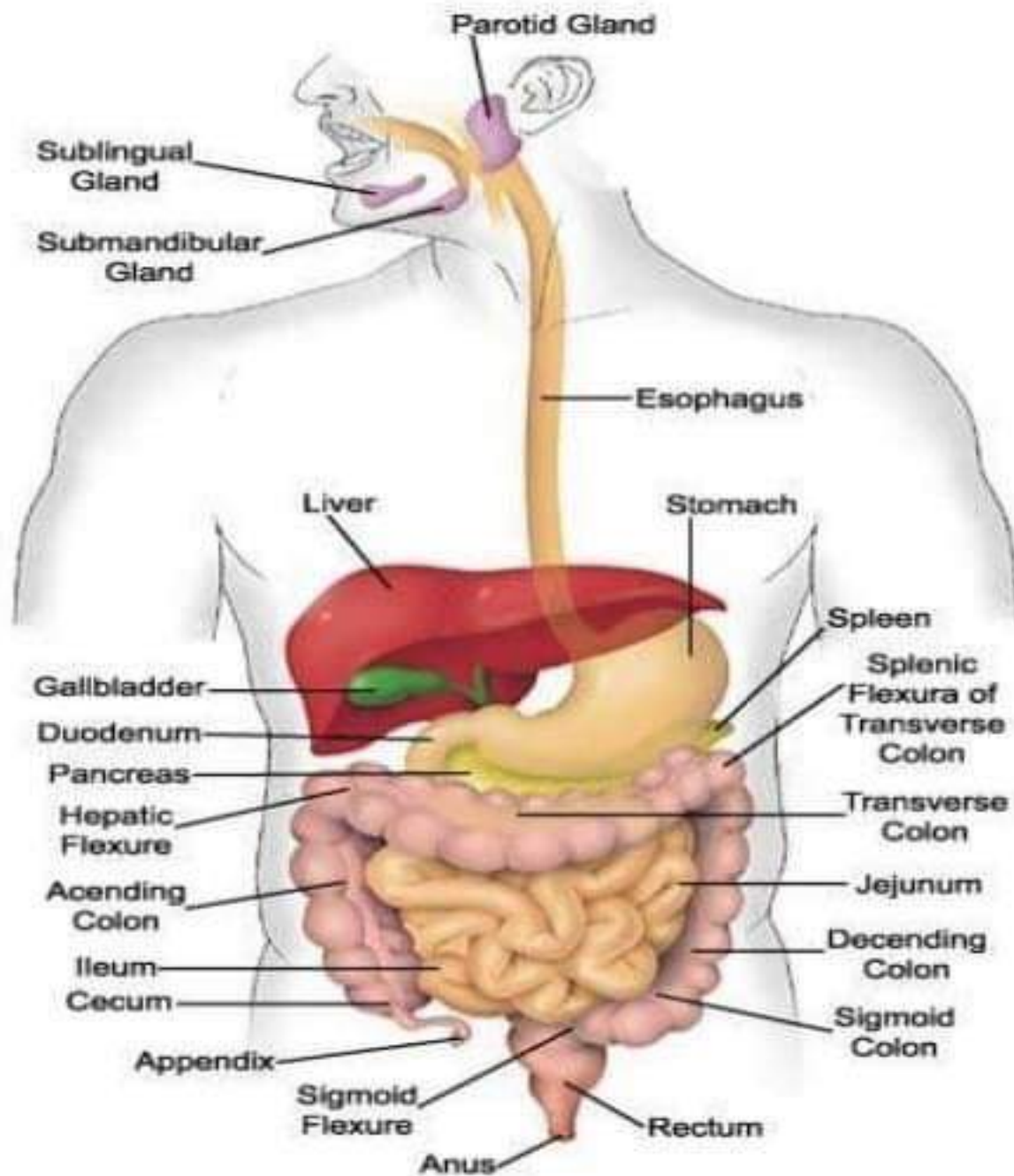




HUMAN DIGESTIVE SYSTEM

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Digestive System

- The human digestive system is a complex series of organs and glands that processes food. In order to use the food we eat, our body has to break the food down into smaller molecules that it can process; it also has to excrete waste.

