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Evaluating Evidence Cards

Scientists evaluate the quality of evidence when they are building a scientific argument. Evidence is higher quality when it is based on more data because there can be more confidence in the patterns seen in the data.

1. With your partner, discuss each evidence card and use the Evidence Gradient to rate whether the evidence is high quality, medium quality, or low quality. For each piece of evidence, ask yourself the following question: *Does this provide enough data to establish a pattern?*
2. Review the evidence cards you rated as low quality. If you feel they are not of high enough quality to include in your argument, put them in a discard pile.
3. Once you have decided which evidence cards to keep, place your cards in your own envelope and write your name on the envelope. Your partner should do the same.

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Lesson 4.2: Analyzing Evidence

Today you will get more evidence about Jordan Jones. You will use this evidence to think about the claims that were made about his improved performance. Did Jordan really use blood doping to improve his performance so greatly? Or, did high-altitude training help his performance? Maybe it was the pre-race meal that he had? It will be up to you to consider the evidence and decide what Jordan Jones did to make such an amazing leap from 35th to 1st place in just one year!

Unit Question

- How do the trillions of cells in the human body get what they need to function, and what do the cells do with the things they absorb?

Chapter 4 Question

- How did the athlete increase his cellular respiration and improve his performance?

Key Concepts

- The respiratory system brings in oxygen molecules from the air. These oxygen molecules are already small enough to fit into cells.
- The digestive system brings in food and breaks it down into smaller molecules, such as glucose and amino acids, that can fit into cells.
- The circulatory system transports glucose, oxygen, and amino acid molecules to every cell in the body.
- In a functioning human body, body systems work together to deliver glucose, oxygen, and amino acid molecules to the cells in the body.
- In order to release energy, cells need both glucose and oxygen molecules.
- Inside the cell, the atoms that make up glucose and oxygen can be rearranged to make different molecules. This chemical reaction is called cellular respiration and releases energy.
- Systems can work together to form a larger more complex system.

Vocabulary

- cellular respiration
- energy
- glucose
- molecules
- claim
- evidence
- metabolism
- oxygen

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Warm-Up

Officials working for the National Biking Association have made different claims about how Jordan Jones won the American Cycling Classic this year. Right now, which claim do you think is the strongest?

- Claim 1:** Jordan Jones increased his cellular respiration and improved his performance by blood doping.
- Claim 2:** Jordan Jones increased his cellular respiration and improved his performance by changing his pre-race meal.
- Claim 3:** Jordan Jones increased his cellular respiration and improved his performance by training at a higher altitude.

Why do you think that claim is the strongest?

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Examining and Discussing Evidence About Jordan Jones's Race

Part 1: Reading and Annotating Evidence Cards

1. Set the three claim cards aside for now.
2. Read each evidence card carefully and annotate as needed.
3. At the bottom of each card, write one sentence to explain how this evidence connects to one or more of the claims about how Jordan Jones improved his performance.
4. Combine these cards with the evidence cards you evaluated in the last lesson.

Part 2: Discussing and Sorting Evidence

1. Place the three claim cards in a row on your desk.
2. With your partner, choose one evidence card at a time to focus on. Before you place each card under a claim, discuss your thinking with your partner.
3. Place each evidence card under the claim you think it best supports. Repeat this process until you've sorted all your cards. (Note: Do not sort Card O yet; set that card aside for now.)

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Compare Jordan Jones' Pre-race Meals

1. Re-read Card N.
2. Read and annotate Card O
3. Discuss what Card O tells you about Card N with a partner.

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Lesson 4.3: The Science Seminar

Did Jordan Jones engage in blood doping? In the Science Seminar today, you and your classmates will be doing most of the talking as you discuss the evidence and try to arrive at the best explanation for Jordan Jones's improved performance. By the end of the lesson, you'll be ready to write a convincing scientific argument.

Unit Question

- How do the trillions of cells in the human body get what they need to function, and what do the cells do with the things they absorb?

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Vocabulary

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- claim
- energy
- evidence
- glucose
- metabolism
- molecules
- oxygen

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Warm-Up

Read the message from Dr. Walker and answer the question below.

To: Medical Students
From: Dr. Walker
Subject: Jordan Jones

After reviewing Jordan Jones's pre-race meals, along with the evidence from Card N, we don't believe the changes in his meals could explain his improved performance. The difference in the amount of starch between the two meals wasn't enough to have a dramatic effect on his body's ability to release energy through cellular respiration.

Therefore, we want you to focus on the two other claims the National Biking Association asked us to investigate:

Claim 1: Jordan Jones increased his cellular respiration and improved his performance by blood doping.

Claim 3: Jordan Jones increased his cellular respiration and improved his performance by training at a higher altitude.

Do you agree with Dr. Walker and his colleagues that the changes to Jordan Jones's meal could not explain his improved performance? Why or why not?

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Preparing for the Science Seminar

Instructions for Preparing Argument Organizers for Claims 1 and 3

1. Review the evidence that you already connected to Claim 1. Choose the most important evidence cards to support this claim.
2. Glue these evidence cards onto the Argument Organizer under the claim.
3. Clip any other evidence cards that support the claim to the back of the Argument Organizer.
4. Repeat steps 1–3 for Claim 3 to make your second Argument Organizer.
5. If time allows, write notes about the evidence cards in the extra space on each Argument Organizer.

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Participating in the Science Seminar

Science Seminar Expectations

Students are expected to:

- run the conversation.
- use evidence to support ideas.
- explain their thinking.
- listen to one another.
- respond to one another.
- be open to changing their minds.

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Science Seminar Observations

Write a check mark in the right-hand column every time you hear one of your peers say or do something listed in the left-hand column. If you hear an interesting idea, write it in the last row of the table.

