

TEACHER GUIDE

ANCHOR LESSON 1



Driving Question: *How can milk help athletes recover from physical exercise?*

What We Figure Out:

Students see various athletes choosing milk products for recovery through a series of videos and text anecdotes. This generates questions about recovery after exercise, nutrition for athletes, the body's use of energy, what happens in the body after exercise, and why milk products might be a good recovery choice. Students create initial explanations to show how the milk that athletes consume can help them recover after physical activity. Students set out to figure out the Driving Question, *How can milk help athletes recover from physical exercise?*

3D Learning Objective:

Students **use multiple formats to communicate** their initial understanding of **how the internal conditions of the human body change in response to changes in external conditions (exercise, drinking milk).**

Time estimate:

50 minutes

Materials:

Lesson 1 Student Guide

Videos for student selection:

- [Soccer Star Kelley O'Hara](#)
- [Put the Gym Behind the Milk](#)
- [You're Going to Need Milk for That](#)
- [Nature's Sports Drink](#)
- [Professional Basketball Player Kevin Love](#)
- [Olympic Swimmer Katie Ledecky](#)
- [Ready. Recovery. Repeat](#)
- [High School Athletes](#)

Class video: [Gain a Performance Edge](#) (stop at 1:26)



Targeted Elements

SEP:

Pre-Assessment: INFO-H5:
Communicate scientific and/or technical information or ideas (e.g., about phenomena and/or the process of development and the design and performance of a proposed process or system) in multiple formats (including orally, graphically, textually, and mathematically).

DCI:

Pre-Assessment: LS1.A-H4:
Feedback mechanisms maintain a living system's internal conditions within certain limits and mediate behaviors, allowing it to remain alive and functional even as external conditions change within some range. Feedback mechanisms can encourage (through positive feedback) or discourage (negative feedback) what is going on inside the living system.

CCC:

Pre-Assessment: SC-H1:
Much of science deals with constructing explanations of how things change and how they remain stable.

Directions



Part 1: Sharing Our Past Experiences

Encourage students to write about their exercise experiences by sharing details about the sports or physical activities they are currently engaged in or have been involved with in the past. Instruct students to write or draw their responses in Lesson 1 Student Guide Part 1: Sharing Our Past Experiences.

Hold a brief whole-class share-out for students to share their ideas. Welcome and encourage sharing from students with a variety of experiences.

STUDENT SUPPORT

You may need to guide the discussion on physical exercise to include students with varying physical abilities. Consider using the following questions to guide the conversation:

- How do you like to move your body?
- What are your favorite sports to watch?
- What other physical activities do you engage in, such as hiking, marching band, etc.?

If students have not already incorporated this into the conversation, you can help ensure relevance to the community by asking about popular local sports or exercises. All students will have differing life experiences when it comes to exercise. This is an opportunity to continue to build on the norm for this unit that we will value the different experiences and opinions that students bring to the classroom.

After students share their responses, ask, "What does it feel like after you exercise while resting and recovering?" Students can write or draw their responses in Lesson 1 Student Guide Part 1: Sharing Our Past Experiences. Hold another brief whole-class share-out and again welcome and encourage a variety of responses.



Part 2: Observing the Anchor Phenomenon

Share with students that we will now observe how different kinds of professional and amateur athletes exercise and how they recover from exercise. Direct students to select two videos from the video list and record what they notice. Students should record their responses in Lesson 1 Student Guide Part 2: Observing the Anchor Phenomenon.

Videos for student selection:

- [Soccer Star Kelley O'Hara](#)
- [Put the Gym Behind the Milk](#)
- [You're Going to Need Milk for That](#)
- [Nature's Sports Drink](#)
- [Professional Basketball Player Kevin Love](#)
- [Olympic Swimmer Katie Ledecky](#)
- [Ready. Recovery. Repeat](#)
- [High School Athletes](#)

TEACHER SUPPORT

Ensure that the videos are optimized for viewing by turning on closed captioning if available.

USE OF PHENOMENA

These videos show the first half of the Anchor Phenomenon for this unit: a variety of athletes that use milk and/or chocolate milk to recover from exercise. In the overall unit, students figure out why milk and/or chocolate milk could be used as an effective exercise recovery drink. Throughout the unit, we treat milk and chocolate milk interchangeably and refer to both generically as “milk.” Both beverages have been studied and shown to support recovery from exercise. In some cases in the unit, we refer to chocolate milk specifically when investigating the molecular components in milk because chocolate milk contains added sugar (sucrose).

