Woman Crush Wednesday: Rachel Carson

Biological Unity and Diversity

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Published by *K20 Center*

Grade Level	9th – 10th Grade	**Time Frame**	1-2 class period(s)
Subject	Science	**Duration**	100 minutes
Course	Biology		

Essential Question

How have female scientists shaped science today? What effects can humans have on our ecosystem?

Summary

This lesson is part of a series, titled "Woman Crush Wednesday" in which we look at how female scientists have shaped our view of science. In this biology lesson, students will explore the contributions of Rachel Carson, the impact of human activity on our ecosystem, and how organisms develop resistance over time.

Snapshot

Engage

Students complete a Bell Ringer activity to assess their prior knowledge about natural selection and resistance before being introduced to Rachel Carson.

Explore

Students use the Inside Out strategy to explore what they know about Rachel Carson. Students play the Antibiotic Resistance Game to explore the concept of bacterial resistance development.

Explain

Students watch a video titled "Lessons from Silent Spring for Controlling Disease."

Extend

Students create a Six-Word Memoir about Rachel Carson or natural selection.

Evaluate

Students participate in a Carousel activity to present their Six-Word Memoir and hear their peers' memoirs.

Standards

ACT College and Career Readiness Standards - Science (6-12)

IOD505: Analyze presented information when given new, simple information
EMI401: Determine which simple hypothesis, prediction, or conclusion is, or is not, consistent with a data presentation, model, or piece of information in text

Next Generation Science Standards (Grades 9, 10, 11, 12)

HS-LS4-4: Construct an explanation based on evidence for how natural selection leads to adaptation of populations.
HS-LS4-5: Evaluate the evidence supporting claims that changes in environmental conditions may result in: (1) increases in the number of individuals of some species, (2) the emergence of new species over time, and (3) the extinction of other species.

Oklahoma Academic Standards (Biology)

B.LS4.3 : Apply concepts of statistics and probability to support explanations that organisms with an advantageous heritable trait tend to increase in proportion to organisms lacking this trait.
B.LS4.4 : Construct an explanation based on evidence for how natural selection leads to adaptation of populations.
B.LS4.5 : Evaluate the evidence supporting claims that changes in environmental conditions may result in (1) increases in the number of individuals of some species, (2) the emergence of new species over time, and (3) the extinction of other species.

Attachments

- Bell Ringer—Rachel Carson - Spanish.docx
- Bell Ringer—Rachel Carson.docx
- Bell-Ringer-Rachel-Carson - Spanish.pdf
- Bell-Ringer-Rachel-Carson.pdf
- Inside Out - Rachel Carson - Spanish.docx
- Inside Out - Rachel Carson.docx
- Inside-Out-Rachel-Carson - Spanish.pdf
- Inside-Out-Rachel-Carson.pdf
- Lesson Slides—Rachel Carson.pptx

Materials

- Lesson Slides (attached)
- Bell Ringer handout (attached, one per student)
- *Women in Science: 50 Fearless Pioneers Who Changed the World* by Rachel Ignotofsky
- Inside Out handout (attached, one per student)
- Art supplies and poster board
- Sticky notes
- Student devices with internet access

Engage

Go to **slide 3.** Before class begins, invite students to complete a Bell Ringer activity that will assess their prior knowledge. Give students the Bell Ringer handout and ask them to record their responses to the following questions:

1. What is natural selection?
2. Can you name any examples of chemicals or products that have been developed to control populations of pests or organisms?
3. Why do you think a single formula doesn't work to control all disease-carrying organisms?

Bell Ringer Questions

Feel free to add questions based on the content you have already covered in class. Encourage students to answer the questions posed even if they aren't sure yet. Avoid giving answers to anything you have not yet covered.

Go to **slide 4** to introduce the essential questions and then to slide 5 to introduce the lesson objectives.

