

Woman Crush Wednesday: Nettie Stevens

Inheritance and Variation of Traits

Mariah Warren, Teresa Randall, Teresa Lansford
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Grade Level	9th – 10th Grade	**Time Frame**	2-3 class period(s)
Subject	Science	**Duration**	120-180 minutes
Course	Biology		

Essential Question

What role do sex chromosomes play in human genetics and heredity? How have women in history shaped science today?

Summary

This lesson is part of a series, titled "Woman Crush Wednesday," where we look at how female scientists have shaped our views of science. In this biology lesson, students explore the contributions of Nettie Stevens and her discovery of sex chromosomes.

Snapshot

Engage:

Students discuss what makes someone a pioneer and watch a video about the work of geneticist Nettie Stevens.

Explore:

Students watch an animation about the discovery of sex chromosomes and solve a basic Punnett square to determine the gender of human offspring.

Explain:

Students listen to an audio clip about sex-linked disorders and research a sex-linked disorder to create and post an informative Padlet video.

Extend:

Students create a social media post to get the word out about Nettie Stevens' contribution and impact on the study of chromosomes to "Help Nettie Go Viral."

Evaluate:

Students reflect in a Padlet post or Exit Ticket on how Nettie's work helped them better understand the disorder they researched.

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

Oklahoma Academic Standards (Biology)

B.LS3.1 : Ask questions to clarify relationships about the role of DNA and chromosomes in coding the instructions for characteristic traits passed from parents to offspring.
B.LS3.2 : Make and defend a claim based on evidence that inheritable genetic variations may result from: (1) new genetic combinations through meiosis, (2) viable errors occurring during replication, and/or (3) mutations caused by environmental factors.

Attachments

- Know the Scientist Nettie Stevens Article—WCW Nettie Stevens - Spanish.docx
- Know the Scientist Nettie Stevens Article—WCW Nettie Stevens - Spanish.pdf
- Know the Scientist Nettie Stevens Article—WCW Nettie Stevens.docx
- Know the Scientist Nettie Stevens Article—WCW Nettie Stevens.pdf
- Lesson Slides—WCW Nettie Stevens.pptx
- Presentation Checklist—WCW Nettie Stevens - Spanish.docx
- Presentation Checklist—WCW Nettie Stevens - Spanish.pdf
- Presentation Checklist—WCW Nettie Stevens.docx
- Presentation Checklist—WCW Nettie Stevens.pdf

Materials

- Lesson Slides (attached)
- Presentation Checklist (attached; one per group or share digitally)
- Know the Scientist: Nettie Stevens (article; to be read aloud in class; also optional)
- *Women in Science: 50 Fearless Pioneers Who Changed the World* book by Rachel Ignotofsky (optional)
- Women Crush Wednesday: Nettie Stevens (video)
- Student devices with internet access

Engage

Teacher's Note: Padlet

Padlet is a tech tool used later in the lesson to share information. Set up a Padlet board to be used with **slides 13 and 14** for students to share their learning.

If you do not have access to Padlet, presentations can be written and given in-person.

Use **Lesson Slides** to introduce the lesson.

Show **slides 3 and 4.** Introduce the essential questions and lesson objectives to students.

Display **slide 5.** Ask the class the following questions:

- What is a pioneer?
- Can you think of any pioneers?
- What makes these individuals pioneers?

Generate a class list of the characteristics one needs in order to be a pioneer. Write answers/lists on the board to refer back to later, if needed.

Teacher's Note

Students may define pioneer as "a person who is one of the first to settle in an area." However, the context of this lesson is "a person who begins or helps develop something new and prepares the way for others to follow." Allow students to share their thoughts and use this time to clear up any misconceptions and expand their understanding of the concept.

Sample Student Responses

Someone willing to take risks, creative, independent, smart, tenacious, confident, etc.

If you have a copy of **Women in Science: 50 Fearless Pioneers Who Changed the World** by Rachel Ignotofsky, read the Nettie Stevens excerpt aloud (pages 24-25). There is a brief biographical article, "**Know the Scientist: Nettie Stevens**," attached if you do not have a copy of Women in Science. This article is to be read aloud to students. It is not intended as a handout.

Move to **slide 6.**

Embedded video
https://youtube.com/watch?v=GA6BsBEMjtE

Watch the video of Nettie Stevens and her contributions to science.

Ask students “Now that you’ve identified traits of pioneers, would you consider Nettie Stevens a pioneer?” Why or why not?

Sample Student Responses

She was a woman in science when it was mostly men at the time. She had innovative ideas to answer questions about her world. She answered questions no one else had the answers to.

Explore

Display **slide 7.** Click the link on the slide to go through overview of Nettie Stevens' work: Specialized Chromosomes Determine Gender Animation. Using the information gathered from the slide, students will practice applying Nettie Stevens' work to Punnett squares to determine the likelihood of different genders.

