

<b>Brain Science</b>
This journal belongs to: .....

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**Sub-Unit 1** • pages 6–49



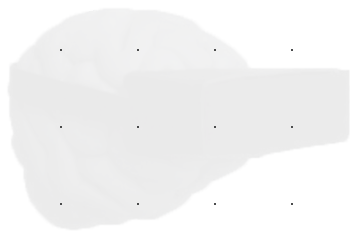
**Sub-Unit 2** • pages 50–71



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**Sub-Unit 4** • pages 82–105















## Sub-Unit 1

# *Phineas Gage: A Gruesome but True Story About Brain Science*



What do you think would happen if a piece of iron went through a person's head? Why do you think so?

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1. Review the list of steps. Summarize how things went wrong for Phineas that afternoon. Go back to the text and try to determine the important moment that caused this accident.

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2. Based on the conclusion of the passage, what do you think happened to Phineas after the accident?

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1. Are the effects on Phineas mostly positive or mostly negative? What evidence from the text makes you think so?

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2. What do you think the author means when he writes, “Phineas Gage will become someone worth knowing” (2)?

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3. Where was the entry point? What evidence from the text makes you think so?

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4. Where was the exit point? What evidence from the text makes you think so?

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5. Be the scientist: What conclusions can you draw about the brain based on Phineas's case?

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6. Look over your writing about Phineas's injury from the beginning of the lesson. Have your ideas about the brain changed? Explain the evidence that changed your mind or confirmed your understanding.

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1. List all the steps Dr. Harlow took and the reasons why you think he took each step. The first row has been completed for you.

Step	Reason
Cleans the skin around the hole	To prevent the dirt from getting in the wound



2. How did the doctors' treatment impact Phineas's physical condition? What evidence from the text makes you think so?

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3. What are the advantages and disadvantages of each type of brain injury?

	Open brain injury	Closed brain injury
Advantages		
Disadvantages		

4. Which type of brain injury do you think is worse? What evidence from the text makes you think so?

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1. Based on your reading of the text, what were the factors that enabled Phineas to survive? Include evidence from the text to support your view.

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2. How have the information and ideas expressed by your partner changed or confirmed your own views?

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1. Add the scientists' names to this table. What did each scientist discover about microscopic life?

When?	1665	1660s–1670s	1860s	1860s
Who?				
What did they discover?				

2. How long did it take scientists to understand that bacteria can cause illness? Why do you think it took so long?

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3. What do scientists know about infections in 1848? What don't they know about infections?

In 1848, scientists know...	In 1848, scientists don't know...

4. How do you think the doctors' knowledge or lack of knowledge affected their treatment of Phineas?

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1. What is an infection? How can an infection be prevented or treated? Include evidence from the text that supports your view.

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2. How has the discussion with your partner changed, deepened, or confirmed your understanding?

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If Phineas's doctors knew what we now know about infections, what would they have done differently? Use evidence from the text to support your ideas.

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Paraphrase three of Dr. Harlow's private notes about Phineas.

- A. "His contractors, who regarded him as the most efficient and capable foreman in their employ previous to his injury, considered the change in his mind so marked that they could not give him his place again." (32)

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- B. "He is fitful, irreverent, indulging at times in the grossest profanity (which was not previously his custom), manifesting but little deference for his fellows, impatient of restraint or advice when it conflicts with his desires." (33)

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- C. "A child in his intellectual capacities and manifestations, he has the animal passions of a strong man." (33)

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1. Which of Phineas's symptoms were *physical* (affecting Phineas's body)?

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2. Which of Phineas's symptoms were *psychological* (affecting Phineas's thinking, speaking, or behavior)?

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1. Write the function of each of the following parts of the brain.

