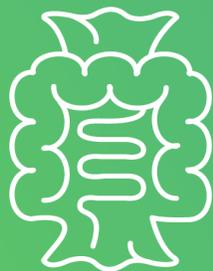




**TRANSPLANT UNWRAPPED
PRESENTS:**

An Overview of The Digestive System



**Transplant
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Overview of the Digestive System

Mouth

Breaks up food particles and salivary enzymes begin carbohydrate (sugar) digestion.

Salivary Glands

Saliva moistens food and glands release the enzyme amylase to start carbohydrate (sugar) digestion.

Esophagus

Carries food from mouth to stomach.

Stomach

Stores and churns food into chyme. Secretes hydrochloric acid which activates enzymes, breaks up food, and kills germs. The enzyme pepsin starts protein digestion.

Liver

Makes bile to aid in fat digestion, changes food into energy, clears the blood of toxins, and stores vitamins and iron.

Pancreas

Makes enzymes to aid in digestion and produces insulin to control blood sugar.

Gallbladder

Stores bile made in the liver and empties it into the small intestine to help digest fats.

Small Intestine

Main site of nutrient digestion and absorption. It is divided into the duodenum, jejunum, and ileum.

Large Intestine or Colon

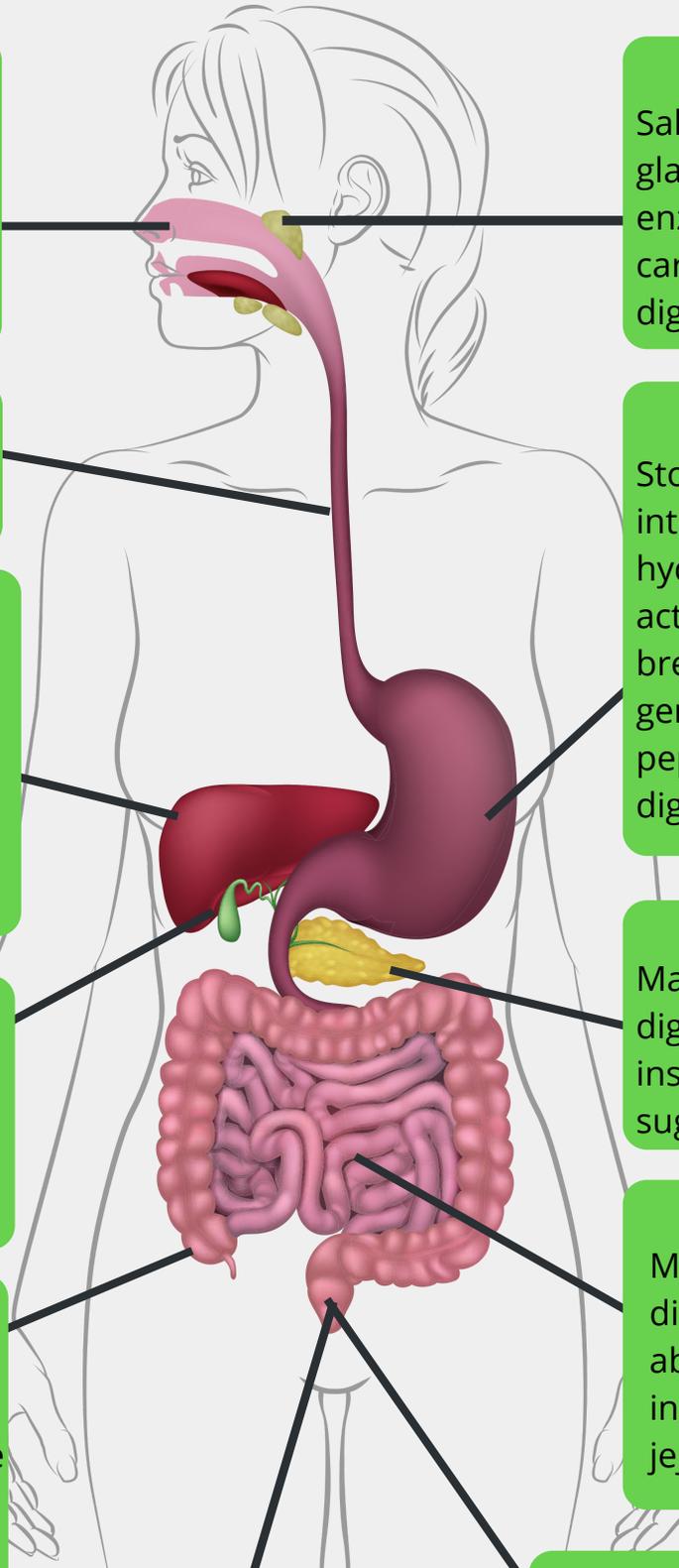
Absorbs water and electrolytes from waste matter to form stool. Beneficial bacteria in the colon also help produce certain vitamins.

