

Muse®

THE SCIENCE OF READING

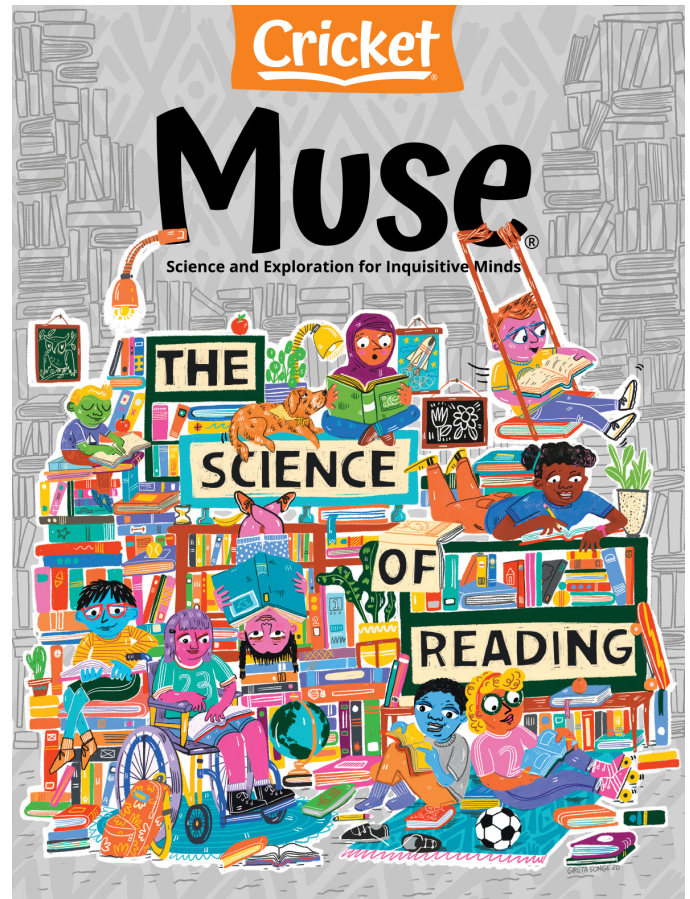
Appreciating a good book takes imagination and curiosity, as well as a significant amount of brain power. This issue of MUSE delves into the cerebral processes that contribute to the ability to read. Beyond the capability to simply decode words, the true magic happens when we are able to gain meaning from a string of words. As Dr. Seuss said, “The more that you read, the more things you will know. The more that you learn, the more places you’ll go.” Where will your reading journey take YOU?

CONVERSATION QUESTION

How do we learn to read?

TEACHING OBJECTIVES

- Students will learn about the developmental stages of reading.
- Students will learn how the brain adapts to help the blind read Braille.
- Students will learn how different sections of the brain work together to allow us to decipher written words.
- Students will synthesize information from the article with personal knowledge.
- Students will collect and analyze data from a scientific text.
- Students will examine the structure and function of the brain centers involved in reading.
- Students will experience the process of reading as described in the article by securing an elementary “Reading Buddy.”
- Students will apply knowledge from the text to create a tactile representation of their name in Braille.
- Students will plot geographical locations on a map of the world.



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

- **Reading Their World**
Expository Nonfiction, ~500L
- **A New Way to See Braille**
Expository Nonfiction, ~1100L
- **Inside the Reading Mind**
Expository Nonfiction, ~900L

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Reading Their World

pp. 10–14, Expository Nonfiction

This article presents the developmental stages of reading and examines the difference between decoding and reading. Students will explore how children make sense of oral language and printed words.



RESOURCES

- Ready to Read

OBJECTIVES

- Students will learn about the developmental stages of reading.
- Students will synthesize information from the article with personal knowledge.
- Students will experience the process of reading with an elementary “Reading Buddy.”

KEY VOCABULARY

- **decode (p. 10)** applying knowledge of letter-sound relationships to correctly pronounce written words
- **emergent reader (p. 11)** a learner who understands the alphabet and is on the cusp of reading/writing conventionally
- **visual language (p. 11)** communication using visual elements such as signs, images, and symbols

ENGAGE

Conversation Question: How do we learn to read?

Create a random list of 20 words on the board with half of the words being simple sight words (ex: *the, at, to*) and half of the words being words that need to be decoded (ex: *shipment, football, monster*). Instruct students to divide the words into two groups. Most students will easily divide the list into sight words and decoded words. Discuss the skills that are necessary to read both groups of words.

