

The Digestive System

Grade 5

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Science Content Standards: Grade 5, 2c — *Students know* the sequential steps of digestion and the roles of teeth and the mouth, esophagus, stomach, small intestine, large intestine, and colon in the function of the digestive system.

Lesson Concept: Different organs and structures perform different functions in the digestion of food.

Conceptual Flow:

- » The digestive system breaks down food so the body can use it for energy.
 - Different organs and structures perform different functions in food digestion.
 - a) In the mouth, teeth break and grind the food into smaller parts; saliva contains chemicals that are important in breaking down food.
 - b) The esophagus moves the food from the mouth to the stomach.
 - c) In the stomach, acids break the food down into parts that can be absorbed into the blood supply.
 - d) In the small intestine, food is neutralized and processed into molecules that can be absorbed into the blood stream.
 - e) The large intestine recovers water from the food.
 - f) The colon collects fecal waste (indigestible parts of food).
 - Once food is broken down into usable energy, it is transported via the circulatory system to all the cells in the body.

Teacher Background:

Digestion starts in the mouth, where chewing breaks down food into smaller pieces that can be easily swallowed and digested. Saliva contains chemicals that are also important in breaking down food. The esophagus is a tube that moves food from the mouth to the stomach after swallowing. In the stomach, the food is mixed with stomach acids that help to break down the food into parts that can be absorbed. Once food reaches the small intestine, it is neutralized and processed into molecules that can be absorbed into the blood supply. The large intestine recovers water from food, and the colon collects fecal waste (indigestible parts of food) and stores it prior to elimination from the body.

—Adapted and excerpted from the *Science Framework for California Public Schools: Kindergarten Through Grade Twelve*

Chemicals in saliva help to break down food in our mouths. Saliva contains an enzyme, amylase, which begins the chemical process of digestion. Enzymes are molecules that catalyze (bring about) chemical reactions. Each enzyme is specific to a certain chemical reaction. Amylase catalyzes the breakdown of starch into sugar. A catalyst is a substance that enables a chemical reaction to proceed at a faster rate than otherwise possible.

Foods that contain much starch but little sugar, such as rice and potato, taste slightly sweet as they are chewed because amylase turns some of their starch into sugar in the mouth.

In this lesson, **amylase** (an enzyme), which is commonly found in saliva, will be added to cause the break down of the starch (in the cracker). As the reaction progresses, less starch will be present and more sugar (maltose) will be formed.

The reaction of amylase will be observed by using iodine, which reacts with starch to form a dark brown/purple/blue/black color (color intensity may vary based on the concentration of the iodine and the amount of starch present). Usually iodine has a red-brown color. But when it contacts starch, iodine will turn a dark purple. In this lesson iodine will be diluted (mixed with water) to form a lighter brown color. As amylase breaks down starch, less and less starch will be present to react with the iodine and the color of the iodine solution will not darken to purple (because sugar molecules do not react with iodine).

<http://en.wikipedia.org/wiki/Amylase>

Note: Iodine stains (clothing, skin, etc.).

Accountable Talk

In Accountable Talk, students are able to discuss with a partner or in groups, a topic they are studying. The “stems” help students to focus their discussions and may be selected by the teacher; but the students should carry on the discussion with minimal interference from the teacher. Students will need to practice to listen to each other.

Accountable Talk sharpens students’ thinking by reinforcing their ability to build and use their knowledge. Teachers create norms and skills of Accountable Talk in their classrooms by modeling appropriate forms of discussion and by questioning, probing, and leading conversations. (from K-12 Alliance/WestEd Accountable Talk)

Accountable Talk Stems useful for this lesson:

I think this goes with _____ because _____.

I disagree because _____.

I agree because _____.

I notice _____.

Materials Needed for the Lesson:

For Engage

Teacher Preparation

- Copy the “Parts of the Digestive System Cards.” Make copies for groups of six and cut cards apart. Place each of the 6 sets of “Digestive System Organ/Structure Cards” into a zip-lock bag and label (Structure). These will be distributed to students first. Place each set of “Digestive System Function Cards” into a zip-lock bags and label (Function). These will be distributed to students after they place the Structure cards in order.

