

Ministry of Higher Education and Scientific Research

Al-Mustaqbal University College

Bio-Medical Engineering Department



Subject: Systemic Physiology

Class: 3 rd

First Semester

Lecture Number: 1

Lecture Title: Digestive System

Prepared By

Asst. Lec. Sarah Hashim

Physiology of Digestive System

The digestive system is the organ system that processes food, extracts nutrients from it, and eliminates the residue. It does this in four stages:

1. ingestion, the selective intake of food.
2. digestion, the mechanical and chemical breakdown of food into a form usable by the body.
3. absorption, the uptake of nutrient molecules into the epithelial cells of the digestive tract and then into the blood or lymph; and finally
4. defecation, the elimination of undigested residue.



The gastrointestinal tract is a continuous tube that stretches from the mouth to the anus. Its primary function is to serve as a portal whereby nutrients and water can be absorbed into the body. All of these functions are tightly regulated in concert with the ingestion of meals. Diseases in the digestive systems, also called gastrointestinal diseases, have become quite common in the modern day world. The health of a body depends on

the health of the digestive system and any barrier in its functioning will ultimately affect the body.

The digestion stage itself has two facets, mechanical and chemical.

- Mechanical digestion is the physical breakdown of food into smaller particles. It is achieved by the cutting and grinding action of the teeth and the churning contractions of the stomach and small intestine. Mechanical digestion exposes more food surface to the action of digestive enzymes.
- Chemical digestion is a series of hydrolysis reactions that break dietary macromolecules into their monomers (residues): polysaccharides into monosaccharides, proteins into amino acids, fats into glycerol and fatty acids, and nucleic acids into nucleotides. Some nutrients are already present in usable form in the ingested food and are absorbed without being digested: vitamins, free amino acids, minerals, cholesterol, and water.

Digestion processes

Digestion involves the processes of motility, secretion, and membrane transport.

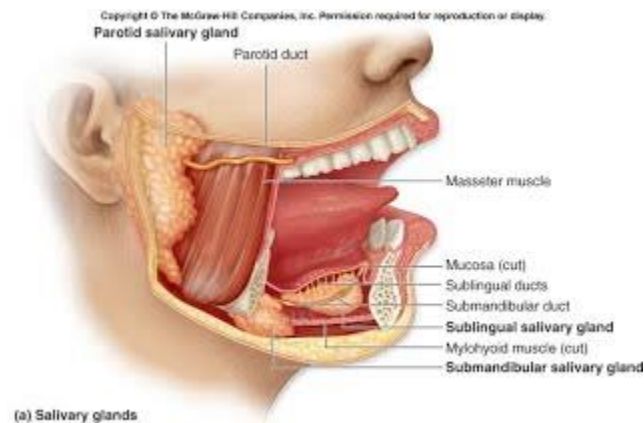
- Motility refers to the muscular contractions that break up food, propel it through the canal, mix it with digestive enzymes.
- Secretion releases enzymes, hormones, and other products that carry out or regulate digestion.
- Membrane transport includes all the mechanisms such as active transport and facilitated diffusion that absorb nutrients and transfer them to the blood and lymph.

Digestive system organs

The main organs that make up the digestive system (in order of their function) are the mouth, esophagus, stomach, small intestine, large intestine, rectum and anus. Helping them along the way are the pancreas, gall bladder and liver.

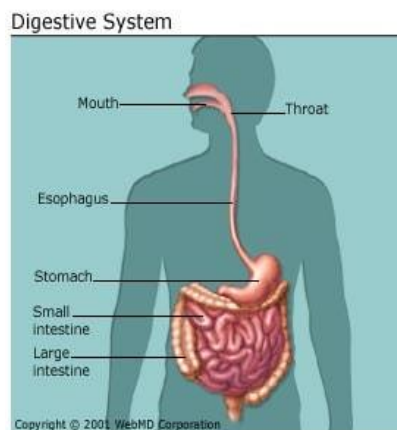
1. Mouth

The mouth is the beginning of the digestive tract. In fact, digestion starts before you even take a bite. The salivary glands get active and after start eating, chewing food into pieces that are more easily digested. Saliva mixes with the food to begin to break it down into a form that the body can absorb and use. When swallow, tongue passes the food into throat and into esophagus.



