

TEACHER GUIDE

ENGAGE LESSON 2



Module Question: *How is milk digested after it is consumed?*

What We Figure Out:

We figure out that the digestive system has several different organs, including the mouth, esophagus, stomach, small intestine, and large intestine, that play a role in the digestion of food. We aren't yet sure how each of these organs helps in the digestion of food.

3D Learning Objective:

Students **develop a model** that utilizes scale references from models that describes how different organs function in the digestion of milk as it passes through the digestive system.

Time estimate:

50 minutes

Materials:

Lesson 2 Student Guide
[Digestion Video](#)

Targeted Elements

SEP:

Pre-Assessment

MOD-H3:

Develop, revise, and/or use a **model** based on **evidence to illustrate** and/or predict the **relationships between systems or between components of a system**.

DCI:

Pre-Assessment

LS1.A-H1:

Systems of specialized cells within organisms help them perform the essential functions of life.

Pre-Assessment

LS1.A-H3:

Multicellular organisms have a hierarchical structural organization, in which any one system is made up of numerous parts and is itself a component of the next level.

CCC:

Pre-Assessment

SPQ-H4:

Using the concept of orders of magnitude allows one to understand how a **model at one scale relates to a model at another scale**.



Directions



Part 1: Our Motivation

USE OF PHENOMENA

Students ended the previous lesson by asking questions they wanted answers to in order to understand how drinking milk helps athletes recover after exercise. The introduction of this module will help guide students to agree that first figuring out what happens to the milk after it is drunk is the best first step in investigating more about how milk helps athletes recover after exercise. In this module, students will begin by observing a module-level phenomenon about how food is digested. This phenomenon will help students figure out what happens to each of the different molecular components of milk before they are used in the rest of the body in exercise recovery.

To begin the lesson and make the connection between the previous lesson and this one clear, return to the Driving Question Board. Share out the different question categories that students created. Ask students which of the question categories would be most important to figure out first to make progress on our Driving Question, ***How can milk help athletes recover from physical exercise?*** Accept and acknowledge student responses. Facilitate the conversation so students agree that before they can figure out any questions about how milk helps the body in exercise recovery, they need to know what happens to milk when it goes into the body. If students suggest a different category of questions about recovery, for example, you can ask a question such as “Would there be steps between recovery and drinking the milk that we might need to know more about first?” to help students see that moving straight to recovery might not be the best place to start.

Have students read off selected questions about how milk is digested and what happens in the body after drinking milk. Students can capture their relevant question(s) on their Lesson 2 Student Guide Part 1: Our Motivation.

These questions might include:

- I know from commercials that milk can help my body be healthy, and I learned in this lesson that it is helpful for recovering from exercise, but I am unsure of exactly what it is in milk that helps with exercise recovery.
- Why does my body need to recover after exercise?
- What happens while I exercise that causes it to need recovery?
- We know that milk is being used in athletic recovery; what is in milk that makes it so good at doing this?

- What happens to milk after you drink it?

Build off student questions to share that students will now observe a new phenomenon that will help them start to progress on answering some of these questions.



Part 2: Observing the Module Phenomenon

As a class, watch the [Digestion Video](#) and record observations about how food is digested and the organs involved in the digestion process. Students can write these observations and any questions they have after watching the video on their Lesson 2 Student Guide Part 2: Observing the Module Phenomenon. Use a Think-Pair-Share to have students share what they noticed happened to the food and what organs were involved.

STUDENT SUPPORT

For multilingual students or students who are internal processors, it's helpful to allow time or opportunity for students to process information individually or by using non-linguistic processing modes before group share-outs.

Facilitate the discussion to agree that:

- Food is broken down into smaller bits. It eventually becomes mush.
- Food travels through multiple organs that look different: the mouth, the esophagus, the stomach, the small intestine, and the large intestine.

Allow students a brief time to record any questions they have based on what they observed in the video. Build off student responses to introduce the Module Question, *How is milk digested after it is consumed?* Share with students that they will set out to figure out the answer to this question in the following lessons.



Part 3: Creating Initial Models

Start by sharing with the class that we will create an initial model to answer the Module Question, *How is milk digested after it is consumed?* Introduce the model conventions to students by writing the following on the board or chart paper. These include:

- Images, icons, and pictures to visually represent different parts of the system.

- A description of what process happens in each part of the system.
- Arrows that show what enters and leaves each part of the system.
- Zoom-ins that show what is happening on a smaller scale in each part of the system.

DCI SUPPORT

LS1.A-H1: Systems of specialized cells within organisms help them perform the essential functions of life. In middle school, students learned that the body is made up of interacting subsystems that contain organs, tissues, and cells and that tissues form organs that have specialization for particular body functions. In this unit, students build on this middle school understanding to explain how the function of organs depends on cell specialization. In this lesson, students have the opportunity to demonstrate their prior knowledge from middle school of the structure and function of cells in organs in the digestive system.