Anus

The opening at the end of the digestive tract where bowel movements leave the body.

Rectum

Lower end of the large intestine, stores and expels stool.

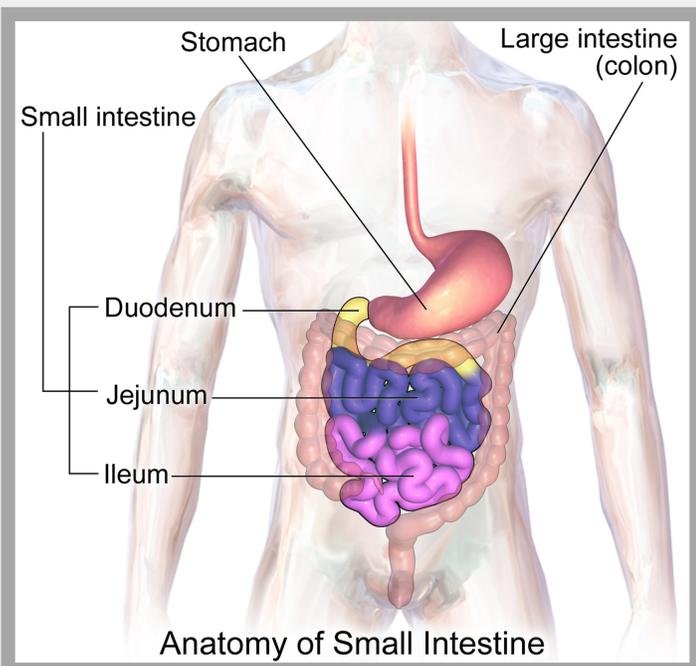
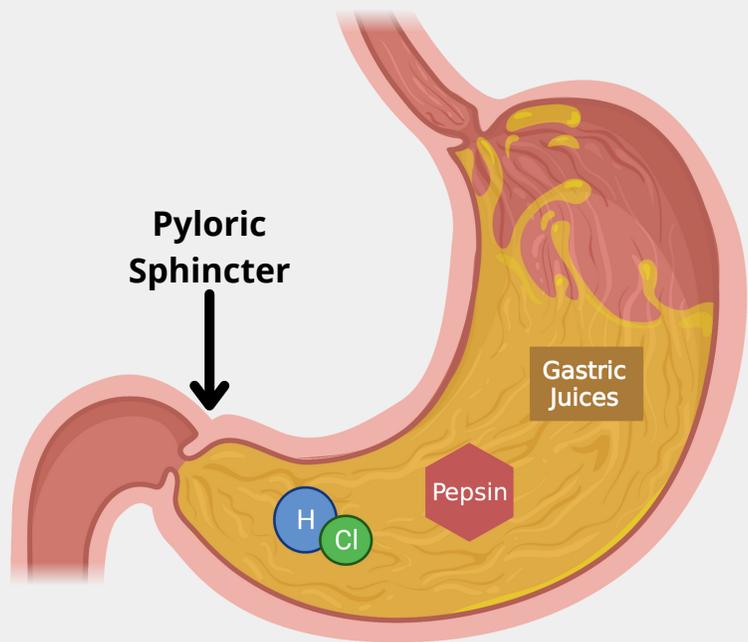


The Digestive Process

In the **mouth**, chewing is the first step of digestion. Chewing increases the surface area of foods to allow for a more efficient breakdown of food by enzymes. The **salivary glands** release saliva to moisten food. Saliva also contains **enzymes** like amylase, which begins to break down starch, a carbohydrate, into simple sugars.

In the **stomach** muscles contract in a churning motion to break down food. Cells in the stomach also secrete hydrochloric acid (HCl) and enzymes, like pepsin, to begin the digestion of proteins. This forms a mixture called **chyme**.

The end opening of the stomach is the pylorus. There you find the **pyloric sphincter**, a strong ring of muscle that controls the movement of chyme from the stomach into the first portion of the small intestine, the duodenum.



