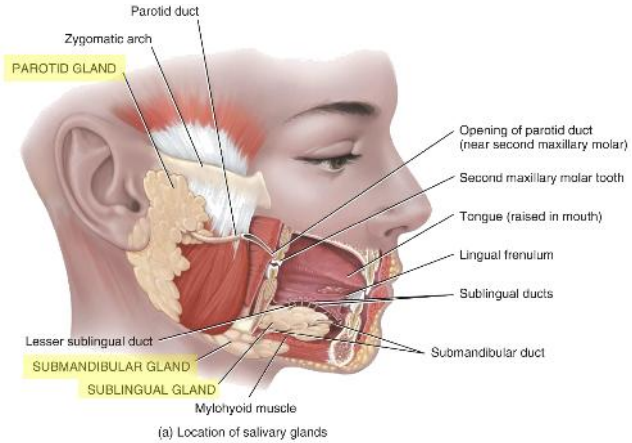
The Mouth

- The **oral or buccal cavity,** is formed by the cheeks, hard and soft palates, and the tongue.
  - **Mechanical digestion** of food through mastication (chewing) enables it to be mixed with saliva to form a soft flexible bolus that can be easily swallowed.
  - Saliva starts the process of **chemical digestion** of food.
    - Saliva is 99.5% water, with tiny amounts of dissolved ions, IgA, lysozyme (a bacteriolytic enzyme), and salivary amylase (a digestive enzyme that acts on starch).

The Mouth

- Three **large salivary glands** secrete most of the saliva: the parotid, submandibular, and sublingual glands. The **smaller glands** are found on the lips (labial), cheeks (buccal), palate (palatal), and tongue (lingual).
- Daily salivary secretions average 1–1½ liters.



(a) Location of salivary glands

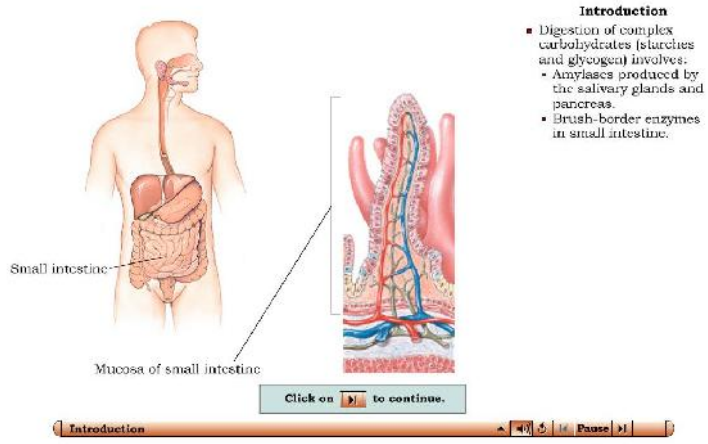
The Mouth

- **Salivary regulation** is under the control of the **ANS**
  - **Parasympathetic stimulation** promotes secretion of a moderate amount of saliva. Salivary centers are located in the brain stem and efferent nerve impulses are transmitted by the facial (VII) and glossopharyngeal (IX) nerves.
    - Touch (pressoreceptors), smell, taste (taste buds), and psychological factors are also salivary stimulators.
  - **Sympathetic stimulation** decreases saliva secretions.

The Mouth

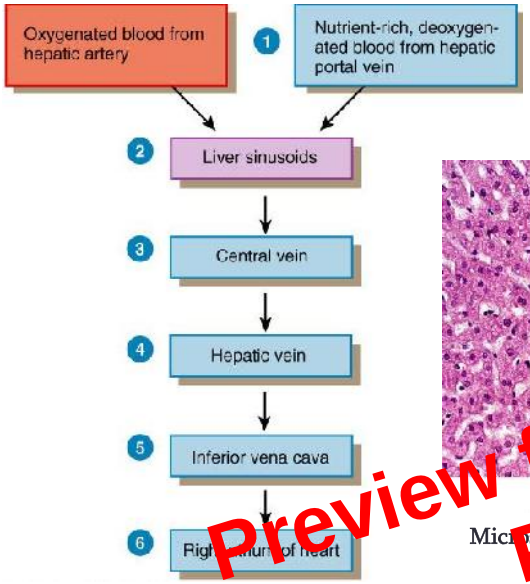
(Interactions Animation)

