

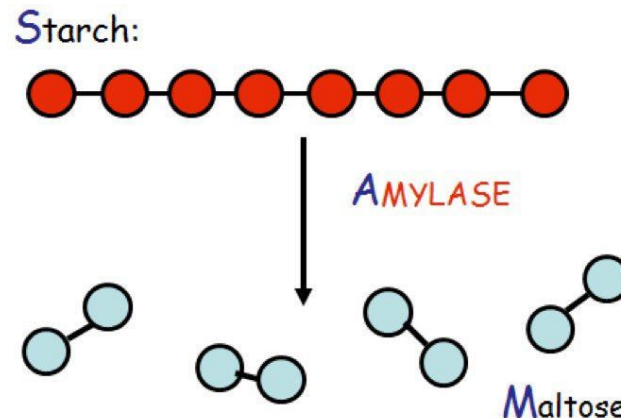
Activities Occurring in the Mouth, Pharynx, and Esophagus

- Food enters the **mouth**
- Food is **masticated** (chewed) by the teeth, beginning **mechanical** digestion



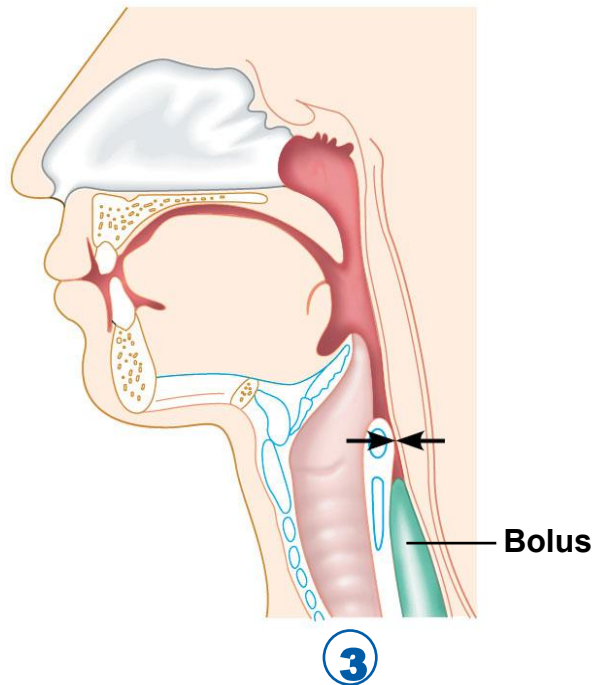
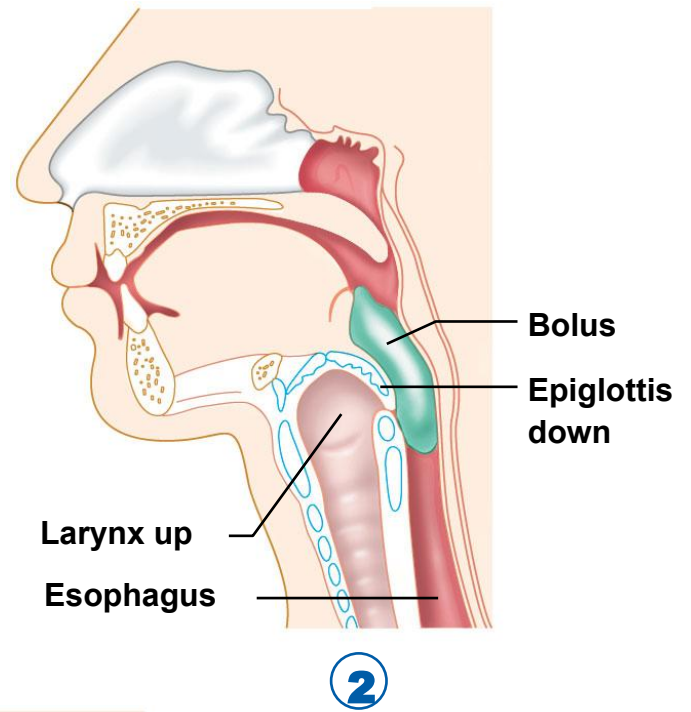
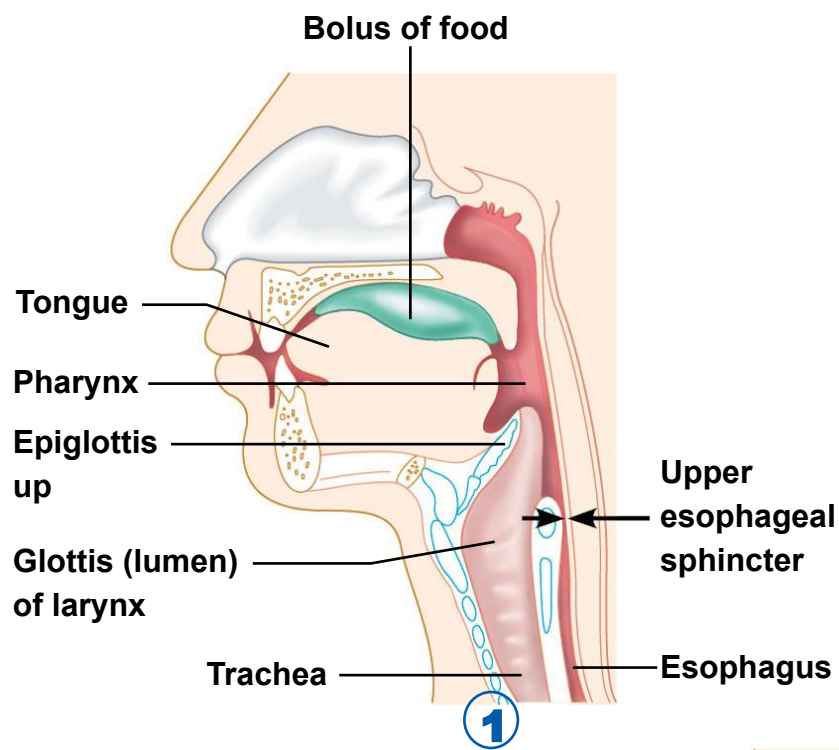
Activities Occurring in the Mouth, Pharynx, and Esophagus