Each of the upcoming modules in the unit will engage students with module phenomena that highlight specific effects that exercise has on the body and specific ways that milk helps with recovery. Students utilize the knowledge acquired in each module about the body and the effects of exercise to explain why milk serves as an effective beverage for athlete recovery. These serve as formative learning opportunities for students.

Use a Mingle-Pair-Share Routine for students to share what videos they watched and what they observed with two different peers. Students can record similarities they noticed across all videos in their Lesson 1 Student Guide Part 2: Observing the Anchor Phenomenon.

1. Students move around the classroom and find a peer who is not a part of their original discussion group.
2. Students take turns sharing their observations.
3. Students then find a new peer and share their observations once again.

Facilitate a whole-class discussion for students to share what they observed in the athlete recovery videos. As students share with the whole class, create a list of the types of activities performed in the videos and the similar messages. The list of activities may include:

- Swimming
- Weightlifting
- Climbing
- Soccer
- Martial Arts

TEACHER SUPPORT

Remind students that, at the moment, we are only describing what we observed and not yet trying to explain how and why milk can help in recovery from exercise. This will come later.

Build on students' observations that all of these athletes seem to be using milk to recover from different sports and that there are different reasons that are claimed for why. Share that milk has in fact been studied extensively to see if it is an effective drink for recovery to make athletes perform better in their next workout or competition.

Watch the [Gain a Performance Edge](#) video with the class and stop it at 1:26.

USE OF PHENOMENA

This video shows the second half of the Anchor Phenomenon for this unit: milk is confirmed to be an effective exercise recovery drink for athletes. This video, together with the previous set of videos, should help students begin to raise questions about how and why milk could be used for exercise recovery.

Have students record their observations from the “Gain a Performance Edge” video in the Lesson 1 Student Guide Part 2: Observing the Anchor Phenomenon. Then, facilitate a whole-class discussion allowing students to share their observations of the claims from the study described in the video. Agree with students that the scientists claimed that the athletes who drank the milk performed better on their next swimming workout.

SEP SUPPORT

SEP DATA-H4: Compare and contrast various types of data sets (e.g., self-generated, archival) to examine consistency of measurements and observations.

Though this is not a targeted SEP in this lesson, throughout this unit, students will often engage with this element. As a part of this SEP, students will analyze the methods used in scientific exercise studies. To support students in building their proficiency with this SEP element, you may review the study design shown in the video. Students may have past experience from middle school with aspects of experiment design. You can ask students questions such as:

- What was the independent variable in this study?
- What was the dependent variable in this study?

- What variables were controlled?
- What was the control group comparison?

Summarize that in all of the videos students watched, the athletes consumed milk and other sports drinks to recover from exercise, and according to the study, milk does appear to support exercise recovery effectively. Build off these observations to introduce the Unit Driving Question, ***How can milk help athletes recover from physical exercise?***



Part 3: Communicating Initial Ideas

Ask students to name someone they know who is an athlete, exercises, or engages in a lot of physical activity. Student responses may vary. Ask students if they think these people could benefit from knowing how to better recover from exercise and how milk can help their bodies do so. Facilitate the conversation to confirm that this would be beneficial knowledge for these people because it can help them perform better in physical activity. Build off this idea to share that, in this unit, students will design a presentation, choosing the audience and format to explain how milk can help the body improve recovery from exercise.

TEACHER SUPPORT

While this unit will focus on how milk helps athletes recover from exercise, some students may not drink milk. Students may come from cultures that do not typically drink milk or may be lactose intolerant. If you think your students may not have peers who drink milk to communicate a presentation to, consider choosing yogurt as an alternative milk product to focus on in the unit. Yogurt may be an alternative to milk for people of some cultures and may be eaten by those who are lactose intolerant. Importantly for this unit, it has a similar nutrient profile to milk, which helps it fit in the context of the way the different investigations within the unit are designed.

In addition, be careful to frame this presentation carefully such that we are not advertising that all athletes should consume milk. Instead, the focus is on the benefits that milk can have if that is a choice individuals would like to make. It is also important to note that milk can have some downsides for some individuals, such as those who are lactose intolerant or have a dairy allergy or sensitivity.