Student Handout

- “Parts of the Digestive System” Cards (For a group of six students: A set of “Structure Cards” and a set of “Function Cards”)

For Explore #1: The Mouth

Teacher Preparation

Gather the following materials:

- Saltine crackers (1 per student)
- Paper towel (1 per student)
- Iodine solution (can use tincture of iodine purchased at a pharmacy); make an iodine solution 1 part tincture of iodine to 4-8 parts water. Dilute iodine to a color of light brown and check how well that works to identify a starch. Pour the iodine solution into dropper bottle. You will need about 2 drops per student. This solution is light sensitive, so keep away from light if made ahead of time.
- Amylase solution (since saliva contains amylase you could collect about 4 teaspoons of your own saliva – or get some from a student volunteer); pour into dropper bottle (you will need about 5 drops per student)
- Test the iodine solution and the amylase solution ahead of time. Adjust ratio of tincture of iodine to water or number of drops used on cracker to make the experiment work. Usually iodine has a red-brown color and when it contacts starch, the iodine will turn a dark purple. You will be using a diluted iodine solution. The starch in the cracker should react with iodine to form a dark color. When the starch is almost all broken down by the amylase, the iodine solution will stay the original color. Some saliva has a very low or high concentration of amylase. You may need to obtain saliva for a different person to make the experiment work well.

Student Hands-on Materials

- For each pair of students: 2 crackers, 1 paper towel, 2 drops of iodine solution, 5 drops of amylase solution (number of drops may change based on teacher’s tests)
- Colored pencils

Student Handout

- Use science notebooks

For Explore #2

Teacher Preparation

Gather the following materials and keep a set to demonstrate:

- Long, thin balloons (but not too thin or students won't be able to place the bread into the balloon and move it down the balloon) (1 for each pair of students)
- Cooking oil (1 tsp per pair of students)
- White bread (1/4 slice for each pair of students)

Student Hands-on Materials

For each pair of students

- 1 long balloon, 1 tsp of cooking oil, 1/4 slice of white bread

Student Handout

- Use science notebooks

For Explore #3

Teacher Preparation

Gather the following materials:

- Unfrosted animal crackers (2 for each student)
- Zip-lock baggies (1 for each pair of students)
- 1/4 cup of water (1 for each pair of students)

Student Hands-on Materials

For each pair of students

- 4 unfrosted animal crackers
- 1 zip-lock baggie
- 1/4 cup of water

Student Handout

- Use science notebooks

5E Lesson: The Digestive System

Teacher Does	Student Does	Concept
<p><u>ENGAGE:</u></p> <p>Remind students that they have been learning about systems of the human body.</p> <p>▶ <i>What are some systems we have learned about?</i></p> <p>Write on the board:</p> <p>▶ <i>What do you know about the digestive system?</i></p> <p>Have students “think, pair, and share.”</p> <p>Place students in groups of 6. Distribute a set of “Digestive System Organ/Structure Cards” to each group. Ask students to place these cards in order that food would travel through the digestive system, starting with the mouth. After students have placed the cards in an order they think is correct, have them share the order. Write the correct order on the board.</p> <p>Distribute the set of “Digestive System Function Cards” to each group. Ask students to work in their groups to match the functions that go with each organ/structure of the digestive system.</p> <p>Write “Accountable Talk Stems” (ATS) on the board for students to use for their discussion:</p> <p>I think this goes with _____ because _____.</p> <p>I disagree because _____.</p> <p>I agree because _____.</p> <p>▶ <i>How did your group determine which function went with each organ?</i></p> <p>Ask each group to share one match, then write their match on the board; check to see whether any group(s) disagrees and have them give reasoning.</p>	<p>Expected Student Response (ESR): The respiratory system; the circulatory system</p> <p>ESR: It turns food into “poop”; stomach acid dissolves food.</p> <p>Place cards in order, then check with the list on the board; make any necessary adjustments on the order:</p> <p style="padding-left: 40px;">Teeth/mouth Esophagus Stomach Small intestine Large intestine Colon</p> <p>Determine which functions go with each organ/structure of the digestive system.</p> <p>Use the following AT stems for discussion:</p> <p>I think this goes with _____ because _____.</p> <p>I disagree because _____.</p> <p>I agree because _____.</p> <p>ESR: By reading the description, we matched the ones that seemed to go together first, then what was left we could tell by what we already knew.</p>	<p>Different organs and structures perform different functions in food digestion.</p>