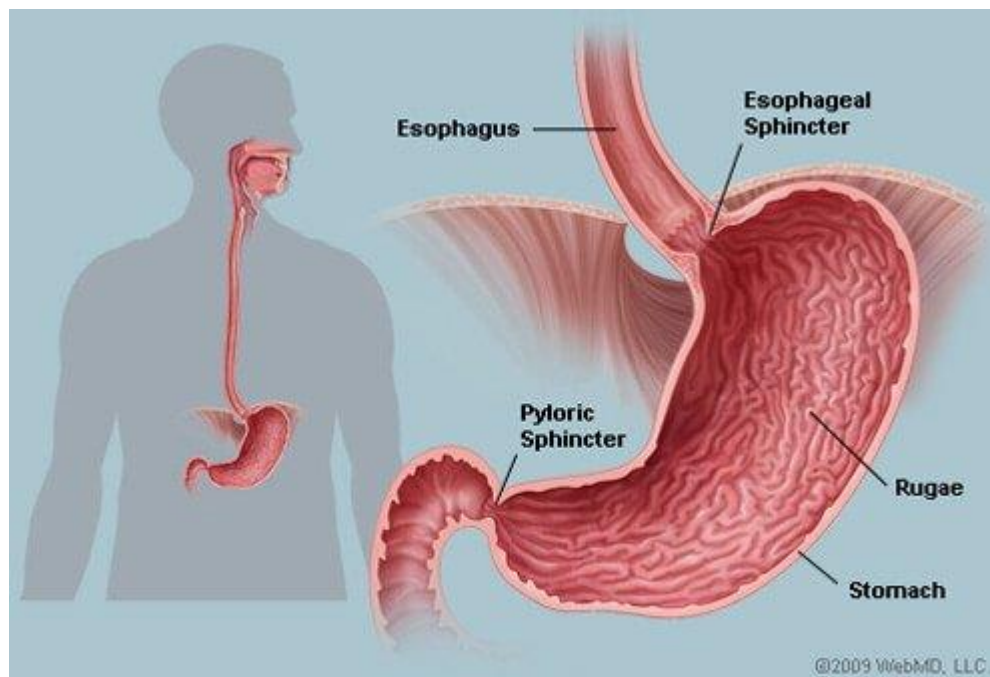
2. Esophagus

Located in throat near trachea, the esophagus receives food from mouth when swallow. The epiglottis is a small flap that folds over trachea as you swallow to prevent choking (when food goes into trachea). A series of muscular contractions within the esophagus delivers food to stomach.



3. Stomach

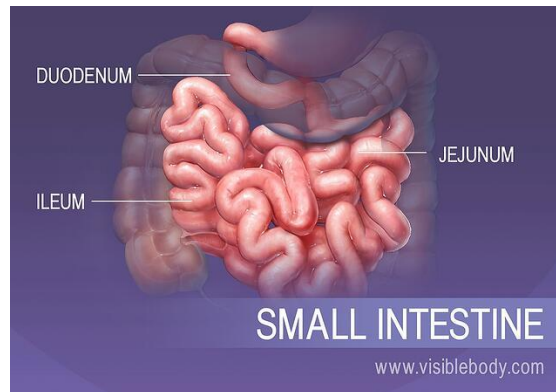
The stomach is a hollow organ, or "container," that holds food while it is being mixed with stomach enzymes. These enzymes continue the process of breaking down food into a usable form. Cells in the lining of the stomach secrete a strong acid and powerful enzymes that are responsible for the breakdown process. When the contents of the stomach are processed enough, they're released into the small intestine.



4. Small intestine

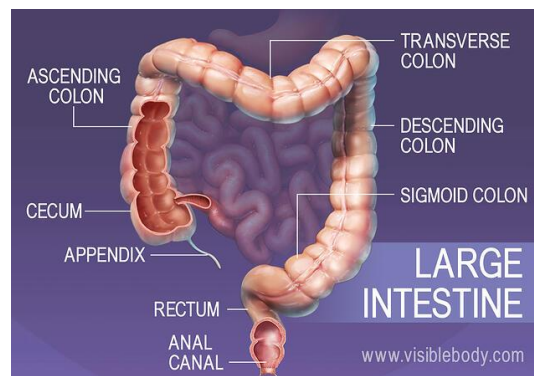
Made up of three segments -- the duodenum, jejunum, and ileum -- the small intestine is a 22-foot long muscular tube that breaks down food using enzymes released by the pancreas and bile from the liver. Peristalsis also works in this organ, moving food through and mixing it with digestive juices from the pancreas and liver.

