Lecture 1
Digestive System

By Dr Vipan Goyal

https://www.facebook.com/vipangoyal13

https://www.instagram.com/vipangoyal13

vipan.studyiq@gmail.com

Digestive System

- Human digestive system
- The Alimentary Canal
- The Esophagus
- Stomach
- Enzymes in Stomach
- Small Intestine
- Large Intestine

- The digestion process takes place in the following steps.
- **Ingestion :**
- The very first step involves mastication (chewing). The salivary glands, along with the tongue helps to moisten and lubricate food, before being pushed down into the food pipe.
- **Digestion**
- The process of converting complex food particles into simpler substances in the presence of enzymes and acids secreted by different digestive organs.
- **Absorption**
- This process begins in the small intestine where most of the nutrients and minerals are absorbed. The excess water in the indigestible matter is absorbed by the large intestines.
- **Assimmilation**
- Use of energy
- **Excretion**
- The process of removing indigestible substances and waste by-products from the body through the process of defecation.

Human Digestive System

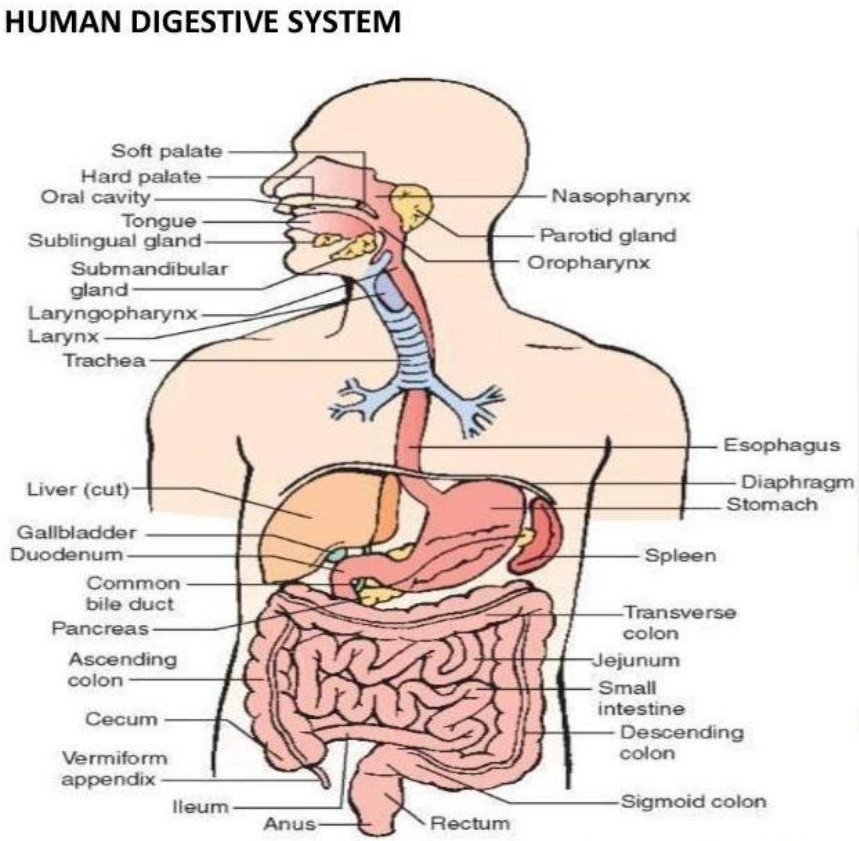
Definition : The process of reducing food into smaller molecules that can be absorbed into the body is called digestion.

Major Organs

- Mouth
- Esophagus
- Stomach
- Small Intestine
- Large Intestine.

Accessory Organs:

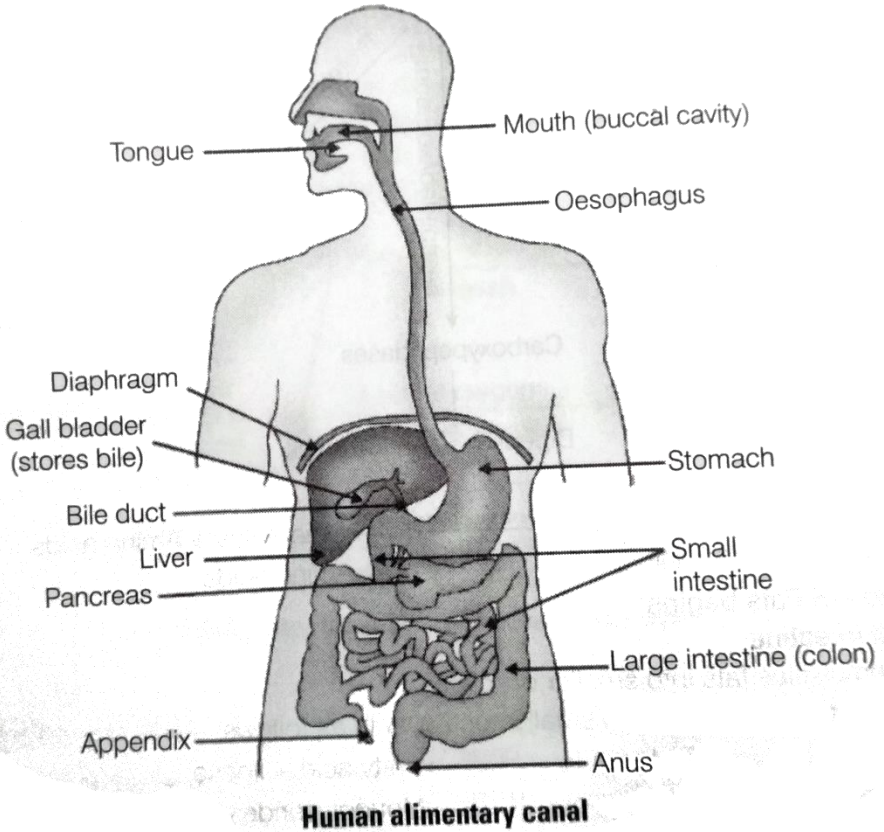
- Liver
- Gallbladder
- Pancreas.



The Alimentary Canal

The Alimentary Canal

- **Ingestion**: The process of taking substances into the body through the mouth.
- **Digestion**: The breakdown of large, insoluble food molecules into small water soluble molecules using mechanical and chemical processes.
- **Absorption**: The movement of digestive food molecules through the wall of the intestine into the blood or lymph.
- **Assimilation**: The movement of digestive food molecules into the cells of the body where they are used, becoming part of the cells.
- **Egestion**: The passing out of the food that has not been digested, as passes , through the anus

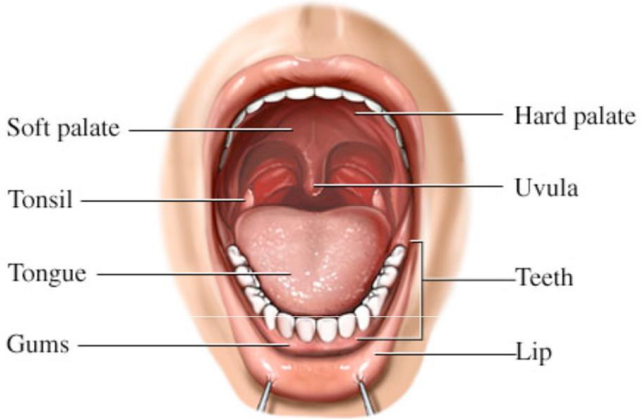


Human alimentary canal

The Mouth

Digestive System Diagrams

Mouth Diagrams



The Mouth: The first part of the digestive system. The Entry point of food.

Structures in the mouth that aids digestion are

- Teeth (cut, tear, crush and grind food)
- Salivary glands–Produce and secrete saliva into the oral cavity.

Saliva:

It moistens the food, contains enzymes (**ptyalin** or **salivary amylase**). The beginning of digestion of starch into smaller polysaccharides.

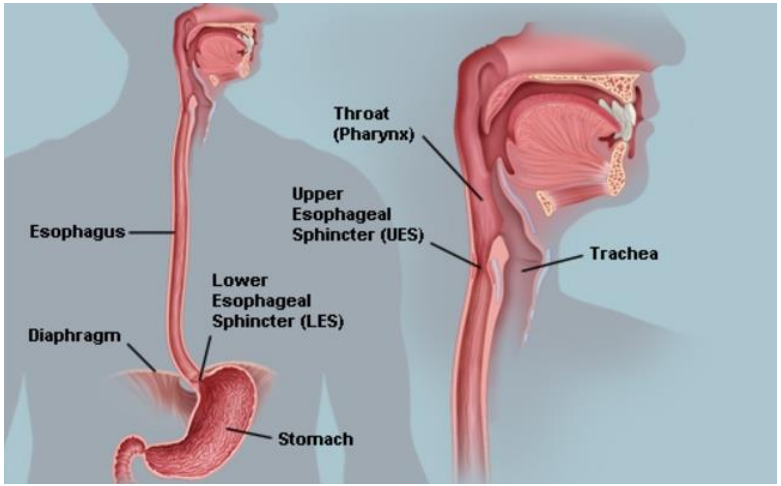
Function:

- Mechanical digestion.
- Increasing surface area for faster chemical digestion

The Esophagus

The Esophagus:
A tube connecting the mouth to the stomach, running through the thoracic cavities. It lies behind wind pipe (trachea).
The trachea has as an epiglottis, preventing food from entering the wind pipe, moving the food to the esophagus while swallowing food travels down the esophagus, through a series of involuntary rhythmic contractions (wave-like) called peristalsis.