- **Saliva** is continuously secreted, but much larger amount of saliva are produced due to **stimuli**
 - Physical stimulus of **food entering the mouth**
 - Emotional stimulus of **thinking about food**
- Salivary glands release **salivary amylase**, an **enzyme** that breaks down **carbohydrates**
 - Carbohydrates are broken into simple sugars



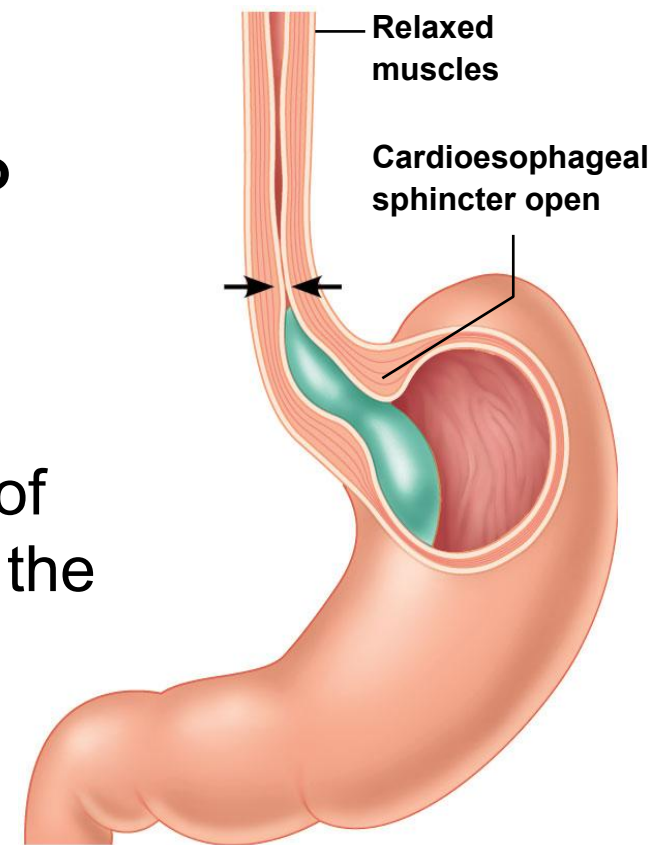
Activities Occurring in the Mouth, Pharynx, and Esophagus

