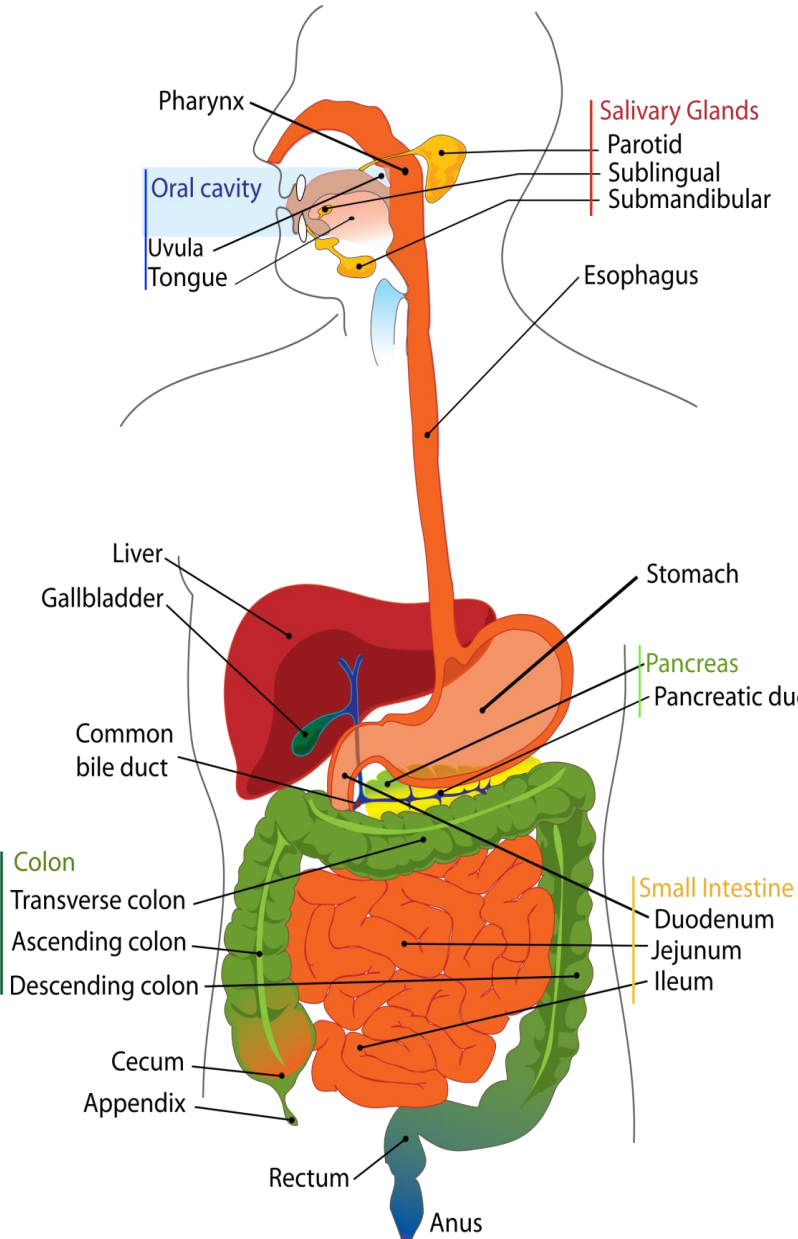


DIGESTIVE SYSTEM

➤ **Digestive System consist of following organs:**



1. Oral Cavity
2. Pharynx
3. Esophagus
4. Stomach
5. Small Intestine:
 - a. Duodenum
 - b. Jejunum
 - c. Ileum
6. Large Intestine:
 - a. Ascending Colon
 - b. Transverse Colon
 - c. Descending Colon
7. Rectum
8. Anus
9. Accessory Glands:
 - a. Salivary gland (Oral cavity)
 - b. Liver
 - c. Pancreas

➤ Digestive system is also known as alimentary (relating to nourishment or sustenance) system or gastro intestinal tract (GIT).

➤ **Main functions of digestive system:**

- Ingestion (Food intake)
- Digestion
- Absorption
- Assimilation (transport nutrients to various parts of body for different functions)
- Water balance
- Elimination

➤ **Metabolism:**

The whole range of biochemical processes that occur within a living organism. Metabolism consists of anabolism (the buildup of substances) and catabolism (the breakdown of substances). The term metabolism is commonly used to refer specifically to the breakdown of food and its transformation into energy.

➤ **Oral Cavity:**

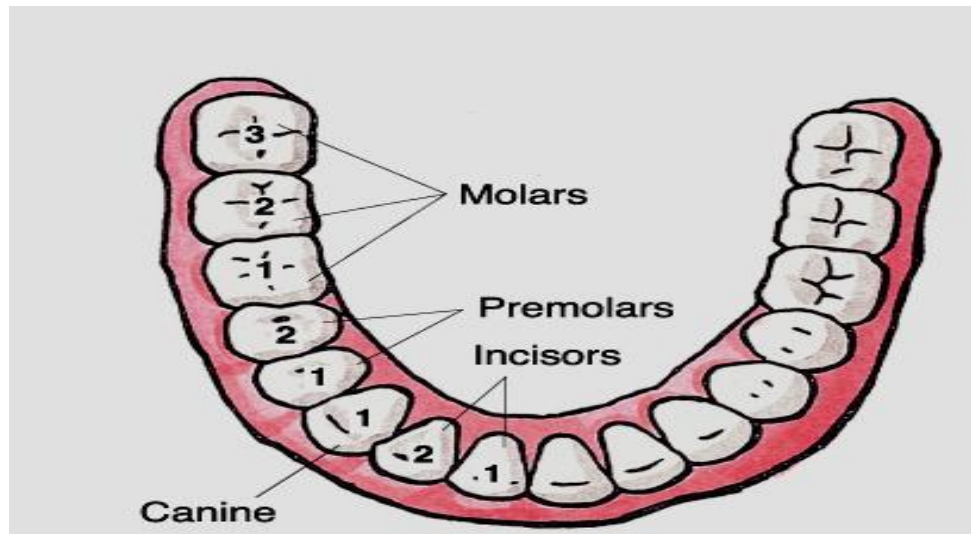
- ✓ It consists of lips, cheeks, tongue and teeth.
- ✓ Main function include chewing, swallowing, tasting, and speaking.

● **Lips and cheeks:**

- ✓ Lips hold the food inside the mouth cavity and not allow food to fall down outside of mouth.
- ✓ Cheeks provide space for mixing and chewing of food.