Teacher Does	Student Does	Concept									
<p>solution on cracker #1. Wait 5 min. While waiting have students draw the chart on the right in their science notebooks.</p> <p>Encourage students to use the following AT Stems for discussion with their partners:</p> <p>I notice _____.</p> <p>Provide colored pencils to students.</p> <ul style="list-style-type: none"> ▶ <i>Place 2 drops of iodine solution on each cracker. Observe the change that occurs; record observations on chart. Use colored pencils to record observations.</i> <p>Go to <u>“Explain #1”</u>.</p>	<p>Record observations of both crackers.</p> <table border="1" data-bbox="764 352 1166 653"> <thead> <tr> <th></th> <th>Cracker #1 With amylase</th> <th>Cracker #2 Without amylase</th> </tr> </thead> <tbody> <tr> <td>After 5 minutes</td> <td></td> <td></td> </tr> <tr> <td>After adding iodine solution</td> <td></td> <td></td> </tr> </tbody> </table> <p>Use the following AT Stem for discussion: I notice _____.</p> <p>Use colored pencils to record observations of cracker #1.</p>		Cracker #1 With amylase	Cracker #2 Without amylase	After 5 minutes			After adding iodine solution			
	Cracker #1 With amylase	Cracker #2 Without amylase									
After 5 minutes											
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<p>Explore #2: The Esophagus</p> <ul style="list-style-type: none"> ▶ <i>From the mouth, where does the food enter?</i> ▶ <i>The esophagus is a long muscular tube that leads to the stomach. Food doesn’t travel by gravity; rather it is pushed by a wavelike contraction of muscles known as peristalsis. The esophagus makes quick work of this job. It can squeeze food to the stomach in 7 seconds.</i> ▶ <i>The next activity will simulate how the esophagus works. Model and have students follow along:</i> <ol style="list-style-type: none"> 1) <i>Cut the end off the balloon so that it makes a long, flexible tube.</i> 2) <i>Pour 1 teaspoon (5 ml) of cooking oil into the balloon.</i> 3) <i>Take the ¼ piece of bread and make it into a ball about the size of a marble.</i> 4) <i>Stick the bread into one end of the balloon.</i> 5) <i>Squeeze the balloon behind the ball of bread with one hand. Keeping that hand in place, cross your other hand over the first hand, continue squeezing to move the bread down the balloon.</i> ▶ <i>This activity simulates “peristalsis” the</i> 	<p>ESR: Food enters the esophagus.</p> <p>Working with partner, follow along with the teacher.</p>	<p>The esophagus moves the food from the mouth to the stomach.</p>									

Teacher Does	Student Does	Concept
<p><i>rhythmic, wavelike contractions of the muscles that line the digestive tract.</i></p>		
<p>Explore #3: The Stomach</p> <p>Distribute materials to each pair of students: 4 unfrosted animal crackers, zip-lock bag, and ¼ cup of water.</p> <p>Tell students to place broken cookies and water into the zip-lock bag and squeeze the bag many times.</p> <p>Go to “Explain #3”.</p>	<p>Follow along with teacher.</p>	<p>In the stomach, stomach acids break food down into parts that can be absorbed into the blood stream.</p>
<p><u>EXPLAIN:</u></p> <p>Explain #1</p> <ul style="list-style-type: none"> ▶ <i>What color did the cracker without amylase turn when you added the iodine? If you add iodine to a substance and the color of the iodine turns dark purple, what can we infer about what the substance contains?</i> ▶ <i>Did the cracker with amylase turn dark blue/purple with iodine?</i> ▶ <i>What inference can we make about amylase?</i> ▶ <i>In your science journals, write a sentence that contains the following words: saliva, amylase, starches, sugars.</i> <p>Go to “Explore #2.”</p> <p>Explain #3:</p> <ul style="list-style-type: none"> ▶ <i>Food moves from the mouth to the esophagus, then through the esophagus. What do you think the baggie represents? Cookie represents? Water represents?</i> ▶ <i>What does the squeezing represent?</i> <p>(Note: provide students with proper answer “the squeezing of the stomach muscles mixes the food and acid that further digests the food.”)</p>	<p>ESR: Dark blue/purple</p> <p>ESR: Starch</p> <p>ESR: No it did not.</p> <p>ESR: It gets rid of the starch; it changes the starch into something else.</p> <p>ESR: Saliva contains amylase which breaks down starches into sugars.</p> <p>ESR: The baggie represents the stomach, the cookies represent the food, and the water represents stomach acid.</p> <p>ESR: The stomach digesting the food.</p>	<p>Saliva contains compounds that are important in breaking down food.</p> <p>In the stomach, acids break the food down into parts that can be absorbed into the blood supply.</p>
<p><u>EVALUATE:</u></p> <p>Distribute Student Handout “Digesting Food.”</p> <ul style="list-style-type: none"> ▶ <i>Make a diagram of the first three phases of the digestive system and explain each.</i> 	<p>ESR: In the mouth, food is broken into smaller pieces and the saliva breaks down starches into sugars. The esophagus moves the food</p>	

