

Woman Crush Wednesday: Gerty Cori

From Molecules to Organisms: Flow of Energy

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Grade Level	9th – 10th Grade	**Time Frame**	120 minutes
Subject	Science	**Duration**	2-3 class periods
Course	Biology		

Essential Question

How have female scientists shaped science today? What happens to our bodies when our cells do not receive an adequate amount of oxygen?

Summary

In this lesson, students will explore the impact female scientists have had on what we know about respiration. Aerobic respiration should be taught before doing this lesson. Students will discover the impact Gerty Cori has had on our understanding of respiration. Students will determine how the alternative pathway cells perform respiration under environmental conditions that lack oxygen. Students will evaluate the impact that the environment can have on the rate of respiration.

Snapshot

Engage

Students read several pages about Gerty Cori from the book *Women in Science*.

Explore

Students explore what it feels like when muscles switch to anaerobic respiration.

Explain:

Students participate in an interactive discussion on aerobic and anaerobic respiration.

Extend

Students complete a yeast lab connected to anaerobic respiration.

Evaluate

Students summarize, compare, contrast, and evaluate respiration effects due to hormones.

Standards

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

IOD505: Analyze presented information when given new, simple information
SIN301: Understand the methods used in a simple experiment
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.LS1.7: Use a model to illustrate that cellular respiration is a chemical process whereby the bonds of food molecules and oxygen molecules are broken and the bonds in new compounds are formed, resulting in a net transfer of energy.
B.LS2.3 : Construct and revise an explanation based on evidence for the cycling of matter and the flow of energy in aerobic and anaerobic conditions.

Attachments

- 30-Second Expert—WCW Gerty Cori - Spanish.docx
- 30-Second Expert—WCW Gerty Cori - Spanish.pdf
- 30-Second Expert—WCW Gerty Cori.docx
- 30-Second Expert—WCW Gerty Cori.pdf
- Can You Handle It—WCW Gerty Cori - Spanish.docx
- Can You Handle It—WCW Gerty Cori - Spanish.pdf
- Can You Handle It—WCW Gerty Cori.docx
- Can You Handle It—WCW Gerty Cori.pdf
- Career Card Sort Solution—WCW Gerty Cori.docx
- Career Card Sort Solution—WCW Gerty Cori.pdf
- Career Card Sort—WCW Gerty Cori - Spanish.docx
- Career Card Sort—WCW Gerty Cori - Spanish.pdf
- Career Card Sort—WCW Gerty Cori.docx
- Career Card Sort—WCW Gerty Cori.pdf
- Career Reflection-WCW Gerty Cori - Spanish.docx
- Career Reflection-WCW Gerty Cori - Spanish.pdf
- Career Reflection-WCW Gerty Cori.docx
- Career Reflection-WCW Gerty Cori.pdf
- Gerti Cori Interactive Answer Key—WCW Gerty Cori.docx
- Gerti Cori Interactive Answer Key—WCW Gerty Cori.pdf
- How I Know It—WCW Gerty Cori - Spanish.docx
- How I Know It—WCW Gerty Cori - Spanish.pdf
- How I Know It—WCW Gerty Cori.docx
- How I Know It—WCW Gerty Cori.pdf
- Interactive Questionnaire—WCW Gerty Cori - Spanish.docx
- Interactive Questionnaire—WCW Gerty Cori - Spanish.pdf
- Interactive Questionnaire—WCW Gerty Cori.docx
- Interactive Questionnaire—WCW Gerty Cori.pdf
- Lesson Slides—WCW Gerty Cori.pptx
- RERUN—WCW Gerty Cori - Spanish.docx
- RERUN—WCW Gerty Cori - Spanish.pdf
- RERUN—WCW Gerty Cori.docx
- RERUN—WCW Gerty Cori.pdf
- Women in Science Reading—WCW Gerty Cori.pdf
- Yeast Lab Answer Key—WCW Gerty Cori.docx
- Yeast Lab Answer Key—WCW Gerty Cori.pdf

- Yeast Lab Instructions—WCW Gerty Cori - Spanish.docx
- Yeast Lab Instructions—WCW Gerty Cori - Spanish.pdf
- Yeast Lab Instructions—WCW Gerty Cori.docx
- Yeast Lab Instructions—WCW Gerty Cori.pdf

Materials

- Lesson Slides (attached)
- Women in Science: 50 Fearless Pioneers Who Changed the World Book by Rachel Ignotofsky (excerpt attached, one per person)
- How I Know It handout (attached, one per person)
- Can You Handle It handout (attached, one per person)
- Interactive Questionnaire handout (attached, one per person)
- Interactive Answer Key (attached)
- Yeast Lab Instructions handout (attached, one per person/group)
- Yeast Lab Answer Key (attached)
- R.E.R.U.N. handout (attached, one per person)
- 30-Second Expert handout (attached, one per person)
- Career Card Sort (one per group, attached)
- Career Card Sort Solution (attached)
- Career Reflection handout (attached, one per student)
- Balloons (four per group)
- Bottle (one per group)
- Yeast (one per group)
- Flask or plastic/glass soda bottle (16 oz. or smaller) (four per group)
- Funnel
- Packets of yeast (four/9 teaspoons per group)
- Bag of Sugar (6 teaspoons per group)
- Warm water (4 cups per group)
- 4 small balloons
- Student device with internet access (one per group)
- Butcher paper/easel pad paper (one per group)
- Markers

15 minutes

Engage

Use the attached **Lesson Slides** to guide the lesson. Begin with **slide 3.** Briefly read aloud the essential questions: *How have female scientists shaped science today? What happens to our bodies when our cells do not receive an adequate amount of oxygen?* Then, move to **slide 4** and read the lesson objectives.