Go to **slide 6**. If you have a copy of **Women in Science: 50 Fearless Pioneers Who Changed the World** by Rachel Ignotofsky, read students the Rachel Carson excerpt (pages 58-59). If you do not have access to that book, show students the video Rachel Carson - A History for Kids on **slide 7.**

Embedded video
https://www.youtube.com/watch?v=rtX9yf62BXU

Teacher's Note: "Women In Science"

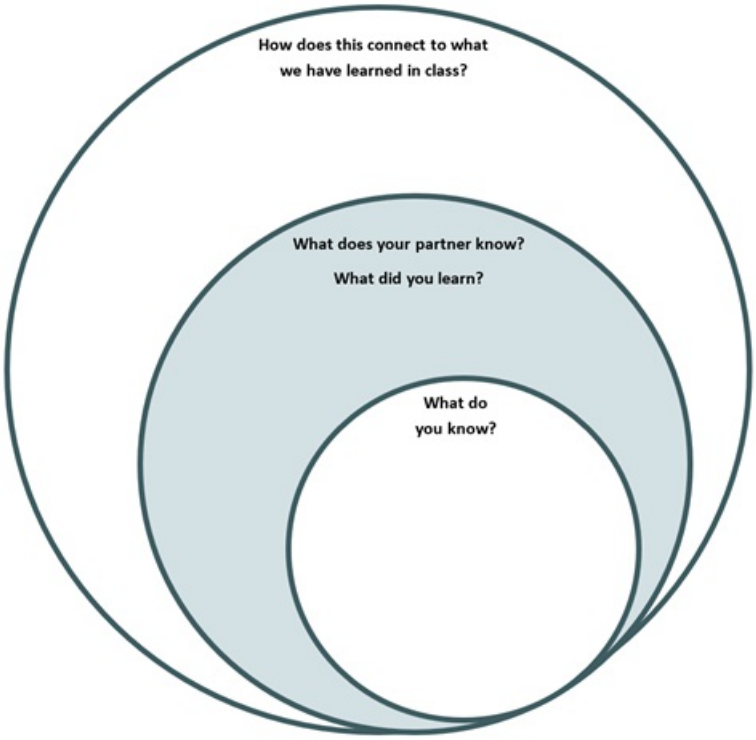
Yes, high school students can be engaged by a picture book! Humans rely on visual observations more than any of us would like to admit, and a picture book capitalizes on that. It will be nostalgic for them, it can be a break from the seriousness, and it establishes a low entry point so that all students can participate.

Explore

Go to **slide 8**. Use the Inside Out strategy to help students explore what they know about Rachel Carson. Provide the **Inside Out handout** to each student. Invite students to fill out the innermost circle with what they know about Rachel Carson. They can use bullet points, drawings, etc. to document their knowledge. After students have had time to complete the innermost circle, have them share with what they know with a partner and record anything their partner says that they did not previously list in the middle circle.

Teacher's Note: Pairing Strategies

You might choose to use a strategy such as Fold the Line, Appointment Clocks, or Elbow Partners to pair students.



Inside Out graphic organizer

Go to **slide 9**. Invite students to access the game Antibiotic Resistance from BrainPop on their devices. The game has a comic strip introduction that students should read before moving on to complete each of the three levels. When students are finished playing, ask them to answer the following questions to debrief:

- What does resistance mean?
- How is antibiotic resistance selected for in bacteria?
- How do other organisms adapt to stimuli from the environment?

Explain

Go to **slide 10**. Show students the video Lessons from Silent Spring for Controlling Disease from the PBS Learning Media website. As students watch the video, invite them to add anything that they learn to the middle circle of their Inside Out graphic organizer.

Teacher's Note: Inside Out Additions

If you prefer, you can have students wait to fill in what they learn until after the video is finished playing.

Teacher's Note: Curriculum

Based on where this lesson fits into your curriculum, you can either loop back to adaptations and change over time after this lesson, or cover the topic in this gap. Alter the discussion points below and add slides to to cover the topic to your satisfaction.

Have a quick discussion with students after the video and before moving to the Extend activity. Discussion topics could include:

- How mosquitoes have become resistant to DDT, allowing them to survive longer and spread malaria.
- How the scenario in the video resembles the bacteria simulation that students saw in the Explore activity.
- Other ways students might have seen whole species change over generations (adaptations) and how those changes differ from changes within an individual (development).
- How species that live longer and have longer gestation periods take longer to adapt or undergo natural selection, while species with lives and gestation periods (like mosquitoes) adapt more quickly, allowing their changes to be observed during our lifetimes.

