

In one way, out the other! A Lesson on Digestion ☺

Lesson Type: Module

Target Grade: Elementary

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Brief Overview

In this lesson students will head down the digestive system highway—in one way and out the other! Along the way there will be three modules that focus on three different stops on the highway—the mouth, the stomach and the intestines. Warning—this lesson may get poop.

For those of you interested in learning more about the digestive system yourself—here is a great link to a khan academy crash course in digestion: <https://www.khanacademy.org/partner-content/crash-course1/partner-topic-crash-course-bio-ecology/crash-course-biology/v/crash-course-biology-127>

Teaching Goals

- Understand the main purpose of the digestive system is to convert food into a form the body can use.
- Understand how the mouth, stomach, and intestines function together to make up a system
- Understand how different systems function together in the body
- Understand the difference between chemical and physical breakdown and how both are used in the digestive system

Agenda

- Introduction **(10 min)**
- Module 1: The Mouth **(15 min)**
- Module 2: The Stomach **(15 min)**
- Module 3: The Intestine **(15 min)**

Lesson Introduction

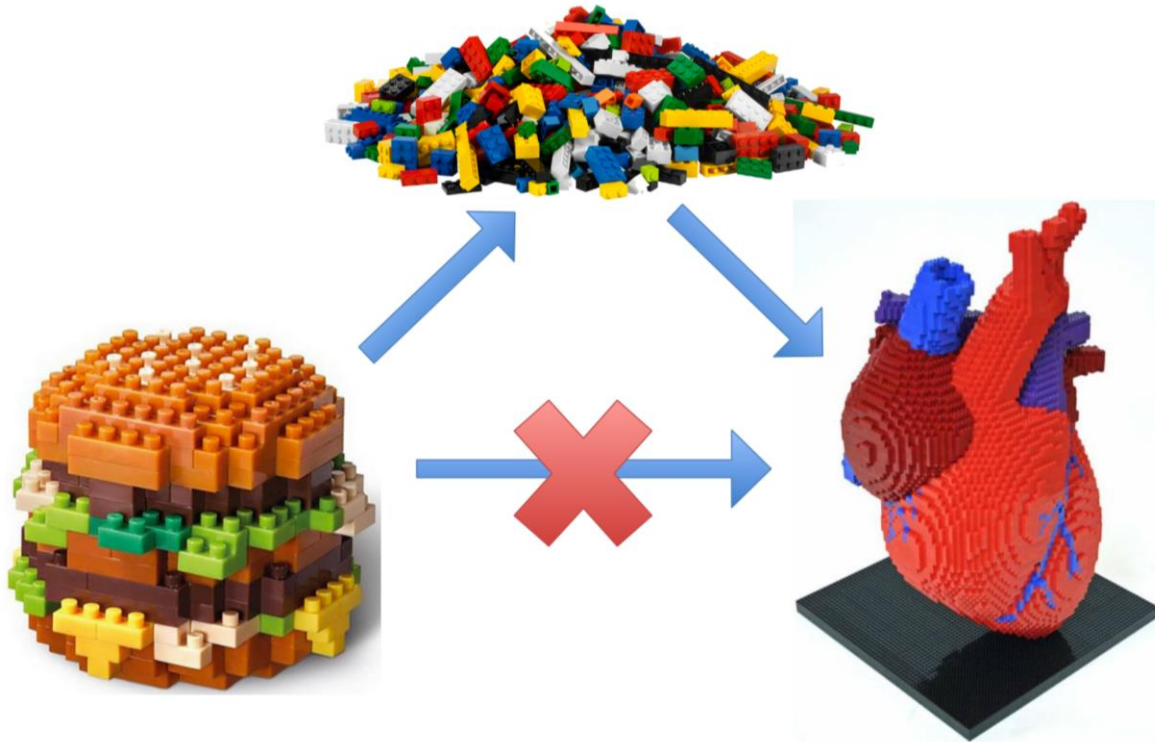
The purpose of the introduction is to encourage students to think about the importance of the digestive system. Some may have a surface level understanding of digestion, others may only know that somehow the food you eat turns into poop.

Begin the discussion with asking the students what they ate for lunch. Then ask them why they ate? Were they hungry? What happens when you get hungry? Do you get drowsy, tired—do you feel like you need energy?