To help students get started with explaining how and why milk helps athletes recover from exercise, ask students to share the content they noticed from the videos about how and why milk can help athletes recover from exercise. Record on the board as students name factors from the videos such as:

- Recovery
- Hydration

- Protein
- Nutrients
- Carbohydrate to protein ratio

Share that while it is helpful to name the different factors that the videos claimed were important in recovery, we want to go further than the videos did and have our presentations explain exactly how these factors are important in recovery, including what they do inside the body to help an athlete recover from exercise.

Give students time to record their response to the Driving Question on their Lesson 1 Student Guide Part 3: Communicating Initial Ideas. Use a Mingle-Pair-Share Routine to have students share their ideas with their peers.

1. Students move around the classroom and find a peer who is not a part of their original group.
2. Students take turns sharing their ideas.
3. Students then find a new peer and share their ideas once again.

Hold a whole-class discussion for students to share their ideas. Students' ideas may vary, and any idea is accepted and encouraged. We want to hear the genuine current thinking that students are bringing to the classroom. Some sample responses might be:

- The muscles get sore and break down. Milk contains protein that helps muscles build.
- You lose fluids when you exercise. Milk provides you with hydration, which helps you recover.
- Exercise drains your body's energy. The milk provides you the energy to recover.

Share that students will now have an opportunity to design an initial draft of their presentation to share their initial thinking about how milk can help athletes recover from exercise. Across the unit, students will revise and improve on this presentation. This presentation should include students' ideas about what they think happens in the body during exercise and how and why they think milk helps the body recover from exercise.

TEACHER SUPPORT

To share the value of creating presentations, share with students that scientists often share their understanding and findings in presentations. It allows scientists to share their research, stimulate discussion, and verify that it is evidence-based and not based on their own opinions. You may ask:

- When have you seen scientific information shared, and how was it presented?
- Who have you seen present scientific information?
- Why do you think they shared that information?

Encourage conversations between students with previous experience with scientific presentations and those without.

Share with students that the presentations should also include multiple forms of communication, including verbal, textual, and graphical. Ask students why they think a meaningful presentation should include multiple formats. Build off student responses to confirm that communicating complex information can be made easier for the audience by presenting in different formats.

SEP SUPPORT

INFO-H5: Communicate scientific and/or technical information or ideas (e.g. about phenomena and/or the process of development and the design and performance of a proposed process or system) in multiple formats (including orally, graphically, textually, and mathematically).

In middle school, students communicate scientific and/or technical information in writing and/or through oral presentations. In this unit, students build on this middle school understanding to communicate scientific information in multiple formats, including text, visuals, verbally, and graphically). Throughout the unit, students develop an explanation that they will present to the class in a format that best suits a targeted audience. Students begin developing these presentations in this lesson and add on to and revise their presentations throughout Modules 1-4 and the Performance Task.

CCSS SUPPORT

WHST 9-10.2 (a) Introduce a topic and organize ideas, concepts, and information to make important connections and distinctions; include formatting (e.g., headings), graphics (e.g., figures, tables), and multimedia when useful to aid comprehension.

In their presentations, students will organize ideas, concepts, graphics, multimedia, and information in the way that they think best suits their targeted audience.

Direct students to their Lesson 1 Student Guide Part 3: Communicating Initial Ideas to begin their draft. To start, students will choose presentation formats and a target audience and create an initial draft to show their initial understanding of how milk might help athletes recover from physical exercise. Share that students will be able to add to and revise their presentations throughout the unit and that it is okay if they are a draft right now. Students' initial presentations should show their own ideas. There is no need to do outside research at this time.

Note that students will choose a presentation format here in the Anchor lesson, and it will be the format they use throughout the unit.

TEACHER SUPPORT

As students revise their presentations across the unit, ask them to collect each of their presentation drafts in a portfolio. This will allow students to see how their presentation has progressed over the course of the unit.

PRE-ASSESSMENT OPPORTUNITY

Students **use multiple formats to communicate** their initial understanding of **how the internal conditions of the human body change in response to changes in external conditions (exercise, drinking milk).**

Assessment Artifacts:


- Students' initial presentation drafts that describe how they think milk helps athletes recover from exercise (Lesson 1 Student Guide Part 3: Communicating Initial Ideas).

Look Fors:

- Students communicate their understanding in multiple formats (INFO-H5).
- Students describe how they think exercise changes the internal conditions of the body and how milk helps the body recover from exercise (LS1.A-H4, SC-H1).

