# Anatomy and Physiology

2. The Digestive System



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# The Digestive System

## Tour of the System

The digestive system is an extensive system that begins at the lips and ends at the anus. The easiest way to explore the digestive system is on a journey with a peanut butter and jelly sandwich (PB&J):

The PB&J passes through the lips and into the mouth (oral cavity).

The oral cavity contains teeth and the tongue. Beneath the tongue is the floor of the mouth and above the tongue, the hard palate.

The soft palate (which does not contain bone) is at the back of the mouth.

The PB&J is *masticated* (chewed) by the teeth.

There are normally 32 teeth and in each arch there are:

- 4 incisors
- 2 cuspids (or canines they resemble the long cuspids that dogs have)
- 4 premolars or bicuspids
- 6 molars. The last molar is the "wisdom tooth."

Chewing the PB&J also requires assistance from the muscular tongue.

Chewing stimulates the release of saliva from the salivary glands in the mouth to moisten the sandwich. Saliva contains enzymes that help to break down carbohydrates.

The PB&J is now a homogeneous smooth mass called a bolus.

Swallowing or deglutition is a complex process controlled by the nervous system.

The lingual nerve in the tongue determines when the bolus is 'ready' for swallowing.

Once the bolus is pushed to the back of the tongue, receptors start the pharyngeal phase of swallowing.

This phase is when breathing, chewing, coughing and other activities stop.

The bolus passes the tonsils, the pharynx and goes into the esophagus to the stomach.

The stomach is located just below the diaphragm and when empty it has a volume of around 45 ml. When full, it can extend to hold as much as three liters of food.

In the stomach, the bolus mixes with liquids, acid and digestive juices.

These break the bolus down into simpler chemical substances so they can be absorbed into the blood more easily.

After some hours, the semi-liquid mass, now called chyme, passes into the small intestine.

In the first part of the small intestine, called the duodenum, bile from the liver emulsifies fats. Pancreatic juice and enzymes also break down materials further.

Broken down materials are absorbed into the bloodstream and taken to the liver for filtration, toxin removal and further processing.

Anything remaining in the small intestine moves to the large intestine via peristalsis.

Fermentation, aided by gut bacteria left in the chyme, breaks down some of the remaining substances.

The chyme moves into the cecum, which is a pouch that connects the last part of the small intestine (ileum) with the first part of the large intestine.

Attached to the cecum is the appendix. In humans, the appendix is vestigial, which means it has no known function.

The large intestine takes around 16 hours to complete the digestive processes.

Digested matter moves from the cecum to the colon.

The colon is able to absorb vitamins (including vitamin K) produced by the bacteria which inhabit the colon (colonic bacteria).

The colon also absorbs salts and water and stores feces until defecation.

Feces move along the colon by peristalsis to the last part of the large intestine, the rectum.

From here, defecation, the final process of digestion occurs.

This whole process of digestion takes between 24 and 72 hours.

## **Functions**

The main function of the digestive system is to digest, or break down food into smaller chemical components (also called *catabolism*).

## Components

#### Pharynx

This is the part of the throat located behind the mouth and nasal cavity.

#### Tongue

This muscle is used to manipulate food during chewing (mastication). The tongue also contains taste buds.

#### Esophagus

This is a muscular tube connecting the pharynx to the stomach. A bolus moves through the esophagus via peristalsis.

#### Epiglottis

This is a cartilage flap attached at the entrance to the voice box (larynx). When this is

closed, it prevents food from entering the trachea (windpipe). Large intestine

This starts at the cecum, contains the colon and ends at the rectum. It is involved in absorbing some nutrients but primarily water and salts.

#### **Small intestine**

Most digestion and absorption occurs in the small intestine and this is why this organ is very long, offering the maximum surface area for its digestive functions.

#### Stomach

This is J shaped and connects the esophagus to the small intestine. As well as a food mixing and processing area, the stomach also 'holds' food until it is ready to move into the small intestine. The stomach is acidic as its enzymes work best at a low pH.

#### Liver

The liver produces several chemicals needed for digestion. It is also able to store some nutrients such as vitamins.



#### Pancreas

This produces several digestive juices to help in digestion.

#### Gallbladder

This produces and stores bile until required by the small intestine.

#### Rectum

The final part of the large intestine which temporarily stores feces.

## **Common Diseases and Disorders**

**Appendicitis:** This is inflammation or infection of the appendix. If infected the appendix can swell and burst. Also called peritonitis, this is very serious because then the contents of the intestines spill into the abdominal cavity.

**Colon cancer:** This can develop without symptoms, which is why doctors often take an occult blood sample every two years. This test detects small amounts of blood in the feces, which can be a symptom of colon cancer.

**Constipation:** Refers to infrequent or difficult evacuation of the feces.

Diarrhea: Is abnormal frequency and liquidity of feces.

**Diverticulosis:** As people age, the large intestine sometimes forms small pouches. Sometimes sharp foods like seeds or grains lodge in these pouches and cause inflammation or infection. This is diverticulitis.

**Gallstones:** Hard stones created from a buildup of bile in the gall bladder. They cause acute pain but are often able to be removed with a catheter and ultrasound.

**Perforated ulcer:** A stomach ulcer has broken through the stomach wall is now perforated. This allows the contents of the stomach to move into the abdominal cavity and can be very serious.

**A 'sore mouth**' could mean one of many things, including cold sores (herpes simplex), mouth ulcers (aphthous ulcers) or lesions of the teeth and gums.

**A Sore throat** is another common problem, usually due to infection in the tonsils, or an inflamed pharynx.

**Stomach ulcers**: Prolonged chronic stress is often the main cause of stomach ulcers. Because the stomach produces too much stomach acid, it damages the mucosal covering of the stomach, causing a lesion.

## **Medical Terminology**

**GI tract:** Gastrointestinal or GI tract can sometimes include all structures from the mouth to the anus, but medically it is often differentiated between the upper and lower GI tracts.

**Lower GI:** The lower gastrointestinal tract includes the large intestine, small intestine and anus.

**Peristalsis:** This is a very strong, rhythmic contraction and relaxation of muscles throughout the digestive system that push the contents along.

**Upper GI:** The upper GI or gastrointestinal tract generally refers to the esophagus, stomach and duodenum.

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