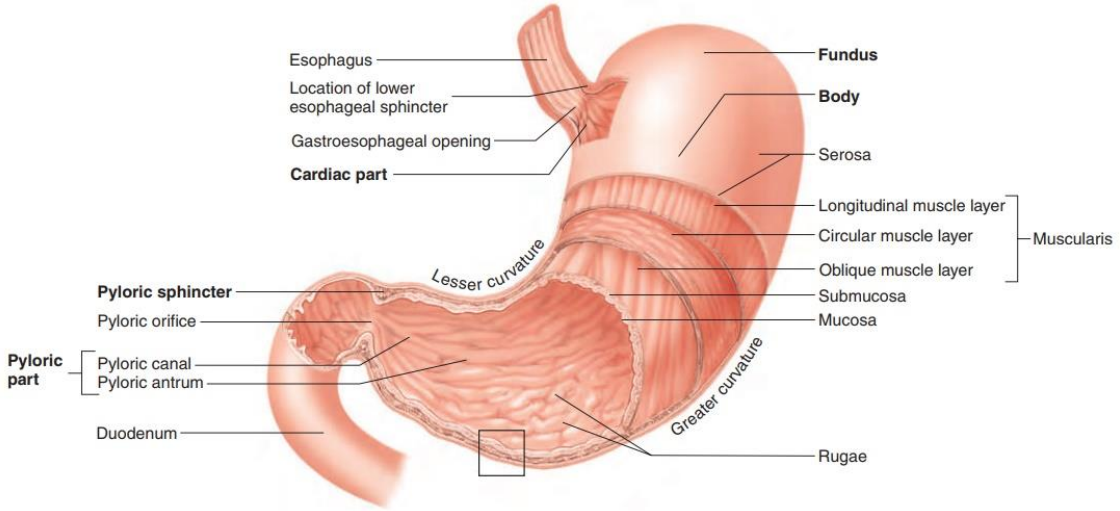
Function:
The lining of the esophagus secretes mucus, lubricating to support the movement of food.



Esophageal sphincter:
Bolus reaches the stomach must pass through a muscular ringed valve called the esophageal sphincter(Cardiac Sphincter).
Function: Prevent stomach acids from back flowing into the esophagus.

Stomach

Stomach : J- shaped muscular sac, has inner folds (**rugae**), increasing surface area of the stomach.



Function:

Stomach performs mechanical digestion, by churning the bolus and mixing it with the gastric juices, secreted by the lining of the stomach.

Gastric juices:

It contains HCl, salts, enzymes, water and mucus. HCl helps breakdown of food and kills bacteria that come along with the food. **The bolus is now called chyme.**

Enzymes in Stomach

Enzymes in stomach (acidic environment):
HCl secreation, kill any microbes that are found in the bolus, creating a pH of 2. Mucus prevents the stomach from digesting itself.

Pepsin secreation
It is responsible for initiating the breakdown of proteins in food, hydrolyzes proteins to yield polypeptides (peptones).
Proteins to peptones
At pH 2, the enzyme from the salivary glands stops breaking down carbohydrates.

Pyloric sphincter:
Chyme moves from the stomach to the small intestine. It passes through a muscular ringed sphincter called the pyloricsphincter.

How stomach does not digest itself?

Three protective mechanisms:-

First the stomach only secretes small amounts of gastric juices until food is present.

Second the secretion of mucus coats the lining of the stomach protecting it from the gastric juices.

The third mechanism is the digestive enzyme pepsin is secreted in an inactive protein called pepsinogen. Pepsinogen is converted to pepsin in the increased presence of hydrochloric acid (Ph1).