- Carbohydrate Digestion in the Mouth

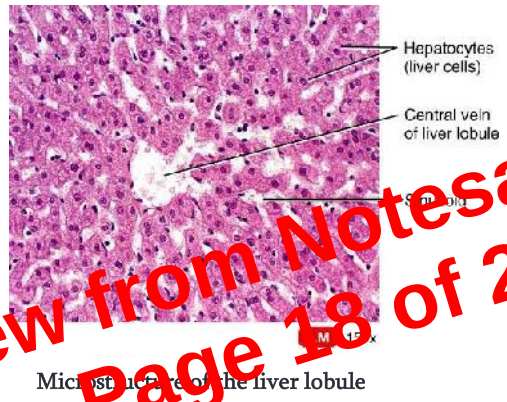


You must be connected to the internet to run this animation

The Liver and Gallbladder



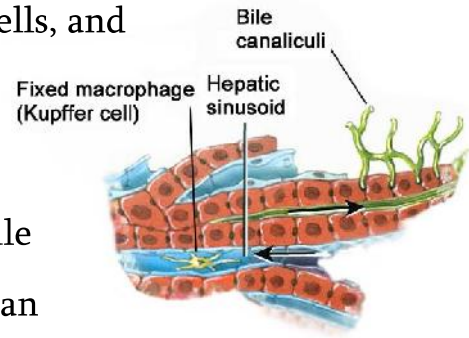
Path of blood in hepatic sinusoid



Microstructure of the liver lobule

The Liver and Gallbladder

- Fixed macrophages within the sinusoids called **Kupffer cells** destroy red cells, white cells, and bacteria in blood draining from the GI tract.



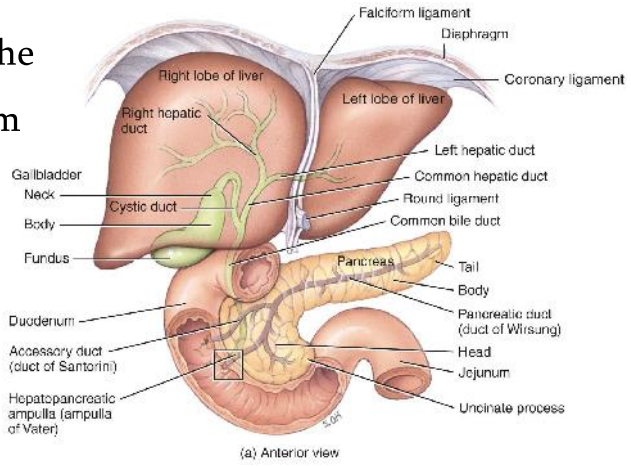
- An important function of lobule **hepatocytes** is to secrete bile, an excretory product that helps emulsify fats for the watery environment of small intestine digestive juices.
  - Hepatocytes secrete about 1 liter of bile per day.

The Liver and Gallbladder

- Bile is an alkaline solution consisting of water, bile salts, cholesterol, and bile pigments. It is both an excretory product and a digestive secretion.
  - Bile salts are used in the small intestine for the emulsification and absorption of lipids.
    - Without bile salts, most of the lipids in food would be passed out in feces, undigested.
  - The dark pigment in bile is called bilirubin and comes from the catabolism of old red blood cells.