The food mixture passes **from the stomach into the small intestine**. The small intestine is the main site of digestion and nutrient absorption.

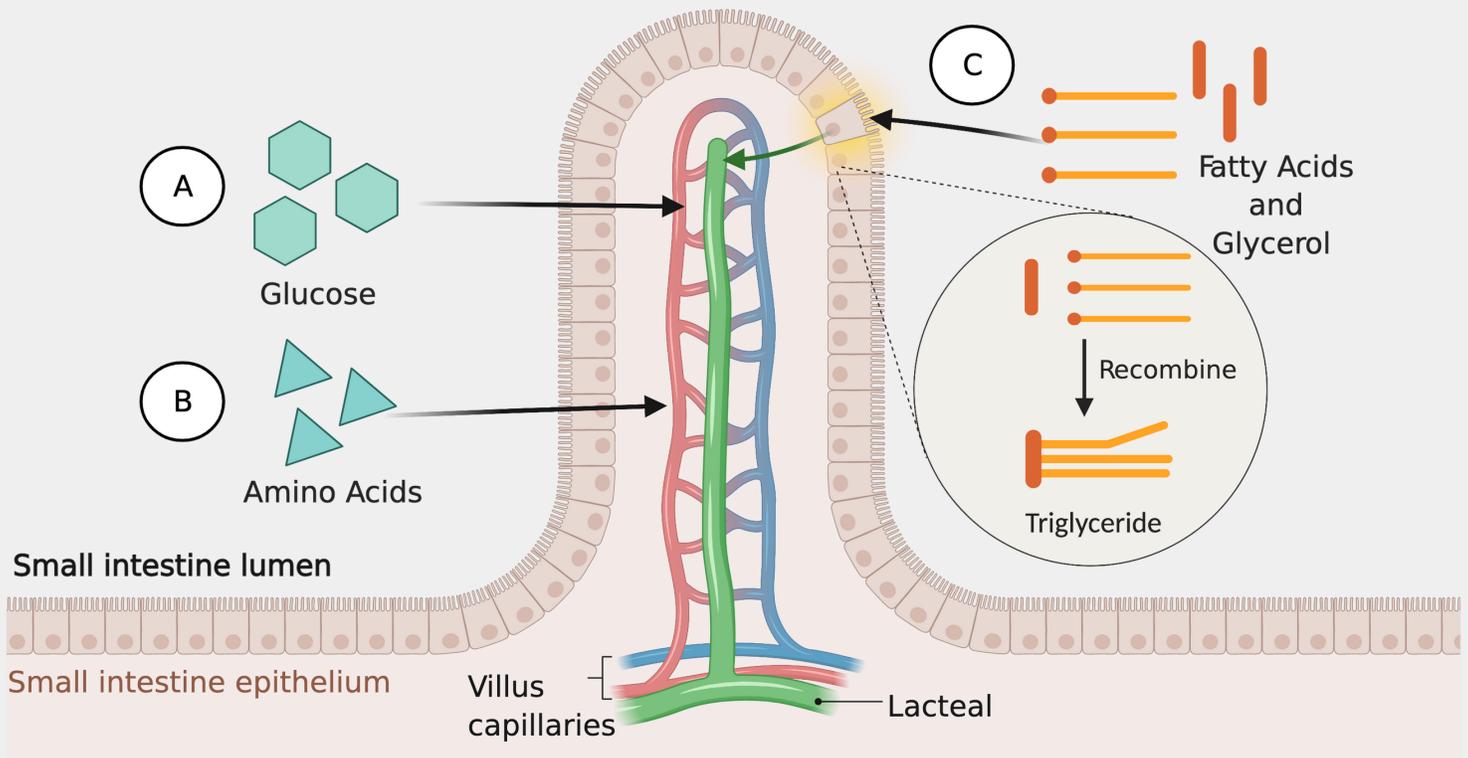
The **small intestine** is divided into three parts:

1. Duodenum
2. Jejunum
3. Ileum

Normal Absorption

In an adult, the small intestine is about 15-20 feet long (400-600 cm). In a full-term infant, the average length of the small intestine is 250 cm.

To increase nutrient absorption, the small intestine's interior **surface area is expanded** by microscopic finger-like projections known as **villi**.



Pictured above is a villus in the small intestine. Each villus has a set of blood vessels and a lymphatic vessel. In the picture:

A: Carbohydrates, or sugars, are broken down and diffuse into the blood capillaries in the villi.