Salivary Glands

Parotid

Submandibular

Sublingual

Oral cavity

Pharynx

Tongue

Esophagus

Pancreas

Liver

Gallbladder

Duodenum

Common
bile duct

Stomach

Pancreatic
duct

Colon

Transverse colon

Ascending colon

Descending colon

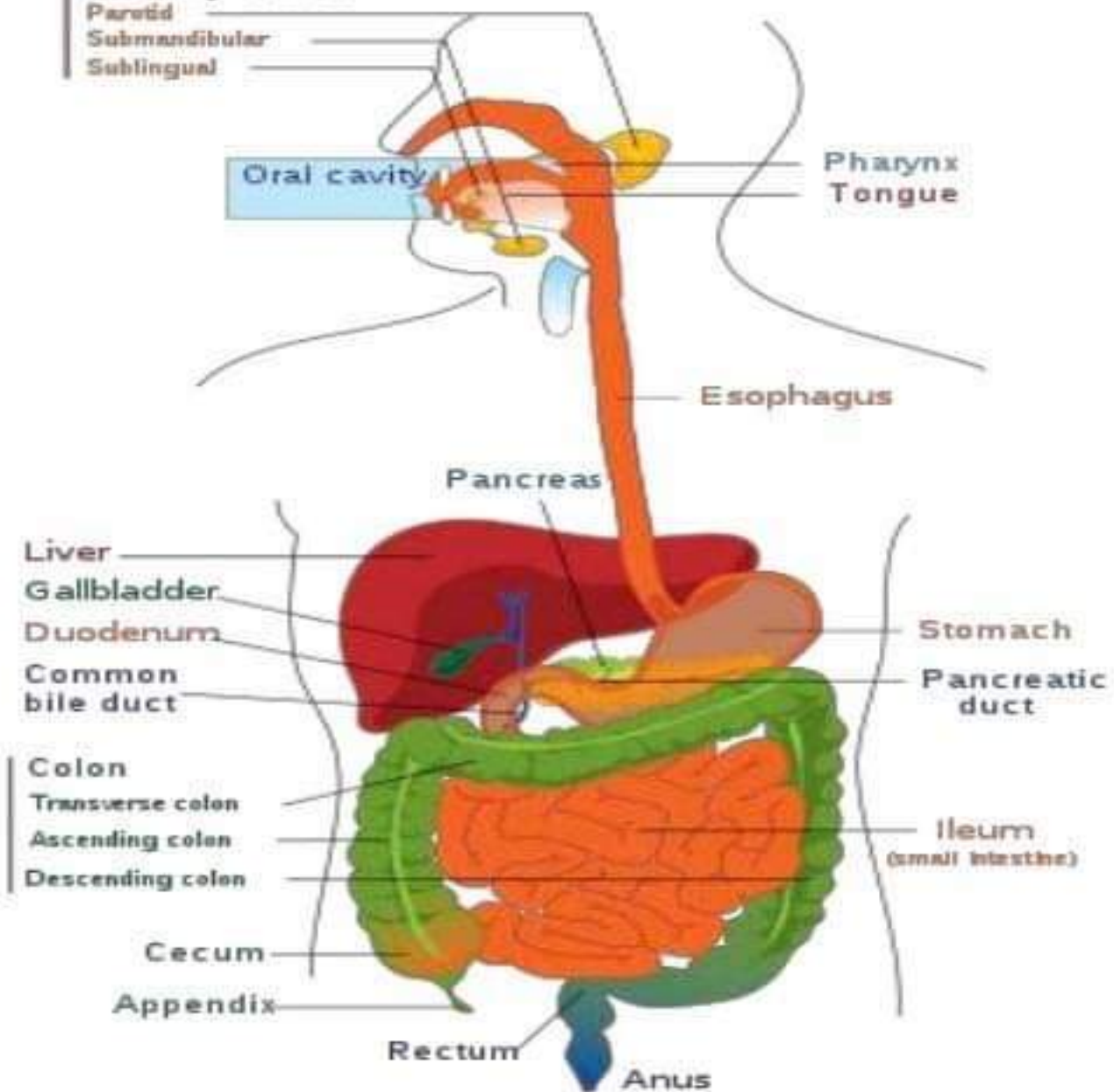
Ileum
(small intestine)

