

# G.I.R.L.S.

## GIRLS INSPIRING RISING LADIES IN STEM

Name: \_\_\_\_\_ Date: \_\_\_\_\_

### TOPIC #2: CELLULAR RESPIRATION

#### BALLOONS AND YEAST

#### SCIENTIST OF THE DAY: GERTY CORI

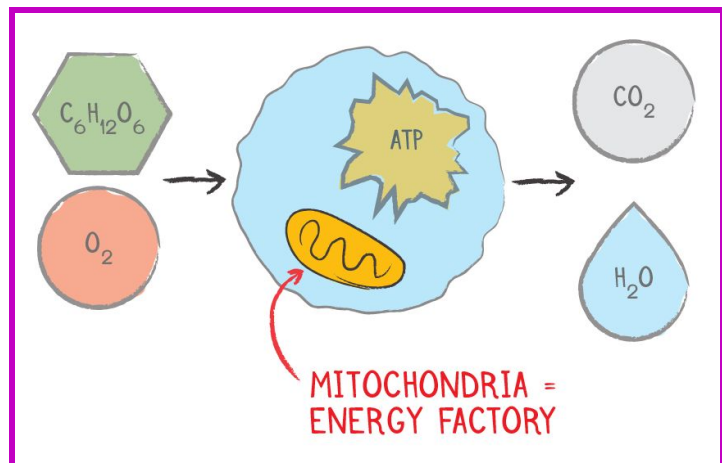
Gerty Cori was born in Prague in 1896. Since she was a young girl, she knew she wanted to help people and eventually found a calling for medicine. While in school, she met her husband, Carl, and the two of them partnered not just as a couple, but also as a research team. They moved from Europe to New York and began researching how the body uses energy. They helped discover how cells use sugar to produce energy. They even uncovered the process by which our muscles use energy when we exercise. This discovery was so significant that it was named after Gerty and Carl and called "The Cori Cycle." In 1947, Gerty and Carl shared a Nobel Prize for their work.



#### BACKGROUND

Cellular respiration is a process that occurs inside living organisms. It takes place inside an organelle in the cell called the **mitochondria**.

Cellular respiration converts sugar and oxygen into carbon dioxide, water, and energy that the cells can then use. This energy is stored in the form of a molecule called **adenosine triphosphate (ATP)**.



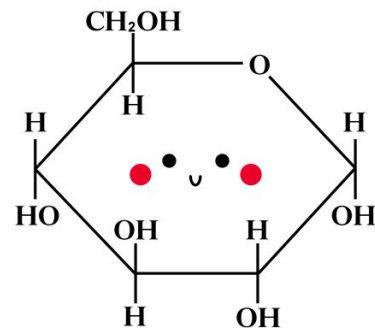
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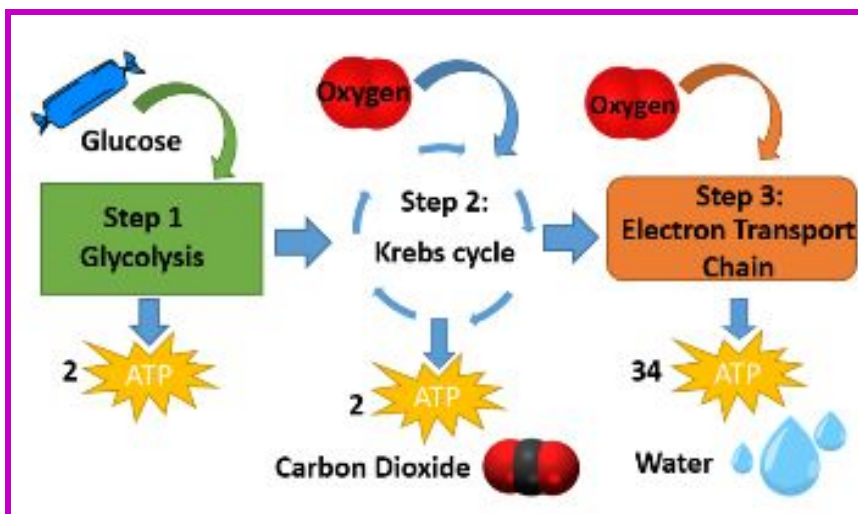
ATP (energy) is formed primarily from a sugar molecule called **glucose**. We obtain glucose from most foods including bread, fruit, and milk. Once glucose is in our bodies, it needs to be broken down to supply energy for our cells.



I'M SO SWEET!



Cellular respiration has three steps: glycolysis, the Krebs cycle and the electron transport chain. The first step in the breakdown of glucose is **glycolysis**. Oxygen is not needed for glycolysis, meaning that it is an **anaerobic** process. Glycolysis breaks down glucose to make a smaller sugar known as pyruvate and 2 molecules of ATP.