Move to **slide 5**. Invite students to read the Gerty Cori pages (attachment, pg. 46-47) from the book *Women in Science: 50 Fearless Pioneers Who Changed the World by Rachel Ignotofsky*. After they have read the excerpt, ask students to identify the area of biology in which Gery Cori did her research.

Teacher's Note: A Picture Book

High schoolers can be engaged by a picture book. Humans rely on sight observations more than any of us would like to admit, and a picture book capitalizes on that. It will be nostalgic for them, can be a break from the seriousness, and gives a low entry point so any student can participate.

Possible Student Responses

Students may respond with cell respiration, the breakdown of sugars/carbohydrate, or the use of sugar to get energy.

Introduce student to the How I Know It strategy and pass out the attached **How I Know It** handout to each student. Invite students to write what they already know about the purpose and process of cellular respiration. Have students share out a few of their points. Next, inform students that they will get to explore the contributions further that Gerty Cori has given us in order to understand alternative pathways for cellular respiration.

30 minutes

Explore

Pass out the attached **Can You Handle It?** handout. Go to **slide 6**. Instruct students to line up against the wall for a competition. Instruct them to do a wall sit for as long as they can. Their backs should be flat against the wall and their knees bent at a 90-degree angle. Students can stand up whenever they feel their muscles are tired. While they are doing this, ask them what their muscles feel like. Once all the students feel their muscles getting a little shaky, you can have them all sit. Have the students write down what they experienced on Question Number 1 (not sharing responses yet).

Next, while students are in their seats, provide each student with a clothes pin and complete the steps in the Can You Handle It handout.

Have students answer the remaining analysis questions and discuss what they noticed.

Possible Student Responses

My leg/forearm/finger hurt/were burning. My muscles got tired. My numbers went down with every trial. I didn't have time to recoup before the next trial.

Teacher's Note: Root Cause of Muscle Fatigue

Some students may not feel comfortable doing this, and that is okay as long as they hear other students discuss what they are feeling. Based on student responses, you can inform them that they will now explore the root cause of their muscle fatigue and pain.

30 minutes

Explain

Move to **slide 7**. Pose the following questions to the students:

- Describe moments where you have experienced this kind of pain/fatigue in your muscles.
- What do you typically do to relieve that kind of pain/fatigue?
- Why do you think this is happening?

Possible Student Responses

- Exercising, playing sports, cutting off pressure to a limb (feeling of spikes on feet),
- Stretching, drink water, walk it off, drink pickle juice
- Asking my body to do more than it can handle, not drinking enough water

Pass out the attached **Interactive Questionnaire** handout. Move to **slide 8**. Inform students that we will revisit Gerty Cori who, with her husband, discovered the cause of this experience we may feel from our muscles. Pair students up and invite them to participate in the **Gerty Cori Respiration Interactive**. Have students answer the questions on their Gerty Cori Interactive handout.

30 minutes

Extend

Gather the supplies for the lab. Move to **slide 9** and pass out the attached **Yeast Lab Instructions** handout. As students complete the lab, have them collect the data and answer the analysis questions. After completion of the lab, have students complete the R.E.R.U.N. strategy by writing up a lab using the **R.E.R.U.N** rubric**.** Be sure to go over the instructions and rubric to make sure students know what is expected of them.

Teacher's Note: Timing

If you want to speed up the reaction, consider placing the four containers in a warm bath. You may be able to record the balloons' growth at 20 minutes.

