complete sentences and details to answer each question.

1. Explain the difference between short-term and long-term memory.
2. What is memory consolidation and when does it occur?
3. How are engrams created and retrieved?
4. What did scientists learn by performing an operation on Henry Molaison?
5. How can memories work against us?
6. How does forgetting serve as a filter?

SKILL FOCUS: Classify Information

INSTRUCT: Elicit from students that the main idea of the article is to provide readers with knowledge about the processes of creating, storing, and retrieving memories. Present the *Classifying Information: The Marvel of Memory* graphic organizer. Tell students they will use information from the article to determine whether each statement describes a function of semantic memory, autobiographical memory, or procedural memory.

ASSESS: Review answers with the class. Discuss any conflicting responses, and then ask volunteers to share their answers to the THINK TANK activity.

EXTEND

Mathematics: Read aloud this sentence from article page 29: "Each human brain contains nearly 90 billion neurons—and each of these can form more than a thousand connections with other neurons." Have students examine the number 90 billion and then represent the number in standard form, word form, expanded form, exponential form, and on a place-value chart. Review different number forms, if necessary. To further challenge students, instruct them to return to the article and circle any numbers. Have them represent the numbers in the forms mentioned above.

Memory Matching Cards Cut out the cards, shuffle them, and then lay them face down in a 4 × 3 grid. With a partner, take turns finding matches.
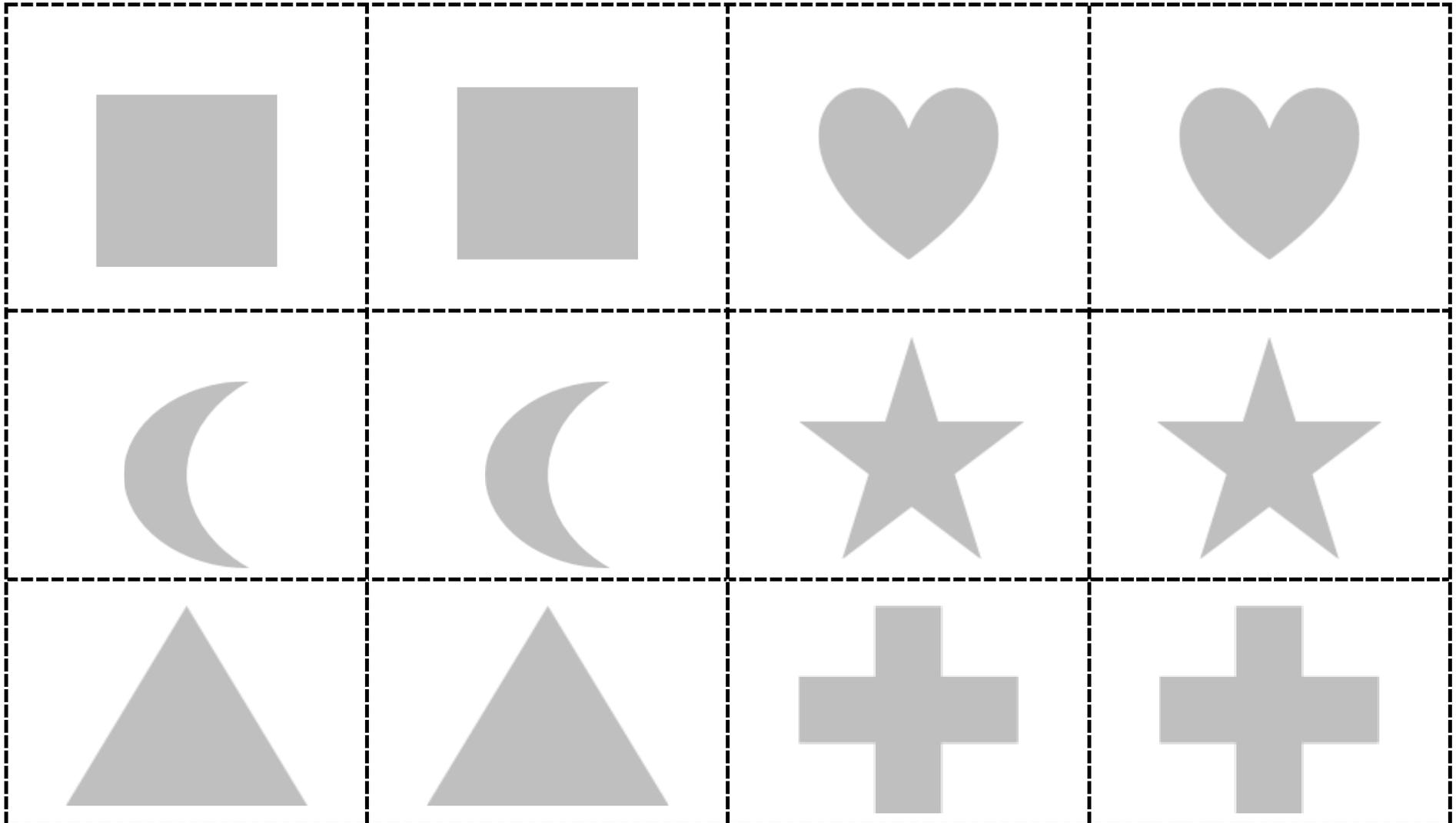
The Marvel of Memory

Classifying Information Use information from the article, as well as your own thinking, to determine whether each sentence is describing a function of semantic memory (**S**), autobiographical memory (**A**), or procedural memory (**P**). Write the correct letter on the line.