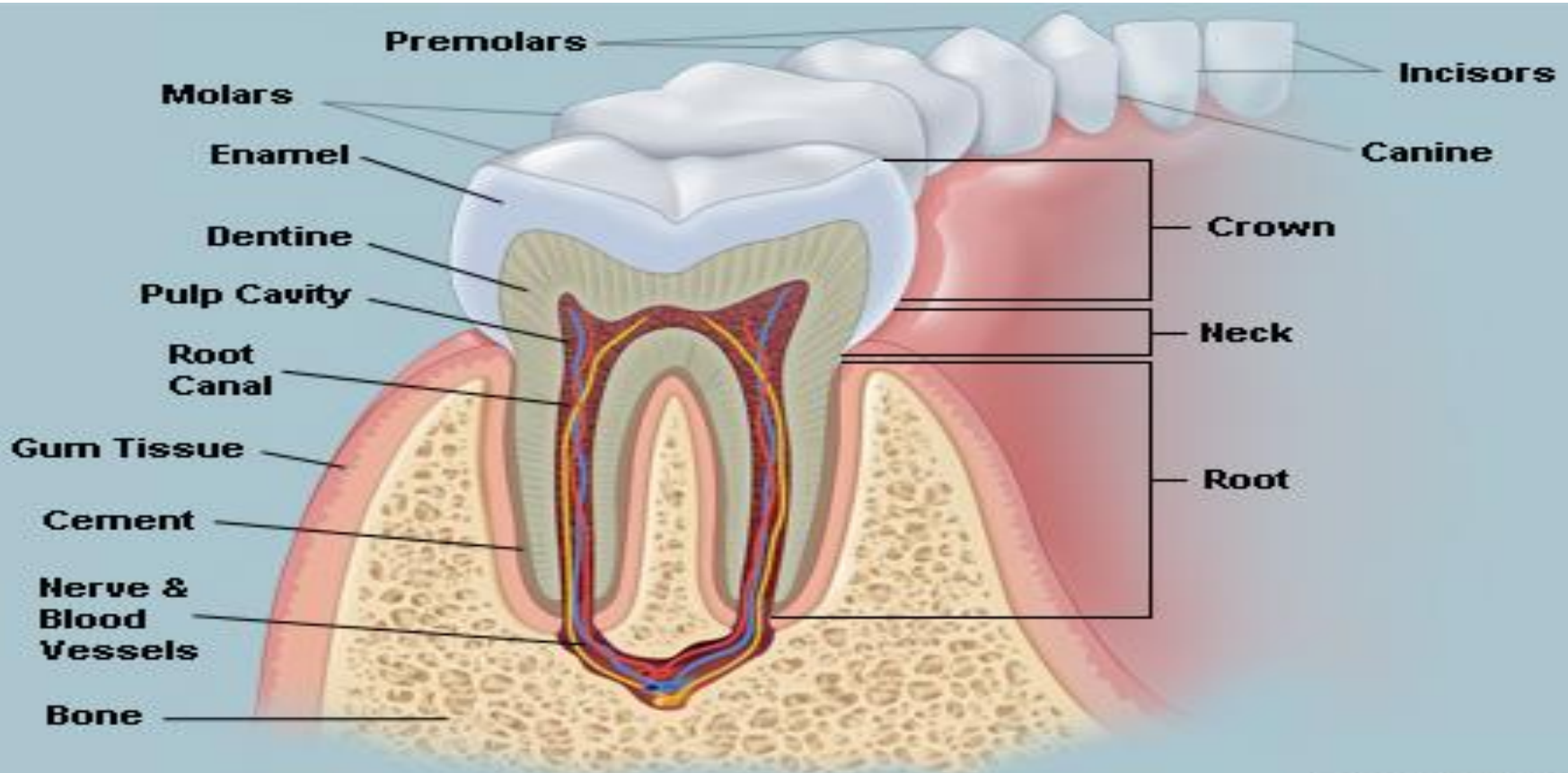
● Teeth:

- ✓ In a healthy adult there are total 32 teeth, 16 in each jaw.
 - 4 -> Incisors (to cut the food)
 - 2 -> Canine (holding and tearing of food)
 - 4 -> Premolars (holding and crushing)
 - 6 -> Molars (grinding of food)



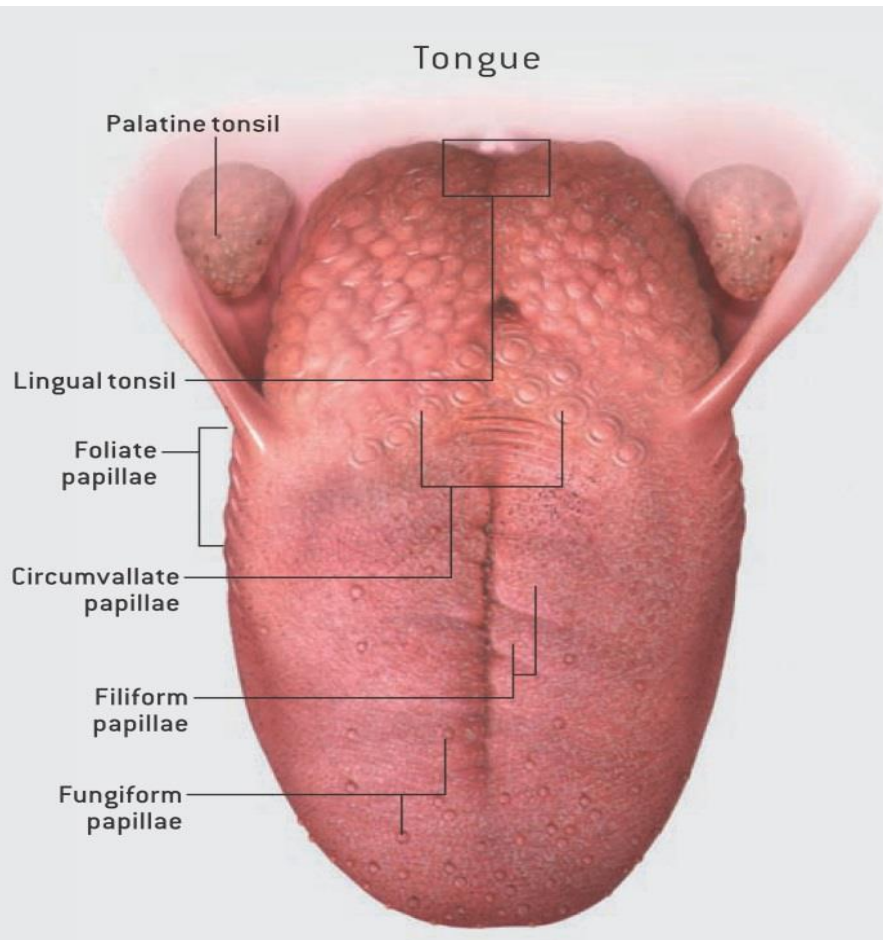
- ✓ Last molars are known as wisdom teeth.

- ✓ A teeth has three parts - crown, neck and root
- ✓ Center part of teeth is supplied with blood vessles, nerves and lymph vessels.
- ✓ Main function of teeth is chewing the food by breaking down into small particles.



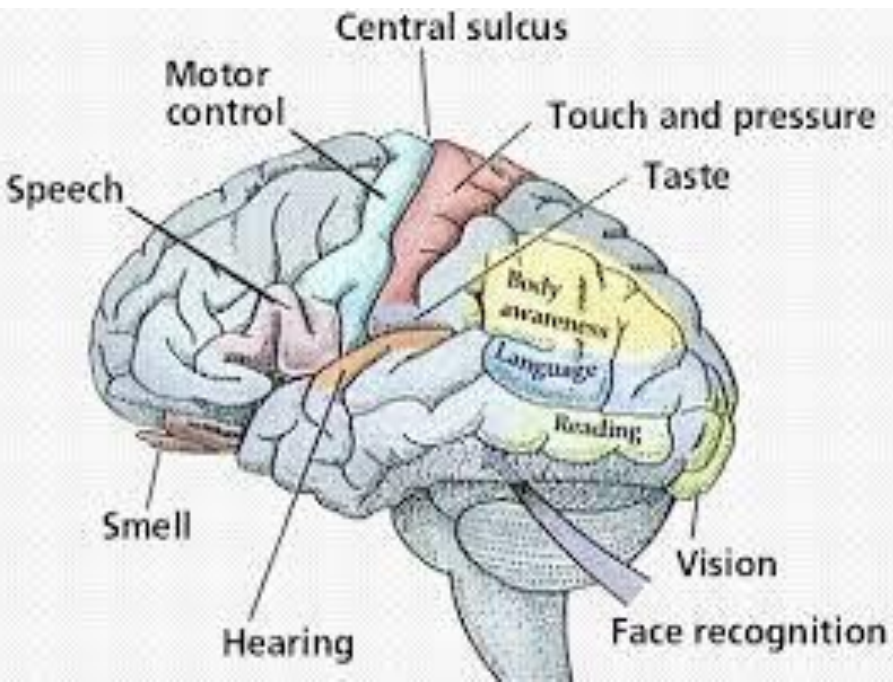
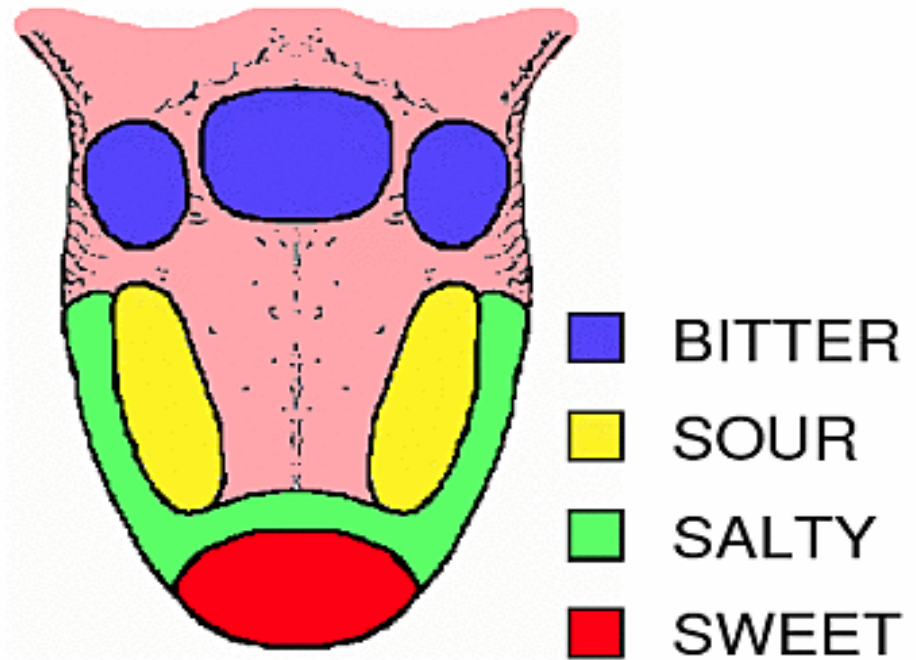
➤ Tongue:

- ✓ It is a muscular organ.
- ✓ Tongue helps to taste food, in mixing of food and give direction to food towards pharynx and help in swallowing process.



