OVERVIEW

BIG IDEA
Our digestive system efficiently processes energy and nutrients from our food, while removing waste

OBJECTIVE
2.2 Describe food's journey through the digestive system.

AGENDA
1. Prior Knowledge?
2. A Pretzel's Journey
3. Reading
4. Assessment

HOMEWORK
Write a 2-3 paragraph creative story describing the journey of a pretzel through the digestive system.

LESSON 2.2
Digestion

SUMMARY:

This lesson provides an overview of digestion. It does not go into great detail (for the sake of time), but gives a sense of each major organ and it's function in the digestive process. Students will begin by examining their prior knowledge and tapping into their natural curiosity about the topic, by labeling the digestive organs and writing questions. They will then pair up to talk about what they think happens to a piece of food after it is eaten. Next, they'll read about each component of the digestive system, answering a few comprehension questions that follow each section along the way. Finally, they will self-assess by writing the function of each component of the digestive system and trying to write the steps in order.

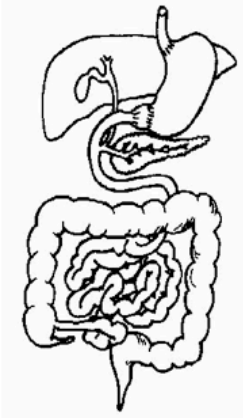
UNIT 2: NUTRITION & FITNESS LESSON 2.2

Digestion

PH2.2: Describe food's journey through the digestive system

DO NOW

Examine the digestive system organs below. Label any parts you already know (or think you know) in PENCIL. Then write any QUESTIONS you have about the digestive system in the box.



QUESTIONS:

DISCUSS

Imagine you are a pretzel that has just been eaten. What happens to you (from beginning to end)? With a partner, discuss the journey the pretzel takes through the digestive system. Combine your knowledge and make some guesses about what the journey will be like if you are not sure.

The Pretzel's Journey:

DO NOW: Students will have varying levels of background knowledge on this process. Encourage them to make guesses if needed.

DISCUSS: If available, pass out one pretzel to each student and ask them to keep it on their desk (it's unbelievable how difficult this might be for some of them!). When the lesson gets to the point where salivary amylase is discussed, ask them to eat the pretzel and describe what they taste. Some may detect the subtle change in taste (it gets slightly sweeter) as the starch is converted into sugar.

UNIT 2: NUTRITION & FITNESS LESSON 2.2

NEW INFO

Digestion happens constantly in our body. Usually we aren't even aware of it---unless diarrhea, constipation, gas, nausea, or other disturbances arise. We will study the process of digestion in order to learn how the complex nutrients (carbs, fats, and protein) are broken down and used in the body, and how waste is removed. On this journey, you should learn about the following components. When you finish reading, come back to this list and summarize the main function of each component:

- mouth: _____
- saliva: _____
- pharynx: _____
- esophagus: _____
- stomach: _____
- small intestine: _____
- large intestine (colon): _____
- gallbladder: _____
- pancreas: _____
- rectum: _____
- anus: _____

READ

Read the story of the digestion system, as written on WebMD.com. As you read, answer questions to make sure you are understanding and remembering the process.

What Is Digestion?

Digestion is the complex process of turning the food you eat into the energy you need to survive. The digestion process also involves creating waste to be eliminated.

The digestive tract (or gut) is a long twisting tube that starts at the mouth and ends at the anus. It is made up of a series of muscles that coordinate the movement of food and other cells that produce enzymes and hormones to aid in the breakdown of food. Along the way are three other organs that are needed for digestion: the liver, gallbladder, and the pancreas.

Before we start, let's play digestive system trivia!

How long do you think the digestive system would be if it were all stretched out? _____ feet

How much time does your food actually spend in the stomach? _____ minutes or more

How often do the stomach's smooth muscles contract? Every ____ seconds

NEW INFO: This list serves as a need-to-know vocabulary list.