- The chewed food forms a **bolus**
- Essentially, **no food absorption occurs in the mouth**
- The **tongue** moves the bolus into the **pharynx** in preparation for swallowing
- All other routes for food are **blocked off**
 - **Tongue** blocks off mouth
 - **Soft palate** blocks off nasal cavity
 - **Epiglottis** covers trachea



Activities Occurring in the Mouth, Pharynx, and Esophagus

- Once the food enters the pharynx, it is moved down the **esophagus** by **peristalsis**
- The pharynx and esophagus have **no digestive function**
 - Act as **passageways**
- Once food reaches the distal end of the esophagus, it presses against the **cardioesophageal sphincter**, causing it to **open**
- Food enters the **stomach**

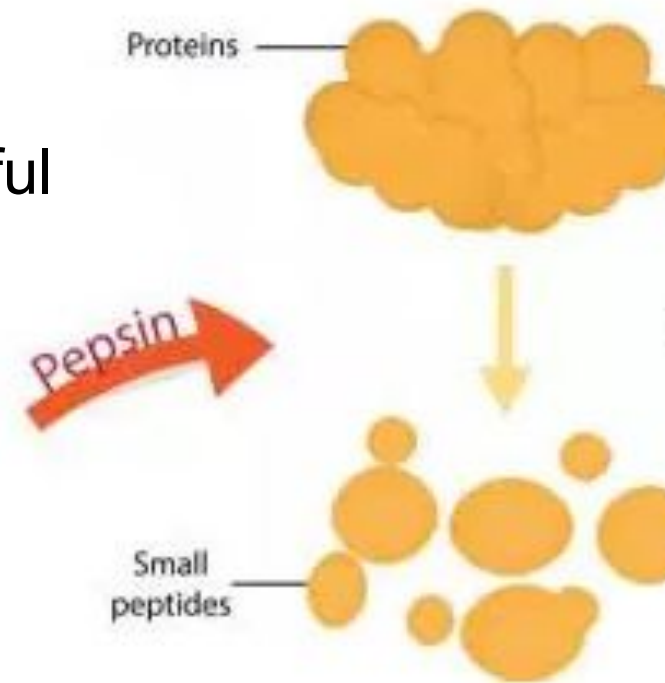


Activities Occurring in the Stomach

- Gastric juice is regulated by **neural and hormonal factors**
 - The **sight, smell, and taste** of food increases secretion of gastric juice
- Presence of food causes the release of the hormone **gastrin**
- Gastrin causes stomach glands to produce **pepsinogen, mucus, and hydrochloric acid**
 - Pepsinogen plays a role in **protein digestion**
 - Mucus **protects stomach lining**
 - Hydrochloric acid **makes stomach acidic**

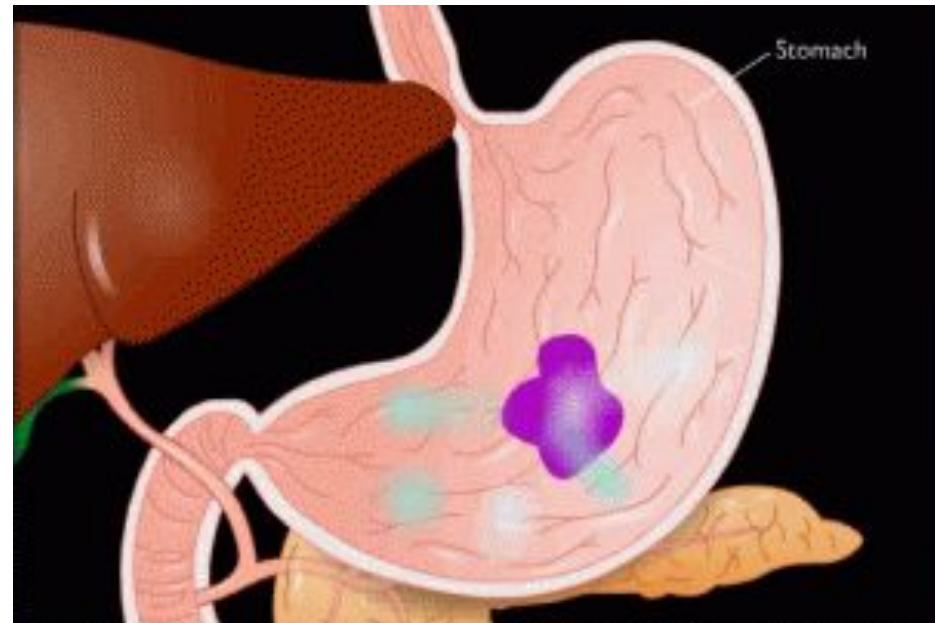
Activities Occurring in the Stomach

- The acidic environment that hydrochloric acid provides is necessary because when **pepsinogen mixes with stomach acid, it is activated into pepsin**
 - Acidic environment also kills harmful bacteria and viruses
- The enzyme **pepsin** digests **proteins**
- The enzyme **rennin** digests **milk** in babies (is not produced in adults)