- ✓ There are three types of papillae which cover the tongue surface.
 1. Circumvallete (at base)
 2. Fungiform (at tip)
 3. Filiform (on entire surface of tongue)

- ✓ Filiform mainly deal with touch sense (hot/cold).
- ✓ Circumvallete and fungiform deals with sense of different taste (both are taste buds) like - sweet, salty, sour, bitter.

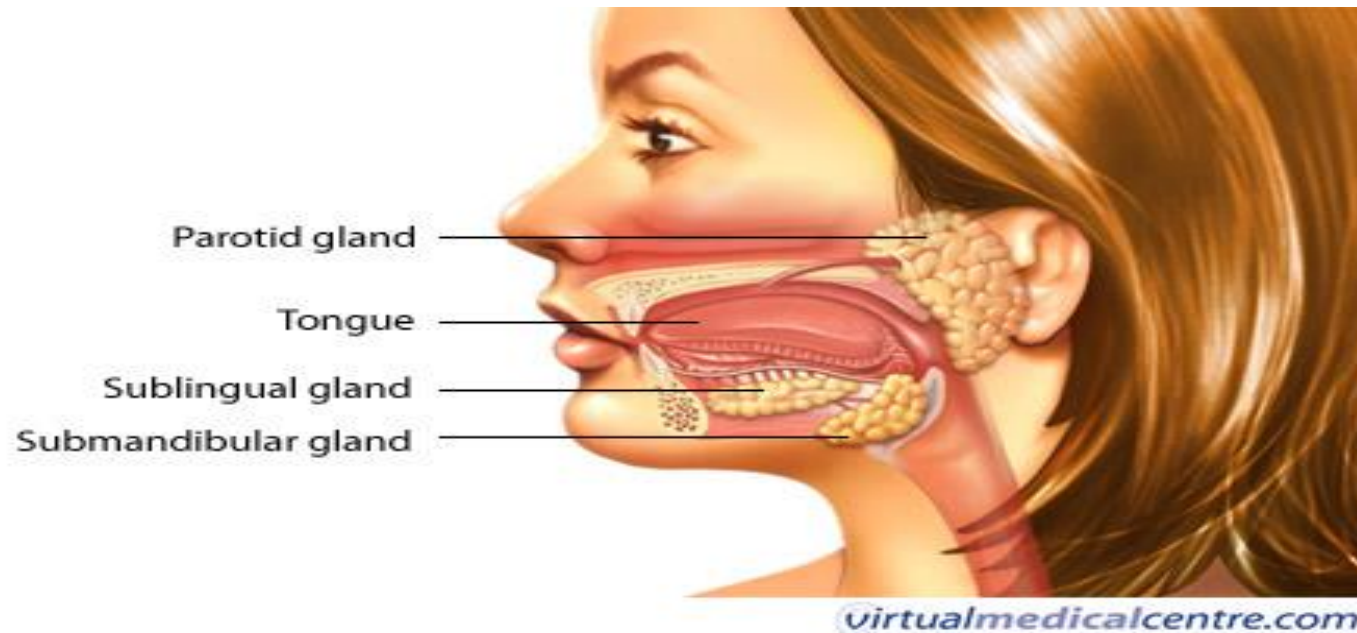


- ✓ These tastes are appreciated by tongue when food come in contact with it, food release chemicals and it is identified by taste buds which are connected with taste area in our brain (parietal lobe).

➤ Digestion process in mouth:

- ✓ 40 – 60% of food is digested in mouth, when a person is hungry / smells or see food, salivation starts
- ✓ Secretion is watery and alkaline
- ✓ Saliva is produced by different Salivary Glands:

1. Parotid
2. Sublingual
- 3 .Submandibular



- ✓ Saliva is the first digestive fluid which comes into contact with food (as it enters the mouth)

ब्रह्मार्पणं ब्रह्म हविः ब्रह्माग्नौ ब्रह्मणा हुतम् ।
ब्रह्मैव तेन गन्तव्यं ब्रह्मकर्मसमाधिना ॥

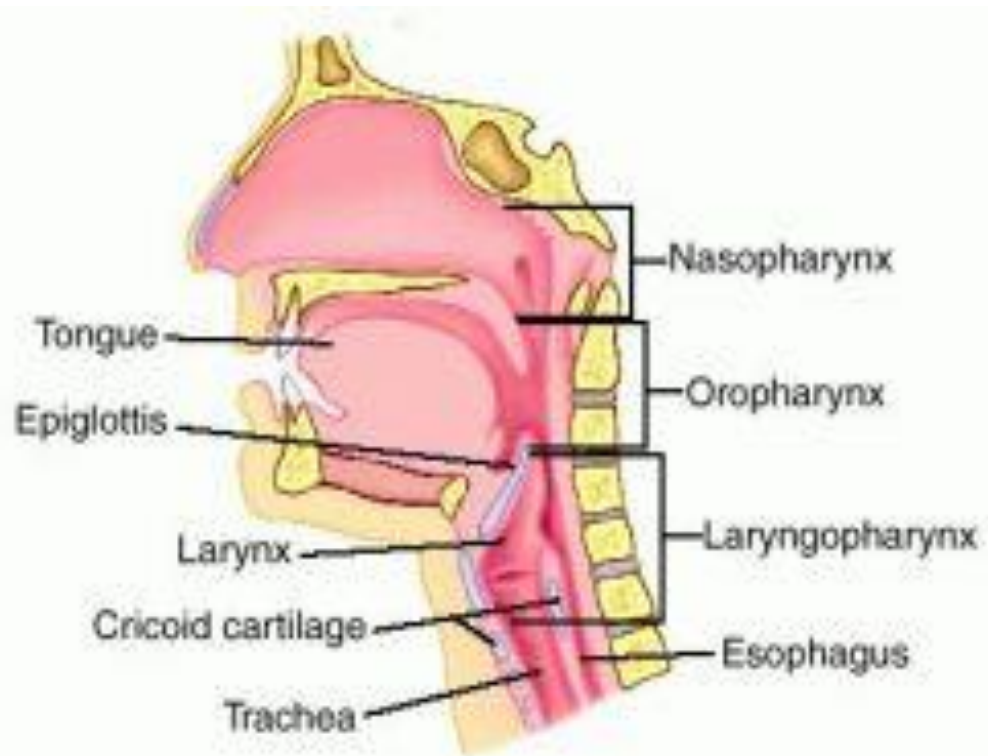
***Brahmarpanam brahma havir brahmagnau
brahmana hutam , brahmaiva tena gantavyam
brahmakarmasamadhina || BG 4.24 ||***

"The ladle is BRAHMAN * , the oblation is BRAHMAN , the offering is poured by BRAHMAN in the fire of BRAHMAN .
BRAHMAN alone is to be reached by one who has concentration on BRAHMAN as the objective"

- ✓ **Digestion of food begins in the mouth itself**
- ✓ **Saliva contains an enzyme called Ptyalin, which helps in breaking down complex carbohydrates into simpler carbohydrates.**
- ✓ **Saliva keeps the mouth moist and help in clear speech.**
- ✓ **Food chewed in the mouth mixed with Saliva forms a bolus (food ball) and enters in the pharynx**