Observations during the Seminar	Check marks
I heard a student use evidence to support a claim.	
I heard a student respectfully disagree with someone else's thinking.	
I heard a student explain how her evidence is connected to her claim.	
I heard a student evaluate the quality of the evidence.	
I heard an idea that makes me better understand one of the claims. That idea is:	

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Homework: Writing a Final Argument

Over the last few days, you and your classmates thought about arguments that could be made to answer this question:

How did the athlete increase his cellular respiration and improve his performance?

You have considered three claims.

- **Claim 1:** Jordan Jones increased his cellular respiration and improved his performance by blood doping.
- **Claim 2:** Jordan Jones increased his cellular respiration and improved his performance by changing his pre-race meal.
- **Claim 3:** Jordan Jones increased his cellular respiration and improved his performance by training at a higher altitude.

Your final written argument about Jordan Jones has three parts:

- **Part 1:** Writing an argument to support Claim 1 or Claim 3.
- **Part 2:** Explaining why the other claim is not as strong.
- **Part 3:** Explaining why Claim 2 is not supported.

Scientific Argument Sentence Starters

Describing evidence:	Describing how evidence supports a claim:
The evidence that supports my claim is . . .	If _____, then . . .
My first piece of evidence is . . .	This is important because . . .
Another piece of evidence is . . .	Since . . .
This evidence shows . . .	Based on the evidence, I conclude that . . .

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Homework: Writing a Final Argument (continued)

Part 1: Use the Science Seminar Evidence Cards, along with any other evidence from the unit you think is important, to support the claim that you think is strongest based on all the evidence that was available to you.

Write the claim you chose first, then complete the argument. In order to be convincing to someone who reads it, your argument should explain:

- what cellular respiration is;
- what blood doping or training at a higher altitude does to increase cellular respiration; and
- why you think your claim is the best explanation for Jordan Jones's improved performance.

Part 2: Use the Science Seminar Evidence Cards to explain why you think the other claim (Claim 1 or Claim 3) is not as strong.

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Homework: Writing a Final Argument (continued)

Part 3: Write an argument against Claim 2.

We do know that diet can affect cellular respiration and performance, even if it doesn't explain why Jordan Jones performed better in his race. In order to explain why Claim 2 is not supported, write an argument that includes:

- how starch/glucose are involved in cellular respiration;
- how a diet high in starch could help an athlete perform well; and
- why the evidence does not support the claim that Jordan Jones's change in diet resulted in his improved performance.

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Homework: Check Your Understanding

This is a chance for you to reflect on your learning so far. This is not a test. Be open and truthful when you respond to the questions below.

1. I understand that scientists can be more or less certain of their claims depending on the evidence they have. yes not yet (check one and explain your answer choice)

2. What are the most important things you have learned in this unit?

3. What questions do you still have?

Metabolism Glossary

amino acids: molecules that are the building blocks of proteins

aminoácidos: moléculas que son los componentes fundamentales de las proteínas

carbon dioxide: a molecule made of carbon and oxygen atoms

dióxido de carbono: una molécula hecha de átomos de carbono y oxígeno

cellular respiration: the chemical reaction between oxygen and glucose that releases energy into cells

respiración celular: la reacción química entre oxígeno y glucosa que libera energía en las células

chemical reaction: a process in which atoms rearrange to form new substances

reacción química: un proceso en el que los átomos se reorganizan para formar nuevas sustancias

circulatory system: the body system that transports molecules to and from all cells of the body

sistema circulatorio: el sistema que transporta moléculas desde y hacia todas las células del cuerpo

claim: a proposed answer to a question about the natural world

afirmación: una respuesta propuesta a una pregunta sobre el mundo natural

digestive system: the body system that takes in food and breaks it down

sistema digestivo: el sistema del cuerpo que toma alimento por dentro y lo desintegra

energy: the ability to make things move or change

energía: la capacidad de hacer que las cosas se muevan o cambien

evidence: information about the natural world that is used to support or go against (refute) a claim

evidencia: información sobre el mundo natural que se utiliza para respaldar o rechazar (refutar) una afirmación

glucose: a molecule that organisms can use to release energy, and that is made of carbon, hydrogen, and oxygen atoms

glucosa: una molécula que los organismos pueden usar para liberar energía y que está hecha de átomos de carbono, hidrógeno y oxígeno

metabolism: the body's use of molecules for energy and growth

metabolismo: el uso de moléculas por el cuerpo para obtener energía y crecer

Metabolism Glossary (continued)

molecule: a group of atoms joined together in a particular way

molécula: un grupo de átomos unidos de una manera particular

oxygen: a molecule that organisms get from the air or water around them and use to release energy

oxígeno: una molécula que los organismos obtienen del aire o del agua a su alrededor y que se utiliza para liberar energía

proteins: a category of large molecules that perform important functions inside living things

proteínas: una categoría de moléculas grandes que desempeñan funciones importantes dentro de los seres vivos

reasoning: the process of making clear how your evidence supports your claim

razonamiento: el proceso de aclarar cómo tu evidencia respalda tu afirmación

respiratory system: the body system that takes in oxygen and releases carbon dioxide

sistema respiratorio: el sistema del cuerpo que toma dentro oxígeno y libera dióxido de carbono

scientific argument: a claim supported by evidence

argumento científico: una afirmación respaldada por evidencia

starch: a type of energy storage molecule made of many glucose molecules connected together

almidón: un tipo de molécula de almacenamiento de energía hecha de muchas moléculas de glucosa unidas

system: a set of interacting parts forming a complex whole

sistema: un conjunto de partes que interactúan formando un todo complejo