Answers:
1. If stretched out, the system would measure about 30 feet, most of it the winding intestines [source: Kids Health: Digestive System]
2. Your liquefied sandwich, however, can be out of the stomach in a mere 20 minutes [source:Gastro.net].
3. The stomach's smooth muscles contract about every 20 seconds, stirring up the acid and enzymes and turning your sandwich into a liquefied blob (**chyme**). (howstuffworks)

UNIT 2: NUTRITION & FITNESS LESSON 2.2

Food's Journey Through the Digestive System

Stop 1: The Mouth

The mouth is the beginning of the digestive system, and, in fact, digestion starts here before you even take the first bite of a meal. The smell of food triggers the salivary glands in your mouth to secrete saliva, causing your mouth to water. When you actually taste the food, saliva increases. Mechanical digestion begins as you start chewing and breaking the food down into pieces small enough to be digested, other mechanisms come into play. Chemical digestion begins as an enzyme in your saliva, salivary amylase breaks down starches into simple sugars. As you chew a starchy food, like a pretzel, you may notice that it gets sweeter as salivary amylase hydrolyzes the starch.

THINK

1. What class of nutrient begins its chemical digestion in the mouth?
2. What is the purpose of chewing?

Stop 2: The Pharynx and Esophagus

Also called the throat, the pharynx is the portion of the digestive tract that receives the food from your mouth. Branching off the pharynx is the esophagus, which carries food to the stomach, and the trachea or windpipe, which carries air to the lungs. The act of swallowing takes place in the pharynx partly as a reflex and partly under voluntary control. The tongue and soft palate -- the soft part of the roof of the mouth -- push food into the pharynx, which closes off the trachea. The food then enters the esophagus. The esophagus is a muscular tube extending from the pharynx and behind the trachea to the stomach. Food is pushed through the esophagus and into the stomach by means of a series of contractions called peristalsis. Just before the opening to the stomach is an important ring-shaped muscle called the lower esophageal sphincter (LES). This sphincter opens to let food pass into the stomach and closes to keep it there. If your LES doesn't work properly, you may suffer from a condition called GERD, or gastro-esophageal reflux disease, which causes heartburn and regurgitation (the feeling of food coming back up).

THINK

3. What parts of the process of swallowing are voluntary? Which are involuntary?
4. What is going wrong if someone has heartburn? Which component of the system is not working correctly?

STOP 1 ANSWERS:

1. carbohydrates, as salivary amylase begins breaking starches into simple sugars
2. Chewing causes food to be mechanically broken down into smaller and smaller pieces for easier digestion; it also mixes food with saliva so it can form a bolus for easy swallowing.

STOP 2 ANSWERS:

3. Voluntary swallowing includes using your tongue and soft palate to push the food into your pharynx. Involuntary include your glottis covering your trachea (windpipe), and your esophagus muscles performing paristalsis, and your lower esophageal sphincter opening and closing
4. In heartburn the lower esophageal sphincter is not closing properly or not staying closed, or both.

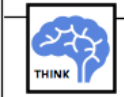
Stop 3: The Stomach and Small Intestine

The stomach is a sac-like organ with strong muscular walls. In addition to holding food, it serves as the mixer and grinder of food. The stomach secretes acid and powerful enzymes that continue the process of digesting the food (breaking the food down) and changing it to a consistency of liquid or paste. From there, food moves to the small intestine. Between meals, the non-liquefiable remnants are released from the stomach and ushered through the rest of the intestines to be eliminated.

Made up of three segments -- the duodenum, jejunum, and ileum -- the small intestine also breaks down food using enzymes released by the pancreas and bile from the liver. The small intestine is the 'work horse' of digestion, as this is where most nutrients are absorbed. Peristalsis is also at work in this organ, moving food through and mixing it up with the digestive secretions from the pancreas and liver, including bile. The duodenum is largely responsible for the continuing breakdown process, with the jejunum and ileum being mainly responsible for absorption of nutrients into the bloodstream.

A more technical name for this part of the process is "motility," because it involves moving or emptying food particles from one part to the next. This process is highly dependent on the activity of a large network of nerves, hormones, and muscles. Problems with any of these components can cause a variety of conditions.

While food is in the small intestine, nutrients are absorbed through the walls and into the bloodstream. What's leftover (the waste) moves into the large intestine (large bowel or colon).



5. What is the difference between digestion and absorption? Where does each occur in the digestive process?

6. Which segment of the small intestine does most of the final digestion, or breakdown, occur?

Stop 4: The Colon, Rectum, and Anus

The colon (large intestine) is a five- to seven -foot -long muscular tube that connects the small intestine to the rectum. It is made up of the ascending (right) colon, the transverse (across) colon, the descending (left) colon and the sigmoid colon, which connects to the rectum. The appendix is a small tube attached to the ascending colon. The large intestine is a highly specialized organ that is responsible for processing waste so that defecation (excretion of waste) is easy and convenient.