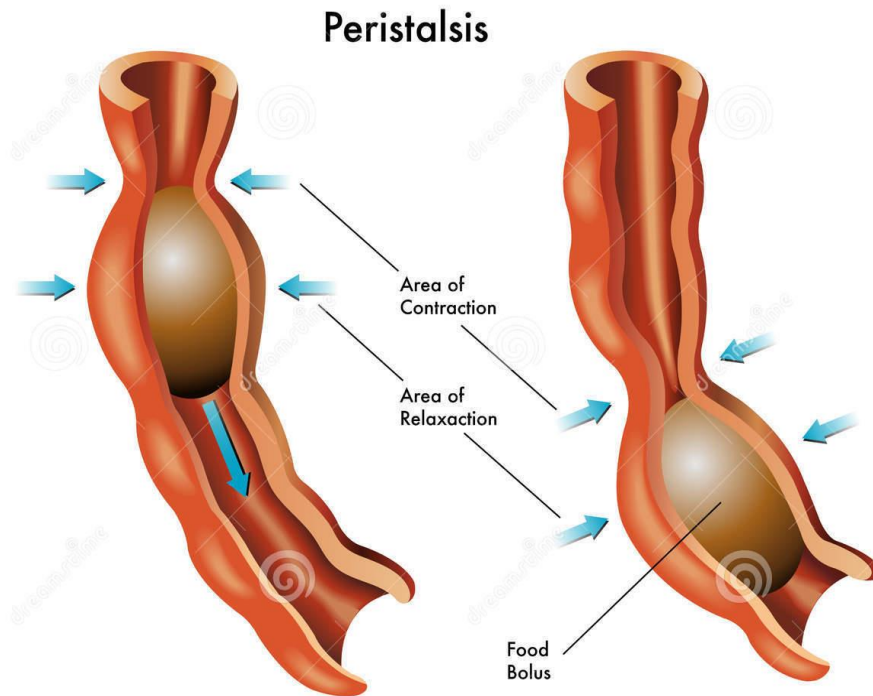
➤ Pharynx and Epiglottis:

- ✓ Pharynx is a common passage for air & food
- ✓ Epiglottis acts as door, which directs food towards esophagus and prevent entry of food inside the trachea.
- ✓ The bolus from the mouth is swallowed into pharynx with the help of tongue, this process is called the process of swallowing.



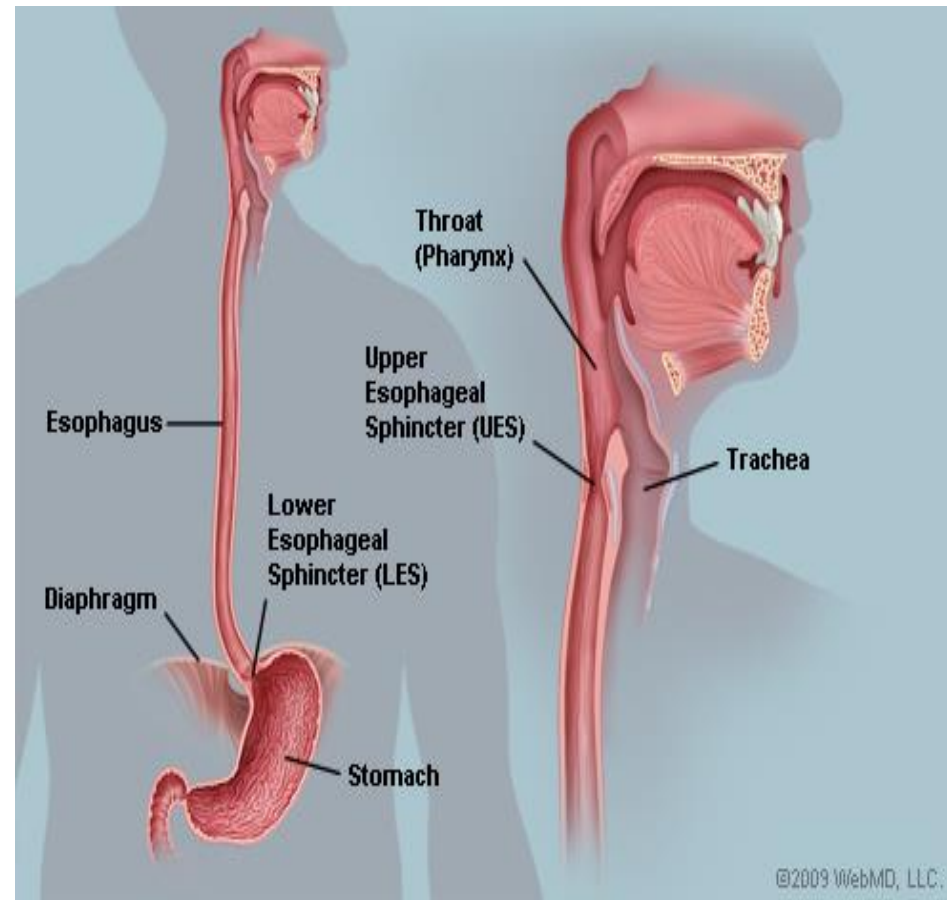
➤ **Esophagus: (food pipe)**

- ✓ **Long tube structure measuring about 25 cm in length, Behind trachea**
- ✓ **Function of esophagus is to transfer the bolus by peristaltic movement to stomach (wavy movement by alternate contraction and relaxation of muscles)**



- ✓ Proximal part of esophagus has a sphincter called Upper Esophageal Sphincter (UES) which normally remains closed and opens only when the food arrives
- ✓ Esophagus has a sphincter at the end where it meets the stomach called Lower Esophageal Sphincter (LES)

- ✓ Here esophagus makes an upward curve before it joins the stomach
- ✓ This angle along with a sphincter prevents food from stomach to coming up back into the esophagus



➤ **Stomach:**

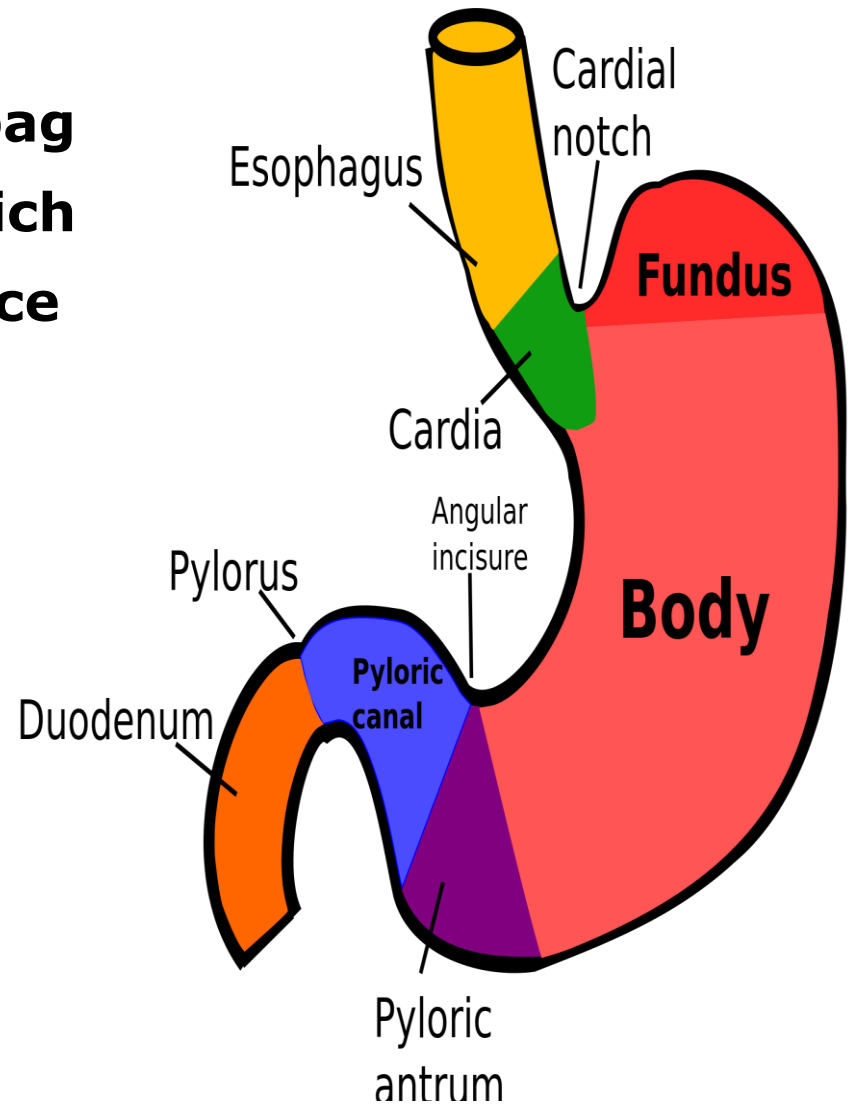
✓ **Stomach is a 'J' shaped bag like structure in which major digestion takes place**