Part of the brain	What does the part do?
Brain stem	
Cerebellum	
Corpus callosum	
Cortex	



2. Explain the function of each part of the brain pictured in the diagram on page 323 of the Student Edition.

- Cortex:

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- Corpus callosum:

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- Cerebellum:

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- Brain stem:

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1. List the different parts of the cortex in the chart. Then, describe the job performed by each part.

Part of the cerebral cortex	What does the part do?

2. If the occipital lobe was damaged, a person might not be able to...

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3. If the temporal lobe was damaged, a person might not be able to...

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4. If the parietal lobe was damaged, a person might not be able to...

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5. If the frontal lobe was damaged, a person might not be able to...

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6. If doctors had access to a brain map like the one you used, how would they have diagnosed Phineas differently?

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Look at the list of Phineas's symptoms that you made on page 21. Write any other symptoms that you can find in the text below.

Physical symptoms:

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Psychological symptoms:

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1. Which specific part of Phineas's brain was injured? Use evidence from the text in your response.

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2. How has the discussion with your partner changed, deepened, or confirmed your understanding?

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1. Which doctors belong to which group? Use your highlights in paragraphs 17–25.

Whole Brainers	Localizers/Phrenologists

2. Summarize the beliefs of the Whole Brainers.

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3. Why did the Whole Brainers believe that Phineas's case proved their theory?

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4. Summarize the beliefs of the Localizers/Phrenologists.

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5. Why did the Localizers/Phrenologists believe that Phineas's case proved their theory?

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Make a list of your own character traits that show your personality, your strengths, and your weaknesses. (Include at least seven traits).

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1. Explain what the author means when he says, “The human brain, it turns out, is both localized and interconnected” (27). Include evidence from the text that supports your ideas.

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2. How has the discussion with your partner changed, deepened, or confirmed your understanding?

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What did Phineas do after he left Boston? List the work he did, the location, and the source of the information in the chart.

What work did Phineas do?	Where did he do it?	What is the source of this information?



1. Select and write one word or phrase that gives you the best sense of whether this story is reliable or not.

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2. How reliable is the information in paragraphs 1–4?

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3. What about the words you selected makes you think the information is or is not reliable?

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4. Select and write one word or phrase that gives you the best sense of whether this story is reliable or not.

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5. How reliable is the information in paragraphs 5–10?

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6. What about the words you selected makes you think the information is or is not reliable?

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1. Based on what you know about Phineas's life and personality, which of the events in paragraphs 1–12 do you think is *most* likely to have happened? What makes you think so?

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2. Based on what you know about Phineas's life and personality, which of the events in paragraphs 1–12 do you think is *least* likely to have happened? What makes you think so?

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1. Based on the information in paragraph 29, list any brain structures and related behaviors that you use when you have a conversation.

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2. Based on this reading, explain why Phineas could still speak and listen, but couldn't interact with workers like he used to.

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1. What evidence did you find in paragraph 29 that makes you think Phineas is the same/  
different?

Claim	Phineas is the same person.	Phineas is not the same person.
Reason		
Evidence		



2. Write the main idea of each section of the debate.

- Main idea of opening argument

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- Main idea of rebuttals

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- Main idea of closing argument

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Take notes on the debate here:

A series of horizontal dotted lines for taking notes.





1. How are the Damasio's patients similar to and different from Phineas?

	Similar	Different
They have frontal lobe damage.		
They have trouble making decisions.		
They are victims of blasting accidents.		
They are emotionally unpredictable.		

2. What are three methods or technologies the Damasio used to study brain injuries?

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3. Describe the step-by-step process the Damasio followed to create a model of Phineas's injury.

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4. According to the Damasio's brain model, what portions of the brain did the tamping iron miss? What skills do those areas control?

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5. The author says that if you study the model created by the Damasio, "you can see Phineas's incredible luck" (11). Based on the passage, why was Phineas so "lucky"?

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1. Reread paragraph 4 and describe the step-by-step process the Boston doctors follow to create a model of Phineas's injury.