Extend

Go to **slide 11**. Have students return to their partners to discuss the new things that they have learned. Together, students should decide how what they have learned connects to what they have been learning in class. Ask students to get out their Inside Out graphic organizers and record these answers in the outermost circle. Ask students, "How did the changes Rachel Carson brought about with her book Silent Spring affect other parts of the ecosystem?"

Sample Student Responses

Rachel Carson brought about the banning of DDT and the formation of the EPA. These changes have helped preserve our environment and push researchers to find better methods of pest control. While some believe she is responsible for the increase in malaria, others believe that malaria cases would have increased even with continued use of DDT because mosquitoes would have become resistant to DDT.

Go to **slide 12**. Ask students to summarize their learning by creating a Six-Word Memoir about either Rachel Carson or natural selection. For guidance on how to write a six-word memoir, provide students with an example using another subject, such as Rosa Parks: "Refused to move. Launched a movement." Let students know it might also be helpful to add a brief description of why they chose those six words to represent their learning, because they will need to explain this when they present their memoirs later.

Teacher's Note: Memoir Format

Students can create their Six-Word Memoirs using their preference of format (hand-made poster, Canva, etc.). Provide art supplies and poster board for students who prefer to decorate their Six-Word Memoir on paper.

Evaluate

Go to **slide 13**. Invite students to display their Inside Out graphic organizers and Six-Word Memoirs around the room. Students will participate in a Carousel activity to view others' work. This activity will be done in two rounds. For round one, half of the students will serve as presenters while the other half carousel around the room to view the presentations, and then for round two the groups will switch roles. When presenting, students should share their Six-Word Memoirs and then give a brief description of why they chose to represent the topic with those six words. They can refer to their Inside Out handout to contribute to their presentations. Provide sticky notes to the students who are viewing the presentations to provide feedback about each presentation.

Closing The Lesson

After the presentations, consider facilitating a whole-class conversation to close the lesson. You could make a list of the connections that students identified in the outermost circle of their Inside Out graphic organizer, or you could ask students to share their favorite Six-Word Memoirs about Rachel Carson was natural selection.

Resources

- BrainPop. (n.d.). Antibiotic resistance [Game]. https://www.brainpop.com/games/antibioticresistancegame/
- ClareM21. (2017, August 19). Rachel Carson - A history for kids [Video]. YouTube. https://www.youtube.com/watch?v=rtX9yf62BXU
- Ignotofsky, R. (2016). Women in science: 50 fearless pioneers who changed the world. Berkeley, CA: Ten Speed Press.
- K20 Center. (n.d.). AppointmentClocks. Strategies. https://learn.k20center.ou.edu/strategy/124
- K20 Center. (n.d.). Bell Ringers and Exit Tickets. Strategies. https://learn.k20center.ou.edu/strategy/125
- K20 Center. (n.d.). Canva. Tech Tools. https://learn.k20center.ou.edu/tech-tool/612
- K20 Center. (n.d.). Elbow Partners. Strategies. https://learn.k20center.ou.edu/strategy/116
- K20 Center. (n.d.). Fold the Line. Strategies. https://learn.k20center.ou.edu/strategy/171
- K20 Center. (n.d.). Gallery Walk/Carousel. Strategies. https://learn.k20center.ou.edu/strategy/118
- K20 Center. (n.d.). Inside Out. Strategies. https://learn.k20center.ou.edu/strategy/93
- K20 Center. (n.d.). Six-Word Memoir. Strategies. https://learn.k20center.ou.edu/strategy/75
- PBS & WGBH Educational Foundation. (n.d.). Lessons from Silent Spring for controlling disease [Video]. PBS Learning Media. https://www.pbslearningmedia.org/resource/amex29rc-sci-silentspringlessons/lessons-from-silent-spring-for-controlling-disease-rachel-carson-american-experience/