B: Proteins are broken down into amino acids and are absorbed into the blood capillaries in the villi.

C: Fats are digested into fatty acids and glycerol. These are absorbed by the intestinal epithelial cells. Once in the cells, the fatty acids and glycerols recombine to form triglycerides. The triglycerides diffuse into the lacteal in the villi.

Sites of Nutrient Absorption

Usually, the average length of the small intestine and the additional surface area from the villi allows ample time for food to contact the intestinal wall, **allowing for optimal nutrient absorption**. However, in those with short bowel syndrome, there is not enough small intestine to allow for nutrient absorption, which can lead to intestinal failure. It is important for short bowel patients to **understand their anatomy** as **each section** of the small intestine **absorbs certain nutrients**.

Segment 1: The Duodenum

- The first segment of the small intestine (~25-30 cm, 10 inches in length).
- Bile salts are excreted from the liver into the duodenum and are required for fat absorption.

Common Nutrient Deficiencies with Resection

- Iron
- Calcium
- Folate
- Magnesium

Segment 2: The Jejunum

- The second segment of the small intestine (~200 cm. long)
- The jejunum has long villi, a large absorption area, and many digestive enzymes making it the primary site of nutrient absorption.

Common Nutrient Deficiencies with Resection

- Sodium
- Magnesium
- Carbohydrates
- Protein and amino acids
- Water-soluble vitamins
- Trace metals (ex: zinc)

Segment 3: The Ileum

- The third segment of the small intestine (~300 cm. long)
- When the duodenum and/or jejunum are resected, the ileum can largely adapt to perform their absorptive functions.

Common Nutrient Deficiencies with Resection

- Vitamin B12 (can only be absorbed in terminal ileum)
- Fat-soluble vitamins (A, D, E, K)
- Malabsorption bile salts

Sites of Nutrient Absorption

Something to Consider: The Ileocecal (IC) Valve

- The IC valve is an important barrier to the reflux of colonic material, including bacteria, from the colon back into the small intestine. It also helps to regulate the passage of fluid and nutrients from the ileum into the colon.
- If the IC valve is **resected or missing**, there is decreased fluid and nutrient absorption and an **increased risk for bacteria overgrowth** in the small intestine.
- For patients with short bowel and intestinal failure, the **presence or absence of the IC valve** is a **predictor** of the **ability to wean** from **parenteral nutrition** (PN).

The Large Intestine or Colon

- The colon is important for the absorption of remaining water and electrolytes.
- The colon also can utilize short-chain fatty acids (SCFAs) produced by colonic bacteria from dietary fibers as energy.