Small Intestine

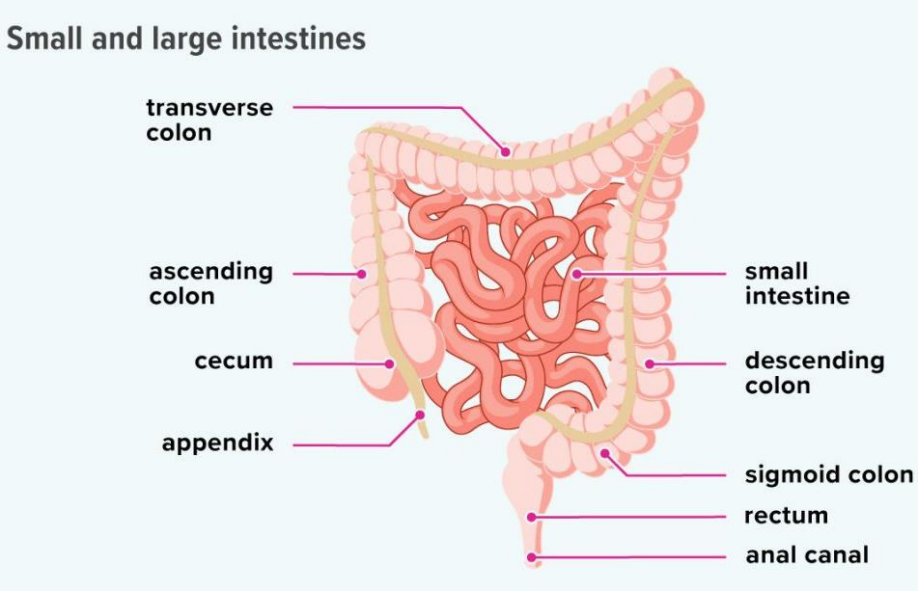
Small Intestine

It is responsible for the complete digestion of all macro molecules, and the absorption of their component molecules. It contains a finger like projection villi which increases the surface area of small intestine. Food can stay 4 to 8 hours in the small intestine.

Parts of small Intestine

The small intestine is made up of three parts :

- Duodenum
- Jejunum (no digestion)
- Ileum (no digestion)



Duodenum

1.Duodenum

The first part is the duodenum, u-shaped organ, approximately 30 cm in length. This area completes most of the digestion processes.

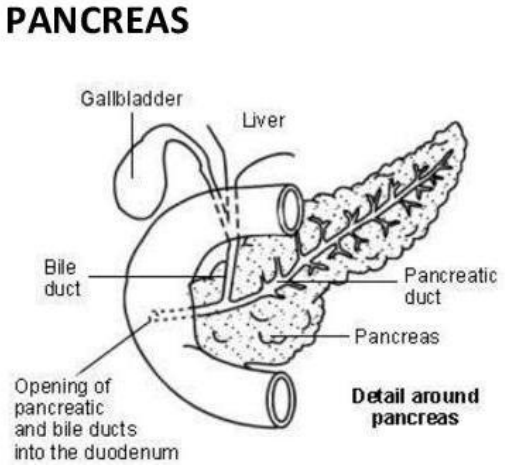
Enzymes are secreted in to the duodenum form the **pancreas**, **gall bladder and intestinal juice**. It is located between the stomach and the middle part of the small intestine, or jejunum.

Pancreas :

It is located behind stomach and produces insulin and glucagon. These two hormones maintains the glucose level in the blood through feedback mechanism. It secretes pancreatic juice containing proteases, pancreatic amylase and lipase.

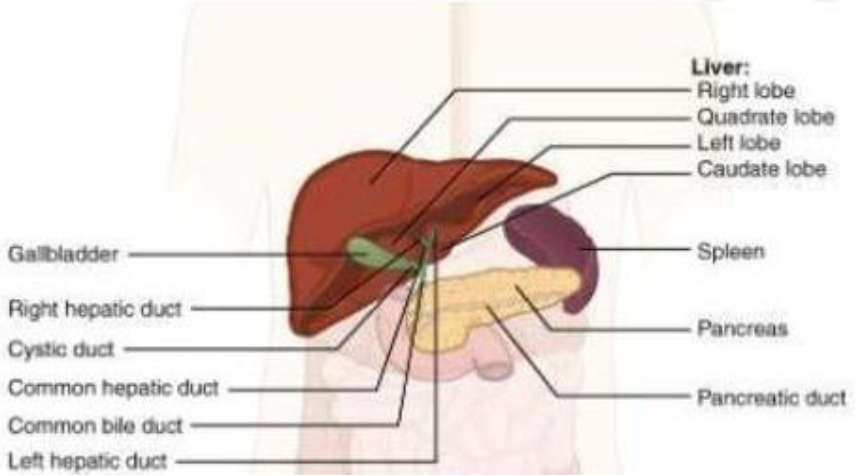
Proteases (pepsin, trypsin and chymotrypsin) Converts proteins into peptides into amino acids.