Assessment Rubric:

| | Emerging | Developing | Proficient |
|--------------------------------|---|---|--|
| Sample Student Response | Milk helps you recover from exercise because it makes you stronger. | Milk helps you recover from exercise because the nutrients in the milk help make you stronger. There are a lot of different kinds of nutrients, like protein, in milk that help you recover. It also provides hydration to make you feel better after exercise. | Milk helps you recover from exercise because it contains nutrients that help you recover. When you exercise, muscles get sore and break down. Milk contains protein that helps muscles build. You also lose fluids when you exercise. Milk provides you with hydration, which helps you recover. Exercise drains your body's energy. The milk provides you with the energy to recover. In all of these |

| | | | |
|----------------------------------|--|--|---|
| | | | ways, milk helps you to recover from exercise.  |
| How to Achieve This Level | Student completes 0 out of 2 Look Fors | Student completes 1 out of 2 Look Fors | Student completes 2 out of 2 Look Fors |

To Provide Additional Support for Students:

- Ask students to keep track of how they used multiple formats of communication in their presentation. For example, how many images/graphics did they show? Is there a mix of presentation methods?
- Press students to say more about what is happening inside of the body after exercise and after drinking milk to help recovery.
- Remind students that their current thinking is okay here – they do not need to do any outside research, and there is no expectation of finding the “right answer” right now.
- Engage students in a peer feedback session. Provide students with the Look Fors, and use a protocol such as [Tell-Ask-Give](#) or norms such as [SPARK](#). Students can use the Look Fors to provide feedback to each other on how they can improve selected Look Fors in their work.

DCI SUPPORT

LS1.A-H4: Feedback mechanisms maintain a living system’s internal conditions within certain limits and mediate behaviors, allowing it to remain alive and functional even as external conditions change within some range. Feedback mechanisms can encourage (through positive feedback) or discourage (negative feedback) what is going on inside the living system.

In middle school, students learned that the brain processes different inputs (electromagnetic, mechanical, chemical) and uses sense receptors and nerves to transmit these signals and respond accordingly. In this unit, students build on this middle school understanding to explore how these sensory systems are used by the body to maintain homeostasis and to respond to changes in external conditions. For example, in Module 2, students figure out that the body has feedback mechanisms that are used to respond to internal changes caused

by external factors, such as an increase in internal body temperature due to exercise or the sweat response due to blood vessel dilation. Each of these mechanisms is controlled by receptors that respond to different internal and external inputs.

DCI SUPPORT

LS1.A-H4: Feedback mechanisms maintain a living system's internal conditions within certain limits and mediate behaviors, allowing it to remain alive and functional even as external conditions change within some range. Feedback mechanisms can encourage (through positive feedback) or discourage (negative feedback) what is going on inside the living system.

In this lesson and throughout the unit, we use the term “recovery” as a student-friendly stand-in for the body’s ability to return to homeostasis after a change in its external (exercise) and internal (depletion of some nutrient or damage to organs and tissues due to exercise) conditions. In upcoming lessons, students will figure out that the body responds to exercise by using a variety of negative feedback mechanisms and that the process of recovery by drinking milk involves returning the conditions of the body to their normal state. Accordingly, you can use students’ initial presentations of how the body uses milk to help recover from exercise as a pre-assessment to understand what students know about how the body uses feedback mechanisms for recovery.

CCC SUPPORT

SC-H1: Much of science deals with constructing explanations of how things change and how they remain stable.

In middle school, students explain stability and change in natural or designed systems by examining changes over time and processes and different scales. In this lesson, students’ initial presentations ask them to describe how they think exercise changes the internal conditions of the body and how milk helps the body recover from exercise. Students may not yet understand that exercise changes a multitude of physiological and molecular factors in the body. Throughout the unit, students will figure out that this is the case and will reflect on the idea that much of the science of studying how the body responds to exercise has to do with studying how various factors in the body change or remain stable.



Part 4: Sharing Initial Presentation Drafts

Have students share their initial presentation drafts with their peers. As they share, students can identify similarities and differences between their presentations and record them on their Lesson 1 Student Guide Part 4: Sharing Initial Presentation Drafts. Then, students will share the main ideas they shared in their presentations with the whole class. As students share, record the different ideas students have about how milk helps athletes recover from exercise. From this list, create a Class Consensus List that describes the different ideas students have about the changes that occur in the body during exercise and how milk helps athletes recover from exercise. Share with students that throughout the upcoming unit, they will continue to refine their presentations on how milk can help athletes recover from exercise.