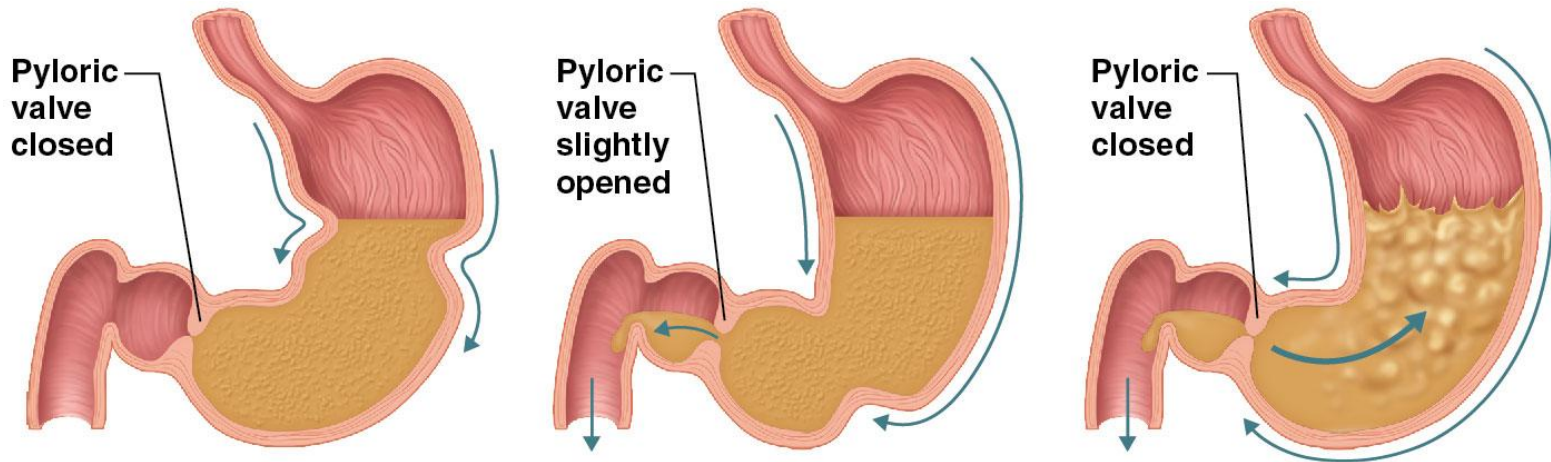
Activities Occurring in the Stomach

- **Protein** is the only macromolecule chemically **digested** in the stomach
 - **Alcohol and aspirin** are the only items **absorbed** in the stomach
- As the stomach is filled, the walls of the stomach **compress** and pummel the food, **mechanically** digesting it
- At the same time, the food is mixed with gastric juice to produce the thick fluid **chyme**