Now here's the fun one—ask the kids where poop comes from. You will likely get some interesting answers, probably a few exasperated “Ewwwwwwwwws” 🤢 🤢 🤢

We need to eat so we can get energy and nutrients from the food so that our bodies can function. But, how does the turkey sandwich Sally ate, or the cheese and crackers George ate power our bodies? Somehow the food needs to be broken down into something that our body can use.

A good analogy to use here are something many of the kids are familiar with—Legos. In order to build something you want you must first break the legos apart so that you can rearrange them as you like. Your digestive system essentially does the same thing to the food you eat—it breaks food down to its component pieces so that it can use it for things that it needs 😊



This is the purpose of our digestive system. It breaks down the food we eat into something the body can use. It is almost like a highway—the sandwich Sally ate and the cheese and crackers George ate goes in the mouth and through a series of tubes and organs, changing and breaking down along the way, until it exits the highway in a way we are all familiar with—and ends up in the toilet. Today we will journey down this digestive highway, making three stops along the way—the mouth, the stomach, and the intestines.

Module 1: The Mouth

Introduction

The first stop on the digestive highway is the mouth. The minute food is placed in your mouth your body wastes no time and begins to break it down right away. Every part of the mouth has a purpose in digestion, from the tongue to the teeth to the saliva.

This module is designed to encourage students to think about the different parts of the mouth and how they work together to physically and chemically break down the food they are chewing.

Background:

So how does the mouth help break down food?

Teeth



The teeth grind and tear the food apart! This is ***mechanical breakdown***. It also helps break food apart so that the enzyme amylase in the saliva can get to more of it!

Saliva



Saliva helps to lubricate the food so it slides down easier. It also contains the enzyme ***amylase***, which breaks down starches

Tongue



The tongue helps to move food around, exposing it to more amylase, and more chomping ☺

Enzymes? What the heck are those?

Enzymes help reactions go faster by lowering the activation energy. One characteristic of enzymes is that they are not consumed in the reaction. It may be helpful to go back to the lego analogy. The legos won't spontaneously break apart on they're on—you need to use your hands to help them do it. In this analogy your hands are the enzymes—they are not used up in the reaction, and you can only break apart the legos so quickly. More hands would help break apart a large amount of legos faster.

Materials

- Test Tube—one per student
- Saliva (I'm sure the kids will be happy to supply their own)
- Iodine solution
- Starch solution (prepared earlier)
- Plastic Pipettes

Procedure:

Note: Have paper towels handy

1. After the introduction split the students into groups of three or four. Hand each student a test tube and test tube cap.
2. Ask all but one person in the group to spit into their test tube until it is half full of saliva (not half empty ☺) Make sure one person in each group does not spit in the test tube —

this is the control. You may also have a control for the entire class. The control will be half filled with water.

3. Add three drops of starch solution to each test tube (including the control) using the plastic pipette. **DO NOT ADD MORE THAN 3 DROPS** (or it will take forever...) **Save one clean pipette for the iodine solution.**
4. Have the students with saliva in their test tube, cap and shake the test tube, inverting it back and forth, so that the amylase comes into contact with all of the starch.
5. Iodine is an indicator for starch. This means that when it comes into contact with starch it will turn a dark bluish-purple. Demonstrate this with one of the control test tubes that has only starch solution by adding one drop of iodine (or as many as it takes to change color—one to three drops should be sufficient). Have them observe the dark bluish purple color the iodine changes.
6. Have the students add the same amount of iodine to the saliva/starch solution and observe what happens.

Note: depending on how much saliva was in the test tube, the temperature and how much it was shaken, some of the starch may not be completely broken down and may turn the iodine purple. If this happens, then set the test tubes aside and have the students come back and observe them after a few minutes. As the starch is broken down the solution will lose its color.

Wrap Up

Here are some questions to discuss with your kids

Question	Explanation
Ask students to make predictions as to why the saliva solution differed from the purely starch solution	The saliva in the student's spit contained amylase, an enzyme that breaks down starch into sugar. The amylase broke the starch so when the iodine was added, there was no starch present to turn the iodine purple.
Why did we need to shake the starch/saliva solution?	One reason is that shaking increased the surface area that the amylase came into contact with. This causes the reaction to proceed faster. This is similar to one of the functions of the teeth and chewing—to increase the surface area of the food so that the amylase can come into contact with the starches.