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2. According to paragraphs 8 and 9, what do doctors of Phineas's day know about the brain? How do they know it?

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3. What did Broca discover? What did Wernicke discover?

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4. How did they and later scientists make their discoveries, according to the passage?

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5. What makes the discoveries of Broca and Wernicke so special?

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## Sub-Unit 2

# *Inventing Ourselves: The Secret Life of the Teenage Brain*



1. How does the author feel when people mock adolescents?

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2. Paraphrase this sentence: Studying adolescence “gives us an insight into how natural changes in the physiology of our brains are reflected in the things we do, and determine who we will become as adults” (3).

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3. What does the author think is interesting or noteworthy about adolescence?

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4. Paraphrase this sentence: “In this definition, the start of adolescence is measured biologically while the end is described socially, and is rather arbitrary “ (5).

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5. Review your highlighted definitions of adolescence in the text. Use the information to write your own definition of adolescence.

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6. How does the author organize the information she presents in this opening section of the book?

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7. Why do you think the author begins her book this way?

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1. The author mentions behaviors associated with adolescence: risk-taking, self-consciousness, and peer influence. What are some real-life examples of those behaviors?

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2. Researchers were interested in learning about two features of adolescent behavior: self-regulation and sensation-seeking. What is the definition of each term?

Self-regulation:

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Sensation-seeking:

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3. The author says, “Adolescent-typical behaviours can be seen across cultures” (7). Why is it significant that these behaviors exist in many different cultures?

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4. Look at the behavior of adolescent mice in Steinberg’s 2014 study. Which of these behaviors did the adolescent mice display?

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5. How does this study support the claim that we should “consider adolescence a unique period of biological development” (8)?

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6. What kinds of adolescent-typical behaviors did Socrates and Aristotle describe?

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7. The author claims that “adolescence is an important, distinct, biological period of development in its own right, in all cultures” (6). How did the author structure the passage to reveal the evidence that supports this claim?

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8. Take a look at the definition of adolescence you wrote on page 53 of this journal. Revise your definition or add evidence from the text to support your ideas, writing a new draft here.

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1. Why does the author mention the case of Phineas Gage in paragraph 25?

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2. What words would Blakemore use to describe Phineas's symptoms?

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3. Based on your reading, how do you think Blakemore would explain the brain science behind Phineas Gage's symptoms?

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1. Explain the results of the “Shopping Task” experiment for healthy patients and for brain injury patients.

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2. Why did the patients with prefrontal damage shop in a more haphazard way?

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3. Explain how the go/no-go test is designed. What do participants have to do and why?

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4. What do the results of the go/no-go experiment reveal about the development of the prefrontal cortex?

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5. What do these results tell us about adolescence?

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6. Which sentence in paragraph 29 contains the conclusions that the author draws about adolescence based on the experiments? Explain the sentence in your own words.

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1. Based on your reading, should the legal system treat adolescents differently than adults? Record your initial response to the question, and include evidence from the texts that supports your view.

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2. How has the discussion with your partner changed, deepened, or confirmed your understanding?

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1. How serious is the problem of adolescent risk-taking? What evidence from the text makes you think so?

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2. What is at least one explanation for adolescent risk-taking that isn't directly related to brain development?

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3. Reread your paraphrase about adolescence based on the go/no-go experiment from the previous lesson, on page 60.

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4. What is one connection you might make between this conclusion and why adolescents tend to take more risks?

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1. According to Steinberg's theory, what is happening in the prefrontal cortex during adolescence?

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2. What is happening in the limbic system?

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3. Use the "developmental mismatch" idea (8) to explain why adolescents might be more likely to drive dangerously.

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4. What did Blakemore's 2014 study attempt to understand?

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1. After calculating the average brain development, Blakemore explains how she, Kate Mills, and Anne-Lise Goddings further investigated their results (in paragraph 15).

What would be the importance of analyzing each individual's data in addition to the average of all the data?