INTRODUCE VOCABULARY

Post and discuss the key terms. Be sure that students understand the definitions before reading the article. As a post-reading activity, have students use the three vocabulary words to summarize the article in paragraph form.

READ & DISCUSS

Post and discuss the questions prior to reading. Read the article aloud, pausing when answers to the questions are revealed and encouraging students to elaborate.

- What is the difference between decoding and reading?
- How do children “read their world” before learning to read?
- How do body language and play help with reading?
- Why is curiosity important in learning to read?
- Why are wordless books a great choice for very young readers?

CONCEPT/SKILL FOCUS: Synthesizing Information

INSTRUCT: List the four elements that assist an emergent reader on the board (Environmental Clues, Visual Language, Emotional Interpretation, and Play). Have students reread the article with a partner and use sticky notes to mark where in the article corresponding information is found. Emphasize that they will be using information from the article, as well as their own thoughts, to complete the *Ready to Read* organizer.

ASSESS: The objective of this lesson is to help students practice the skill of making connections. Review answers on the graphic organizer orally. Be sure students were able to add their own examples in addition to the examples given in the article (synthesize information). Have them amend their list if necessary.

EXTEND

Reading After completing the activities in this guide, give students the opportunity to experience the process of early reading by arranging a “Reading Buddy” program. Tell students to pay attention to the process of emergent/beginner readers by considering the information that they learned about from “Reading Their World.” Have students reference the article and keep a log of their observations. Share findings.

Ready to Read

Refer to the article, "Reading Their World," to record examples of each learning strategy that an emergent reader uses to "read the world." Add your own examples, as well.

Environmental Clues <ul style="list-style-type: none">• sign/logo recognition	Visual/Body Language <ul style="list-style-type: none">• pointing
Emotional Interpretation <p>"O"-shaped mouth means surprise</p>	Learning Through Play <ul style="list-style-type: none">• building a fort

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A New Way to See Braille

pp. 28–29, Expository Nonfiction

At a certain age reading becomes automatic for most people. This article explores the pathways and centers of the brain responsible for reading, specifically focusing on the adaptations that the brain makes to touch-read Braille text.



RESOURCES

- Your Brain on Braille

OBJECTIVES

- Students will learn how the brain adapts to help the blind read Braille.
- Students will collect and analyze data from a scientific text.
- Students will apply knowledge from the text to create a tactile representation of their name in Braille.

KEY VOCABULARY

- lobes** (p. 28) different sections of the brain that are responsible for specific functions
- neurons** (p. 29) nerve cells that make up the brain
- plasticity** (p. 29) the ability of neural networks in the brain to change through growth and reorganization

ENGAGE

Conversation Question: How do we learn to read?

Pose the question: “Who was Louis Braille?” (It is likely that a student will suggest that he was the developer of Braille.) Show the class a video clip or read a quick bio on Louis Braille. Students may be surprised to discover that he created the Braille system as a partially sighted man. Have students share information about other inventions that were the result of the inventor’s necessity.

INTRODUCE VOCABULARY

Review the key vocabulary with the class. Guide students to notice that all of the words contain a different number of syllables. Have students divide a piece of paper into four columns with the following headings: 1 syllable words/2 syllable words/3 syllable words/3+ syllable words. Instruct the class to properly partition each key term into syllables and place it in the correct column. After reading, have the students search the article for other theme-related words to add to each column.

READ & DISCUSS

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

- Explain the Braille system for reading.
- What did researchers discover when they used fMRI to observe the brains of blind readers as they read Braille?
- How does the brain recruit unused areas of the brain for new jobs?
- Why is it significant that scientists have recently revealed that our brains’ ability to adapt is greater than previously thought?

CONCEPT/SKILL FOCUS: Collect and Analyze

INSTRUCT: Direct students to reread the article independently and underline passages that discuss specific brain centers. Distribute copies of the *Your Brain on Braille* graphic organizer and instruct the students to collect and analyze information related to the brain centers that are activated when reading Braille.

ASSESS: Circulate and converse with the students as they are working. Collect and review worksheets to evaluate individual abilities to analyze information.

EXTEND

Art Direct students to revisit the text on the bottom of page 29 featuring the Braille alphabet. Have students create a tactile representation of their name in Braille. Small objects such as buttons, split peas, or red-hot candies work well for this activity. Have students close their eyes and try to “read” their classmates’ name tags with their fingertips.

Your Brain on Braille

Use information from the article, “A New Way to See Braille,” to complete the chart below.
Then, refer to your chart to answer the questions.