Pancreatic amylase Converts starch to amylase Lipase Converts fats into fatty acid and glycerol.



Duodenum

LIVER



Gallbladder :

The storage tank for bile (a greenish- yellow liquid that helps your body break down and use fats), located in liver and shaped like a pear

Liver :

It is a factory for antibodies and bile, helps in breaking down of fats, emulsification of fats. It stores vitamins and sugars until your body needs them.

Bile juice :

It is produced by liver, stored in the gall bladder. The bile salts emulsify fats and break them into smaller globules which are easily digestible by lipase.

Duodenum

Intestinal juice :

The epithelial cells of the villi produce enzymes which complete the breakdown of:

Maltose **to** glucose

Peptides **to** amino acids

Fats **to** fatty acid and glycerol

2 Jejunum

The jejunum is approximately 2.5 m long. Although some digestion is completed here, it has more villi and microvilli; its role is absorption of nutrients.

3 Ileum

The ileum, is approximately 3m long,has fewer villi and microvilli than the other two parts. Although absorption also occurs here, it is responsible for pushing the waste materials into the large intestine.

Large Intestine

Components of large Intestine

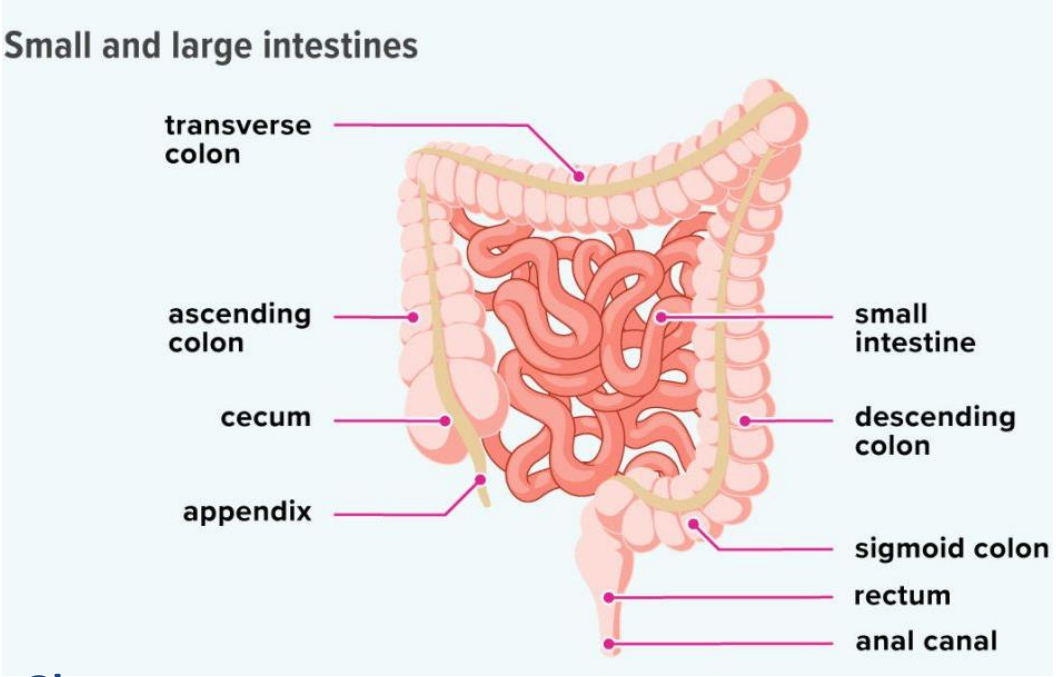
The large intestine contains water with undigested matter, cellulose and fibre that digested partly by bacteria. It is composed of several distinctive parts:

Cecum:

Contains beta cellulose enzyme, absent in human body.

Colon:

The colon consists off our parts: ascending colon, transverse colon, descending colon, sigmoid colon. It contains coliform group of bacterias and this type of bacterias are useful to check the water contamination.



Glucose:

It is stored in the form of glycogen in liver and muscles in animals while in plants, it is stored in starch.

Large Intestine

Disaccharides	Unit 1	Unit 2
Sucrose (*table sugar*, *cane sugar*, *beet sugar*, or *saccharose*)	Glucose	Fructose
Lactulose	Galactose	Fructose
Lactose (*milk sugar*)	Galactose	Glucose
Maltose (*malt sugar*)	Glucose	Glucose
Trehalose	Glucose	Glucose
Cellobiose	Glucose	Glucose
Chitobiose	Glucosamine	Glucosamine

https://www.facebook.com/vipangoyal13

https://www.instagram.com/vipangoyal13

vipan.studyiq@gmail.com

Thank You