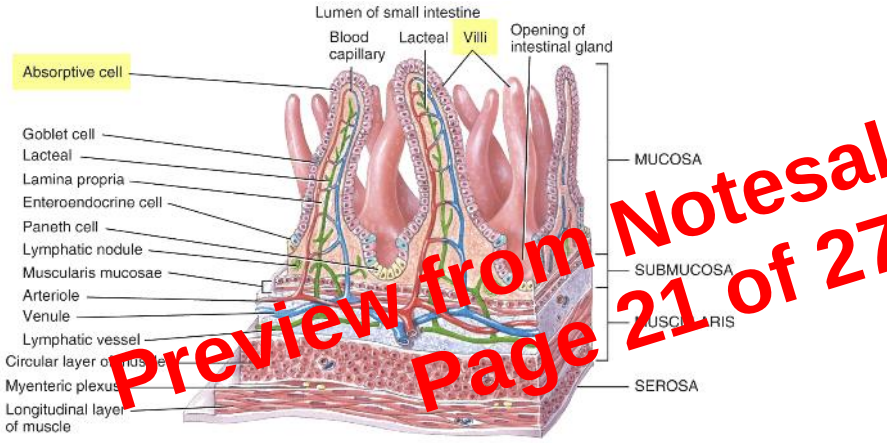
The Liver and Gallbladder

- Bile secreted into the canaliculi (located between the hepatocytes) exits the liver in the **common hepatic duct.**
  - This duct joins the **cystic duct** from the gallbladder to form the common bile duct **(CBD).**



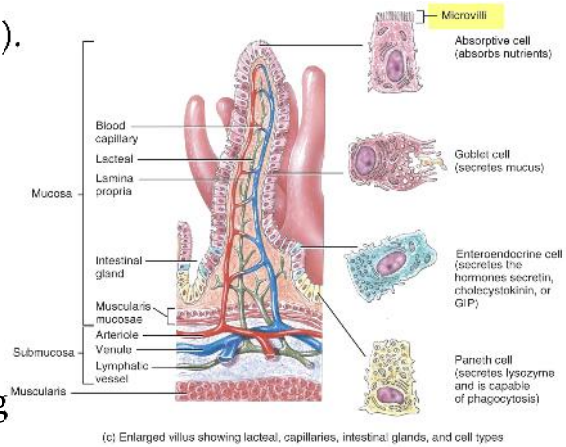
The Small Intestine

- **Villi** are multicellular structures that can barely be seen by the naked eye. They form finger-like projections that are covered with a simple columnar epithelium.



The Small Intestine

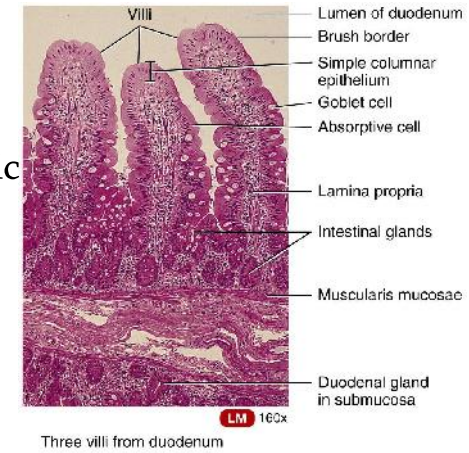
- **Microvilli** are microscopic folds in the apical surface of the plasma membrane on each simple columnar cell (about 200 million/mm^2).
- The plicae circulares, villi, and microvilli all contribute to **increase the surface area** of the small intestine, allowing for maximum reabsorption of nutrients.



(c) Enlarged villus showing lacteal, capillaries, intestinal glands, and cell types

The Small Intestine

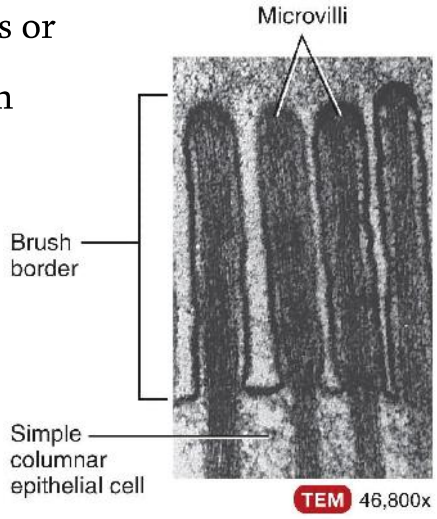
- The small intestinal mucosa contains many deep crevices lined with glandular epithelium **(intestinal glands)** that secrete **intestinal juice.** Its function is to complete the digestive process begun by pancreatic juice.
  - Trypsin exists in pancreatic juice in the inactive form trypsinogen - it and other enzymes are activated by intestinal juice.



