SCIENCE THEATER EXPLORE LESSON 4



Science Theater Teacher Directions

Key Outcomes

- Students experience the model from two points of view: an observer and a participant assigned to the role of an organ and/or specialized cell within an organ.
- Students cooperate to combine information about individual organs and cells to make sense of the pathways, processes, and purpose of digestion of milk in the body.
- Students use orders of magnitude to make sense of the relative sizes of the organs, cells, and nutrient molecules to further understand the model.

Materials

The following is a list of the printed materials which are located in the student handout. There you will find:

Table Tents for each organ that depict the structure of the organ and the specialized cells it is composed of.



Tokens represent relevant nutrients, stimuli, processes, and responses that occur during the mechanism being modeled.

Note: In Module 1, the tokens for nutrients, water, and electrolytes are intended to be used as name tags or labels that can be flipped over after digestion.

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Role Cards for each organ (including any specialized cells) that describe the function of each organ and its specialized cells as well as instructions for how students will engage in the model.



ROLE CARD

Physical Classroom Setup

Set up and label the layout of the classroom as shown below so that a table (or grouping of desks) represents each organ. Ensure each organ has the corresponding visual poster where it is visible. Students will stand or sit at each table as they represent the cells of each organ. Molecule cards will be "moving" from one organ to another.



Below is a table listing the initial locations for each token:

Organ	Tokens
Mouth/Esophagus	 Produce and secrete saliva Amylase
Stomach	 Pepsin Breakdown (digestion) of proteins Produce and secrete gastric juices Destroy potentially harmful bacteria Reduce the size of fat molecules to smaller fat molecules
Small Intestine	 Lactase Breakdown (digestion) of lactose Breakdown (digestion) small fat molecules to fatty acids Digestive waste products
Pancreas	• Lipase
Large Intestine	Form stoolDefecate and remove waste

Science Theater Actions By Role

- Mouth/Esophagus
 - Amylase enzyme digests starches. Milk nutrients (fats, lactose, electrolytes, proteins) are not digested here and move onto the stomach.
- Stomach
 - Epithelial cells secrete pepsin, an enzyme that breaks down proteins into amino acids. Bile released from the pancreas breaks fat globules into smaller droplets of fat. Milk nutrients (fats) are digested. Other milk nutrients (smaller fat globules, lactose, electrolytes, and amino acids) move onto the small intestine.
- Small intestine
 - Epithelial cells secrete lactase and lipase. Milk nutrients (small fat globules, lactose, electrolytes, and amino acids) enter the small intestine. The milk nutrient lactose is digested by lactase, and the enzyme lipase digests fats. Other milk nutrients (electrolytes and amino acids) are absorbed into the bloodstream. Those that are not needed by the body move onto the large intestine.
- Large intestine
 - Water, excess electrolytes, and remaining milk nutrients are turned into waste and prepared for removal from the body by the secretions of epithelial cells.

Science Theater Actions in Sequence

- 1. (Mouth/Esophagus) Receive "Milk" (*water, electrolytes, proteins, lactose, and fat molecules*) from outside the body.
- 2. (Mouth/Esophagus) *Produce and secrete saliva* token is activated to prepare any food for swallowing.
- 3. (Mouth/Esophagus) Use *amylase* token is activated to begin the digestion of any complex carbohydrates (fiber) if present.
- 4. (Mouth/Esophagus) Pass the *water, electrolytes, proteins, lactose, and fat molecules* onto the Stomach.
- 5. (Stomach) Receive *water, electrolytes, proteins, lactose, and fat molecules* from the Mouth/Esophagus.
- 6. (Stomach) Use the Pepsin token to break down (digestion) of proteins.
 - a. Replace the proteins token with the amino acids token.
- 7. (Stomach) Use the Gastric Juices token to
 - a. Activate the *destroy potentially harmful bacteria* token.
 - b. Activate the *reduced fat molecules to smaller fat molecules* token.
 - c. Replace the *fat molecules* token with the *smaller fat molecules* token.
- 8. (Stomach) Pass the *amino acids*, *water*, *electrolytes*, *lactase*, *and small fat molecules* to the small intestine.
- 9. (Small Intestine) Receive *amino acids, lactose, water, electrolytes,* and *small fat molecules* from the stomach.
- 10. (Small Intestine) Use the *lactase* token to activate the *breakdown/digestion of lactose*.
 - a. Replace the *lactose* token with *glucose and galactose* token.
- 11. (Pancreas) Pass the *lipase* token to the small intestine.
- 12. (Small Intestine) Receive *lipase* from the pancreas.
 - a. Use Lipase to breakdown small fat molecules into fatty acids.
 - b. Replace the *small fat molecules* token with *fatty acids* token.
- 13. (Small Intestine) Pass water and electrolytes to the large intestine.
- 14. (Small Intestine) Pass the *digestive waste products to* the large intestine.
- 15. (Large Intestine) Take no action with fibers. (Milk does not contain fiber.)
- 16. (Large Intestine) *Water* and *electrolytes* exit the large intestine but remain in the body.
- 17. (Large Intestine) Use the *digestive waste products* token to activate the *form stool* token.
- 18. (Large Intestine) Activate the *defecate and remove the stool from the body* token.