Show **slide 8**. Click on the link and walk through the steps necessary to determining the likelihood of different genders in the Specialized Chromosomes Determine Gender Problem. Students are prompted in this interactive to make predictions and check their hypothesis.

Teacher's Note

You can choose to go through the Specialized Chromosomes Determine Gender Problem as a whole class or assign the link for students to view on their own devices. If it is worked through as a class, pause to solicit answers from students throughout the interactive module and discuss any misconceptions they might have had while working through the problem.

Explain

Display **slide 9**. Share with students the definition of sex-linked traits and how sex-linked disorders are passed to children.

Slide 10 includes visuals of an example and an audio clip from the National Human Genome Research Institute website that further explains sex-linked disorders. Using the images on the slide, discuss how the trait of hemophilia is inherited.

Sample Student Responses

In Image 1, the mom is the carrier. Her gene is passed on to one son who will have hemophilia and one daughter who will be a carrier. In Image 2, the father has hemophilia and passes his gene on to his daughters who are carriers.

Listen to the audio clip on **slide 10** as a class.

Teacher's Note

If students seem confused after going through this slide, clarify the passing of these traits by drawing a Punnett square for each of the 2 scenarios shown. Have students discuss either as a whole class or individually. Additionally, students may view this and think that females do not get hemophilia. They can, but it is very rare. Ask students what traits the parents would have to have in order for a female to have hemophilia.

Display **slide 11.** For this activity, ask students to follow the steps below:

- Break into groups of 2-3 in order to learn more about a specific sex-linked disorder to share with the class.
- Review the information on the **Presentation Checklist** handout.
- Use the Choice Board on **slide 12** to choose a topic that interests the group.
- Have students get your approval for their topics before they begin the research/Padlet video presentation.
- Use the Checklist to guide research and Padlet video presentation.
- Research the disorder that the group has selected.
- Create the Padlet video presentation.
  Show **slide 13** to review the Presentation Checklist to ensure that the Padlet video presentation meets the Checklist requirements.

Teacher's Note

Turner's Syndrome, Trisomy X, and Klinefelter Syndrome are NOT sex-linked traits, but they are sex-linked disorders because they occur due to the addition or subtraction of a sex chromosome.

Teacher's Note

Have groups get the disorder they plan to research approved so that there are fewer repeats and to ensure greater variety. Students can have the option to ask for approval to research a sex-linked disorder not listed on the choice board. Some possible questions to help students as they research include: What is a sex-linked trait, what are the possible genotypes and phenotypes, what proportions do these phenotypes appear in?

Teacher's Note

This is a good place to stop and give groups time to post their Padlet videos before having others view them the following day.

Extend

Display **slide 14**. Give students time to each watch at least two Padlet videos from other groups to start class for the day.

After students have had time to view some of the other Padlet videos, move to **slide 15** and explain that since students have learned about Nettie Stevens' work and how it applies to health and science today, it is time to "Help Nettie Go Viral!"

- Place students into groups of two, with a different partner.
- Ask them to create a viral post about Nettie Stevens using a social media platform of their choice.
- Ask them to consider what they have learned from their research and how they might use that in creating their post.

Teacher's Note

Have students make a mock social media post. Advise them that they have the option to share it if they like. You may want to create a unique hashtag (i.e.: #NettieNews) and ask students to tag their work. To assess understanding, have them share a screenshot of their "posts."

Evaluate

Display **slide 16**. Use the prompt “How did Nettie’s work help you better understand the disorder you researched?” Students may either answer it as an Exit Ticket or on Padlet.

Teacher's Note

If you use Padlet for your exit ticket, remember to add a link or QR code to **slide 16**.

Resources

- DNA Learning Center. (2011). Specialized chromosomes determine gender. [Animation]. DNA Learning Center. http://www.dnaftb.org/9/animation.html
- Ignotofsky, R. (2016). *Women in science: 50 fearless pioneers who changed the world*. New York: Potter/TenSpeed/Harmony.
- K20 Center. (n.d.) Bell Ringers and Exit Tickets. Strategies. https://learn.k20center.ou.edu/strategy/125
- K20 Center. (n.d.). Padlet. Tech Tools. https://learn.k20center.ou.edu/tech-tool/1077 k20.ou.edu/padlet
- K20 Center. (2021, Nov 12). Woman Crush Wednesday: Nettie Stevens [Video]. https://www.youtube.com/watch?v=GA6BsBEMjtE
- National Human Genome Research Institute. (2014). Sex Linked. National Human Genome Research Institute. [Narration]. https://www.genome.gov/genetics-glossary/Sex-Linked#:~:text=And%20in%20humans%20this%20is,and%20also%20Fragile%20X%20syndrome