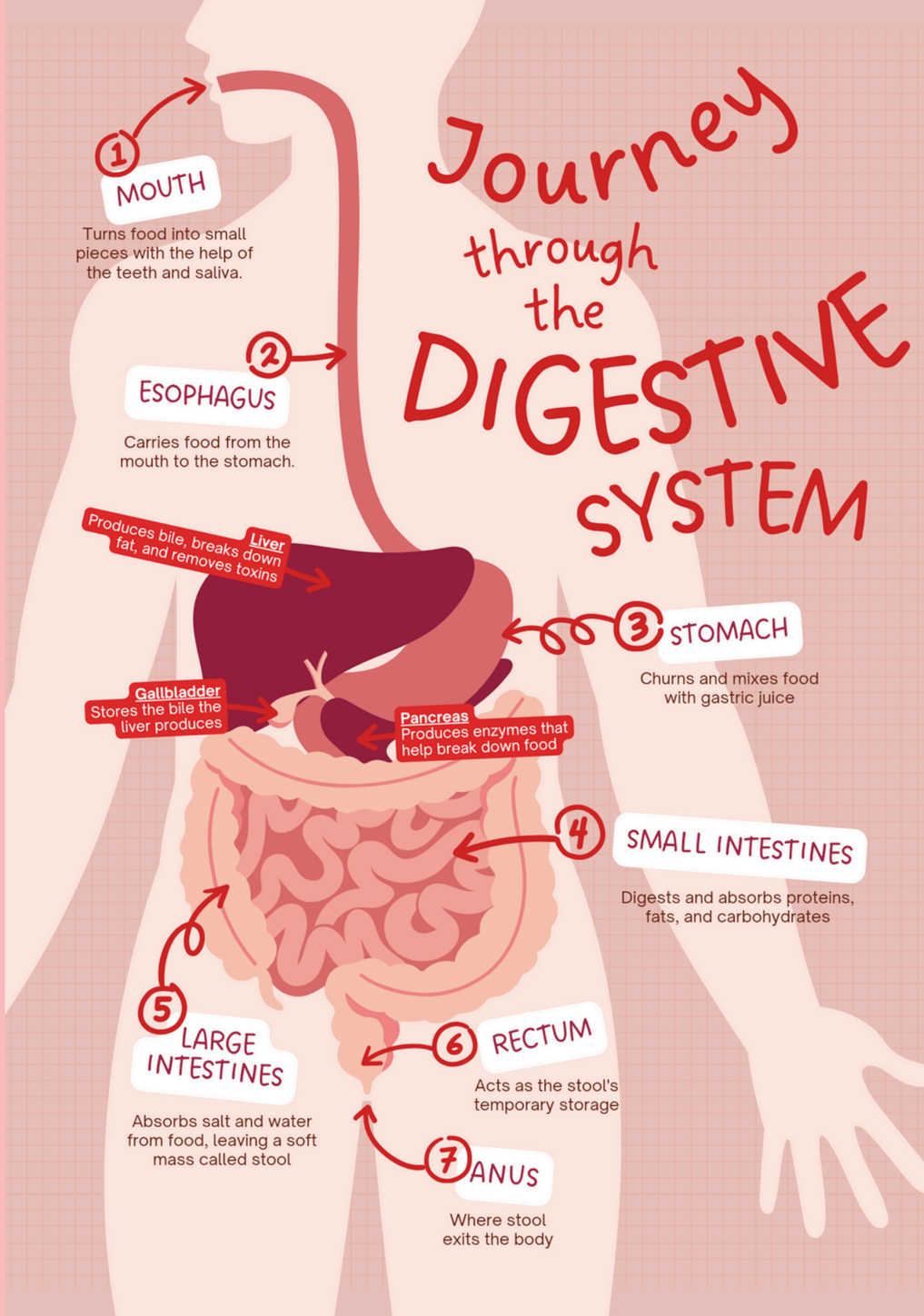
Gastrointestinal tract (GIT)



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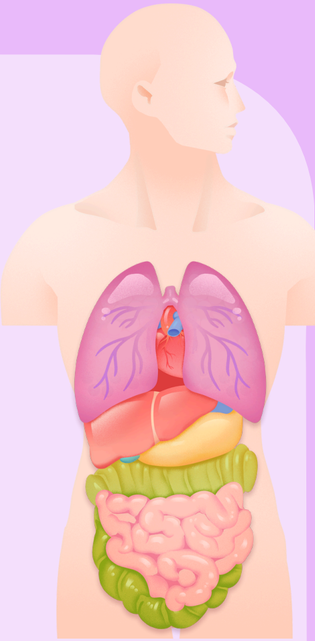


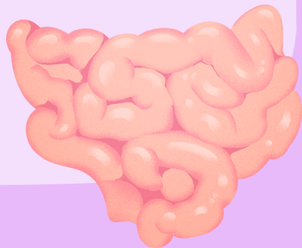
1.Functional anatomy of GIT.