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2. Both Steinberg and Blakemore study and write about the science of adolescent brain development. What is one difference in the way these two researchers think about the “average teenager”?

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What do you think your answers to the poll questions say about you?

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1. Describe the materials and methods used in the Marshmallow Test (44).

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2. What are the different ways the kids respond when they are asked to delay eating the marshmallow (45)?

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### **Group 1 Questions**

1. Describe four or five life outcomes associated with your higher self-control.

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2. Overall, as a child with higher self-control, how do you feel about your future?

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## **Group 2 Questions**

3. Describe four or five life outcomes associated with your lower self-control.

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4. Overall, as a child with lower self-control, how do you feel about your future?

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1. Blakemore defines “correlational” as “associations between self-control and other factors.” What does she mean?

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2. Blakemore defines causal as “certain outcomes occur because of high or low self-control.” What does she mean?

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3. What is the significance of the findings being “correlational rather than causal”?

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4. How could differences in self-control be connected to brain structure?

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5. What could be one factor that could *cause* both the development of strong self-control and positive life outcomes? Or one factor that could undermine the development of self-control and positive life outcomes?

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1. What is mindfulness training?

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2. What are the goals of mindfulness training and what methods does it use to achieve those goals?

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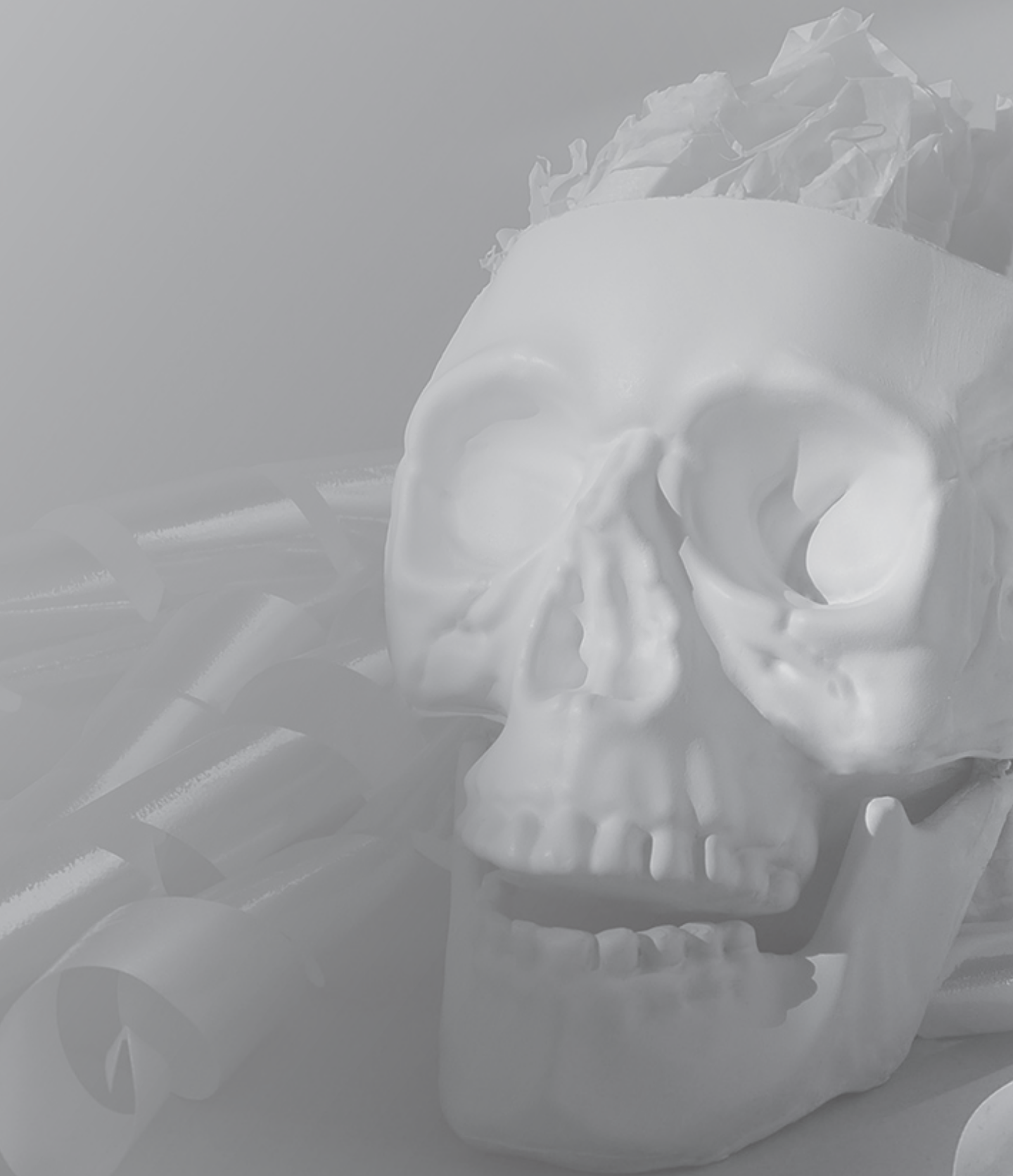
3. What do you think are some other possible ways of achieving the same goals?