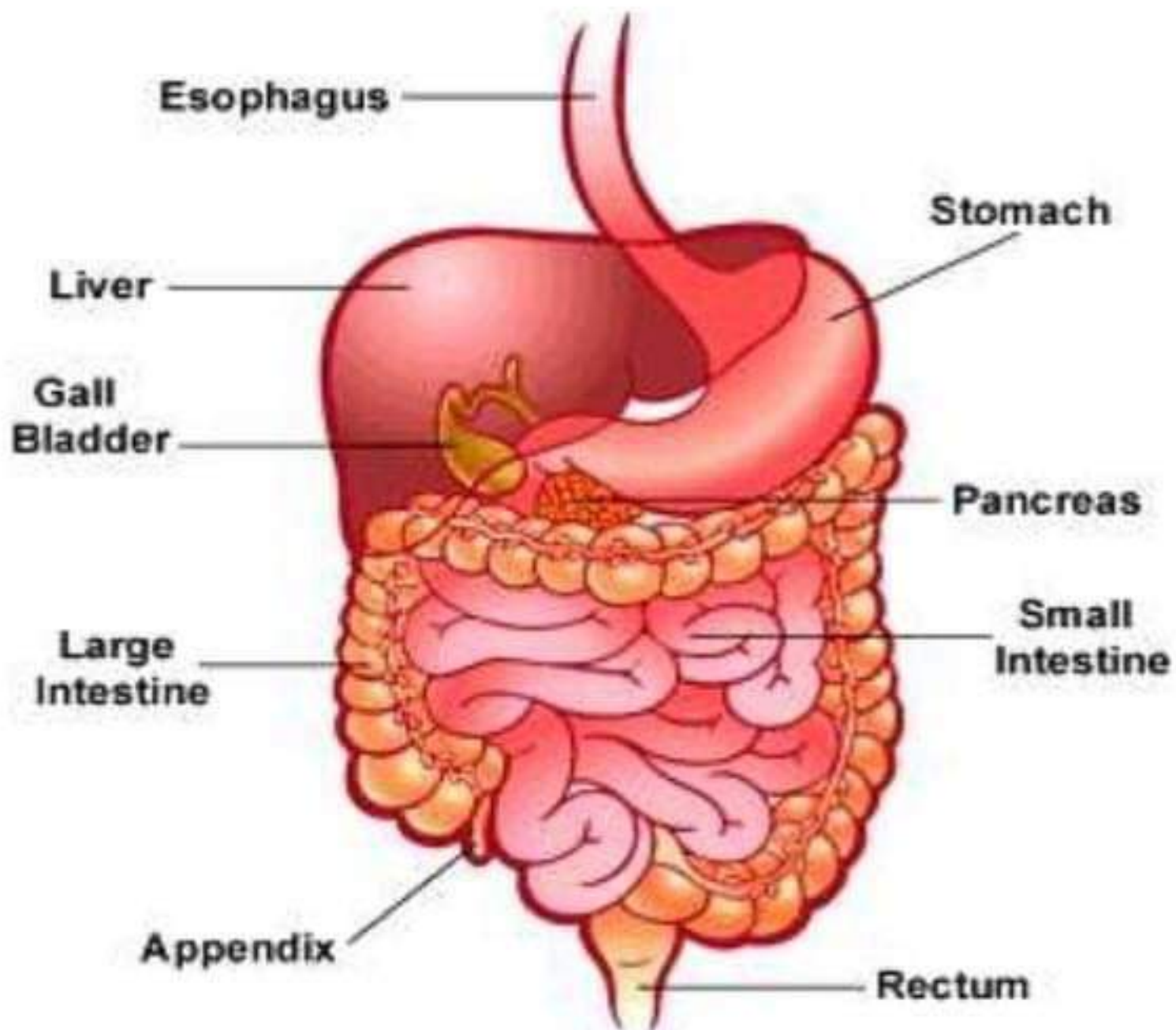
Cecum

Appendix

Rectum


Anus






The Digestive Process


- 1. The start of the process - the mouth:** The digestive process begins in the mouth. Food is partly broken down by the process of chewing and by the chemical action of salivary enzymes (these enzymes are produced by the salivary glands and break down starches into smaller molecules).