2. Mechanism of secretion and composition of different digestive juices.

3. Function of salivary glands,Stomach,liver, pancreas,Small intestine,Large intestine

4. Movement of gut (Deglution,Peristalsis,defacation)/ control

5.Enteric Nervous system



•DIGESTIVE PROCESS

•Digestion is defined as the process by which food is broken down into simple chemical substances that can be absorbed and used as nutrients by the body

•Digestive process is accomplished by mechanical and enzymatic breakdown of food into simpler chemical compounds

•FUNCTIONS OF DIGESTIVE SYSTEM

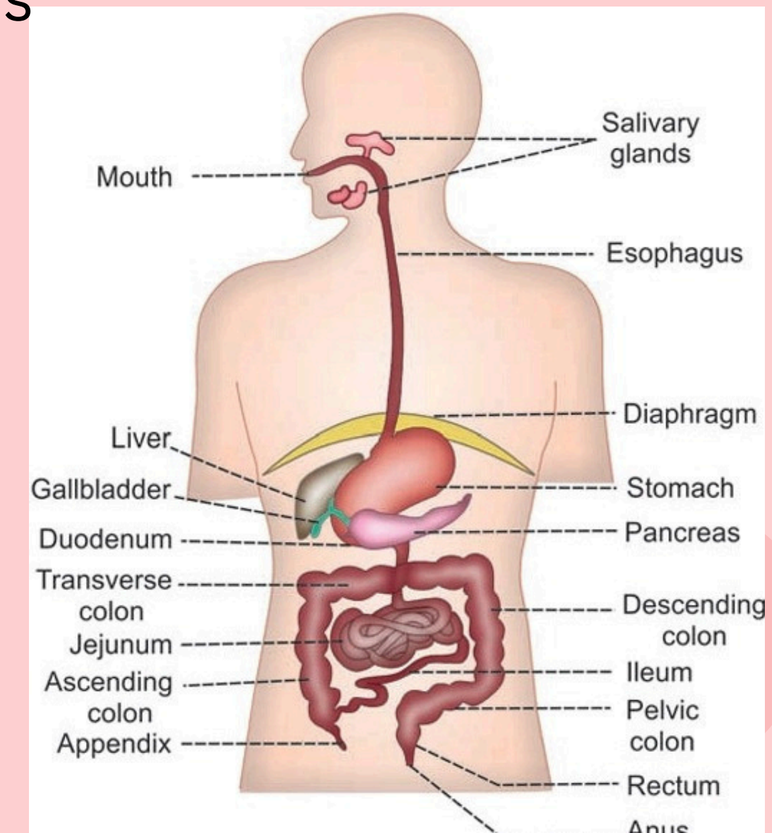
•Consumption of food substances.

•Breaking them into small particles.

•Secretion of necessary enzymes and substance.

•Absorption of digestive products.

•Remove of unwanted substances from body.



Functional Anatomy Of Digestive System

•Digestive system is made up of gastrointestinal tract (GI tract) or alimentary canal and accessory organs, which help in the process of digestion and absorption.

•GI tract is a tubular structure extending from the mouth up to anus, with a length of about 30 feet. It opens to the external environment on both ends.

•Digestive Organs

Primary digestive organs are: i. Mouth ii. Pharynx iii. Esophagus iv. Stomach v. Small intestine vi. Large intestine.

Accessory Digestive organs:i. Teeth ii. Tongue iii. Salivary glands i v. Exocrine part of pancreas v. Liver vi. Gallbladder.

FUNCTIONS OF STOMACH

1. Mechanical function

•STORAGE FUNCTION -Food is stored in the stomach for a long period, i.e. for 3 to 4 hours and emptied into the intestine slowly. The maximum capacity of stomach is up to 1.5 L.

•FORMATION OF CHYME-Peristaltic movements of stomach mix the bolus with gastric juice and convert it into the semisolid material known as chyme.