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Sub-Unit 3

*The Man Who Mistook  
His Wife for a Hat*

Describe three symptoms of frontal lobe damage.

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1. What symptoms or behaviors do you think are most noteworthy in Jimmie's case?

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2. What symptoms or behaviors do you think are most noteworthy in Miguel's case?

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3. What symptoms or behaviors do you think are most noteworthy in Mrs. B.'s case?

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4. What symptoms or behaviors do you think are most noteworthy in Dr. P.'s case?

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1. Explain why Mrs. B.'s behaviors might be symptoms of frontal lobe damage.

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2. Compare how each of these writers tries to understand the effects of frontal lobe damage. What is their method for examining this damage?

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1. What similarities did you notice between the cases of Peggy and Mrs. S.?

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2. What conclusions about the brain can you draw based on these two cases?

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1. What different kinds of evidence does the writer use in the sample essay?

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2. Which sentence do you think best represents the claim?

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3. What is one piece of evidence that the writer uses to support the claim?

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4. How does the writer explain that evidence?

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## Sub-Unit 4

# Write an Essay

## Essay Prompt

In what ways are Phineas's behavior and brain similar to those of an adolescent? In what ways are they different?

## Essay Text

*Phineas Gage: A Gruesome but True Story About Brain Science*

*Inventing Ourselves: The Secret Life of the Teenage Brain*

## Notes

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## Gathering Evidence

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A series of horizontal dotted lines for writing an essay.



A series of horizontal dotted lines for writing an essay.









## Revise Body Paragraphs

### Partner Work:

1. Reread your essay with your partner, asking him or her to pay attention to the evidence you use and describe to support your claim.
2. Have your partner underline and annotate two places to revise in your body paragraphs:
  - One place where your evidence is strong and well-explained.
  - One place where you could add more evidence or describe your evidence more completely.
3. Once your partner explains his or her suggestions, review the moments from the text that connect to the parts of your essay you want to revise.
4. Highlight any additional details in the text that provide evidence for your claim.

### Individual Work:

5. For each place you've identified as needing revision, write 3–5 sentences that present additional evidence to support your claim or describe your evidence further.

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## Add Transitions

1. In the spaces below, experiment by writing a new transition to go between each body paragraph in your essay.

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2. Reread your essay with your new transitions.
3. Decide if you prefer your original transitions or your new transitions. Annotate your transitions to use for your final essay.





A series of horizontal dotted lines for writing an essay.