STOP 3 ANSWERS:

5. Digestion is the breaking down of food (physically and chemically). It occurs mainly in the stomach, but also the mouth and small intestine. Absorption is when nutrients are taken up into the bloodstream. It occurs almost exclusively in the small intestine.

6. The duodenum, the first section of small intestine

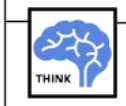
Stool, or waste left over from the digestive process, passes through the colon by means of peristalsis, first in a liquid state and ultimately in solid form. As stool passes through the colon, any remaining water is absorbed. Stool is stored in the sigmoid (S-shaped) colon until a "mass movement" empties it into the rectum, usually once or twice a day.

It normally takes about 36 hours for stool to get through the colon. The stool itself is mostly food debris and bacteria. The e bacteria perform several useful functions, such as synthesizing various vitamins, processing waste products and food particles, and protecting against harmful bacteria. When the descending colon becomes full of stool, it empties its contents into the rectum to begin the process of elimination.

The rectum is an eight-inch chamber that connects the colon to the anus. The rectum:

- Receives stool from the colon
- Lets the person know there is stool to be evacuated
- Holds the stool until evacuation happens

When anything (gas or stool) comes into the rectum, sensors send a message to the brain. The brain then decides if the rectal contents can be released or not. If they can, the sphincters relax and the rectum contracts, expelling its contents. If the contents cannot be expelled, the sphincters contract and the rectum accommodates so that the sensation temporarily goes away. The anus is the last part of the digestive tract. It consists of the muscles that line the pelvis (pelvic floor muscles) and two other muscles called anal sphincters (internal and external)



7. What is primarily absorbed in the large intestine?

8. Name the segments of the large intestine in order from beginning to end.

9. What is the purpose of bacteria in our colon?

Accessory Digestive Organs

Pancreas
Among other functions, the pancreas is the chief factory for digestive enzymes that are secreted into the duodenum, the first segment of the small intestine. These enzymes break down protein, fats, and carbohydrates.

Liver
The liver has multiple functions, but two of its main functions within the digestive system are to make and secrete an important substance called bile and to process the blood coming from the small intestine

STOP 4 ANSWERS:
7. Water
8. Ascending colon, transverse colon, descending colon, sigmoid colon, rectum
9. Synthesizing vitamins, processing waste and food, and protecting against harmful bacteria

containing the nutrients just absorbed. The liver purifies this blood of many impurities before traveling to the rest of the body.

Gallbladder

The gallbladder is a storage sac for excess bile. Bile made in the liver travels to the small intestine via the bile ducts. If the intestine doesn't need it, the bile travels into the gallbladder, where it awaits the signal from the intestines that food is present. Bile serves two main purposes. First, it helps absorb fats in the diet, and secondly, it carries waste from the liver that cannot go through the kidneys.

THINK

10. What is the purpose of bile?

11. How do the functions of the gallbladder and pancreas differ?

ASSESS

Go back to the list of digestive system components on page 2 and summarize the function of each in one sentence or less. Then list all of the organs and components of the digestive system THAT FOOD PASSES THROUGH in order from beginning (at the mouth) to end (at the

HOME WORK

Creative Writing: At the beginning of this lesson, you imagined the journey of a pretzel through the digestive system. Now that you are armed with facts and new knowledge, re-write the pretzel's story from the moment it gets eaten to the very end of the journey. Your story should be approximately 2-3 paragraphs long. Be sure to use correct terminology and describe each stop accurately, yet creatively.

ACCESSORY DIGESTIVE ORGANS ANSWERS:

10. Bile is a substance that emulsifies fat. It's produced in the liver and stored in the pancreas. It is released through the bile duct into the duodenum of the small intestine.
11. The gallbladder is merely a storage container for bile that is waiting to be released into the small intestine. The pancreas, on the other hand, produces several enzymes that help in the digestion of carbs, fats, and proteins.

ASSESS PART 2 ANSWER:

Organs/components of digestive system in order: Mouth (saliva), pharynx, esophagus, stomach, small intestine (duodenum, jejunum, ileum), large intestine (ascending, transverse, descending, sigmoid colon), rectum, anus

The purpose of this homework is to help students review the process and make it "stick" by applying it to a situation creatively. Encourage students to be descriptive. For example: (speaking from the pretzels point of view, in first-person)… "then I fell into a giant cavernous pit called the stomach, where I began riding a wave of acidic fluid back and forth in a churning sea. Slowly I felt my insides break down even more until…")