Brain Center	Explanation of Responsibilities
visual word form area	
parietal lobe	
cerebellum	
hypothalamus	

What is the primary brain center being stimulated when you . . .

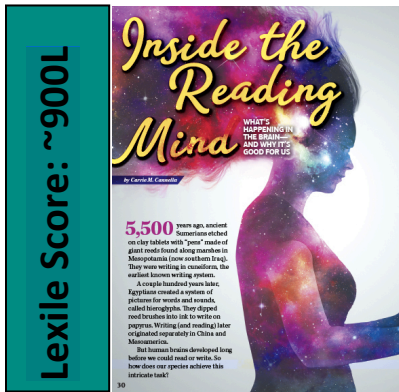
view a sunset? _____	walk a tight rope? _____
pet a dog? _____	watch a movie? _____
ride a bike? _____	squeeze dough? _____
spike a fever? _____	browse the internet? _____

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Inside the Reading Mind

pp. 30–33, Expository Nonfiction

This article takes a look inside the brain and explains how the process of reading is a result of the intricacies of this complex and interconnected organ. Learn what is actually happening inside your brain as you read printed words.



RESOURCES

- If I Only Had a Brain

OBJECTIVES

- Students will learn how different sections of the brain work together to allow us to decipher the written word.
- Students will examine the structure and function of the brain centers involved in reading.
- Students will plot geographical locations on a map of the world.

KEY VOCABULARY

- **neuroscientist** (p. 31) a scientist who studies the nervous system and the brain
- **oxygenated** (p. 32) supplied or enriched with oxygen
- **papyrus** (p. 30) a material prepared in ancient Egypt from the stem of a water plant and used for writing or painting on

ENGAGE

Conversation Question: How do we learn to read?

Read aloud the last sentence of the article, which states, “I wish you to gasp not only at what you read, but at the miracle of its being readable.” Encourage students to share their interpretations of this quote. Introduce the article, “Inside the Reading Mind,” and invite students to expand on their responses.

INTRODUCE VOCABULARY

Post and discuss the key vocabulary words and definitions. Examine the terms in greater depth by having students supply the correct word in the sentences below. Which key word is a verb?

1. The lungs _____ the blood before it returns to the heart.
2. The ancient document was written on delicate _____.
3. In the past several years, _____ have made great progress in understanding brain functions.

READ & DISCUSS

Reinforce comprehension of the concepts in the article by using the following prompts to direct discussion.

- What is cuneiform?
- Explain the four lobes of the brain.
- How does the brain translate letters on a page into words?
- How does reading benefit our brains?
- Why is skimming a text less lucrative to the brain than reading?

CONCEPT/SKILL FOCUS: Obtaining Information

INSTRUCT: Elicit from students that the main idea of the article is to provide information that details how different sections of the brain contribute to the process of reading. Instruct students to reread the article, pausing to study page 31. Distribute the *If I Only Had a Brain* worksheet. Students should correctly match the brain structure on the left with its function on the right.

ASSESS: Collect and review graphic organizers. Have students revisit the text to correct errors, if necessary.

EXTEND

Geography Instruct students to reread the article with a partner and to highlight all of the geographical locations contained in the article. Provide each pair of students with a blank map of the world and have them plot and label each location. After marking each location, have students label each region with a few words that describe its role in the development of the reading/writing process.

If I Only Had a Brain

Use information from the article, “Inside the Reading Mind,” to correctly match the brain structure on the left with its function on the right. Place the letter on the line next to the name.

- | | |
|---------------------------------------|---|
| 1. _____ frontal lobe | A. specializes in visual input, including seeing letters and words |
| 2. _____ temporal lobes | B. the speech center; responsible for how we organize and produce spoken language |
| 3. _____ parietal lobe | C. helps us to recognize and understand speech; the key to meaningful speech |
| 4. _____ occipital lobe
executive | D. controls planning, thinking, and attention; our desk |
| 5. _____ angular gyrus | E. section of the brain concerned with pronunciation |
| 6. _____ Wernicke’s area | F. section of the brain involved in turning spelling into sound |
| 7. _____ left occipital temporal area | G. sections responsible for hearing and decoding sounds and words |
| 8. _____ Broca’s area | H. responsible for how we put words together and give them meaning; key for many language processes |
| 9. _____ precentral gyrus | I. specializes in visual input, including seeing letters/words |
| 10. _____ supramarginal gyrus | J. regulates our senses, especially touch, spatial sense, and movement; our sensation manager |