Activities Occurring in the Stomach

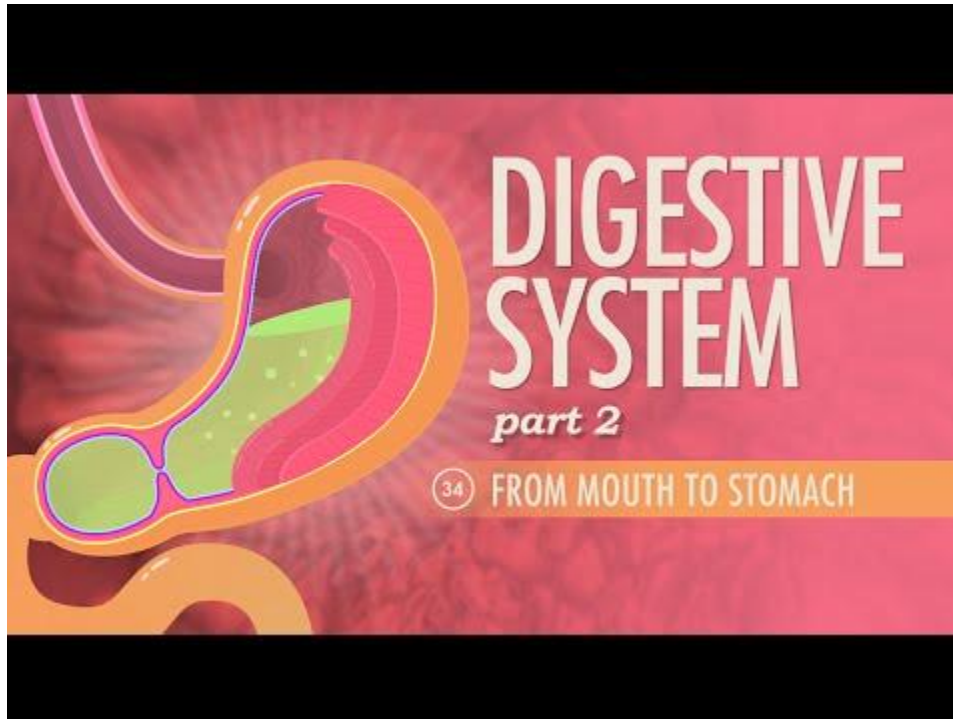
- Once food is well mixed, **peristalsis** begins, moving chyme toward the **pyloric sphincter**
- The pyloric sphincter opens **very little**
 - Allows only **3 mL (60 drops)** of chyme into the small intestine per stomach contraction



Activities Occurring in the Stomach

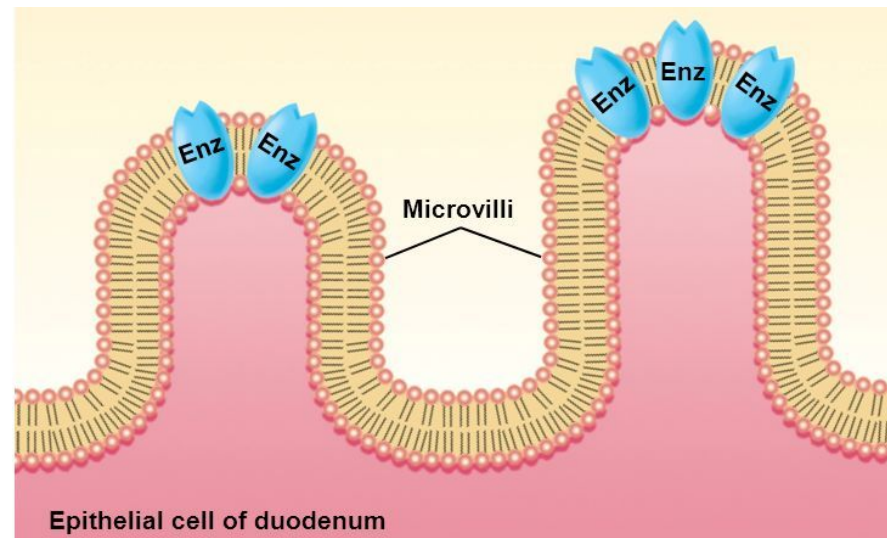
- When the **duodenum** is full, stretch receptors “**put the brakes**” on gastric activity
 - The pyloric sphincter **closes** and allows the small intestine to catch up
 - It takes approximately **4-6 hours** for the stomach to completely empty after a person eats a well-balanced meal
- Irritation of the stomach may activate the brain to induce **vomiting**
- Vomiting is **reverse peristalsis** of the stomach along with contraction of the **diaphragm and abdominal muscles**

Crash Course #34, Digestive System Part 2



Activities Occurring In the Small Intestine

- Chyme entering the small intestine is only **partially** digested
 - **Carb and protein** digestion has begun
 - No **lipid or nucleic acid** digestion has started
- The **microvilli** of small intestine cells contain **brush border enzymes** that break down sugars and complete some protein digestion