Three villi from duodenum

The Small Intestine

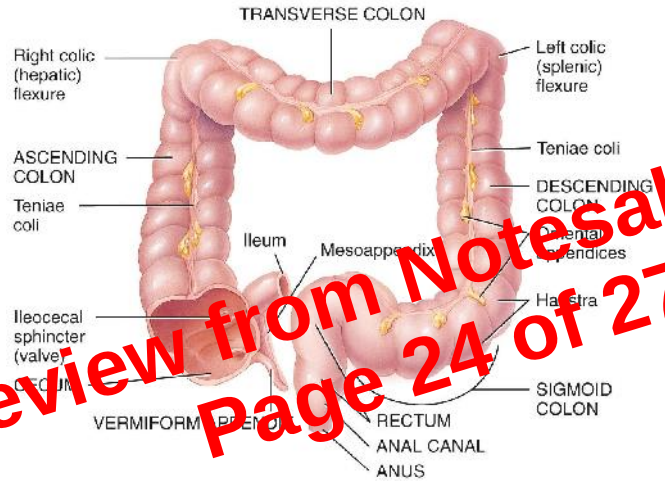
- Most of the enzymatic digestion in the small intestine occurs inside the epithelial cells or on their surfaces (rather than in the lumen of the tube) as intestinal juice comes in contact with the **brush border** of the villi.



(d) Several microvilli from duodenum

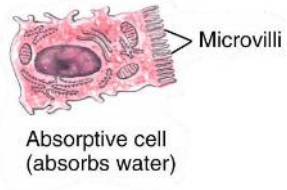
The Large Intestine

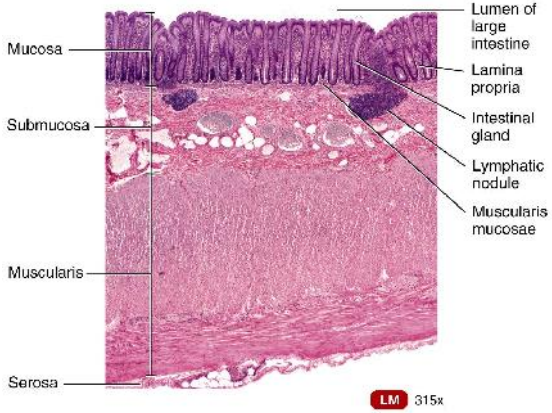
- The **large intestine** is about 5 feet in length. Starting at the ileocecal valve, the large intestine has 4 parts:
  - The cecum
  - The colon
    - ascending
    - transverse
    - descending
    - sigmoid
  - The rectum
  - The anal canal



The Large Intestine

- There are no circular folds or villi in the large intestine.
  - The mucosa is mostly an absorptive epithelium (mainly for water), and microvilli are plentiful.
  - Interspersed goblet cells produce mucous, but no digestive enzymes are secreted.





(c) Portion of wall of large intestine

The Large Intestine

- The large intestine is attached to the posterior abdominal wall by its **mesocolon** peritoneal membrane.
- **Teniae coli** are 3 separate longitudinal ribbons of smooth muscle that run the length of the colon.
  - Because the teniae coli is shorter than the intestine, the colon becomes sacculated into small pouches called **haustra** (giving it a segmented appearance).
    - As one haustrum distends, it stimulates muscles to contract, pushing the contents to the next haustrum.

The Large Intestine

- Hanging inferior to the ileocecal valve is the **cecum**, a small pouch about 2.5 in long.
  - Attached to the cecum is a 3 in coiled tube called the **appendix.**
- The open end of the cecum merges with a long tube called the **colon**, with its various parts.
  - Both the ascending and descending colon are retroperitoneal; the transverse and sigmoid colon are not.