2. On the way to the stomach:
the esophagus - After being chewed and swallowed, the food enters the esophagus. The esophagus is a long tube that runs from the mouth to the stomach. It uses rhythmic, wave-like muscle movements (called peristalsis) to force food from the throat into the stomach. This muscle movement gives us the ability to eat or drink even when we're upside-down.




3. In the stomach - The stomach is a large, sack-like organ that churns the food and bathes it in a very strong acid (gastric acid). Food in the stomach that is partly digested and mixed with stomach acids is called chyme.



3. In the small intestine - After being in the stomach, food enters the duodenum, the first part of the small intestine. It then enters the jejunum and then the ileum (the final part of the small intestine). In the small intestine, bile (produced in the liver and stored in the gall bladder), pancreatic enzymes, and other digestive enzymes produced by the inner wall of the small intestine help in the breakdown of food.



4. In the large intestine - After passing through the small intestine, food passes into the large intestine. In the large intestine, some of the water and electrolytes (chemicals like sodium) are removed from the food. Many microbes (bacteria like *Bacteroides*, *Lactobacillus acidophilus*, *Escherichia coli*, and *Klebsiella*) in the large intestine help in the digestion process. The first part of the large intestine is called the cecum (the appendix is connected to the cecum). Food then travels upward in the ascending colon.




The food travels across the abdomen in the transverse colon, goes back down the other side of the body in the descending colon, and then through the sigmoid colon.

5. The end of the process - Solid waste is then stored in the rectum until it is excreted via the anus.

Key Players

Other organs that play a key role in digestion include the liver, gallbladder, and pancreas. The **pancreas** is a gland organ located behind the stomach that manufactures a cocktail of enzymes that are pumped into the duodenum. A duct also connects the duodenum to the **gallbladder**. This pear-shaped sac squeezes out green-brown bile, a waste product collected from the liver that contains acids for dissolving fatty matter

