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Topic
Digestive system

Key Question
What is the length of your digestive tract?

Learning Goals
Students will:
• determine the lengths of their digestive tracts, and
• model their tracts on outlines of their bodies.

Guiding Documents
Project 2061 Benchmarks
• For the body to use food for energy and building materials, the food must first be digested into molecules that are absorbed and transported to cells.
• Like other animals, human beings have body systems for obtaining and providing energy, defense, reproduction, and the coordination of body functions.
• Length can be thought of as unit lengths joined together, area as a collection of unit squares, and volume as a set of unit cubes.

NRC Standard
• The human organism has systems for digestion, respiration, reproduction, circulation, excretion, movement, control, and coordination, and for protection from disease. These systems interact with one another.

NCTM Standards 2000*
• Understand such attributes as length, area, weight, volume, and size of angle and select the appropriate type of unit for measuring each attribute
• Select and apply appropriate standard units and tools to measure length, area, volume, weight, time, temperature, and the size of angles

Math
Measurement
length
Estimation
Computation
Proportional reasoning

Science
Life science
human body
digestive system

Integrated Processes
Observing
Collecting and recording data
Comparing and contrasting
Generalizing

Materials
Bulletin board paper
Crepe paper streamers
Metric tape measures
Glue
Construction paper
Scissors
Student pages

Background Information
The digestive tract is the body’s passageway through which food moves and digests. The digestive tract, also called the alimentary canal, is a continuous muscular tube that extends from the mouth to the anus. It includes the mouth, esophagus, stomach, small intestine, large intestine, and the anus. Contributing organs are the salivary glands, pancreas, liver, and gallbladder.

The task of the digestive system is the physical and chemical breakdown of food to supply the body with its energy and nutrient needs for growth and repair.

There are several analogies that help us understand the digestive tract. One compares the digestive tract to a doughnut hole. The doughnut’s hole is in the center and there is protective crust all around. Likewise, the digestive tract is a hole that runs from the mouth to the anus. The tube itself protects the body’s interior from things external to it. There is no opening along the tube through which substances can enter the body. Substances can only enter the body when they are broken into pieces small enough that they can pass through the walls of the tube and enter the bloodstream.

Another analogy is that of an assembly line. Along the digestive tract, teeth physically break down the food and muscles move it through the passage to different “stations.” Along the way, various stations of the digestive tract produce enzymes that aid in
the chemical breakdown of food. The food is finally absorbed and waste products are collected and expelled.

The length of time involved in this assembly-line process varies from individual to individual. However, it is safe to say that the food must stay at each station along the way long enough for that station’s job to be completed, whether that is the breakdown of carbohydrates, the breakdown of fats, the absorption of water, etc. Some approximate station times are: Mouth—less than one minute; Esophagus—a couple of seconds; Stomach—two to four hours; Small Intestine—one to four hours; Large Intestine—10 hours to several days.

An adult’s digestive tract is approximately nine meters (30 ft) in length, or about five times the adult’s height. In this activity, students will gain an appreciation of the length of the digestive tract and, if appropriate, begin to understand why its great length is necessary.

Management
1. Students will use traced body outlines on which to glue their digestive tracts. One outline per group is needed.
2. This activity is designed to be used at several levels. The simplest level is the measurement and placement of the digestive tract on the body cutout, and the identification of the major components. The most difficult level includes the placement, identification, and functional description of the components, including the contributing organs involved in the digestive process. You are encouraged to adapt this experience to meet your needs.
3. If the tracing of the students’ bodies presents a management problem in the classroom, send some bulletin board paper home with a student from each group along with parental instructions to trace around their child’s body.
4. Because the crepe paper color tends to run when glued, it is advisable to use light-colored streamers such as pink or yellow.
5. Use a paper cutter or scissors to cut the crepe paper streamers in half. These narrower streamers represent the small intestine, mouth, and esophagus. Use the full width to represent the large intestine.
6. Metric tape measures (item number 1926) are available from AIMS.

Procedure
1. Ask students how they think the food we eat nourishes our bodies. Discuss the fact that food must be broken down into a small enough size before it can be used by the body. Inform them that they will be exploring the digestive tract, or the passage the food takes from the moment it enters the mouth until it is excreted.
2. Have students get in groups of three. Distribute the bulletin board paper and have each group trace around one member’s body. (See Management 3.)
3. Ask the Key Question. Write students’ responses on the board.
4. Distribute the student page and the materials. Encourage students to follow the instructions to determine the lengths of their digestive tracts and create their models. (Students will be amazed at how much they have to “scrunch up” the small intestine to fit it in the appropriate space. Use this as a teaching opportunity to discuss the reason for its long length.)
5. Distribute the appropriate information page describing the digestive tract. Discuss the parts of the digestive system and their functions.