Activities Occurring In the Small Intestine

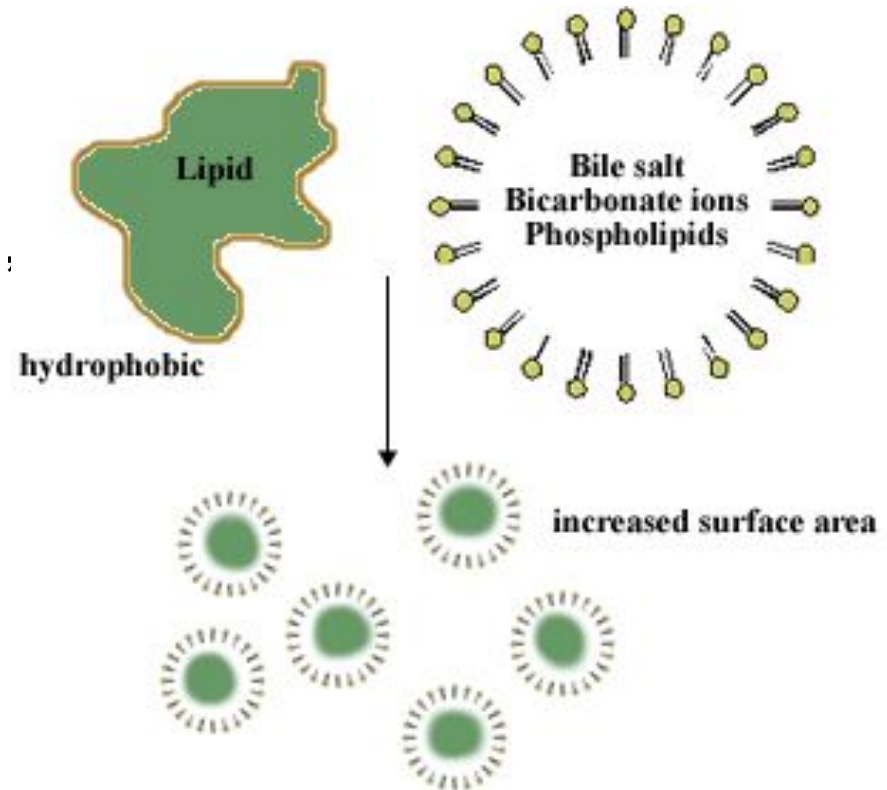
- **Pancreatic juice** is delivered from the pancreas via a duct and contains:
 - **Pancreatic amylase** that completes digestion of **starch**
 - **Trypsin, chymotrypsin**, and others that completes about half of **protein** digestion
 - **Lipase** that digests all **fats**
 - **Nucleases** that digest **nucleic acids**
- Pancreatic juice also **neutralizes** the acidic chyme
- **Bile** from the liver and gallbladder is released

Activities Occurring In the Small Intestine

- The release of pancreatic juice is controlled by the **vagus nerve** and by **hormones**
- When chyme enters the small intestine, the hormones **secretin** and **cholecystokinin (CCK)** are produced
 - **Both** hormones stimulate the release of **enzymes** from the **pancreas**
 - **Secretin** causes the **liver** to increase its output of **bile**
 - **CCK** causes the **gallbladder** to contract and release stored **bile**