STUDENT SUPPORT

If you haven't done so previously, consider starting a list of norms for how students engage in productive and respectful classroom discussions. Ask students how they can have respectful conversations with each other. Create a class list with the norms the class generates and hold students accountable for participating in these norms throughout the unit. Some examples are shown below, but be sure to co-create your list with your students.

- Be Respectful: We can discuss and disagree on ideas, but we do not look down on or talk down to people.
- Listen, Then Talk: Show that you are listening to your partner by repeating what they say or asking a question.
- Find Common Ground: When disagreeing, find at least one thing you agree with before discussing what you disagree with.



Part 5: Asking Questions

As a final step in this lesson, students will create a list of questions that can help them determine what additional information they need to know to help them figure out how milk can be used for exercise recovery by athletes. Students can write these questions on their Lesson 1 Student Guide Part 5: Asking Questions.

To facilitate students asking questions, use the Question Formulation Technique.

1. With their group, students take 5 minutes to brainstorm questions about what they need to know about how dairy foods are created and distributed.
2. Students then look at all their questions and choose the 3-5 questions they think are most important to be answered to help them figure out the Driving Question.
3. A representative from each group will then share their prioritized questions with the whole class. As students share their prioritized questions, they will add them to the Driving Question Board.

As students share their questions, ask them to create categories and group similar questions. As these question groups start to form, give the categories a name. The goal is that the emerging categories correspond with the upcoming modules so that students can see that the questions motivate and drive the introduction of the following lessons.

What's In Milk?

- What's in milk that helps with exercise recovery?
- What makes up milk?

How Does My Body Digest Milk?

- How does the body get what it needs from milk to recover from exercise?
- Does digestion help the body use milk?
- How does the body process milk to aid in exercise recovery?

Exercise, Milk, and Hydration

- Why does a body need to hydrate as part of exercise recovery?
- What happens in the body after it is hydrated?
- Does the amount we sweat impact the amount of fluids we need to replenish?
- Does drinking specific items, like milk, increase hydration only? Are there other effects?

Exercise, Milk, and Energy

- How or why does milk give our body energy after physical activity?
- Is energy involved in _____? How? Why?
- Does drinking more milk give you more energy to exercise?
- Do you get energy from milk?

Milk Protein and Muscle Soreness

- Are muscles affected by _____? How? Why?
- How does protein help with exercise recovery?
- Does milk help muscle soreness go away?
- Does milk help build bigger muscles?

Recovery From Exercise

- What is recovery from physical exercise?
- What factors indicate your body has or has not recovered from exercise?
- What does our body lose during exercise, and how do we replenish it?
- What processes is the body using for recovery after physical exercise?

Exercise and the Body

- What happens to the body after physical exercise?
- What body systems are being used in exercise?
- What makes a person strong enough to do these types of physical activities/exercises?

USE OF PHENOMENA

Each of these suggested groupings of questions corresponds to one or more modules in the unit. By grouping questions in this way, students can see how the module phenomena they observe in each module are introduced based on the questions students have raised.

STUDENT SUPPORT

Another activity you may choose to do is to have students brainstorm and record phenomena from their own lives they believe are related to the Anchor Phenomenon. This may look like further describing their own physical exercise and recovery experiences or describing other recovery foods or drinks students have heard of or used themselves. Allowing students to connect to phenomena from their own lives can help strengthen their connection to and interest in figuring out more about this Anchor Phenomenon.

Wrap up the lesson by sharing how students' ideas will be used going forward. This may sound like, “Your questions and ideas are the most important part of our classroom work together, so we will use them to decide on what our upcoming investigations will be. We will use your questions to help us investigate what happens in our bodies during exercise and how milk could help with recovery from exercise.”

In their Student Guide, students record questions they asked or ideas they want to resolve moving forward in the unit. This will help students identify existing gaps in their initial explanations that they still need more information to figure out.

These gaps might include:

- I know from commercials that milk can help my body be healthy, and I learned in this lesson that it is important for recovering from exercise, but I am unsure of exactly what it is in milk that helps with exercise recovery.
- We talked about dairy helping an athlete if they drink it after they work out. What happens to the body after you exercise?

- My partner and I added “recovery” into our initial explanations, but I’m not sure what recovery really means for athletes after exercise.