

a WOW Lab

BLUEPRINT

The Glovely Digestion Model

Inquiry Approaches

Initial Inquiry

What is the role of digestion in the human body?

Digestion breaks down food into the molecules which the body needs for nourishment and energy.

Which parts of your body are used to digest food?

Much of our body participates in the digestion of food. The brain tells the salivary glands in the mouth to produce saliva. Food enters the esophagus through the upper esophageal sphincter and muscle contractions in the esophagus push the food along toward the stomach. At the end of the esophagus, the lower esophageal sphincter opens quickly to let food into the stomach. After the food is broken down, the stomach contents enter the small intestine through the duodenum. Indigestible parts of food enter the large intestine through the cecum. Muscles move the waste through the colon, where salts, fluids and other substances are absorbed by bacteria until only feces remain, which are evacuated through the rectum.

Can humans digest all the components of a plant? If not, which components are not digestible and why?

Humans cannot digest the fibre in plants, which is found in stems and leaves. These components contain cellulose, which is composed of molecules linked together in a long chain. Cellulose can only be digested by certain herbivores with symbiotic bacteria that produce enzymes able to digest cellulose, such as cows. Unlike the digestive system of humans, the digestive system of cows has four compartments. One of these compartments, called the rumen, contains the symbiotic bacteria required to break down cellulose.

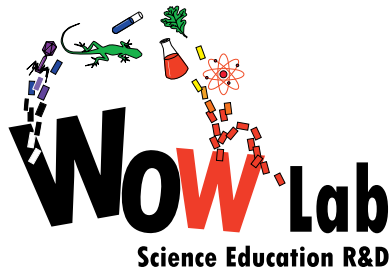
Experimental Procedure Inquiry

What are the differences between a fart and a burp?

Sometimes when we eat or drink, we swallow a small amount of air, which contains nitrogen and oxygen. The air may be pushed down into the stomach then expelled from the mouth as a burp, or it may be pushed down through the gastrointestinal tract and combine with other gases to produce a fart. Farts can also be formed from eating certain kinds of food, such as beans and cabbage. Some of the carbohydrates in these types of foods cannot be digested and absorbed in the intestines, and continue into the colon. Bacteria in the colon break down these carbohydrates. In the process, they produce gases, such as methane, which are released as a fart.

What is peristalsis?

Peristalsis is the rhythmic movement of the muscles in the walls of the gastrointestinal tract and esophagus. "Peri" means "surrounding" and "stalsis" means "constriction".



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What is the difference between chemical and mechanical digestion, and how are they represented in the demonstration?

Mechanical digestion is the process in which food is torn or mashed into smaller pieces. In the activity, chewing is represented by crushing the cookie sandwich against the Plexiglas. The peristaltic contractions are represented by squeezing the cookies down the arm of the OB glove (esophagus). Lastly, the large balloon (stomach) is squeezed to assist in the reaction. Chemical digestion is the process in which food is broken down by chemicals in the body. The salivary gland, represented by the small water-filled balloon on the model, secretes saliva, which contains amylase, in the mouth. Chemicals in the stomach also break down food; this process is represented by the baking soda and vinegar.

In-Depth Inquiry

Which glands and organs are used for the chemical digestion of food and how do they work?

The salivary glands are located in the mouth and release the enzymes needed for chemical digestion. The next set of digestive glands are found in the stomach lining: mucous cells secrete mucous that protects the lining from the gastric acids—produced by the parietal cells—which denature proteins. Chief cells secrete pepsinogen that breaks down proteins. After the stomach empties the food and juice mixture into the small intestine, the juices of the pancreas and liver are mixed with the food. The pancreatic juice contains a wide array of enzymes used to break down the carbohydrates, fats and proteins in food. The liver produces an important digestive juice called bile, which is stored in the gallbladder until needed for digestion. At that moment, the bile is squeezed out of the gallbladder, through the bile ducts and into the intestine to mix with the fats in food. The bile acids dissolve the fats into the watery contents of the intestine, much like detergents that dissolve grease from a frying pan. After the fats are dissolved, they are digested by the pancreatic enzymes and the intestinal lining.

Which organs are used for the mechanical digestion of food and how do they work?

Both the mouth and stomach are involved with mechanical digestion. In the mouth, the teeth crush and grind food to increase surface area for optimum enzyme function. The tongue helps move food around the mouth to allow for chewing. In the stomach, churning of the muscle layers occurs to mix the gastric juices with the food until a thick mixture is formed, called chyme.

Why do different foods provide different amounts of energy?

The amount of energy in a particular food depends on the composition of the food. Fat is the most energy-dense macronutrient, followed by alcohol, proteins and carbohydrates.