✓ **Divided into 3 parts:**

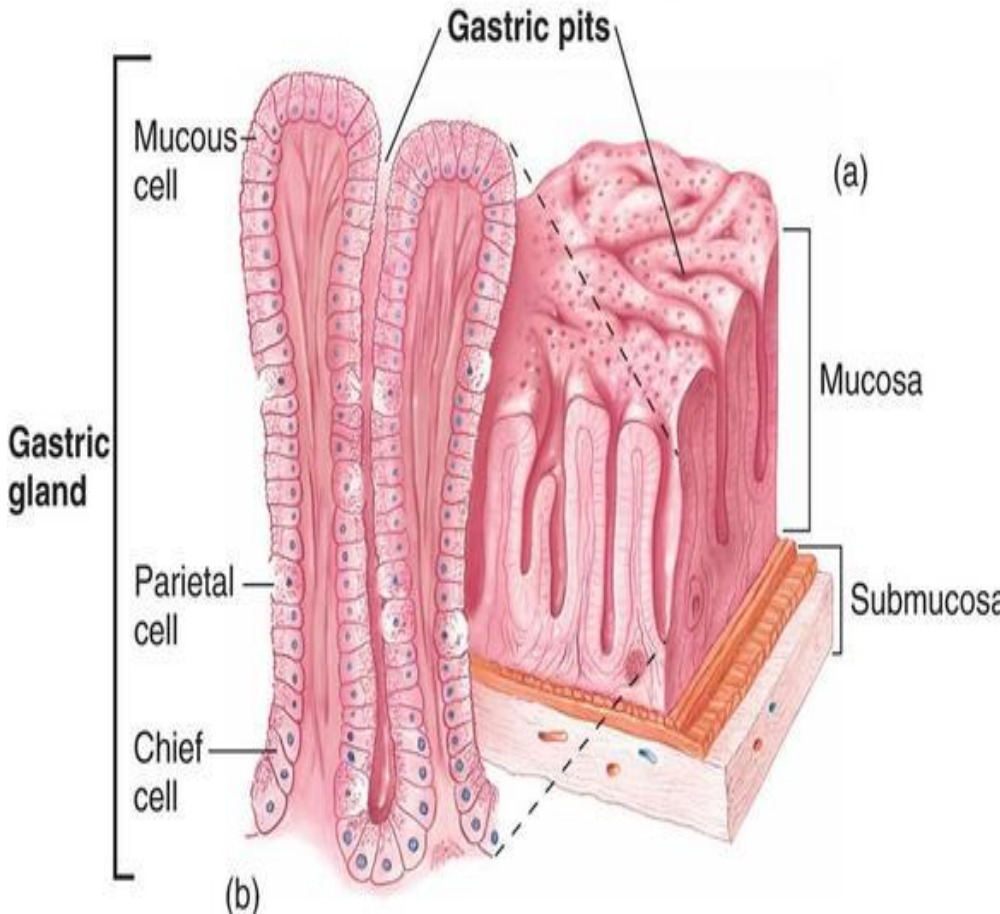
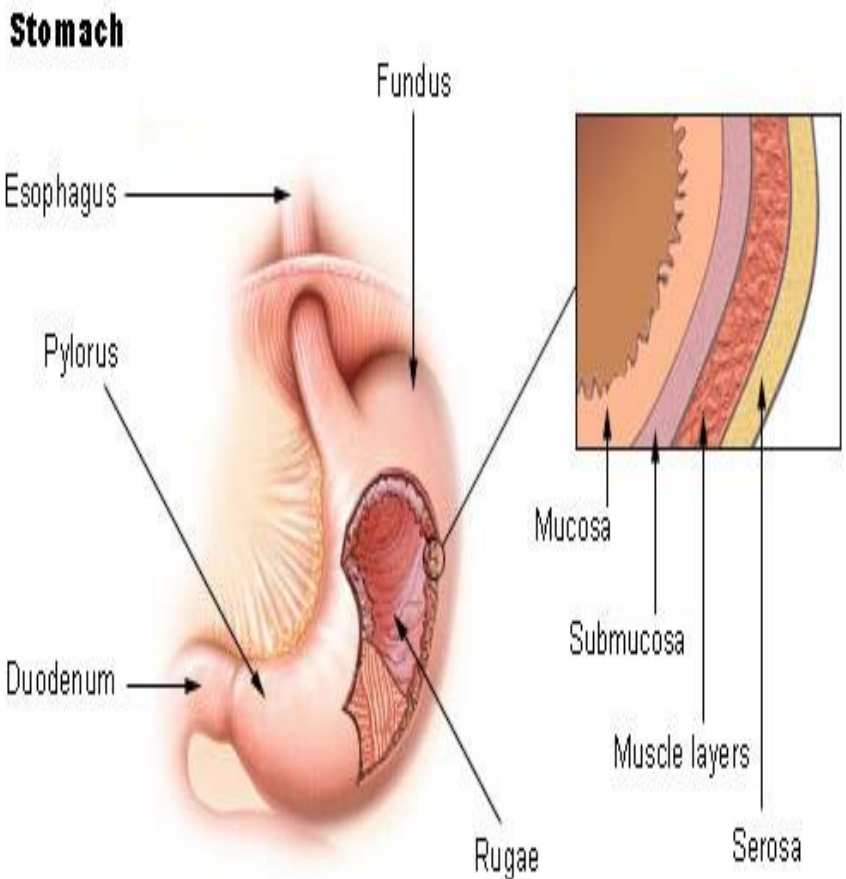
o **Fundus**

o **Body**

o **Pyloric canal**



➤ **Inner layer of stomach is made up of epithelial cells behind which many gastric glands are present which secrete different digestive juices to help in digestion**



➤ Gastric Juices:

- ✓ There are mainly four types of gastric juices secreted by gastric glands.

1. Hydrochloric Acid (HCL)

main function of HCL is to kill all bacteria if any present in food and provide an acidic medium for digestion