DCI SUPPORT

LS1.A-H3: Multicellular organisms have a hierarchical structural organization, in which any one system is made up of numerous parts and is itself a component of the next level. In middle school, students learned that the body is made up of interacting subsystems that contain groups of cells called tissues and that tissues form organs that have specialization for particular body functions. In this unit, students build on this middle school understanding to explain the hierarchical structural organization of the body and body systems. For example, in this module, students learn about the individual components of the digestive system and also develop an understanding of how various kinds of specialized cells within different organs contribute to the function of the whole system. Students here have the opportunity to show what knowledge of this DCI that they bring in from middle school.

Share that students' models should include the parts of the digestive system that the class agreed on from the video and students' ideas of how each of these parts of the digestive system plays a role in digesting milk. The model should also use zoom-ins to show what is happening to milk on a smaller scale at each organ.

Allow students time, in small groups, to create their initial models on their Lesson 2 Student Guide Part 3: Creating Initial Models. As students work, circulate the room and ask questions to help elicit student thinking, such as:

- What is going into an organ? What leaves it?
- How do you think (organ) digests milk? What does it do? How do cells contribute to its function?
- What happens to the milk when it gets to (organ)?
- What might be occurring here that we can't see? What structures in the organs are involved in that process?

FORMATIVE ASSESSMENT OPPORTUNITY

Students **develop a model at multiple scales** that describes **how different organs function in the digestion of milk as it passes through the digestive system.**

Assessment Artifacts:

- Students' initial models of how milk is digested by cells in the digestive system (Lesson 2 Student Guide Part 3: Creating Initial Models).

Look Fors:

- Student models show how matter moves from one component of the system to another (MOD-H3).
- Student models describe the function of the different components of the digestive system and how the function of specialized cells contributes to the function of organs (LS1.A-H1, LS1.A-H3).
- Student model shows some representation of the relative scales of the organs and cells present in the digestive system (SPQ-H4).

Assessment Rubric:

	Emerging	Developing	Proficient
Sample Student Response	Student model shows/describes: <ul style="list-style-type: none"> • Some organs of the digestive system. 	Student model shows/describes: <ul style="list-style-type: none"> • Organs of the digestive system, including the mouth, stomach, small intestine, and large intestine. • How milk moves from one organ of the digestive system to the next, and at each stage, it undergoes a change in its composition. 	Student model shows/describes: <ul style="list-style-type: none"> • Organs of the digestive system, including the mouth, stomach, small intestine, and large intestine. • Zoom-ins show that each organ is made of cells that contribute to the function of the organ. • How milk moves from one organ of the digestive system to the next, and at each stage, it undergoes a change in its composition.
How to Achieve This	Student completes 0 out of 3	Student completes 1 - 2 out of 3 Look Fors	Student completes 3 out of 3 Look Fors

Level	Look Fors		
-------	-----------	--	--

To Provide Additional Support for Students:

If students need additional support in developing their models, consider:

- Asking students what they know about the digestion of other types of food and in what organs that digestion occurs.
- Asking students to verbally explain how they think milk is digested, then have students record this explanation in their model.
- Reminding students that any idea is acceptable at this stage.
- I see you're showing this in the model; how does this relate to explaining the phenomenon?
- I see you drew this. Can you explain to me what it represents?
- How did you decide to show this idea/concept in this manner?
- Which part of this system is the largest? Which is the smallest? What are their sizes relative to one another?
- 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.

At the end of the initial creation of the small group models, each group will share their models with the class using the Stay and Stray Strategy.

1. After small group models are complete, have groups discuss how they may adjust their group's models.
2. Then, ask groups to have one person "stay" at their table with the model they created to explain the model to classmates from other groups.
3. The rest of the team members "stray" to the other groups to learn about the other group's models, allot about 2 to 5 minutes per rotation.
4. During the rotation time, students can ask questions to help gain clarity on the decisions they made. Students can ask questions such as, "What parts of the models do we seem to agree on?"
5. At every signal to rotate to a new group, a different team member goes back to stay with the group's work, and everyone else (including the person who first stayed) moves on to view the next product. This allows everyone to see all but one product.
6. After visiting all groups, initial small groups regroup and share new information gathered.
7. Groups discuss new ideas and decide whether or not they will integrate them into their work.

TEACHER SUPPORT

Using the Stay and Stray Strategy allows students to compare and contrast their models with other groups. This will help them self-evaluate the strengths and weaknesses of their model before implementing edits.

Hold a whole-class discussion in which the class builds a Class Consensus Model. You can use the following steps:

1. Each group should select one or more reporters to share their model. Have the first group share their model and add one part of it to the consensus model. This can be one component, arrow, relationship, or any other feature the group wants to select.
2. The next reporters can agree with, disagree with, or revise parts of the model that have already been added or can add new parts. Continue this process until the full Class Consensus Model is built.
3. As students share, some strategies you can use to help the class build the consensus model are:
 - a. Helpful sentence starters such as:
 - i. We agree with _____'s group, and we also want to add _____.
 - ii. We disagree with _____'s group because _____.
 - iii. We would like to change _____ because (evidence).
 - b. Use discussion prompts such as asking the class:
 - i. What evidence do you have for _____?
 - ii. How come you did not include _____ in the system?
 - iii. How are you defining your system in your model?
 - iv. How do your system components compare to _____'s?