 Write an Essay

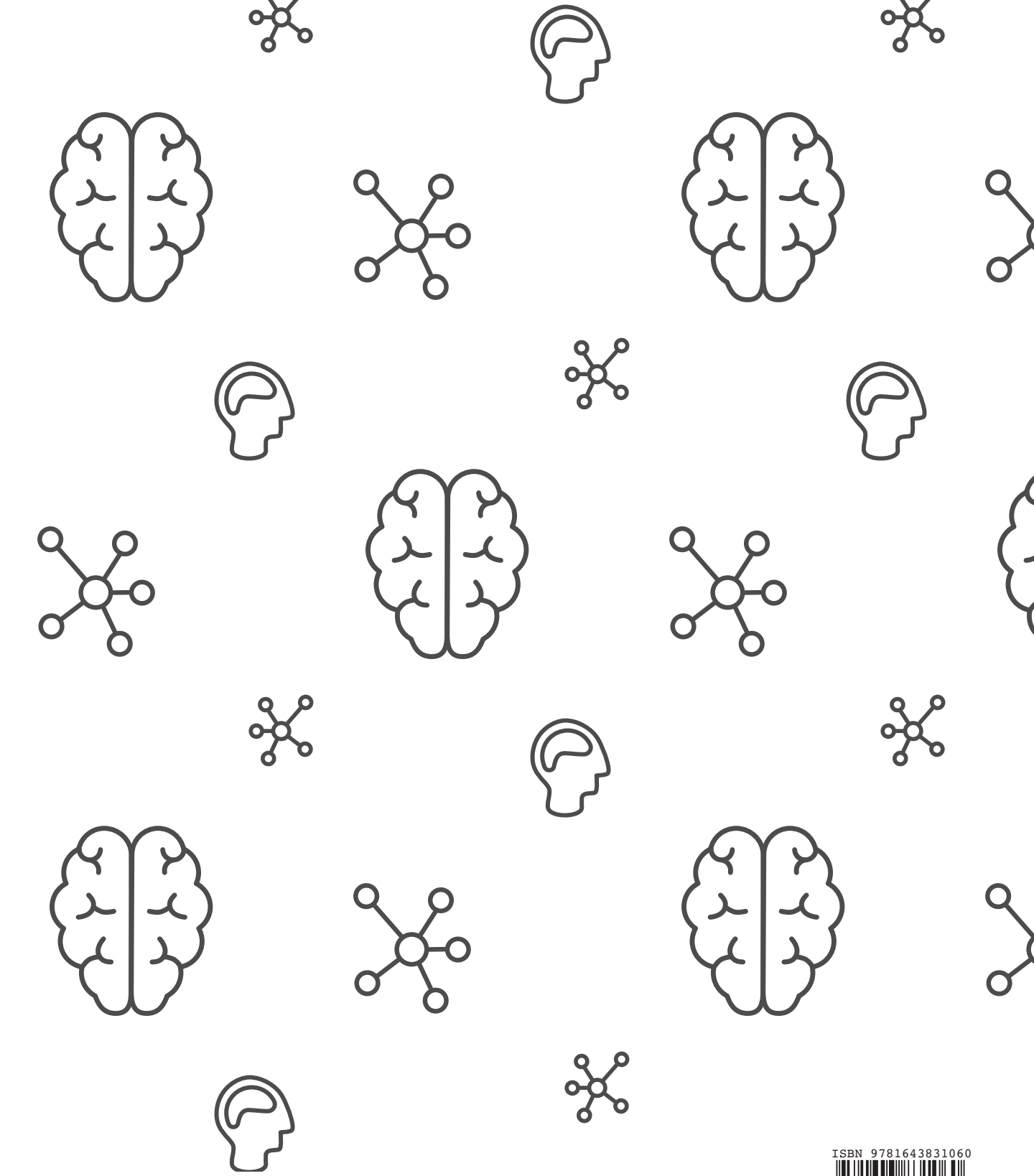
A series of horizontal dotted lines for writing an essay.











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