2. Pepsin

breaks down complex protein into a simpler form called Pepton

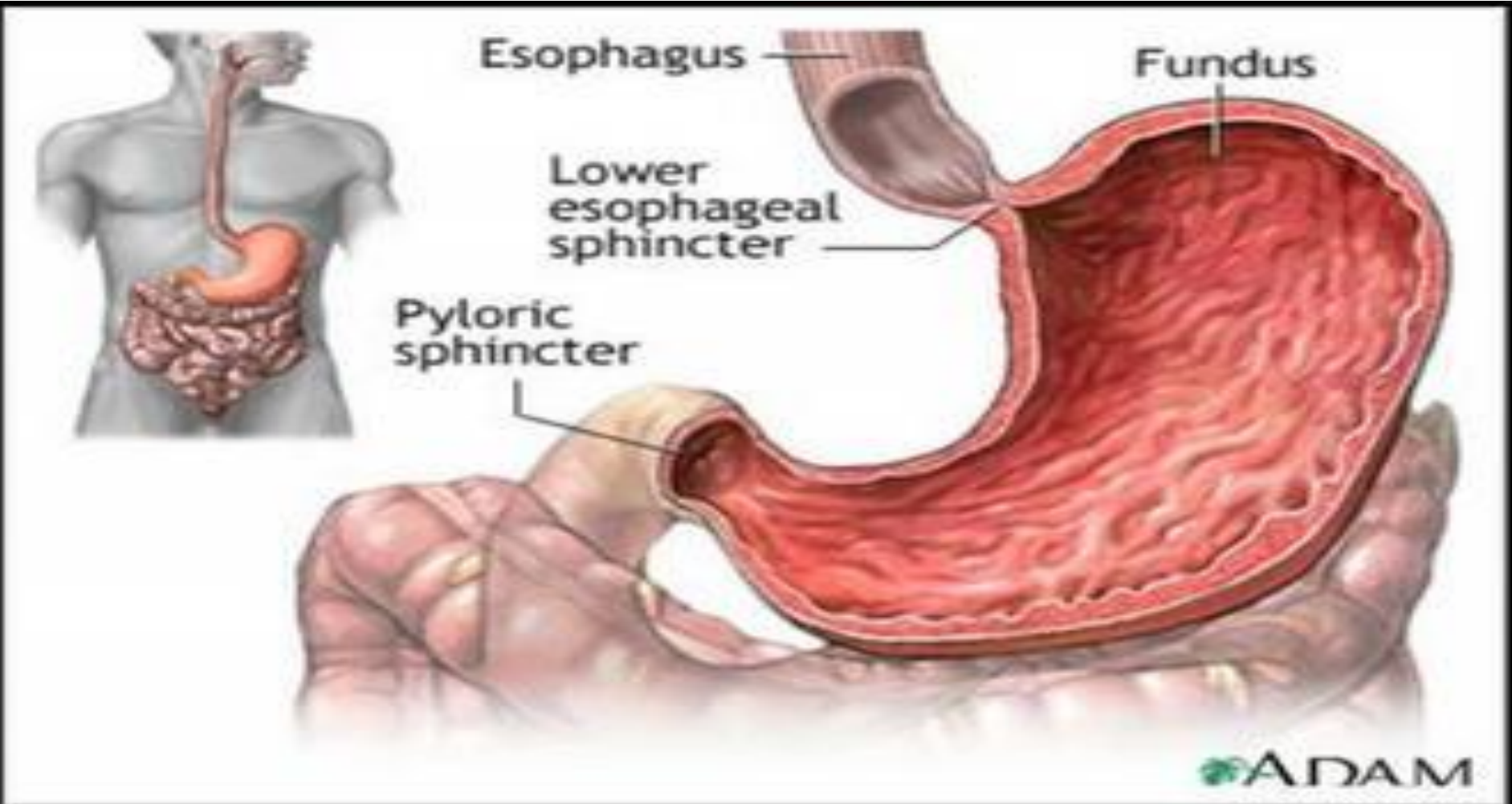
3. Renin

helps in digestion of milk and milk products

4. Lipase

helps in digestion of lipids or fats

✓ Outlet of stomach is known as Pyloric Sphincter from where it continues as Duodenum. This Sphincter allows a very small portion of digestive food to enter into the Duodenum at a time.

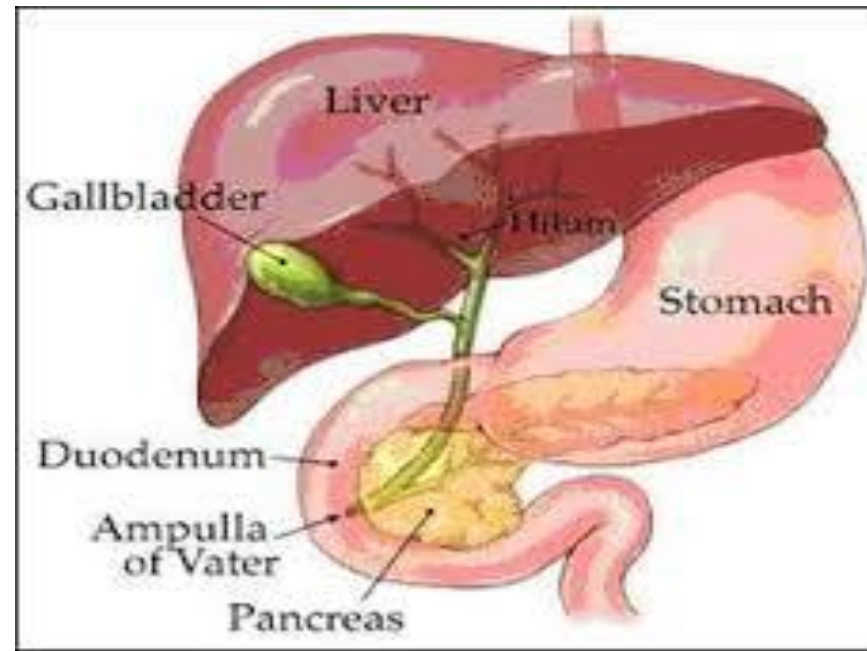
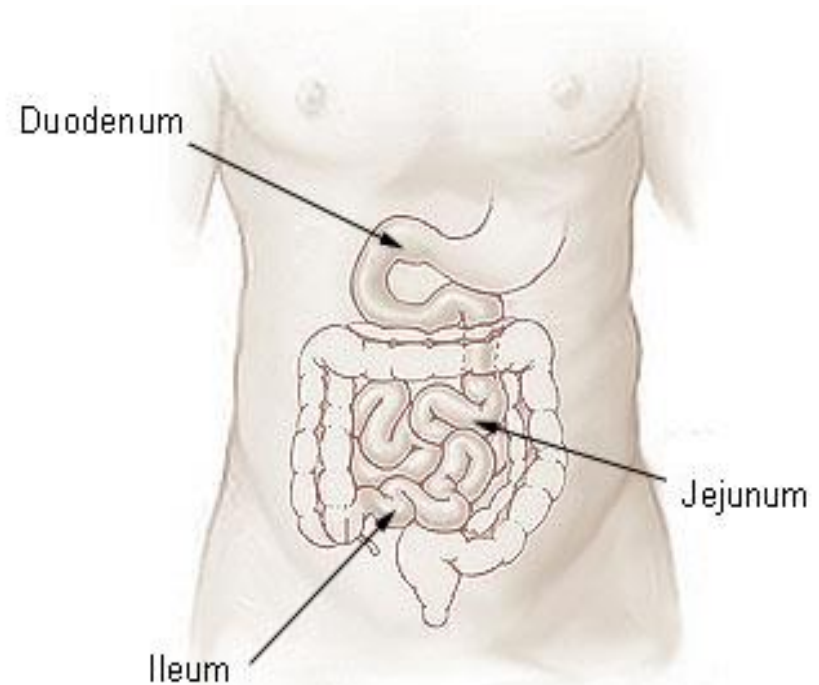


➤ Small Intestine:

- It has three major parts - Duodenum, Jejunum and Ileum.

➤ Duodenum:

- ✓ It is a 'C' shaped structure
- ✓ Food leaving stomach and entering Duodenum is called "Chyme"
- ✓ Here also food passes through peristaltic movement
- ✓ Duodenum has two connections Liver on the right side and Pancreas on the left side



➤ Pancreas:

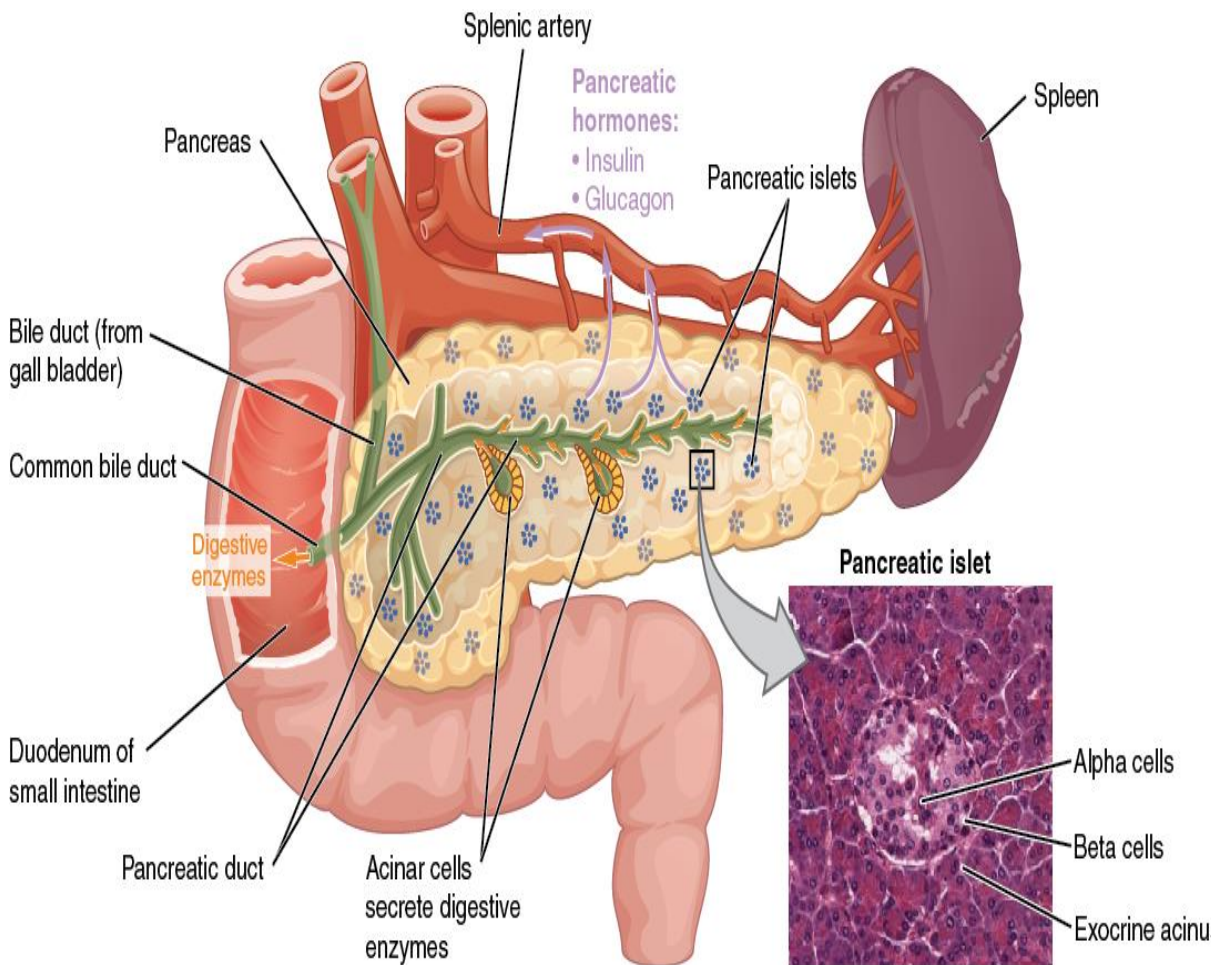
✓ Pancreas is a dual gland situated in the abdomen and placed horizontally behind the stomach.

✓ Dual gland means it acts as **Endocrine** as well as **Exocrine** gland.

● Exocrine gland

✓ It secretes juices into the system through a duct.

✓ As a exocrine gland pancreas releases Pancreatic juices into Duodenum, which are alkaline in nature.



➤ **Pancreas releases 3 varieties of juices:**

● **Amylase**

✓ **It helps in further digestion of simple carbohydrates and remaining complex carbohydrates**

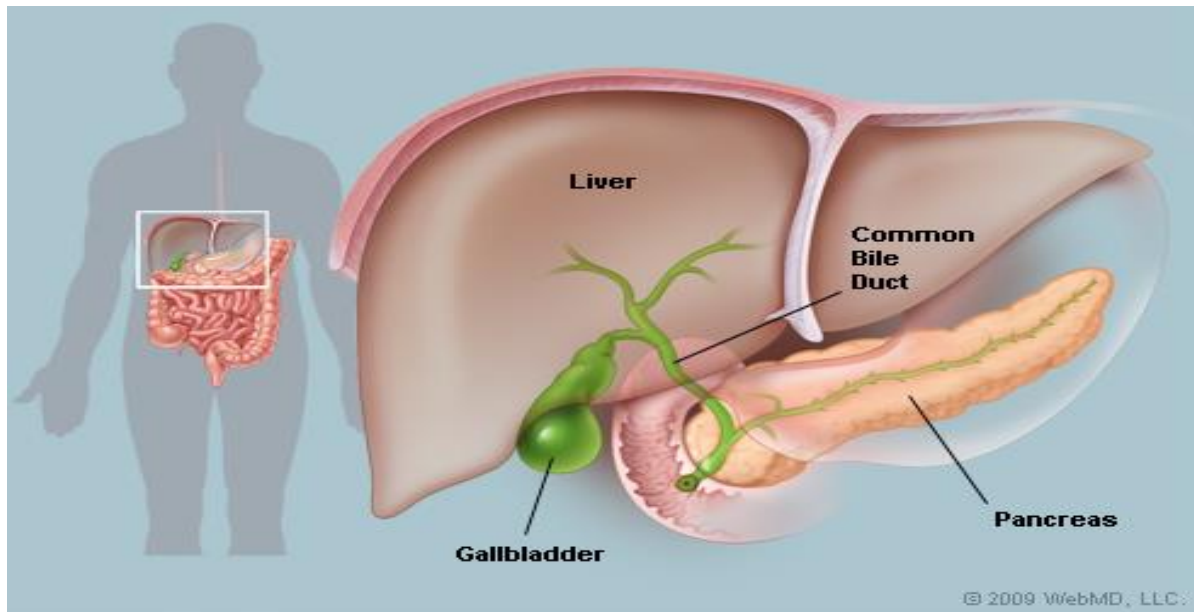
✓ **It is stronger than Ptyaline and able to digest uncooked food (*raw foods – cucumber, apple, tomatoes*)**

● **Tripsin**

✓ **Helps in digestion of proteins and converts to simple form of amino acids (*thick toor daal*)**

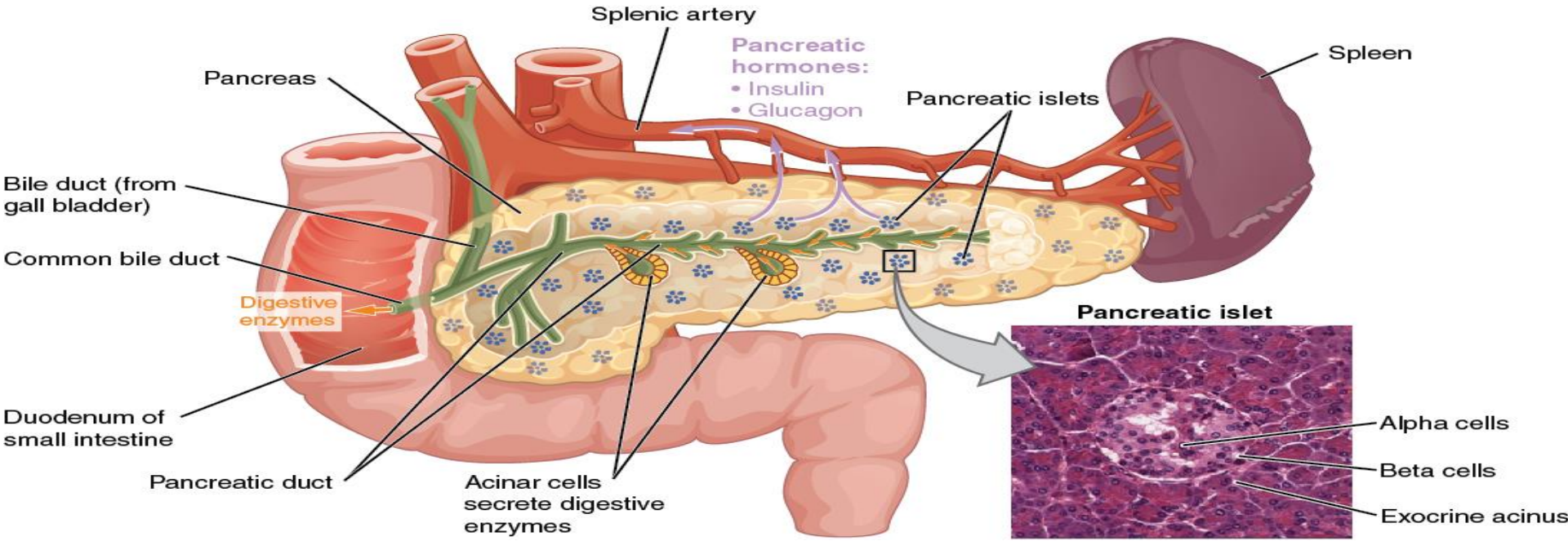
● Lipase

- ✓ Deals with metabolism of fat. Complex fats are digested with help of Bile.
- ✓ Bile is secreted from Gall Bladder, which is a pear-shaped, hollow structure located under the liver and on the right side of the abdomen. Its primary function is to store and concentrate bile, a yellow-brown digestive enzyme produced by the liver.
- ✓ Fat is broken down into small particles with help of bile so that more surface area of fat particles come in contact with Lipase



● Endocrine Gland

- ✓ Endocrine glands release hormones directly into the blood without any duct.
- ✓ In Pancreas there are groups of cells called “Islets of Langerhans” which releases hormones directly into blood.
- Alpha cells - Glucagon
- ✓ Glucagon increases the blood sugar level when required



➤ Beta cells – **Insulin**

- ✓ Insulin hormone is made up of many amino acids (Polypeptides)
- ✓ After a meal, the level of glucose increases in blood; and insulin acts on cell membrane and makes cell membrane permeable to glucose
- ✓ Glucose from blood enters cells and helps in different cellular functions by providing energy.
- ✓ If still there is excess Glucose in blood, it will be converted to glycogen and stored in liver and muscles

➤ Delta cells – **Growth Hormone Release Inhibitory Hormone (GHRIH)**

Glucose enters the bloodstream from the intestine.