SafetyTip: In this activity you will be using Iodine. Iodine is not extremely toxic, it has many topical uses and even a small amount of it is needed in your body for proper thyroid function. Encourage students to exercise common sense—it should not be consumed, put in the eyeballs, and take precaution not to spill it because it does stain and can be a mild irritant.

Module 2: The Stomach

Introduction

Once the chewed up food is swallowed it enters what is known as the esophagus, a long tube that leads to the stomach. The food is pushed down the esophagus by a process called

peristalsis, which is basically a series of random muscle contractions. (Demonstrate peristalsis by squeezing the fist of one hand and then the other hand). This keeps the food moving in the right direction.

Begin this module by asking the students: What do you already know about the stomach? What is its purpose? How big is it? How does it work? These questions will be answered in this module.

Materials

- Soda crackers
- Ziploc bags (quart sized or sandwich sized)
- Orange juice

Procedure

1. Hand each student a Ziploc bag—explain to them that this is going to be their stomachs. Explain that the actual stomach looks more like a balloon than a Ziploc bag and it expands and contracts depending on the amount of food in it.
2. Have students crush up crackers with their hands and put them in their Ziploc—this is to remind them of how the mouth has already started to break down the food before it even gets to the stomach.
3. Add orange juice to the “stomach”—this is to represent the stomach excreting stomach acid and enzymes. (The orange juice does not contain these enzymes, and is not as acidic as stomach acid (pH of 2 versus pH of 4) but it still serves as a decent model)
4. Have the students squeeze their “stomachs” with their hands. This represents the stomach muscles contracting and undergoing peristalsis.

Discussion

Question	Explanation
How has the consistency of the crackers changed? What do you think allowed this to happen? Was it the crushing? The orange juice? Or a combination?	Once the contents of the “stomach” are a paste-like consistency, the food contents are now called chyme , the stomach has done its job, and the chyme will now travel into the small intestine—our next stop on the digestion highway.

Module 3: The Intestines

Introduction

The partially digested food—now called chyme---is entering the most important part of the digestive system—the small intestine. The stomach and mouth begins the breakdown of food, but it is the small intestine that completely breaks down the food, and absorbs all of the nutrients your body requires to function. After the nutrients are absorbed the waste material your body does not need continues to the large intestine where it eventually makes its way to the toilet.

Materials

- Nylon panty hose
- Cooked oatmeal
- Newspaper/plastic (something to put on floor to deter mess)
- 20 feet of yarn

Module Overview

This module serves two purposes: to help students understand the way small nutrients are absorbed through the villi of the intestine whereas the larger waste material is passed on through the large intestine and eventually out of the body. It will also give a visual for how long the intestine is.

Procedure

Note: this may need to be done outside—it's going to get messy.

1. Divide the students into as many groups as there are panty hose and distribute a panty hose leg to each group. Make sure the panty hose leg is cut off on both ends
2. Put the newspaper or garbage bags on the floor/desk to protect it from mess. Use at least 2 layers of newspaper as the oatmeal will be wet.
3. Give each group a cup of partially cooked oatmeal. Have one student hold the pantyhose open and have another student hold the pantyhose about 5 inches down to making sure the oatmeal doesn't fall completely through. Instruct the students to work the oatmeal through the panty hose by squeezing it downward. Explain to them that the oatmeal is representative of the chyme that has just come from the stomach and is now working its way through the small intestine.
4. The smaller "molecules" in the "chyme" will be absorbed through the pantyhose much like the smaller sized nutrients and molecules would permeate through the walls and villi of the small intestine. The solid part of the oatmeal is too big to fit through the intestine walls and represents the indigestible material such as fiber and cellulose, which the body cannot break down. It will remain in the intestine and work its way to the large intestine and then eventually out of the body.
5. Be sure to explain to students that the smaller molecules that are absorbed enter into the bloodstream where they are then delivered to cells and organs, which need them to function.

After this activity is finished ask the students how long the small intestine is. Then bring out the 20 ft long yarn as a reference to show them how long it really is. Why do you think the intestine needs to be this long?

Explanation: One main reason the intestine is so long is to increase the surface area so the maximum amount of nutrients and small molecules can be absorbed and delivered to the rest of the body. More intestine= more chances for nutrients to be absorbed.

Tips for Mentors: This will get messy. Do it outside if possible. Have paper towels on hand.