The duodenum is the first segment of the small intestine. It's largely responsible for the continuous breaking-down process. The jejunum and ileum lower in the intestine are mainly responsible for absorption of nutrients into the bloodstream.



5. large intestine

The large intestine, or colon, is responsible for processing waste so that emptying the bowels is easy and convenient. It's a 6-foot long muscular tube that connects the small intestine to the rectum.



6. Rectum

The rectum is a straight, 8-inch chamber that connects the colon to the anus. The rectum's job is to receive stool from the colon, let you know that there is stool to be evacuated (pooped out) and to hold the stool until evacuation happens. When anything (gas or stool) comes into the rectum, sensors send a message to the brain. The brain then decides if the rectal contents can be released or not.

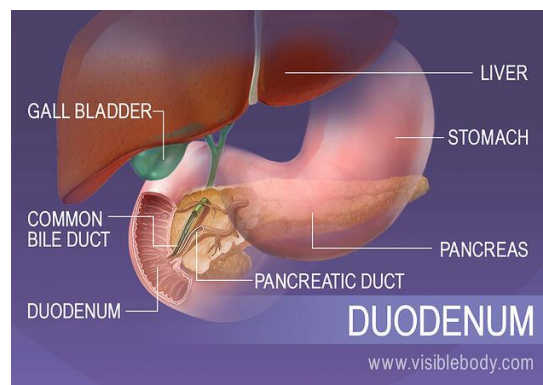
7. Anus

The anus is the last part of the digestive tract. It is a 2-inch long canal consisting of the pelvic floor muscles and the two anal sphincters (internal and external). The lining of the upper anus is able to detect rectal contents. It lets you know whether the contents are liquid, gas or solid.

Organs related with the digestive system

1. Pancreas

The pancreas secretes digestive enzymes into the duodenum that break down protein, fats and carbohydrates. The pancreas also makes insulin, passing it directly into the bloodstream. Insulin is the chief hormone in our body for metabolizing sugar.



2. Liver

The liver has many functions, but its main job within the digestive system is to process the nutrients absorbed from the small intestine. Bile from the liver secreted into the small intestine also plays an important role in digesting fat and some vitamins.

The liver also detoxifies potentially harmful chemicals. It breaks down and secretes many drugs that can be toxic to the body.

3. Gallbladder

The gallbladder stores and concentrates bile from the liver, and then releases it into the duodenum in the small intestine to help absorb and digest fats.

Digestive system with other systems of the body

As is the case with all body systems, the digestive system does not work in isolation; it functions cooperatively with the other systems of the body. Consider for example, the interrelationship between the digestive and cardiovascular systems. Arteries supply the digestive organs with oxygen and processed nutrients, and veins drain the digestive tract.

The interrelationship of the digestive and endocrine systems is also critical. Hormones secreted by several endocrine glands, as well as endocrine cells of the pancreas, the stomach, and the small intestine, contribute to the control of digestion and nutrient metabolism. In turn, the digestive system provides the nutrients to fuel endocrine function. Table 1 gives a quick glimpse at how these other systems contribute to the functioning of the digestive system.

Table 1: contribution of other body systems to the digestive system

Body systems	Benefits received by the digestive system
Cardiovascular	Blood supplies digestive organs with oxygen and processed nutrients
Endocrine	Endocrine hormones help regulate secretion in digestive glands and accessory organs
Integumentary	Skin helps protect digestive organs and synthesizes vitamin D for calcium absorption
Lymphatic	Mucosa-associated lymphoid tissue and other lymphatic tissue defend against entry of pathogens; lacteals absorb lipids; and lymphatic vessels transport lipids to bloodstream
Muscular	Skeletal muscles support and protect abdominal organs
Nervous	Sensory and motor neurons help regulate secretions and muscle contractions in the digestive tract

Respiratory	Respiratory organs provide oxygen and remove carbon dioxide
Skeletal	Bones help protect and support digestive organs
Urinary	Kidneys convert vitamin D into its active form, allowing calcium absorption in the small intestine