As you are building the class model, if you find disagreements, follow these steps to help resolve the disagreement:

1. Summarize the two sides of the disagreement.
2. Ask the students to pause and reflect on their reasonings to be on that side.
3. Prompt students to again re-discuss the area of disagreement.
4. If students still disagree, suggest that we can represent areas of disagreement on the class model with question marks or other annotations of uncertainty.

The final Class Consensus Model should have the following features:

- Parts of the digestive system, represented as system parts, including the mouth/esophagus, stomach, small intestine, and large intestine.

- Arrows showing the movement of food matter from one system part to another.
- Zoom-ins that show the cells of one or more organs and some uncertainty about the function of these cells in digesting milk.

Record whatever descriptions your class has agreed to on the function of each of the parts of the digestive system. For example, your class might say the stomach “breaks down food with stomach acid” or the mouth “chews food.” Any responses for the function of each system part are to be accepted at this point.

CCC SUPPORT

SPQ-H4: Using the concept of orders of magnitude allows one to understand how **a model at one scale relates to a model at another scale**. In middle school, students learn that time, space, and energy phenomena can be observed at small or large scales using models. In this unit, students build on this idea by using orders of magnitude to explain relationships at various scales in a series of models. Students start showing their prior knowledge about different spatial scales present in the human body in this lesson. Students will progress towards using orders of magnitude to describe these scale relationships throughout this module.

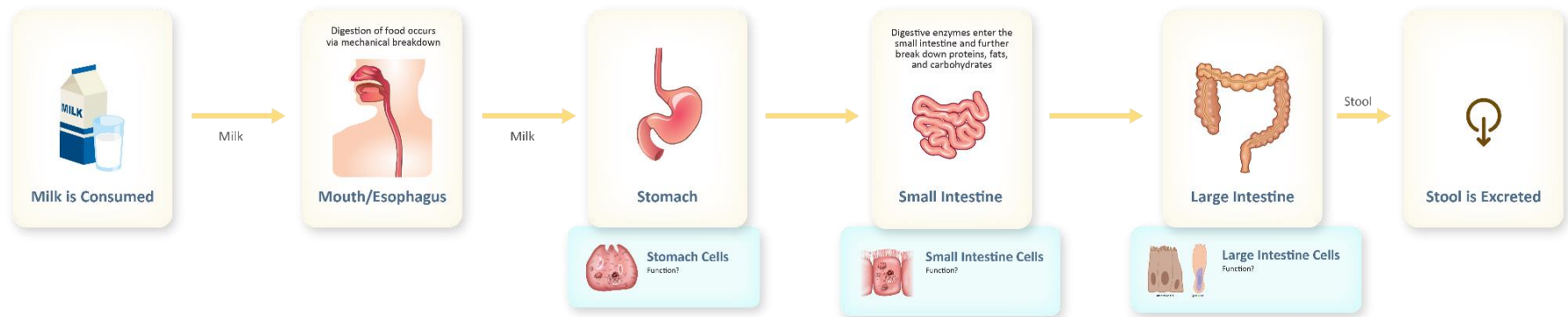
CCSS SUPPORT

SL 9-10.1(d) Respond thoughtfully to diverse perspectives, summarize points of agreement and disagreement, and, when warranted, qualify or justify their own views and understanding and make new connections in light of the evidence and reasoning presented.

In the Class Consensus Model, students will utilize the skills associated with this standard to come to an agreement on what the model should look like. Utilize the sentence starters provided to support student skill development.

Here is one example of what a Class Consensus Model may look like, though you will want to follow the ideas of your class rather than drive them to this exact model. Students will copy the final Class Consensus Model on their Lesson 2 Student Guide Part 3: Creating Initial Models.

Example Class Consensus Model & Explanation:



Milk is consumed, then swallowed, and enters the esophagus, entering the stomach where acid digests milk and then moves to the small intestine and the large intestine. What is left of milk in the large intestine is removed as stool.



Part 4: Asking New Questions

As a final step in this lesson, have students create a new list of questions that can help them determine what additional information they need to know to help them figure out how milk is digested after it is consumed. They can write these questions on their Lesson 2 Student Guide Part 4: Asking New Questions. Add these questions to the “How Does My Body Digest Milk?” category of the Driving Question Board so they can continue to be referenced in the coming lessons.

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 Module 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.

LOOK FOR

In student responses, listen for the following questions:

- How does milk get broken down in the body?
- What are organs doing with milk?
- Where do milk's nutrients go in the body?
- Where does the digestion of milk occur?
- What specifically does the body do to get nutrients from milk?
- What processes are taking place inside of me to allow milk's nutrients to be pulled out and used?
- What is happening to milk at each of these locations?
- What does the stomach/small intestine/large intestine do?
- What is the milk made of?