Connecting Learning
1. What is the function of the digestive system?
2. Approximately how long is your digestive tract?
3. About how many times longer is your digestive tract than your height? (You may want to have students cut a length of string equal to the length they have determined for their digestive tract. Using the string, they can concretely compare its length to the length of their body cutouts. Sample answers may be: “My digestive tract is over four times as long as my height, but less than five times.” or “My digestive tract is four and three-fourths the length of my height.”)
4. How does the length of your digestive tract compare to that of another student’s? How can you explain the difference? [The other student is taller (or shorter) than I am.]
5. What is the longest component of the digestive tract? [the small intestine] Why do you think it is called the “small” intestine? [Its diameter is less than that of the large intestine.]
6. How were you able to fit the small intestine into place? [by wrinkling it up]
7. Why do you think the small intestine is so long?
8. How is this model like the real thing? How is it different?
9. What are you wondering now?

Extensions
1. Correlate the various digestive enzymes with the organs that produce them.
2. Have students determine the average ratio of their heights to the length of their digestive tracts. Have them apply this ratio to a professional basketball player whose height they know.

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Key Question

What is the length of your digestive tract?

Learning Goals

Students will:

• determine the lengths of their digestive tracts, and

• model their tracts on outlines of their bodies.
You need:
Body outline  Glue  Scissors
Construction paper  Metric tape measure
Crepe paper streamers (narrow and wide)

Do this:
1. Find and record the height of your group’s model. cm
2. Use the key to calculate the length of the digestive tract from the mouth to the top of the stomach. Cut a length of narrow crepe paper that is this long.
3. Cut a stomach from construction paper that is the right size. Glue the mouth, esophagus, and stomach in place on the body outline.
4. Calculate the length of the digestive tract so far (from the mouth to the end of the stomach). cm
5. Determine the length of the small intestine. Cut a length of narrow crepe paper that is this long. cm
6. Determine the length of the large intestine to the anus. Cut a length of wide crepe paper that is this long. cm
7. Glue the small and large intestine in place on the body outline. Use the diagram to help you.
8. Find the total length of the digestive tract. cm
9. On your body cutout, label the mouth, esophagus, stomach, small intestine, large intestine, and anus.

How many times longer is the digestive tract than your model’s height?

On the back of this paper, explain how you determined this.
Mouth
The teeth physically break the food into smaller bits. The tongue helps to move the food particles into a ball that is then swallowed.

Esophagus
Once the food has been swallowed, it moves down the throat into the esophagus. The esophagus is lined with muscles that help to mix the food and push it down toward the stomach.

Stomach
The stomach is a J-shaped expansion of the digestive tube that can hold two to four liters of food! The stomach stores food. Its muscles knead the food, breaking it down even more. The stomach adds chemicals to the food that turn the food into a soupy liquid.

Small Intestine
The soupy liquid moves into the small intestine, a narrow tube (two to four cm in diameter)—the longest portion of the digestive tract. Here the food is broken down into small enough particles that it can be absorbed into the bloodstream.

Large Intestine
Undigested food is passed into the large intestine. Water and salt are absorbed by the large intestine. The undigested food, dead cells, and dead bacteria left in the large intestine are called feces. Muscles in the large intestine move the feces on toward the anus.

Anus
The anus is the exit point for the feces. The anus has strong muscles that, when relaxed, allow the body to get rid of its solid waste.
Salivary Glands
The salivary glands produce saliva that starts the chemical breakdown of carbohydrates. Saliva also moistens the food making it easier to swallow.

Mouth
The teeth physically break the food into smaller bits. The tongue helps to move the food particles into a ball that is then swallowed.

Esophagus
Once the food has been swallowed, it moves down the throat into the esophagus. The esophagus is lined with muscles that help to mix the food and push it down toward the stomach.

Stomach
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The Food Tube

Connecting Learning

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4. How does the length of your digestive tract compare to that of another student’s?

5. What is the longest component of your digestive tract? Why do you think it is called the “small” intestine?
6. How were you able to fit the small intestine into place?

7. Why do you think the small intestine is so long?

8. How is this model like the real thing? How is it different?

9. What are you wondering now?