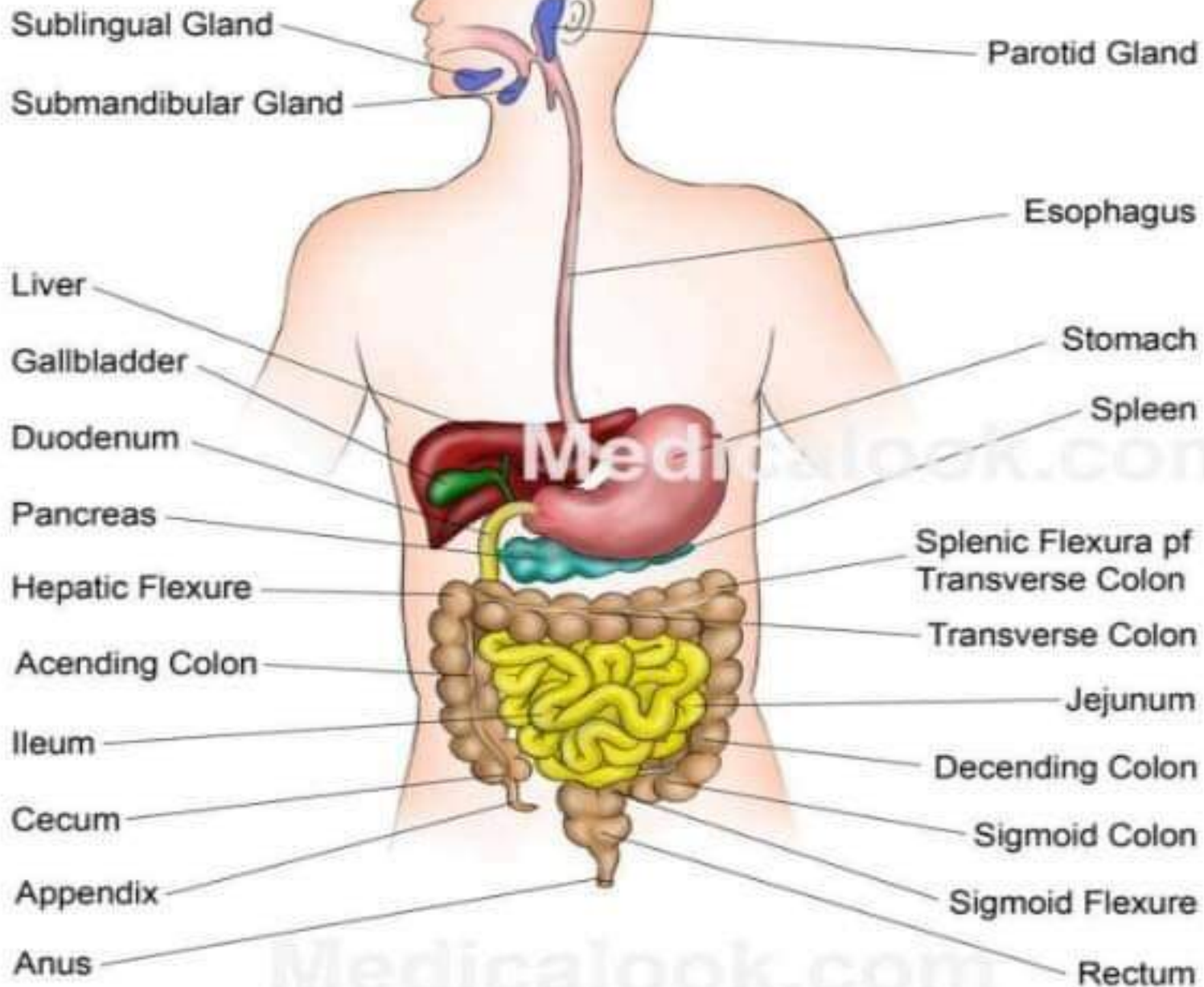


The **liver** itself is the body's main chemical factory, performing hundreds of different functions. It processes nutrients absorbed into the blood by the small intestine, creating energy-giving glycogen from sugary carbohydrates and converting dietary proteins into new proteins needed for our blood. These are then stored or released as needed, as are essential vitamins and minerals. The liver also breaks down unwanted chemicals, such as any alcohol consumed, which is detoxified and passed from the body as waste.

How is the digestive process controlled?


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Hormone Regulators

The major hormones that control the functions of the digestive system are produced and released by cells in the mucosa of the stomach and small intestine. These hormones are released into the blood of the digestive tract, travel back to the heart and through the arteries, and return to the digestive system where they stimulate digestive juices and cause organ movement.



The main hormones that control digestion are gastrin, secretin, and cholecystokinin (CCK):

- **Gastrin** causes the stomach to produce an acid for dissolving and digesting some foods. Gastrin is also necessary for normal cell growth in the lining of the stomach, small intestine, and colon.

- 
- **Secretin** causes the pancreas to send out a digestive juice that is rich in bicarbonate. The bicarbonate helps neutralize the acidic stomach contents as they enter the small intestine. Secretin also stimulates the stomach to produce pepsin, an enzyme that digests protein, and stimulates the liver to produce bile.

- **CCK** causes the pancreas to produce the enzymes of pancreatic juice, and causes the gallbladder to empty. It also promotes normal cell growth of the pancreas.

□ Additional hormones in the digestive system regulate appetite:

- **Ghrelin** is produced in the stomach and upper intestine in the digestive system and stimulates appetite.

- **Peptide YY** is produced in the digestive tract in response to a meal in the system and inhibits appetite.

Both of these hormones work on the brain to help regulate the intake of food for energy. Researchers are studying other hormones that may play a part in inhibiting appetite, including glucagon-like peptide-1 (GPL-1), oxyntomodulin (+), and pancreatic polypeptide.

Nerve Regulators

- Extrinsic, or outside, nerves come to the digestive organs from the brain or the spinal cord. They release two chemicals, acetylcholine and adrenaline.
- The intrinsic, or inside, nerves make up a very dense network embedded in the walls of the esophagus, stomach, small intestine, and colon. The intrinsic nerves are triggered to act when the walls of the hollow organs

Thank you