



Digestive System Simulation

Lesson Concept	<p>The digestive system consists of the mouth/teeth, esophagus, stomach, small and large intestine, colon, rectum/anus.</p> <p>(Teacher Note: The pancreas, liver, and gall bladder also play a role in the digestive system but they are not addressed here because they are not in the California standards for grade 5.)</p>
Link	<p>In the previous lesson, students learned about how digestions begin in the mouth. In this lesson, students will learn the structure and function of the other organs of the digestive system. In the next lesson, students will show their understanding of the digestive system in a creative writing.</p>
Time	45 minutes
Materials	<p><u>Whole Class</u></p> <p>Digestion Story (R1)</p> <p><u>Per Group of 4-6 students</u></p> <p>1 Ziploc sandwich bag (mouth)</p> <p>1 Ziploc quart sized bag (stomach)</p> <p>Piece of flexible clear tube (esophagus)—see advance preparation</p> <p>1 Leg of a panty-hose (small intestine)</p> <p>1 Knee-high nylon (large intestine and colon)</p> <p>2 5-8 oz Paper cups; one with a slit cut in the bottom (rectum and anus)</p> <p>Duct tape (to connect mouth to esophagus; stomach to small intestine; small intestine to large intestine)</p> <p>½ Banana</p> <p>4-5 Saltine crackers</p> <p>2-3 oz Water (approximately 60 mls)</p>

Scissors

Enough newspaper to cover workspace

Digestive System Simulation Steps (R2)

Individual

Science notebook

Digestive System Model Chart (H1) (see advance preparation)

**Advance
Preparation**

1. Gather materials and lay out the parts for the digestive system: sandwich bag (mouth); quart sized bag (stomach); Piece of flexible clear tube (esophagus; leg of a panty-hose (small intestine); Knee-high nylon (white/black/patterned) (large intestine and colon); Paper cups--one with a slit cut in the bottom (rectum and anus).
2. To make the esophagus, cut a 3-4 inch piece of flexible clear tubing that is about 2 inches in diameter. Suggestions for the tube include large “fingers” in food service gloves; the plastic wrap on fast food utensils, or clear rubber tubing from a home improvement or pet store. This tubing needs to be flexible so that students can squeeze it and move “food” through it.
3. Cut materials for the parts of the digestive system:
 - a. Duct tape (to connect mouth to esophagus; stomach to small intestine; small intestine to large intestine).
 - b. Cut a small corner of the sandwich sized Ziploc bag (not the zippered end) off. Insert this cut into the esophagus and tape it in place with the duct tape.
 - c. Seal the quart sized Ziploc bag and then make a small opening on the side of the zippered end of the bag to attach to the bottom end of the esophagus; tape into place.
 - d. Cut the legs off of panty hose at the “hip” (small intestine). Cut a small corner of the quart sized Ziploc bag (not the zippered end) off. Insert this cut into the cut part of the pant hose and tape it in place with the duct tape.
 - e. Label one of the cups “nutrients.”
4. Build a model to show the students before they begin to build theirs.
5. Set up newspaper on desks to prevent mess.
6. Duplicate the Digestive System Model Chart (H1) if students are to glue it into their notebooks; or have them copy the chart directly into their notebooks.

Procedure:

Engage (5 minutes) *The digestive system has different structures.*

1. Display the Engage chart from Lesson 9 and ask students to open their notebooks to the place that they drew what they thought the digestive system looks like.
2. In partners, ask students to review their drawing and see if they want to add any other parts. Have them share their ideas and add to the chart.
3. Explain that in this lesson they will explore the parts of the digestive system by building a model.

Teacher Note: Keep the chart to review at the end of the lesson.

Explore (30 minutes) *The digestive system consists of the mouth/teeth, esophagus, stomach, small and large intestine, colon, rectum/anus.*

4. Read R1 (Digestion Story). Ask students to put their heads down and just use their imaginations to paint a picture of this journey.
5. Ask students to look at the Engage Chart—and check which organs were addressed in the story. Circle those organs or add them to the chart if necessary.

Teacher Note: make sure the chart has: teeth, mouth, esophagus, stomach, small intestine, large intestine, colon, rectum/anus

6. Distribute the Digestive System Model Chart. Ask each student to enter the names of the organs from the Engage chart. Then ask them to work with a partner to recall the story and determine the function of each structure. Have both partners complete their own chart.
7. Have partners share their ideas, creating a class chart of the structures and functions.
8. Explain that students will now construct a working model of their digestive system. Conduct a brief discussion about what it means to make a model (e.g., it is a representation, not real; it may or may not have all the parts represented; it helps us visualize how something MIGHT work).
9. Point to the organ on the class structure chart and hold up each “model” organ and ask students how the model may or may not be like the real thing:
 - sandwich bag—mouth (can open and shut; has no “teeth” but by pushing on it with both hands you could “mush” food up.
 - clear tube-esophagus (long tube; can squeeze it to represent swallowing; it is shorter than the real one which in humans it is about 9 inches).
 - quart bag—stomach (a sack that can hold things; can be mashed more; doesn’t have acid to help digestion).

panty hose—small intestine (flexible so it can bend, long, but not as long as the one in humans which is about 23 feet; doesn't have infolding (villi) on the inside to help digest the food).

knee high—large intestine (larger than small intestine tube; short tube that can be squeezed to move waste along; in humans the real size is about 5 feet).

cup—rectum/anus (acts as a holding area; slit allows waste to come out; doesn't have muscles to hold waste in).