_____ 1. I know that all of the interior angles of a triangle add up to 180 degrees.

_____ 2. I know how to ride a unicycle.

_____ 3. I know that my mother's name is Carolyn.

_____ 4. I know how to play baseball.

_____ 5. I know that the capital of New York is Albany.

_____ 6. I know that I had waffles for breakfast.

_____ 7. I know how to knit a baby blanket.

_____ 8. I know that my dog is a cocker spaniel.

_____ 9. I know that my tenth birthday had a Spiderman theme.

_____ 10. I know how to play the piano.

THINK TANK Turn and talk with a partner to identify two additional examples each of semantic, procedural, and autobiographical memories. Write your answers below.

Quit Paying Attention!

pp. 32–37, Expository Nonfiction

Daydreams can serve as a simple escape from the mundane, can provide us with great inspiration, or can be disruptive in certain contexts. Readers will learn what scientists have discovered about the mind's ability to wander.
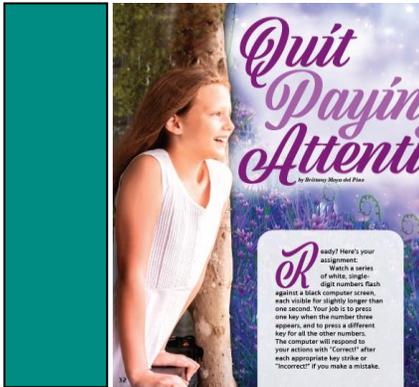
RESOURCES

- Collect Evidence: Dream On

OBJECTIVES

- Students will learn the science behind daydreaming.
- Students will collect evidence to support a claim.
- Students will identify idioms and provide their intended meanings.

KEY VOCABULARY

- *abstract ideas* **(p. 34)** ideas relating to general concepts such as happiness and courage rather than specific people, objects, or actions
- *stream of consciousness* **(p. 34)** the continuous flow of ideas, thoughts, and feelings forming the content of an individual's mind
- *empathy* **(p. 35)** the ability to understand and share the feelings of others

ENGAGE

Conversation Question: How does the brain function?

Ask students to share techniques that help them avoid drifting off into daydreams while they are studying for a test. List answers on the board and discuss mindfulness (described on page 37 of the article) as a tool that some people use to stay calm and alert. It involves slow, steady breathing. Teach students the steps of the box breathing technique: 1. *Breathe in for 4 seconds;* 2. *Hold for 4 seconds;* 3. *Breathe out for 4 seconds;* 4. *Hold for 4 seconds. Repeat.* Have students use this technique throughout the week and report interesting findings to the class.

INTRODUCE VOCABULARY

Post and discuss the three vocabulary terms and definitions. Have students Think-Pair-Share with a partner. Give them the following directives, one at a time:

1. Why do most inventions begin as **abstract ideas**?
2. Verbalize examples of a **stream of consciousness** monologue.
3. How does having **empathy** help you build social connections?

Emphasize the key words as they are revealed in the reading.

READ & DISCUSS

Reinforce comprehension of the concepts presented in the article by using the following questions to direct a discussion.

1. Why do younger people daydream more often than older people?
2. How can daydreaming be disruptive?
3. Why do researchers think that daydreaming may be involved in empathy and social skills?
4. What methods do scientists use to collect data about daydreaming?
5. How could you avoid daydreaming?

SKILL FOCUS: Collect Evidence

INSTRUCT: This article presents the reader with information about the formation and function of daydreams. Present the *Collect Evidence: Dream On* graphic organizer. Tell students to review the article and highlight sentences that provide evidence to support each of the claims stated. After they have collected evidence addressing all of the statements, they will record the information on the organizer. Remind students to cite information and details using page numbers.

ASSESS: Have mini conversations as students are working. Collect worksheets.

EXTEND

Language Arts: Read aloud this sentence from page 37: "But your best ideas might just come when your head is in the clouds." Explain that the expression "head in the clouds" is an idiom—an expression that has meaning different from the meaning of its individual words. Other examples: *under the weather* = feeling sick; *a piece of cake* = easy to do

Have students work with a partner to list five idioms and their meanings. Then display the 50 most common idioms, easily found online.

Dream On

Collect Evidence Gather evidence from the article to support each claim below. Include details and cite your findings by using page numbers.

Claim: Multitasking (daydreaming while doing other activities) can be useful, but it also has drawbacks.

Supporting evidence (P._____)

Claim: Daydreamers have a bad reputation for being unaware of what's happening around them.

Supporting evidence (P._____)

Claim: Daydreamers are responsible for some of the greatest ideas and achievements in human history.

Supporting evidence (P._____)