Activities Occurring In the Small Intestine

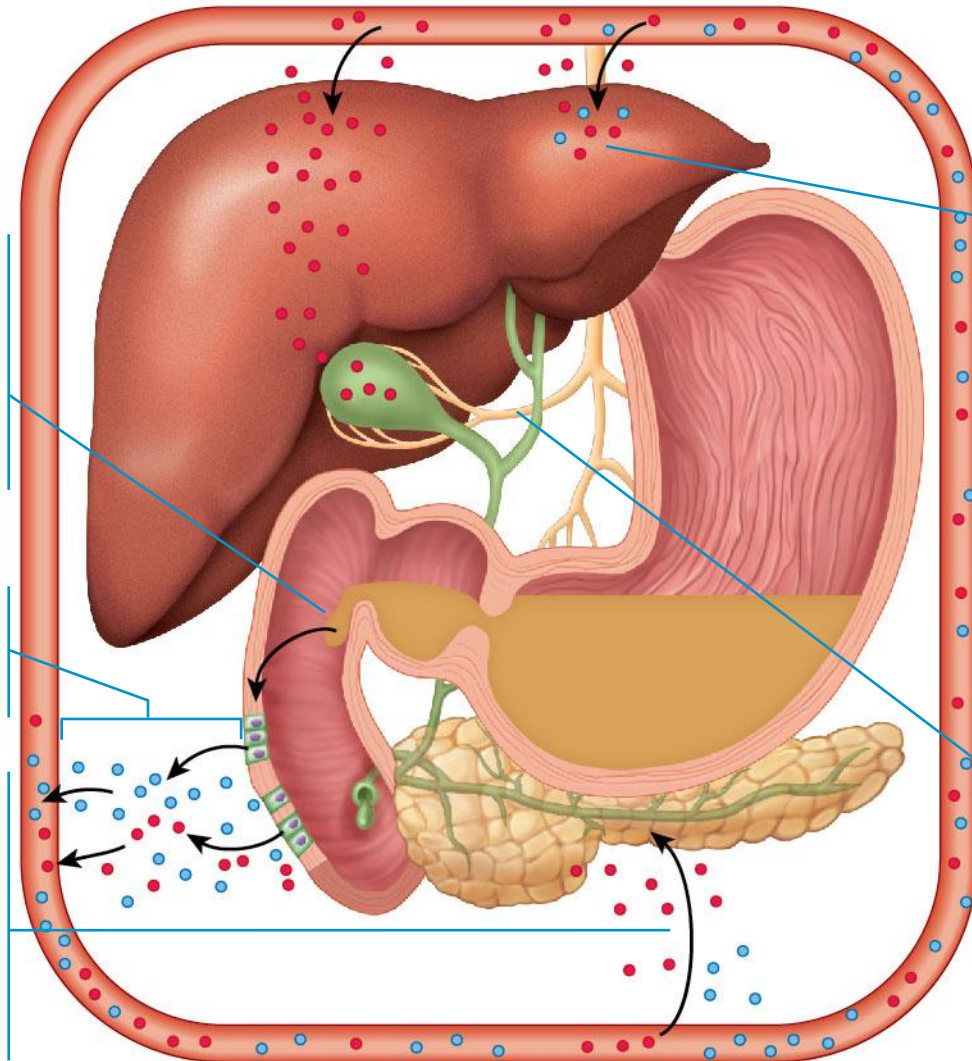
- Bile is **NOT** an enzyme
 - It acts as a detergent to **emulsify** large lipid (fat) molecules into smaller ones, providing a larger **surface area** for lipase to work on
 - Bile is also necessary for some **vitamins** to be absorbed



1 Chyme entering duodenum causes cells to release cholecystikinin (CCK) and secretin.

2 CCK (red dots) and secretin (blue dots) enter the bloodstream.

3 Upon reaching the pancreas, CCK and secretin induces secretion of enzyme-rich pancreatic juice.



4 Secretin causes the liver to secrete more bile; CCK stimulates the gallbladder to release stored bile and the hepatopancreatic sphincter to relax (allows bile from both sources to enter the duodenum).

5 Stimulation by vagal nerve fibers causes release of pancreatic juice and weak contractions of the gallbladder.

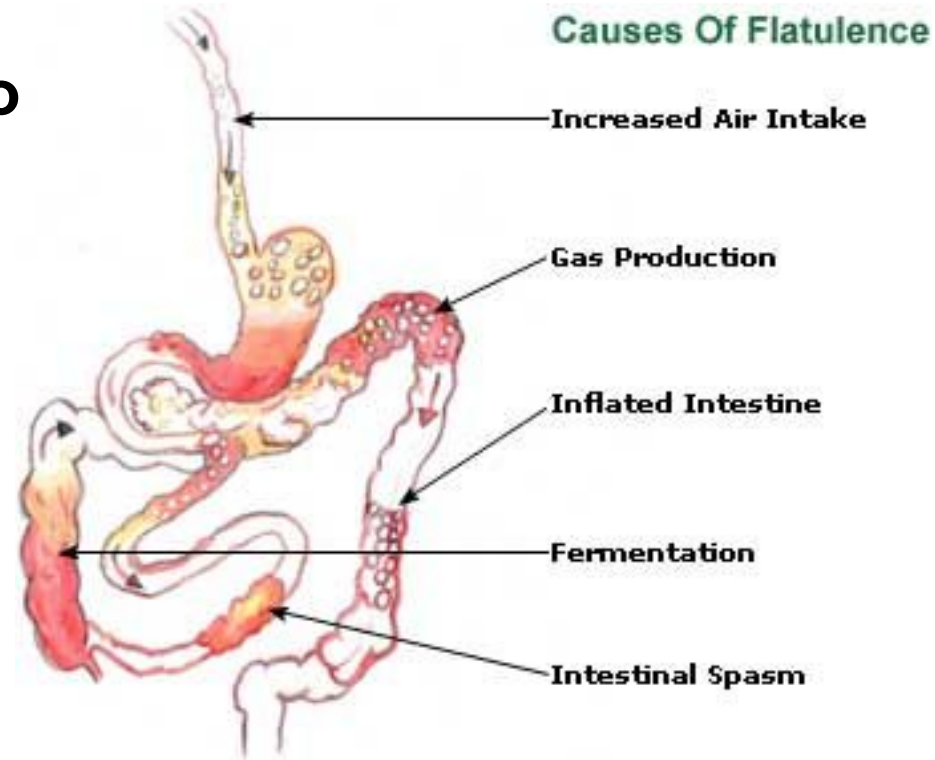
Activities Occurring In the Small Intestine