10. Ask students which two organs from the story are not represented in the model (gall bladder and pancreas). This is an example of when a model does not represent all of the parts. For this lesson, these organs will not be needed.
11. Distribute materials to groups and demonstrate how to build the model. Show students the one you made in advance preparation.
12. Once groups have constructed their models, distribute the Digestive System Simulation steps; give them the "food" and have them put it through the digestive system. Caution students to carefully put the food in the food and mush it gently.

Teacher Note: Be prepared for squeals; help students keep their "track" on the newspaper to avoid a big mess! You might consider guiding the activity as a whole class.

Explain **(15 minutes) A model can be used to represent the parts of the digestive system and simulate the functions of those parts.**

13. Ask groups to share what was their favorite part of the model? Which was the hardest to represent? Why?
14. Ask students to return to the Digestive System Model Chart and independently complete the chart.

Extend/Evaluate **(20 minutes) The digestive system is made of parts that help to digest food and provide energy to the body.**

15. See **Formative Assessment #3**.

Digestive System Model Chart

H1

Structure (Organ)	Function	How was the function modeled in the simulation?	Is this organ essential for digestion? Why or why not?

Adapted from Rialto Unified School District

The Digestion Story

The story we're about to tell is of stormy seas, acid rains, and dry, desert-like conditions. It's an arduous journey that traverses long distances and can take several days. It's one in which nothing comes through unchanged. It's the story of your digestive system whose purpose is to turn the food you eat into something useful – energy known as fuel for your body!

Down the Hatch

It all starts with that first bite of pizza. Your teeth tear off that big piece of crust. Your saliva glands start spewing out spit like fountains. Your molars grind your pizza crust, pepperoni, and cheese into a big wet ball. Chemicals in your saliva start chemical reactions. Seemingly like magic, starch in your pizza crust begins to turn to sugar! A couple of more chews and, then, your tongue pushes the ball of chewed food to the back of your throat. A trap door opens, and there it goes, down your gullet!

Next, your muscles squeeze the wet mass of food down, down, down a tube, or esophagus, the way you would squeeze a tube of toothpaste. It's not something you tell your muscles to do -- they just do it -- in a muscle action called peristalsis. Then, the valve to the stomach opens and pizza mush lands in your stomach!

Inside your stomach

Imagine being inside a big pink muscular bag -- sloshing back and forth in a sea of half-digested mush and being mixed with digestive chemicals. Acid rains down from the pink walls, which drip with mucus to keep them from being eroded.

Sound a little like an amusement ride gone crazy? Every time you think you've got your equilibrium back, the walls of muscle contract and fold in on themselves again. Over and over again, you get crushed under another wave of slop. Every wave mixes and churns the food and chemicals together more--breaking the food into even smaller and smaller bits. Then another valve opens. Is the end in sight you ask, as the slop gets pushed into the small intestine?

Inside the small intestine, chemicals and liquids from places like the pancreas and gall bladder break down and mix up the leftovers. The small intestine looks like a strange underwater world filled with things that resemble small finger-like cactuses. But they're not cactuses, they're villi. Like sponges, they're able to absorb tremendous amounts of nutrients from the food you eat. From the villi, the nutrients will flow into your bloodstream.

But hold on! The story's still not over yet -- the leftovers that your body can't use still have more traveling to do! Next, they're pushed into the large intestine. It's much wider and much drier. You find that the leftovers are getting smaller, harder and drier as they're pushed through the tube. After all, this is the place where water is extracted and recycled back into your body. In fact, the leftovers that leave your body are about 1/3 the size of what first arrived in your intestines!

Where Food Turns Into Poop

Finally, the end of the large intestine is in sight! Now the drier leftovers are various handsome shades of brown. They sit, at the end of their journey, waiting for you to expel them -- out your anus. Of course, you know the rest! A glorious, if slightly stinky, journey, don't you think?

Digestive System Simulation Steps

1. Build your model.
2. “Eat” (place in the mouth/sandwich bag) the banana and cracker. Slowly add the water.
3. Close your “mouth” (you should not chew with your mouth open!) by zipping the bag shut, and then “chew” (smash all the ingredients until no more clumps are present) in your snack.
4. Move the food to one side of the bag, toward the opening, and down the esophagus.
5. Swallow your food by squeezing the esophagus in rhythmic waves to move the food along.
6. Keep squeezing the esophagus until all of the food makes it way into the stomach.
7. From the stomach, the snack needs to pass into the small intestine. Squeeze the contents of the “stomach” into the small intestine. Place toe end of the panty hose inside the cup labeled “nutrients”. To simulate the removal of nutrients from the food, squeeze the liquid from the contents in the panty hose [Note: Removal of the liquid actually occurs in the large intestine.] into the cup.
8. Once all of the liquid has been squeezed from the food, take the panty hose out of the cup, cut the toe end of it and place it in the large intestine (knee high). Squeeze the food from the small intestine into the large intestine.
9. Once in the “large intestine” things should really be squeezed hard to remove the water into the “nutrients” cup.
10. Cut the toe end of the nylon (“the colon” – the end part of the large intestines) and squeeze the remaining solids into the paper cup (the rectum) with the slit in the bottom. Then fold the cup down to push the waste through the slit (anus) as poop.