Lesson 2.6
Why Do Scientists Argue?
Lesson Overview

This lesson begins with the teacher introducing students to a book about scientific argumentation, *Why Do Scientists Argue?* This book describes how scientists engage in argumentation and introduces students to Rachel Carson, a scientist who argued about the effects of certain poisonous chemicals on ecosystems. Students read in pairs and discuss how Rachel Carson convinced her fellow scientists that her claim about the danger of these chemicals was correct. After reading, the class discusses the importance of using evidence in scientific arguments—both in Rachel Carson’s arguments with other scientists and in their own classroom arguments. The purpose of this lesson is to underscore the importance of evidence to support the claims in a scientific argument by showing how the practice is what professional scientists do.

**Anchor Phenomenon:** The jaguars, sloths, and cecropia trees in a reforested section of a Costa Rican rain forest are not growing and thriving.

**Investigative Phenomenon:** Pesticides affect ecosystems.

**Students learn:**

- Scientists convince others that their claims are correct by using data and ideas as evidence.
- Scientists don’t always agree.
- Scientists use tools and technologies to make accurate measurements and observations.
- Scientific explanations can change based on new evidence.
- Scientific theories are based on a body of evidence and many tests.
- Most scientists and engineers work in teams.
- Science affects everyday life.
- Science findings are limited to what can be answered with evidence.
Introducing Why Do Scientists Argue?

Students are introduced to the book, given a purpose for reading, and begin reading as a class.

Instructional Guide

1. Connect to previous lesson. Hold up a copy of *Restoration Case Studies* and ask students to recall what they read about.

   - You read a case study about restoring aspen trees in Yellowstone National Park. What did ecologists do to restore the aspen trees?
   
   - Scientists realized there was a connection between the wolves, the elk, and the Aspen trees. They brought back the wolves who controlled the elk population. The elk population were eating the aspen leaves.

   - How do you think the scientists convinced people about the connection between the wolves, the elk, and the aspen trees?

   Accept all student responses.

2. Introduce *Why Do Scientists Argue?* Hold up a copy of the book.

   - Today, we’re going to read a book about the work of a scientist named Rachel Carson. She investigated the relationships between plants and animals in ecosystems. She was concerned that something called pesticides, which are chemicals that kill insects and weeds, were harming many plants and animals in the ecosystem.

   - The book is called *Why Do Scientists Argue?* We are going to explore more about how and why scientists argue—why they support their claims with evidence.

3. Present new Investigation Question.
Rachel Carson argued with other scientists because she wanted to convince them that her claim was correct. Today, we’ll keep this question in mind as we read: *How do scientists convince others that their claims are correct?*

4. **Activate prior knowledge.** Ask students to turn to a partner and briefly discuss what they think about this question, based on their experience making scientific arguments so far in this unit.

5. **Distribute and preview books.** Distribute one copy of *Why Do Scientists Argue?* to each pair. Give partners two minutes to preview the book. Ask students to share what they noticed. Point out that the book has two sets of pages—the left-hand pages are all about Rachel Carson (the green pages); the right-hand pages are about scientists today (the white pages). Point out that students can read the pages in order, or they can read one color first, then the other.

6. **Set purpose for reading.**

As you read, notice what steps Rachel Carson took in order to convince other scientists that her claim was correct. See if you can make connections between what she did and things that you have been doing as you make arguments.

### Teacher Support

#### Instructional Suggestion

**Providing More Experience: Today’s Daily Written Reflection**

*How are scientists’ arguments different from arguments that kids might have on the playground?* This prompt (on page 45 in the Investigation Notebook) asks students to share what they have learned about scientific argumentation and to think about how this term is used differently in science than it is in everyday experience. Students have had several opportunities to make scientific arguments thus far in the unit, so they should be able to explain how scientific arguments are not fights but are, instead, claims about the world that are supported with evidence. Students’ responses to this question may also provide you with an opportunity to help students personally connect their own experiences to what they will read about in the book *Why Do Scientists Argue?*

#### Background

**About the Book: *Why Do Scientists Argue?***

*Why Do Scientists Argue?* delves into the scientific practice of argumentation and details how and why arguments are so important to scientists. The book’s unique format provides both information about the scientific community in general and a specific example of argumentation in action—the work of ecologist Rachel Carson. Left-hand pages tell the story of Carson’s work, while right-hand pages place that story in the context of argumentation within the scientific community at large. The book follows Carson as she gathers evidence that supports her claim that pesticides cause damage to entire ecosystems, not just the insects they were designed to stop. Even though her claim was different from what most other scientists thought at the time, Carson convinced others that her claim was correct by supporting it with extensive evidence. This argument helped convince people to stop using some of the most harmful pesticides. Along the way, the text introduces the idea of the scientific community, which includes scientists all over the world who

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share information and ways of thinking and who argue with one another to move science forward. Students use this book to connect a real-world example of scientific argumentation to their own experiences making arguments about ecosystems.

**Instructional Suggestion**

**Promoting Deeper Thinking: The Global Scientific Community**
Students will read about how the technology available for communication during Rachel Carson’s scientific career was different from what is available today. If you have a globe or world map available, ask students to think about how scientists from all around the world communicated before the availability of the Internet. Invite students to think about how having global access to the Internet could impact the work of the scientific community.