Teacher Does	Student Does	Concept
	<p>down to the stomach by squeezing. The stomach squeezes and squishes food and along with stomach acid continues breaking down the food</p>	
<p><u>EXTEND:</u></p> <p>Some saliva has a very low or high concentration of amylase. Have students design an experiment to test different saliva. The design should keep the importance of hygiene in mind.</p> <p>How Amylase Works http://www.lessonsrips.com/docs/pdf/amylasework.pdf</p> <p>Kid's Health – Digestive System http://kidshealth.org/parent/general/body_basics/digestive.html</p> <p>Based on what they learned in the lesson, have your students rewrite or add to some of the "Digestive Function Cards".</p> <p>Conduct an activity that connects the digestive systems to the circulatory system (see "Blood Circulation Simulation" lesson on this website: www.lakesc.lake.k12.ca.us/lessons/doc/Grade5_Blood_Circulation_Simulation_TLC2010.doc</p>		<p>The digestive system breaks down food into molecules that can be used as energy for the body. The circulatory system carries oxygen and nutrients to various body parts through blood.</p>

Input Question: Match the functions that go with each organ/structure of the digestive system. (Engage)

Process Question: How might the digestive system change food into a form that can be used by the body? (Explore)

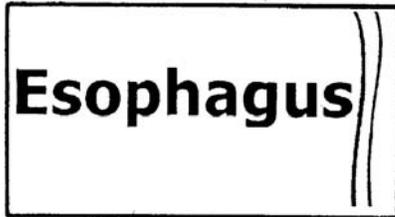
Output Question: What does the squeezing represent? (Explain #3)

FOR "ENGAGE"
Parts of the Digestive System

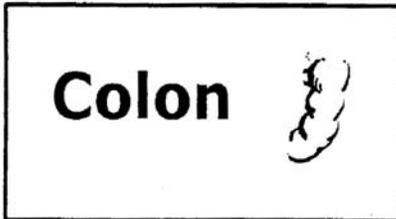
Make six copies of this page. Cut apart cards. Place each set of the "Digestive System Organ/Structure Cards" into one set of baggies and "Digestive System Function Cards" into another set of baggies.

Digestive System Organ/Structure Cards

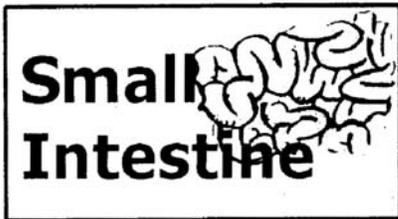
Digestive System Function Cards



I chew up food into small pieces and mix it with saliva.



I'm a large tube that removes water from undigested food. I also get rid of all the food the body can't use.



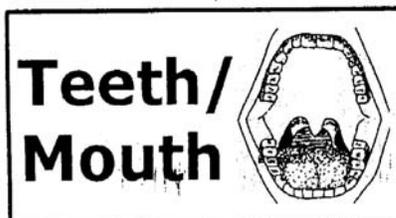
I'm a muscular tube that makes sure food gets from the mouth down to the stomach.



I'm a bag that blends food together and stores it for use by the body.



I'm a long, curly tube with a shaggy lining, that breaks down food more thoroughly. I pass on any food that isn't used to the large intestine.



I collect fecal waste and keep it until it is eliminated (pooped).

STUDENT ASSESSMENT
Digesting Food

Make a diagram of the first three phases of the digestive system and explain what happens in each (mouth, esophagus, stomach).