Insulin enters the bloodstream from the pancreas.

A healthy balance of insulin and glucose circulates in the bloodstream.

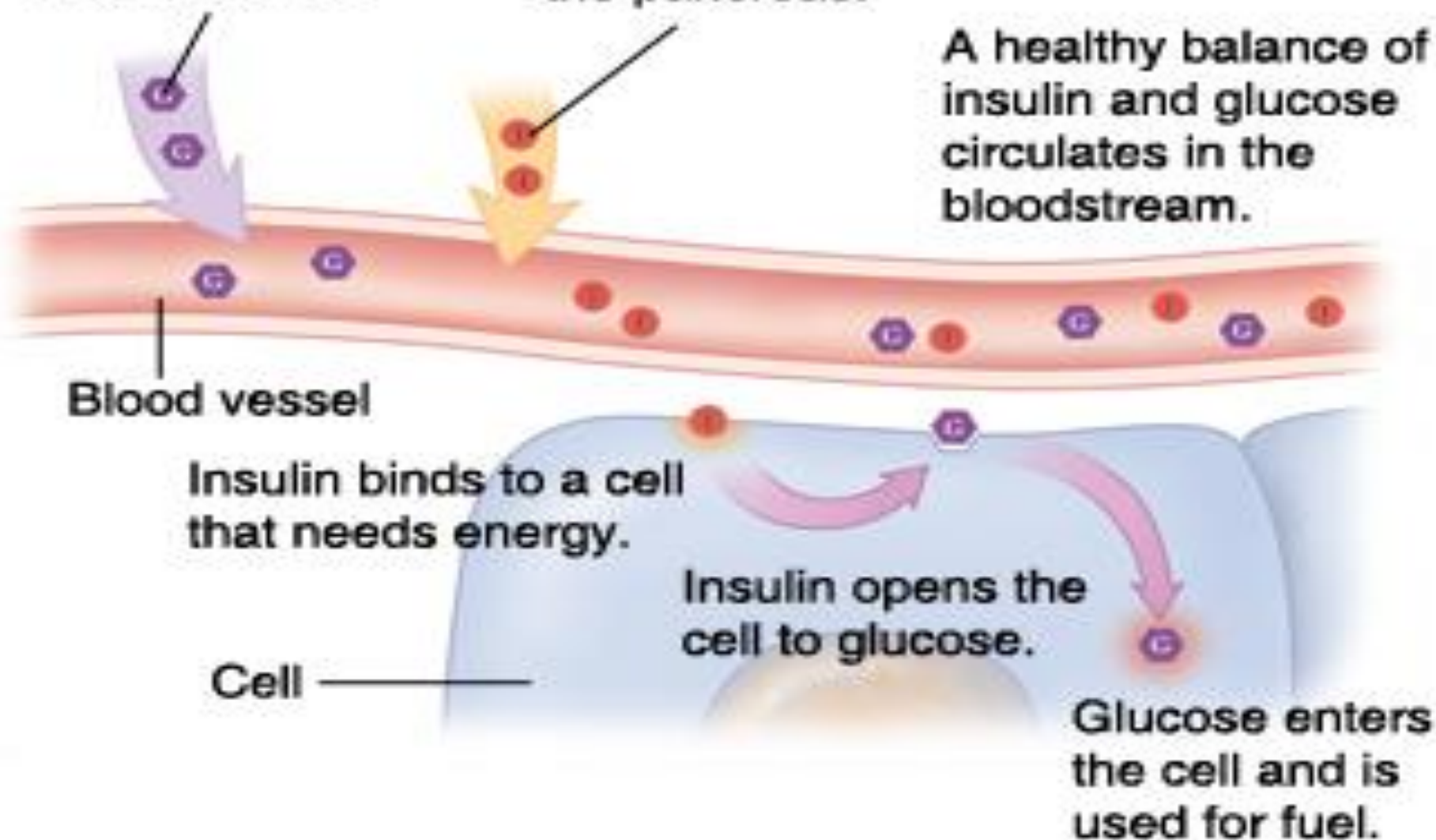
Blood vessel

Insulin binds to a cell that needs energy.

Insulin opens the cell to glucose.

Cell

Glucose enters the cell and is used for fuel.



➤ **Liver:**

- ✓ **Liver is the largest gland in the body**
- ✓ **It produce bile, this bile is stored in the Gallbladder.**
- ✓ **The Gallbladder acts as a storehouse of bile and when food enters into the Duodenum, bile is released also with Pancreatic juice**
- ✓ **Bile is alkaline in nature and is used to neutralize acidity of Chyme**

➤ **Functions of Liver:**

- 1. Metabolism - provides the required nutrients which are absorbed for different uses in different parts of the body.**
- 2. Maintains blood glucose level by converting excess glucose to Glycogen and storing it. When Glucose is needed in the body, this Glycogen is again converted into Glucose.**
- 3. Secretes bile when helping with the digestion of fats.**
- 4. Forms red blood cells in Fetal life (the fetus of a pregnant woman)**
- 5. Old blood cells are destroyed in the liver.**

➤ Jejunum and Ilium:

- ✓ **The Jejunum and Ilium are in the form of long coiled tubes.**
- ✓ **The process of digestion continues in the Jejunum and Ilium and same time process of absorption starts.**
- ✓ **Here the inner layer has special arrangement, that is layers are folded, and known as Villi.**
- ✓ **Villi increases the surface area of the jejunum and ilium so that more absorption can take place.**
- ✓ **Here food move with “Segmental movement” means food is held for a short period of time and then by contraction it moves forward and this gives more time for absorption.**
- ✓ **Most of the food is digested and absorbed by the small intestine.**

➤ Large Intestine:

- ✓ It is also known as the colon and it has three parts:
 - o Ascending colon
 - o Transverse colon
 - o Descending colon
- ✓ Most of the content that enters into the colon are in liquid form.
- ✓ Excess water gets absorbed from here and content becomes solid
- ✓ In colon, small amount of vitamins are synthesized by bacteria and also absorbed by colon only
- ✓ Also absorption of minerals take place here.
- ✓ Gas produced during digestion are passed out as Flatus (flatulence or a “fart”) from large intestine.

✓ Here also food move with peristaltic movement, but not by continuous peristaltic movement, food moves forward about twice in one hour with strong peristaltic movement and the content is pushed towards the rectum. This movement is known as "mass movement"

➤ **Appendix:**

- ✓ It is a thin tube-like structure located at junction between large and small intestine
- ✓ Its function is as such unknown but it is believe that it stores good bacteria and helps in recovery from illnesses like diarrhea.

➤ **Rectum:**

- ✓ A curve-like structure below the Descending colon
- ✓ Gives space for storage of solid waste products and when it gets filled up it gets irritated and sends signals to the brain
- ✓ We are able to hold the urge for a while with the help of the outer sphincter

➤ **Anus:**

- ✓ This signal from the rectum acts upon the muscles of the anus
- ✓ There are two sphincters in the anus, the inner and the outer
- ✓ Function of the anus is voluntary and involuntary
- ✓ The inner sphincter is involuntary and the outer sphincter is voluntary
- ✓ So one is able to suppress this urge till availability of suitable place and time .