**Instructional Suggestion**

**Providing More Support: Accessing Prior Knowledge About Pesticides**
Before introducing *Why Do Scientists Argue?*, give students a few minutes to think about what they know about pesticides. Ask students to share with a partner and call on a few students to share their ideas with the class. Establish that pesticides are something that people make in order to kill “pests,” which are organisms that can harm people or crops (this word is also defined in the glossary at the back of the book). Have students think about what they know about ecosystems and consider what might happen to an ecosystem if a pesticide was sprayed there. Let students know that they will be reading about a scientist who made a claim about the effect of pesticides on ecosystems.
Partners read *Why Do Scientists Argue?* and then record ideas from the reading in their notebooks.

**Instructional Guide**

1. **Partners read.** Let students know that they will read the book with a partner. Remind them that they can choose to read the green or white pages first, or all the pages in order, as long as they make sure to read all the pages. As students read, circulate to assist as needed.

2. **Review Rachel Carson’s argument.** When most partners have finished reading, regain the class’s attention.

   - We know that a scientific argument starts with a claim. What was Rachel Carson’s claim?
     - [Pesticides kill many organisms in an ecosystem, not just insects and weeds.]

   - That’s not what other scientists thought at the time. What did they claim?
     - [Pesticides only kill insects and weeds and don’t harm ecosystems.]

   - Let’s think next about what Rachel Carson did to convince others who didn’t think that her claim was correct that, in fact, her claim was correct and was supported by evidence. We can think about how this is similar to what scientists today do and how it is also similar to what you have been doing as you have made arguments about ecosystems.

**Teacher Support**

**Instructional Suggestion**

*Providing More Experience: Reviewing Students’ Arguments*

You may wish to give students time to review the arguments they made at the end of Chapter 1 (page 28, Rain Forest Restoration Plan 1, in their notebooks). Providing additional time for students to review how they have gathered evidence to support claims can help them connect their own practices to those of Rachel Carson and other scientists.
Instructional Suggestion

Going Further: Discussing Evidence
Invite students to reread page 14 of the book and consider if more evidence is always better than less evidence, or if some evidence can be stronger than other evidence. Prompting students to consider the quantity and quality of evidence that supports a claim can help students engage deeply with the scientific practice of argumentation.
Synthesizing Ideas About Why Scientists Argue

1. Read the question below and think about what you read in Why Do Scientists Argue? as well as your experience making scientific arguments.
2. In each box, record important ideas related to the question. (You can write more than one idea in each box.)
3. In the box below the arrow, record a new understanding you have, based on thinking about the ideas together.

Question: How do scientists convince others that their claims are correct?

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<th>Source: Why Do Scientists Argue? (pages about scientists today)</th>
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<th>Source: My experience as an ecologist making arguments</th>
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New understanding:
Introducing Why Do Scientists Argue?

Students are introduced to the book, given a purpose for reading, and begin reading as a class.

Instructional Guide

1. Connect to previous lesson. Hold up a copy of Restoration Case Studies and ask students to recall what they read about.

- Ustedes leyeron un estudio de caso sobre restaurar álamos temblones en el Parque Nacional Yellowstone. ¿Qué hicieron los ecologistas para restaurar los álamos temblones?
  [Los científicos comprendieron que había una conexión entre los lobos, los uapitíes y los álamos temblones. Reintrodujeron a los lobos que controlaban la población de uapitíes. La población de uapitíes estaba comiendo las hojas de los álamos temblones].

- ¿Cómo piensan que los científicos convencieron a la gente sobre la conexión entre los lobos, los uapitíes y los álamos temblones?

Accept all student responses.

2. Introduce Why Do Scientists Argue? Hold up a copy of the book.

- Hoy vamos a leer un libro sobre el trabajo de una científica llamada Rachel Carson. Ella investigó las relaciones entre las plantas y los animales en los ecosistemas. Le preocupaba que los pesticidas, que son químicos que matan insectos y maleza, estaban dañando a muchas plantas y animales en el ecosistema.

- El libro se llama ¿Por qué argumentan los científicos? Vamos a explorar más sobre cómo y por qué argumentan los científicos: por qué respaldan sus afirmaciones con evidencia.

3. Present new Investigation Question.
4. **Activate prior knowledge.** Ask students to turn to a partner and briefly discuss what they think about this question, based on their experience making scientific arguments so far in this unit.

5. **Distribute and preview books.** Distribute one copy of *Why Do Scientists Argue?* to each pair. Give partners two minutes to preview the book. Ask students to share what they noticed. Point out that the book has two sets of pages—the left-hand pages are all about Rachel Carson (the green pages); the right-hand pages are about scientists today (the white pages). Point out that students can read the pages in order, or they can read one color first, then the other.