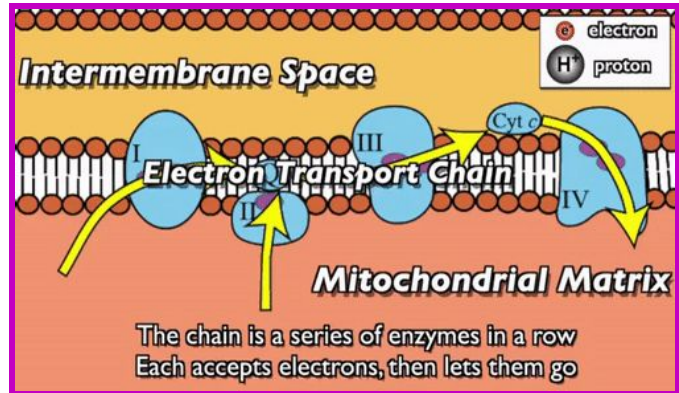


The next step in cellular respiration is the **Krebs cycle** (also called the Citric Acid Cycle). This process requires oxygen, making it an **aerobic** process. The Krebs Cycle forms ATP from ADP, another form of energy that the cell does not use, and expels carbon dioxide.

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The third and final step of cellular respiration is the **electron transport chain (ETC)**. The ETC is also an aerobic process that takes place in the mitochondria. The electron transport chain produces the greatest amount of ATP by moving electrons from areas of high energy to areas of low energy. This movement forms a proton gradient, which is responsible for powering the production of ATP. During this step of cellular respiration, water is formed.



### COMPREHENSION CHECK—MATCHING ACTIVITY

- |                                                                                        |                                   |
|----------------------------------------------------------------------------------------|-----------------------------------|
| 1. Location of cellular respiration.                                                   | A. Glycolysis                     |
| 2. Reactants of cellular respiration.                                                  | B. Krebs Cycle                    |
| 3. Products of cellular respiration.                                                   | C. Electron Transport Chain       |
| 4. First step of cellular respiration                                                  | D. Glucose and oxygen             |
| 5. Second step of cellular respiration                                                 | E. Carbon dioxide, ATP, and water |
| 6. Third step of cellular respiration                                                  | F. Mitochondria                   |
| 7. Aerobic portions of cellular respiration                                            |                                   |
| 8. Anaerobic portion of cellular respiration                                           |                                   |
| 9. Step of cellular respiration in which glucose is broken down into ATP and pyruvate. |                                   |
| 10. Step of cellular respiration that expels carbon dioxide.                           |                                   |
| 11. Step of cellular respiration that makes the most ATP and uses a proton gradient.   |                                   |

***You can use the letters more than once!***

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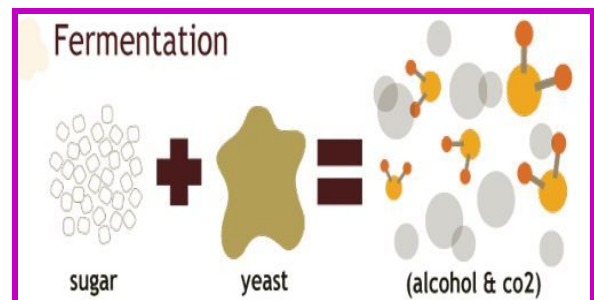
## GIRLS INSPIRING RISING LADIES IN STEM

### NEW WORDS

- **Aerobic:** describes a process or mechanism that must take place in the presence of oxygen.
- **Anaerobic:** describes a process or mechanism that can take place without the presence of oxygen.
- **Mitochondria:** an organelle that breaks down nutrients to create energy rich molecules; commonly called the “powerhouse” of the cell..
- **Fermentation:** an anaerobic process that consumes sugar and produces organic acids, gases, or alcohol; it takes place in yeast and bacteria.
- **Glycolysis:** the first step of cellular respiration in which glucose is broken down anaerobically to form ATP and pyruvate.
- **Krebs Cycle:** the second step of cellular respiration; it involves a cycle of reactions that occur in the mitochondria to produce ATP.
- **Electron Transport Chain (ETC):** the third step of cellular respiration; it is a process used to make a large amount of ATP.

### TODAY'S EXPERIMENT

In this experiment, we will see how cellular respiration works through the use of a balloon and yeast model. We will mix yeast with sugar to produce carbon dioxide, which is one of the major products of cellular respiration. The CO<sub>2</sub> gas produced by the yeast and sugar mixture should cause the balloon to grow larger.



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### SCIENCE CONCEPT: PREDICTIONS AND OBSERVATIONS

A science experiment is not complete without forming hypotheses, making predictions, and recording your observations. (Remember the Scientific Method!) Before beginning the experiment, be sure to make predictions about what you think will happen.

What do you think will happen when you mix yeast with bottle of water?

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What do you think will happen when you mix yeast with diet soda?

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What do you think will happen when you mix yeast with regular soda?

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During the experiment, be sure to make note of anything you see happening in the experiment that may seem significant.