Common Complications without a Large Intestine

- Dehydration
- Electrolyte deficiencies

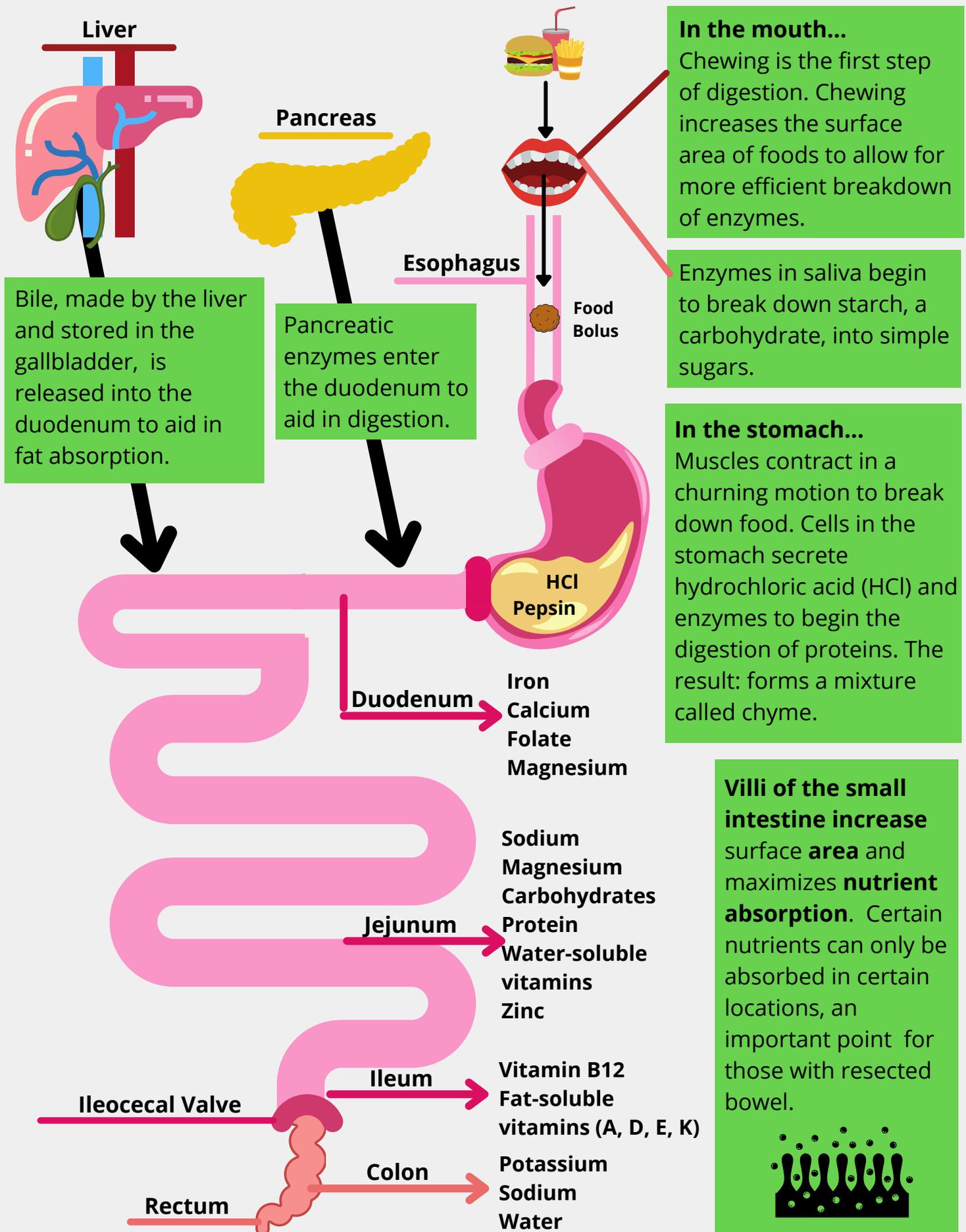


Poop Fact!

It may be tempting, but please check your cell phones, tablets, and other electronics at the bathroom door. In a recent study, 1 in 6 cell phones were found to be contaminated with poop like me! Your status post can wait.



Overview of Nutrient Absorption



For Kids: Your Digestive System

Fun Fact: In one day, your salivary glands can produce up to six cups of saliva! (1)

When you put food into your **mouth** and chomp down with your teeth, you break the food into smaller pieces. This also causes special structures in your mouth called **salivary glands**, to produce saliva.



Fun Fact: Your stomach can expand to the size of a football with food inside.

Food then moves down a tube in your throat, the **esophagus**, and enters your stomach. This only takes about 7 seconds! (2)

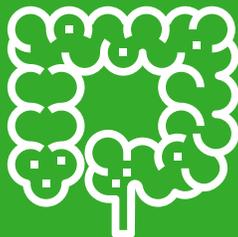


The **stomach** is a stretchy muscular sack that releases digestive juices and acid to help breakdown food. The muscular contractions of the stomach, known as peristalsis, pushes the food out of your stomach and into your small intestine.





The **small intestine** breaks down the food more, allowing the nutrients and energy it contains to pass through the lining of the small intestine and give your body the **fuel** it needs.



Fun Fact: Poo smells because of the bacteria in your gut and the chemicals they release.

Fun Fact: In the average adult the small intestine is 20 ft. and large intestine is 5 ft.



The mush that is left then moves to the last portion of the digestive tract known as the **large intestine**. The large intestine helps to absorb any water or minerals that may have been left-over. The remaining substances is known as feces, or **poop!**



When you feel like you need to go to the restroom, a ring of muscle called the anus relaxes to allow the poop to come out!

More Info? Contact or Visit us.



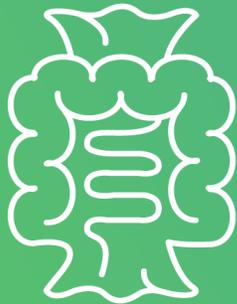
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3. Clayton JD, Patino E, Rapaport L, et al. 11 Icky but Interesting Facts About Poop: Everyday Health. *EverydayHealth.com*. <https://www.everydayhealth.com/digestive-health-pictures/icky-but-interesting-facts-about-poop.aspx>. Published December 19, 2017. Accessed May 10, 2021.

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