- **Water and end products** of digestion are **absorbed** along the length of the small intestine
 - Carried by the **blood and lymphatic vessels**
- At the end of the ileum, all that remains is some **water**, **indigestible food materials**, and large amounts of **bacteria**
- These remains enter the **large intestine** through the **ileocecal valve**
- Journey through the small intestine takes **3-6 hours**



Activities Occurring In the Large Intestine

- The remains that enter the large intestine (also called the colon) contain **few nutrients**
- The remaining **water** is absorbed
- The large intestine contains **no digestive enzymes**
 - **Bacteria** that live in the lumen metabolize the remaining nutrients and **release gas**
 - About **500 mL** of gas is produced each day

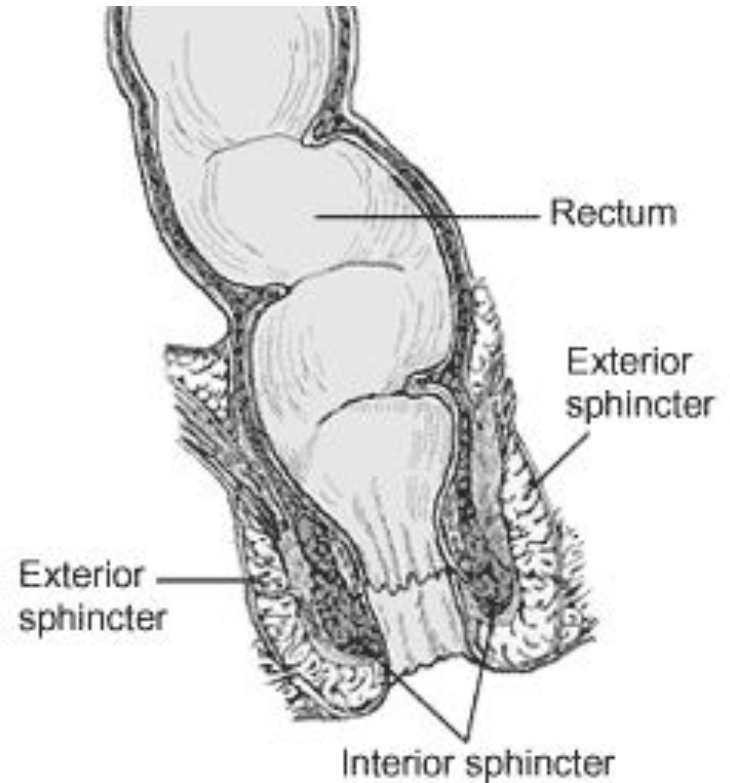


Activities Occurring In the Large Intestine

- The colon begins **haustral contractions**, which are **slow segmenting** movements
 - Last about 1 minute and occur every **30 minutes**
- **Mass movements** are **long, slow-moving** but powerful contractile waves
 - Move over large areas of the colon
 - Occur **3-4 times** daily
 - Force contents toward the **rectum**

Activities Occurring In the Large Intestine

- Presence of **feces** in the rectum causes a **defecation reflex**
- Internal anal sphincter is **relaxed**
- Defecation occurs with **relaxation** of the **voluntary (external) anal sphincter**
- Journey through the large intestine takes **12-24 hours**



Crash Course #35, Digestive System Part 3