### MATERIALS LIST

- ☐ Water Bottle
- ☐ Soda Bottle
- ☐ Diet Soda Bottle
- ☐ Yeast

- ☐ Water
- ☐ Balloon

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### PROCEDURE

1. Put  $\frac{1}{2}$  a teaspoon of dry yeast into each of the three bottles (water, soda, diet soda). Swirl the mixture around.
2. Blow up the balloon a few times to stretch it out then place the neck of the balloon over the neck of the bottle.
3. Let the bottle sit in a warm place for about 20 minutes. Then, check on the balloon every five minutes for the next half hour or so.

### DATA

Please draw the how the soda bottle and the balloon changes over time.

|                         | Water + Yeast | Diet Soda + Yeast | Regular Soda + Yeast |
|-------------------------|---------------|-------------------|----------------------|
| Beginning of Experiment |               |                   |                      |
| During Experiment       |               |                   |                      |
| End of Experiment       |               |                   |                      |

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### QUESTIONS

1. Explain how fermentation occurs in this experiment.

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2. Why do you think the diet soda and regular soda conditions exhibited different results?

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3. Explain the results of the bottle of water condition.

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4. Why do you think the balloon reacted to the yeast/sugar mixture the way it did?

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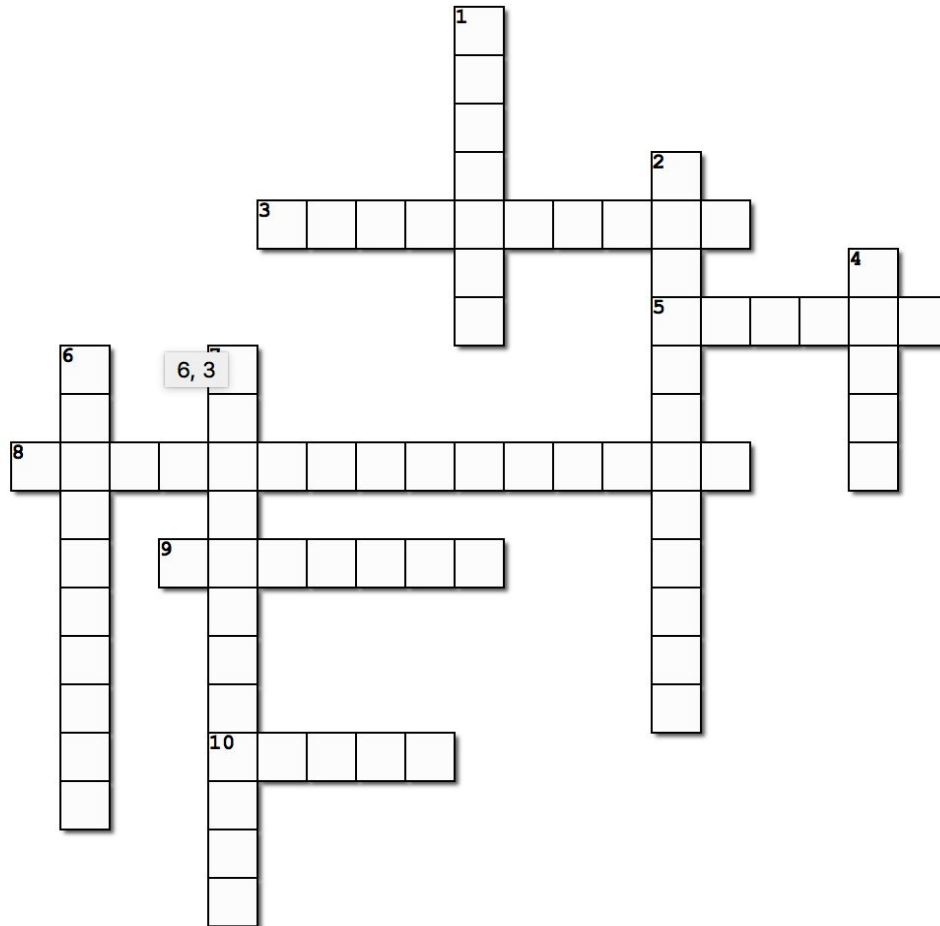
Once the experiment is complete, be sure to clean up any messes and throw any trash away!



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### EXIT PASS



#### **Across**

3. The first step of Cell Respiration. Glucose is broken down anaerobically and forms ATP.
5. An anaerobic process occurs in the absence of \_\_\_\_\_
8. A process that converts sugar and oxygen into carbon dioxide, water, and ATP.
9. An organism, a cell, process or mechanism that takes place in the presence of oxygen
10. The number of steps in Cell Respiration

#### **Down**

1. Cells' main source of energy
2. The powerhouses of the cell
4. Forms CO<sub>2</sub> gas when mixed with sugar.
6. the second step of cellular respiration; it involves a cycle of reactions that occur in the mitochondria to produce ATP.
7. Anaerobic. Yeast or bacteria reacts with sugar to makes acids, gases, or alcohol

### EXPERIMENT LINKS

- <http://www.indypl.org/kids/blog/?p=9601>
- [http://www.biology4kids.com/files/cell\\_mito.html](http://www.biology4kids.com/files/cell_mito.html)