6. **Set purpose for reading.**

Teacher Support

**Instructional Suggestion**

*Providing More Experience: Today’s Daily Written Reflection*

*How are scientists’ arguments different from arguments that kids might have on the playground?* This prompt (on page 45 in the Investigation Notebook) asks students to share what they have learned about scientific argumentation and to think about how this term is used differently in science than it is in everyday experience. Students have had several opportunities to make scientific arguments thus far in the unit, so they should be able to explain how scientific arguments are not fights but are, instead, claims about the world that are supported with evidence. Students’ responses to this question may also provide you with an opportunity to help students personally connect their own experiences to what they will read about in the book *Why Do Scientists Argue?*

**Background**

*About the Book: Why Do Scientists Argue?*

*Why Do Scientists Argue?* delves into the scientific practice of argumentation and details how and why arguments are so important to scientists. The book’s unique format provides both information about the scientific community in general and a specific example of argumentation in action—the work of ecologist Rachel Carson. Left-hand pages tell the story of Carson’s work, while right-hand pages place that story in the context of argumentation within the scientific community at large. The book follows Carson as she gathers evidence that supports her claim that pesticides cause damage to entire ecosystems, not just the insects they were designed to stop. Even though her claim was different from what most other scientists thought at the time, Carson convinced others that her claim was correct by supporting it with extensive evidence. This argument helped convince people to stop using some of the most harmful pesticides. Along the way, the text introduces the idea of the scientific community, which includes scientists all over the world who...
share information and ways of thinking and who argue with one another to move science forward. Students use this book to connect a real-world example of scientific argumentation to their own experiences making arguments about ecosystems.

**Instructional Suggestion**

**Promoting Deeper Thinking: The Global Scientific Community**

Students will read about how the technology available for communication during Rachel Carson’s scientific career was different from what is available today. If you have a globe or world map available, ask students to think about how scientists from all around the world communicated before the availability of the Internet. Invite students to think about how having global access to the Internet could impact the work of the scientific community.

**Instructional Suggestion**

**Providing More Support: Accessing Prior Knowledge About Pesticides**

Before introducing *Why Do Scientists Argue?*, give students a few minutes to think about what they know about pesticides. Ask students to share with a partner and call on a few students to share their ideas with the class. Establish that pesticides are something that people make in order to kill “pests,” which are organisms that can harm people or crops (this word is also defined in the glossary at the back of the book). Have students think about what they know about ecosystems and consider what might happen to an ecosystem if a pesticide was sprayed there. Let students know that they will be reading about a scientist who made a claim about the effect of pesticides on ecosystems.
**Partner Reading**

Partners read *Why Do Scientists Argue?* and then record ideas from the reading in their notebooks.

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**Instructional Guide**

1. **Partners read.** Let students know that they will read the book with a partner. Remind them that they can choose to read the green or white pages first, or all the pages in order, as long as they make sure to read all the pages. As students read, circulate to assist as needed.

2. **Review Rachel Carson’s argument.** When most partners have finished reading, regain the class’s attention.

   - Sabemos que un argumento científico comienza con una afirmación. ¿Cuál era la afirmación de Rachel Carson? [Los pesticidas matan muchos organismos en un ecosistema, no solo insectos y maleza].

   - Eso no es lo que otros científicos pensaban en ese tiempo. ¿Qué afirmaban ellos? [Los pesticidas solo matan insectos y maleza y no dañan a los ecosistemas].

   - A continuación pensemos en lo que hizo Rachel Carson para convencer a otros que no pensaban que su afirmación era correcta de que, en realidad, su afirmación era correcta y estaba respaldada por evidencia. Podemos pensar en cómo es similar esto a lo que los científicos de la actualidad hacen y cómo es similar también a lo que ustedes han estado haciendo cuando han hecho argumentos sobre los ecosistemas.

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**Teacher Support**

**Instructional Suggestion**

**Providing More Experience: Reviewing Students’ Arguments**

You may wish to give students time to review the arguments they made at the end of Chapter 1 (page 28, Rain Forest Restoration Plan 1, in their notebooks). Providing additional time for students to review how they have gathered evidence to support claims can help them connect their own practices to those of Rachel Carson and other scientists.
Instructional Suggestion

Going Further: Discussing Evidence
Invite students to reread page 14 of the book and consider if more evidence is always better than less evidence, or if some evidence can be stronger than other evidence. Prompting students to consider the quantity and quality of evidence that supports a claim can help students engage deeply with the scientific practice of argumentation.
Sintetizar ideas sobre por qué argumentan los científicos

1. Lee la pregunta debajo y piensa en lo que leíste en ¿Por qué argumentan los científicos?, así como en tu experiencia de hacer argumentos científicos.
2. En cada cuadro, apunta ideas importantes relacionadas con la pregunta. (Puedes escribir más de una idea en cada cuadro).
3. En el cuadro bajo la flecha, apunta una nueva comprensión que tengas, basándote en pensar sobre las ideas juntas.

Pregunta: ¿Cómo convencen los científicos a los otros de que sus afirmaciones son correctas?

| Fuente: ¿Por qué argumentan los científicos? (páginas sobre los científicos de hoy) |
| Ideas: |

| Fuente: ¿Por qué argumentan los científicos? (páginas sobre Rachel Carson) |
| Ideas: |

| Fuente: Mi experiencia como ecologista haciendo argumentos |
| Ideas: |

Nueva comprensión: