

DIGESTIVE SYSTEM Grade 3-5

BACKGROUND

Tissue is the building block of body organs. Organs perform specialized functions in the body. Organs that work together to perform a particular function in the body are called a **Body System**. In the human body there are numerous body systems, each with a particular function. All body systems work together to sustain life.

Several different kinds of tissue can be present in one organ. For example, within the stomach, a major organ in the Digestive System, one kind of tissue churns food and moves it to the intestine. A second tissue produces digestive juices in the stomach and a third tissue makes up the protective covering for the entire stomach.

ORGANS OF THE DIGESTIVE SYSTEM:

- **Mouth** (including the tongue and the teeth) – This is the **entry point** for food into the body.
- **Esophagus** – A hollow tube (about 10" long in an adult), it **extends from the throat to the stomach**.
- **Stomach** – The stomach is a hollow organ. It can expand, holding up to five cups (2 ½ pints) of food. The **stomach churns and chews** food by means of muscle action and digestive juices.
- **Small Intestine** – This hollow organ **connects the stomach and the large intestine**. **Nutrients** are absorbed from the SI into the body. In an adult the small intestine is about 20 feet long, and about 1" in diameter. It is folded and coiled in the **abdomen**.
- **Large Intestine** – This is a hollow organ also. The **small intestine empties into the large intestine**, sometimes referred to as the colon. It is about 5 feet long, and about 2 ½" in diameter.

FUNCTIONS

The functions of the Digestive System are to take the food we eat and break it down (**digestion**), retain the nutrients (**absorption**), and remove the remainder (**elimination**) from our body.

DIGESTIVE PROCESS

In many ways the digestive process begins with our sense of smell and sight. Triggered by aroma, the salivary glands begin making **saliva**, a digestive juice. The esophagus begins to move and the stomach releases digestive juices in anticipation of food.

When the first bite is taken, **teeth chop and grind** the food. The **tongue**, a muscle, moves food around in the mouth to mix it with saliva, for more chewing, and then to the back of the mouth for swallowing. **Saliva contains enzymes that assist the breakdown of food.**

Swallowing is a complex coordinated series of activities where we momentarily stop breathing and talking. Openings to the voice box, the lungs and the nasal passages are temporarily shut off, allowing food to enter the proper opening and travel down the esophagus.

The **esophagus** is a hollow tube located behind the windpipe (trachea) and in front of the spine. The esophagus has layers of muscle that contract in circular and lengthwise motions. This causes powerful wavelike movement called peristalsis. **Peristalsis moves food** from the throat to the stomach in about 10 seconds. Peristalsis even allows food to be moved through the esophagus when we are upside down!

Food moves from the esophagus into the stomach, which is located beneath the left lung. The five lowest ribs protect the stomach.

The stomach contracts and expands, **chewing the food while mixing it with digestive juices**. These juices contain **enzymes** that break down the complex chemicals in food into simpler units that can be absorbed or eliminated by the body. Stomach acid is also released, which kills off bacteria and assists in digestion.

The churning of the food from the muscle action and the breakdown of the food structure from the digestive juices turns what began as a hamburger, a garden salad, or an apple into a **soupy paste**. Stomach muscles then move the paste to the duodenum, which is the first part of the **small intestine**.

Carbohydrates are usually the first to move into the small intestine. Proteins and fats are more difficult to digest and remain longer in the stomach. It generally takes from two-four hours for food in the stomach to be digested.

Hollow and very long (about 20' long in the average adult), the small intestine is folded and coiled into the abdomen. The inside of this organ is lined with millions of **villi**, very small projections (in an area as small as a fingernail there may be as many as 4,000 villi!) that move back and forth and help **bring nutrients from the small intestine into the bloodstream**.

The **pancreas** and the **liver** secrete more digestive juices into the small intestine. Enzymes in these juices finish the digestive process. Carbohydrates are converted into **sugar**, and later into **glucose** by the liver. Digestion of proteins and fats continues.

Finally, amino acids and simple sugars become absorbed into the bloodstream with the help of the villi. Fatty acids move through the lymph vessels, while vitamins and minerals can pass unchanged from the small intestine into the blood or lymphatics.

What cannot be used or stored by the body is eventually **eliminated** from the body. The remaining material moves **from the small intestine to the large intestine**, secreting mucous but not enzymes, so no further digestion occurs.

Some of the water in the remaining paste is re-absorbed and the waste material becomes more solid. It is then stored in the large intestine until the **muscle peristaltic action (contractions) of the large intestine move the stool (feces) to the rectum where it passes out of the body**. Dietary fiber from fresh vegetables, fruits and whole-grains aids in large intestine peristalsis and helps prevent constipation.

VOCABULARY

Digestion: How the body changes food into energy

Absorption: How energy from food is taken (or assimilated) into the body

Elimination: How the body gets rid of (expels) waste products

Abdomen: The part of the body between the chest and the pelvis which encloses the stomach, intestines, liver, spleen and pancreas.

Saliva: A clear liquid produced in the mouth which begins the process of digestion. Special chemicals in saliva called enzymes not only begin breaking down the food, but also help fight off infections in the mouth. You produce between two-four PINTS of saliva each day!

Esophagus: The tube that connects the throat to the stomach. (It is about 10 inches long in a typical adult.)

Stomach: A hollow sac-like organ that continues the process of breaking down the food that we eat and changing it into energy. The stomach mixes the food, bathing it in acids and enzymes until it becomes a semi-liquid substance, only absorbing a few substances into the blood.

Small Intestine: The longest part of the digestive tract (about 20 feet long!), the small intestine is where the digestion of fats, proteins, and carbohydrates takes place.

Large Intestine: Larger in diameter than the small intestine but much shorter (only about five feet long), the large intestine is responsible for absorbing water and getting rid of (excreting) solid waste.

BASIC LESSON

Objective(s)

Students will be able to... identify the **major organs** of the Digestive System, identify the **function** of the digestive system, and explain the **digestive process** from the mouth to the large intestine. (knowledge and comprehension)

State Science Content Standard(s)

1.1: Develop abilities necessary to safely conduct scientific inquiry, including asking questions about objects, events, and organisms in the environment.

- ❖ Make observation using the five senses
- ❖ Record observations by drawing or orally explaining

3.1: Identify that plants and animals have structures and systems that serve functions for growth, survival, and reproduction.

- ❖ List characteristics of living organisms (body systems)

Materials

Safety

From the Kit

- Digestive System Chart
- Spray bottle (labeled "SALIVA")
- Bowl (labeled "MOUTH")
- Tube (preferably clear, labeled "ESOPHAGUS")
- Bottle (labeled "GASTRIC ACIDS")

Provided by Teacher

- Cracker
- Bag of microwave popcorn
- Blender (labeled "STOMACH")
- Gallon Ziploc bag

- Be aware of cleanliness when using food items and are when using the blender.

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| <ul style="list-style-type: none"> Clear plastic tube labeled "SMALL INTESTINE" Clear plastic tube labeled "LARGE INTESTINE" 10 inch piece of ribbon 20 Ft. piece of ribbon 5 ft. piece of ribbon One liter soda bottle Two Forks Food smasher | | |
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|-----------------------|--------------------------|
| Key Vocabulary | Mastery Questions |
|-----------------------|--------------------------|

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|---|---|
| <ul style="list-style-type: none"> Mouth Saliva Digestive System Stomach Gastric Acids Esophagus Small Intestine Large Intestine Abdomen | <ul style="list-style-type: none"> See lessons for questions |
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| Detailed Plan |
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Lesson 1: What Major Organs are Part of the Digestive System?
What is the Digestive Process?

Introduction: (Do not have the digestive chart displayed yet. You are trying to see what your students already know.)

Write "**Digestive System**" on the board. Have the students take out a sheet of paper and draw every part of the body that has to do with the Digestive System. Tell them NO MORE than that. Let the students think. When they are done have them flip their papers over.

Explore

Problem: What parts of the body are included in the Digestive System?

1. Explain to the students that the Digestive System includes any part of the body that changes food into ENERGY or FUEL for the body. Show the students a cracker and ask, ***"What happens to this cracker when I eat it? Where does it go in the body? Think of EVERY place it goes."***
2. Next have students draw a NEW picture of every part of the body that is involved with this cracker after we put it into our body. Ask: ***"Did anything change from your first picture? Did you remember anything different this time?"***
3. When the students are done drawing, ask, ***"What would be the FIRST step in the process of digesting this cracker?"*** Call on students (if a student says the stomach is first, draw the stomach on the board, then ask if anyone can think of anything else that would come BEFORE the stomach.) Try to draw digestive system parts proportionally as you go along so that you eventually draw the

outline of the Digestive System.)

4. Ask: ***“Is there anything BETWEEN the mouth and the stomach?”*** (If no one thinks of the esophagus, remind them and draw it in. Say: ***“We now have steps one, two, and three. Now where does the cracker go AFTER it reaches the stomach? Does it just stay there? Did anyone think of what comes NEXT in the process of digesting the cracker?”*** (Again, have students share their ideas with the class. Otherwise tell the students about the small and large intestines. Have the students adjust their drawing.)

Explanation

1. Ask: ***“The MOUTH is part of which Body System?”*** (The Digestive System.) ***“What does the mouth do?”*** (The mouth chews our food. This is where food begins its journey in the body. The mouth chews food into smaller pieces, and chemicals in the saliva begin the process of breaking down the food into usable energy (digestion.)
2. Ask: ***“What is ANOTHER part of the Digestive System?”*** (The stomach.) ***“Where is the stomach?”*** (You will likely hear many misconceptions, so if possible, show the students on a chart of the Digestive System, then have them try to locate where their ribs are and indicate where their stomach is.)
3. Ask: ***“What do you know about the stomach?”*** (Write responses on the board, and refer again to an anatomical chart. Explain to the students that the stomach is like a BAG. It is HOLLOW and can hold a lot in it.)
4. Ask: ***“How much can the stomach hold?”*** (Explain that an adult’s stomach can hold about ONE LITER of food. Illustrate this concept by showing the students a **one-liter soda bottle**.) Say, ***“An ADULT’S stomach can hold about 1 liter (1 quart) of food; a CHILD’S stomach holds a little less. As you eat your stomach gets BIGGER. It EXPANDS, like a balloon.”***
5. Ask: ***“How does food get from the mouth to the stomach?”*** (A tube called the **esophagus**.) Using a **10-inch length of ribbon or tubing** as a visual aid, explain that the esophagus of a grown person is about ten inches long.
6. Ask: ***“Where does food go after it leaves the stomach?”*** (Note responses from the students. Use the **digestive chart** to show the students that digested food moves from the stomach to the **small intestine** and then to the **large intestine**. Explain that the small and large intestines are very long tube-like organs. The small intestine in an average adult is approximately 20 feet long. Show the students a **20-foot length of ribbon** coiled up on a table or desk. Ask a student to volunteer to hold the string. Put the string in the student’s open palms and have them hold one end of the string with their thumb and finger. Take the other end of the string and SLOWLY pull it out lengthwise, walking away from the student who is holding the string until the entire 20-foot length is fully extended. Point out that this illustrates just how long the small intestine is.)
7. Ask: ***“How does all of that FIT into your belly?”*** (It is coiled and folded over many, many times.) Tell the students that the small intestine is where food is DIGESTED completely and absorbed into the bloodstream. What can’t be digested is then sent to the LARGE INTESTINE.
8. Ask: ***“Do you know why it is called the LARGE intestine?”*** (It is larger in diameter than the small intestine. The diameter of the large intestine is two and a half inches, compared to one inch for the small intestine. Use **two labeled hollow tubes** to illustrate the difference between the two intestines. One tube should have a 1” diameter, and the other a 2 ½” diameter.)
9. Ask: ***“How long is the LARGE INTESTINE?”*** (Have students guess, then show the students the **five-**

foot length of ribbon. Have volunteers stretch it out and measure it.) Ask: "And how does all that fit in your belly, too?" (It has folds too, and it forms sort of a big circle inside the body.)

10. Ask: **"What is another name for the belly?"** (The ABDOMEN.) Ask: **"Where IS your abdomen?"** (The soft belly of our body, right below the ribs.) Have students put their hands on their abdomen. Ask: **"What does the abdomen do?"** (It is the place in our body between the chest and the pelvis that holds our small intestine and our large intestine.)

Assessment: "My Digestive System"

Have students do this part individually. Cover the information that was previously written on the board, then review material above and use this as an assessment.

Have students work in pairs for the first part of this practice, tracing the outline of each others' body on a large sheet of butcher paper or newsprint. Instruct students to draw their faces, hair, nose, glasses, and other features on the outline. Then have students label the major parts/organs of the Digestive System on the paper.

Now have the children draw a cracker (or other food of their choice) in each major organ, showing each place where that food travels. **NOTE: Save this paper for Lesson 2.**

Collect the students' first drawing of the Digestive System and compare to their more recent drawing.

This life size drawing can also be saved and used with the other body systems' lessons.

Lesson 2: What is the Process of the Digestive System? What are the Functions of the Digestive System?

Introduction

1. Pop a bag of popcorn and set it in the classroom.
2. Ask: **"What do you smell? See? From what you smell and see, what is now happening inside your mouth?"** (The mouth is producing more saliva (fluids produced in your mouth to help digestion).)
3. Ask: **"Does what you smell make you hungry? Does what you see make you want to eat this bag of popcorn?"** (Use the answers to get the students to discuss how sight and smell affect their desire to eat. Tell the students that the sight and smell of food actually DOES START the digestive process. Your body is ready for the food even before you've taken even one bite of food.)
4. Pass the popcorn around to the students and let them take a few pieces. Ask them to take ONE piece and place it in their mouth, letting it stay there UNCHEWED for a minute or two. Then have them begin to chew the popcorn SLOWLY, paying attention to the amount of saliva in their mouth, AND to how the TASTE and TEXTURE of the food changes from the contact with the saliva and then from the process of chewing.

Exploration/Explanation

Ask: ***“Why does our body have digestion?”*** (If students do not understand right away, ask further questions: ***“Why do we eat? What happens if we do not eat?”***)

Reinforce: ***“We need energy to be alive, to play, to learn, to read, and even to sit. Our Digestive System takes the food we eat and turns it into energy. It does this by breaking it down. This is called DIGESTION.”***

Steps in the Digestive Process

Simulate how our body digests food. NOTE: You may want to do this after lunch – ask the lunch room attendants if you can have one complete meal after lunch to use for the experiment (or you may bring in your own food – a sandwich or piece of fruit or cracker.)

You’ll need the following items:

- **Spray bottle (labeled “SALIVA”) with water**
- **Bowl (labeled “MOUTH”)**
- **Tube (preferably clear, labeled “ESOPHAGUS”)**
- **Blender (labeled “STOMACH”)**
- **Bottle (labeled “GASTRIC ACIDS”) with water**
- **Two Forks and food smasher**

Have the Student create a four column table or make copies of the table provided in the binder to record what is happening to the food as the digestive process occurs step by step. At each step have students write down where the food is, what it looks like, and explain what the body is doing at each point along the digestive tract (four columns.) For example, Step 1: ***“Where is the food?”*** (In the bowl labeled Mouth.) ***“What does it look like?”*** (A cracker.) ***“What is the body doing?”*** (The mouth is making saliva, the esophagus is moving, and stomach is making juices.) Make observations and record information throughout the entire lesson.

Step #1. Sight and Smell: Digestion

“The first part of the digestion process happens even BEFORE we eat our food. A lot happens in our body to get ready for the food. When we see or smell food, our mouth creates a watery juice. Does anyone know what that juice is called?” (Saliva.) Have a volunteer add 1 or 2 sprays of “saliva” into the **mouth bowl.** ***“What is the tube called that connects our throat with our stomach?”*** (The esophagus.) ***“The esophagus begins to move.”*** (Show how the esophagus starts to move – wave like motion to move the food down.) ***“Then the stomach starts to make special juices that help turn the food into fuel.”*** (Have a volunteer pour stomach juices into the stomach (blender).)

Step #2: In the Mouth: Digestion

Take the first piece of food from the tray and place it in the “mouth”(bowl). Have a couple of volunteers come forward. Ask: ***“What does your mouth have to help break up food?”*** (Teeth, tongue.) ***“What do your teeth do?”*** (Chop, grind, smash, etc.) ***“What would happen if you put a piece of food in your***

mouth?"

1. Give a volunteer **two forks** to break down the food and tear it apart. Have another volunteer "smash" the food with a **food masher**. Ask students to think about what the tongue does to help. Have the students examine the food to see how it has changed.
2. Ask: **"What happened to the food?"** (It was broken up into chunks.)
3. Ask: **"How did the food get smaller?"** (The teeth chopped up the food.)
4. Ask: **"Besides chopping the food, what else does the mouth do? What kind of juice is our mouth making the whole time we are eating?"** (Make saliva and help cover the food with saliva. Remember – saliva contains enzymes that help break down the food.)
5. **"Let's see what saliva does to the food."** Demonstrate by spraying "saliva" into the "mouth" bowl. Continue to mash and chop. Ask: **"What happened when the saliva started working on the food?"** (The food got softer and became more of a liquid.) **"The mouth, with the saliva, the teeth and the tongue, mash the food up into small, soft parts so we can swallow it."**
6. **"Observe: what does the food look like?"** Have students record their observations.
7. Reinforce: **"TEETH CHOP and GRIND the food when we take a bite. The TONGUE, which is a MUSCLE, moves food around in the mouth, and the watery juice that our mouth has been making, SALIVA, goes to work breaking down the food."**
8. Ask: **"How does food get from the throat to the stomach?"** (We swallow the food at the back of our mouth and it travels down the esophagus into the stomach.) **"The esophagus is a very STRONG tube. It has muscles in it that move food down to our stomach. It only takes about 10 seconds for food to get to the stomach."**
9. Make sure the food is broken down enough to go down the tube (esophagus.) Do not actually put food in it because it may plug up and then is impossible to clean. Ask: **"What happens if you don't take the time to thoroughly break up the food in your mouth?"** (The pieces may be too big to go down the esophagus and you could **CHOKE**.) (NOTE: you may not want to take the time to completely break up all of the food. Just tell the students to pretend and put it in the "stomach.")

Step #3. In the Stomach: Digestion

"Now let's see what happens in the stomach. Predict: what do YOU think the stomach does? How does the stomach turn food into liquid?" (The stomach has **MUSCLES** that continue to chew the food, and it also has

DIGESTIVE JUICES that help breakdown the food even further.)

Explain: "Now we are going to see what happens to the food in the stomach. To demonstrate, add more "gastric acids" to the mix so that the blender will have about 3-4 cups of "digested" food when you are finished. Run the blender on "Medium" or "High" to liquefy the food and turn it into a soupy paste. Pour the mix into a strong, clear gallon zip lock bag, and have the students look at it, explaining that this is the digested food in the stomach (the bag.)

Ask: **"How long do you think it takes the stomach to digest food?"** (It takes the stomach two-four **HOURS** to digest food.) **"Foods like bread, cookies, and vegetables, called CARBOHYDRATES, get digested first. Foods like meat, called proteins, and the fat in food (like mayonnaise or butter) take longer to digest."**

Again, have students record their observations. (What does the food look like in the stomach? What does the stomach do? etc.)

Extend: *“Besides breaking down food through grinding and fluids the Digestive System also has two OTHER important functions: ABSORBING NUTRIENTS from the food and then ELIMINATING what it doesn’t use.”*

Step #4. The Small Intestine:Absorption: **Do not put food in the tube because it is very difficult to clean!**

Ask: *“Where does this paste go?”* (Into the small intestine.)

Ask: *“What does the small intestine do with the food?”* (The small intestine takes the nutrients from the food and puts them into the body. This is called ABSORPTION and this it’s another important function of digestion. Whatever it can’t use is sent away so it can eventually leave the body.)

Ask: *“How LONG is the small intestine?”* (About 20 feet long in an adult.)

Showing the students the two tubes used to demonstrate the difference between the two intestines in the first lesson, ask: *“Which one of these tubes is about the width of the small intestine?”* (The one-inch tube.)

Step #5. The Large Intestine: Elimination: **Do not put food in the tube because it is very difficult to clean!**

Ask: *“Where does the remaining digested food go after it leaves the small intestine?”*

Answer: The large intestine.

Ask: **What does the large intestine do?**

Answer: It moves waste out of the body. This is called elimination. Elimination is the third important function of digestion.

To **summarize** and conclude the Instruction, draw the following Digestive System Table on the board. Use a series of “Ask and Respond” questions to have the **students fill in the boxes** of information.

The Digestive System

| Function | What that means | Body parts involved |
|-------------|---|--|
| Digestion | Breaks food down | Eyes (sight) and nose (smell) Mouth Esophagus Stomach |
| Absorption | Nutrients pass through the intestinal lining & are carried away by blood & lymph fluids | Small Intestine |
| Elimination | Removes waste from the body | Large Intestine |

Assessment: "My Digestive System"

Using information from Lesson One and Two, lead the class once again through the steps of the digestive process. As you ask each question, have students write their answers on their paper. You could have the students create a "Digestive System" instruction book with the questions and answers included or you could have them just answer the questions as individuals or in a group.

1. **What two important parts of the mouth help with digestion?** Answer: Teeth, tongue
2. **What does the mouth do?**
Answer: Chews the food.
3. **What is this process called?**
Answer: Digestion
4. **What is the watery juice in the mouth that helps in this process?**
Answer: Saliva
5. **Where does the food travel to next?**
Answer: Down through the esophagus.
6. **Where does food go after it travels down the esophagus?**
Answer: To the stomach.

7. What happens to the food when it's in the stomach?

Answer: It is turned into a soupy paste.

8. Where does food go next?

Answer: Into the small intestine.

9. What does the small intestine do?

Answer: It absorbs nutrients for the body to use.

10. Where does the small intestine send what's left?

Answer: Any undigested food goes to the large intestine.

11. What does the large intestine do?

Answer: It absorbs water and eliminates the solid waste.

Assessment

Included in the lessons

Resources

Healer Within: http://www.healerwithin.org/IMLS/Gr2_digestion.pdf