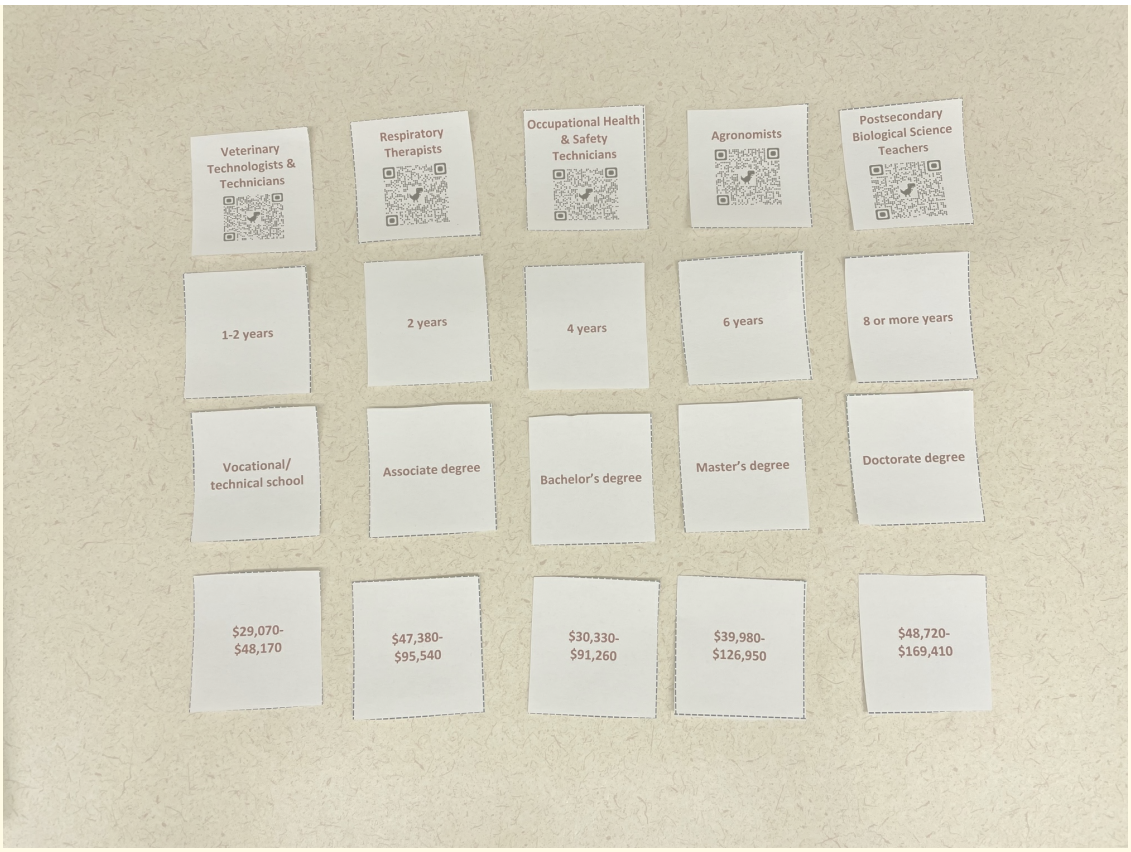
Optional ICAP Activity

The following activity can be used to add a career exploration element to this lesson. Prior to the activity, print the attached **Career Card Sort** handout so that there are enough for eight groups of students.

Display **slide 10** and place students into eight groups. Pass out the Career Card Sort handout to each group. Tell students the cards have information for five careers related to respiration. Instruct students to cut out the cards and then sort them into the following categories.

- Career Title
- Required education level
- Years of education needed
- Salary range

Tell students that the QR codes on each of the career title cards has a link with the information they need to complete the card sort. As each group finishes sorting, use the attached **Career Card Sort Solution** to check student work. Below is how the card sort should appear after sorting the cards:



Next, pass out the attached **Career Reflection** handout to each student. Move to **slide 11** and ask students to answer the questions on the Reflection handout. Students choose the career from the choices that interest them the most, what the day-to-day job description is, and determine what post-secondary education options are available in their state to attend for that certification/degree (if one is not listed for their state, then student can list for a neighboring/different state.)

***Teacher's Note**: In the Career Reflection handout, students can find the different postsecondary education options by clicking on the "Find Training" option in the "education" section of the websites. From there, they can enter their zip code or state to search.*

For the fourth quadrant, students may choose an occupation such as the military and develop an understanding of how important respiration is in terms of eating to maintain the proper energy level to keep up with the physical training or an occupation in a museum where they might enclose a brought in item in carbon dioxide to remove oxygen to kill any foreign pest that may exist on that item by stopping respiration in turn, preventing the pest from entering the museum.

15 minutes

Evaluate

Move to **slide 12**. Using what they now know about aerobic and anaerobic respiration, invite students to complete the 30-Second Expert strategy. Pass out the attached **30-Second Expert** handout and have students complete the T-Chart. Partner the students and have them choose between the hormones: insulin and epinephrine/adrenaline. Students will complete on the left side of the T-chart with what they understand about how the hormone affects respiration. Students will share and jot down their partner's comments on the right side of the T-Chart and then create a collective summary of hormone's effects on respiration. If time permits, have each pair share out their understandings.

Optional Activity

If you are pressed for time, you may consider having the students complete a gist, a short summary, about how essential insulin or epinephrine is to the process of respiration, especially if we lack oxygen. You can decide a maximum number of words per gist; somewhere around 15-20 is a good number.

Resources

- Ignotofsky, R. (2016). *Women in science: 50 fearless pioneers who changed the world*. New York: Potter/TenSpeed/Harmony.
- K20 Center. (n.d.) How I Know It. Strategies. https://learn.k20center.ou.edu/strategy/144
- K20 Center. (n.d.). 30 Second Expert. Strategies. https://learn.k20center.ou.edu/strategy/1048
- K20 Center. (n.d.). R.E.R.U.N. Strategies. https://learn.k20center.ou.edu/strategy/819?rev=3451
- K20 Center. (n.d.). WCW: Gerty Cori, Respiration. H5P. https://k20center.ou.edu/h5p/gerti-cori-interactive/