2.SECRETORY FUNCTION

Glands of the stomach secrete gastric juice which contain many enzyme stomach glands also secreate hormone

3.DIGESTIVE FUNCTION

PEPSIN- convert protein into proteoses,peptones and polypeptides .Also causes curdling and digestionof milk.

GASTIC LIPASE-it is active only when the pH between 4 and 5 it hydrolises butter fat into fatty acids and glycerols.

4.Protective Function :Function of mucus

•Mucus is a mucoprotein, secreted by mucus neck cells of the gastric glands and surface mucus cells in fundus, body and other parts of stomach. It protects the gastric wal,protect stomach wall.

5.HEMATOPOIETIC FUNCTIONS

•Intrinsic factor of Castle, secreted by parietal cells of gastric glands plays an important role in erythropoiesis. It is necessary for the absorption of vitamin B12 (which is called extrinsic factor) from GI tract into the blood.

6.EXCRETORY FUNCTION

•Many substances like toxins, alkaloids and metals are excreted through gastric juice.

ENTERIC NERVOUS SYSTEM

•Intrinsic nerves to GI tract form the enteric nervous system that controls all the secretions and movements of GI tract. Enteric nervous system is present within the wall of GI tract from esophagus to anus. Nerve fibers of this system are interconnected and form two major networks.

1.Auerbachs Plexus or Myenteric Nerve Plexus

•It is present in between the inner circular muscle layer and the outer longitudinal muscle layer.

•Major function of this plexus is to regulate the movements of GI tract. Some nerve fibers of this plexus accelerate the movements by secreting the excitatory neurotransmitter substances like acetylcholine, serotonin and substance P. Other fibers of this plexus inhibit the GI motility by secreting the inhibitory neurotransmitters such as vasoactive intestinal polypeptide (VIP), neurotensin

2.Meissners Nerve Plexus or Submucus Nerve Plexus

•Meissners plexus is Situated in between the muscular layer in some submucosal layer of GI tract. This flexes the regulates the secretary functions of Gtract by cause a contraction of blood vessels of GI tract.

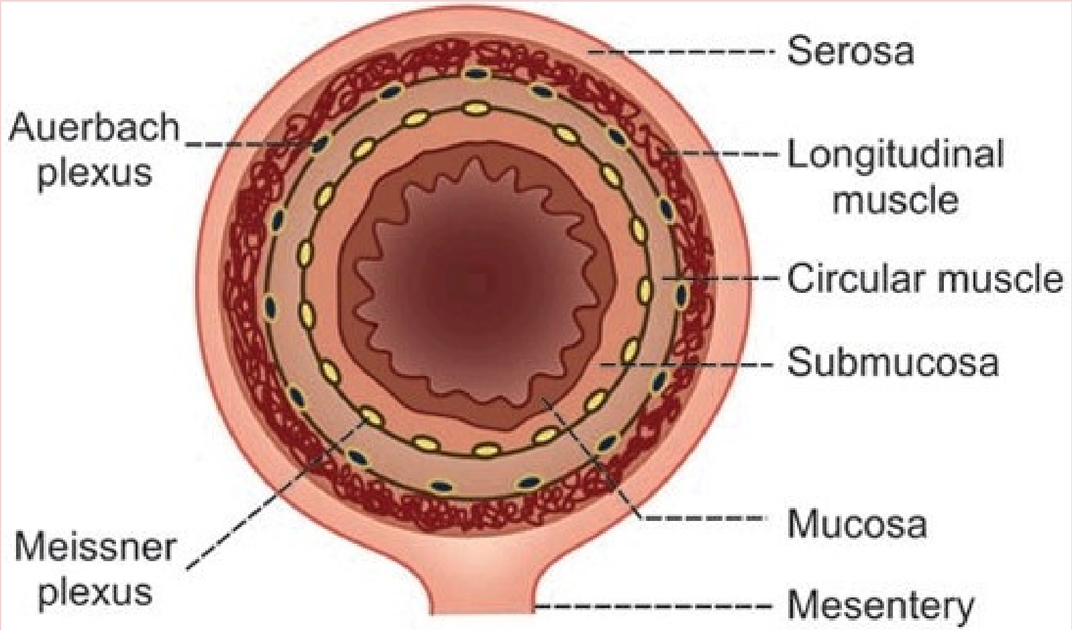


FIGURE 36.2: Structure of intestinal wall with intrinsic nerve plexus

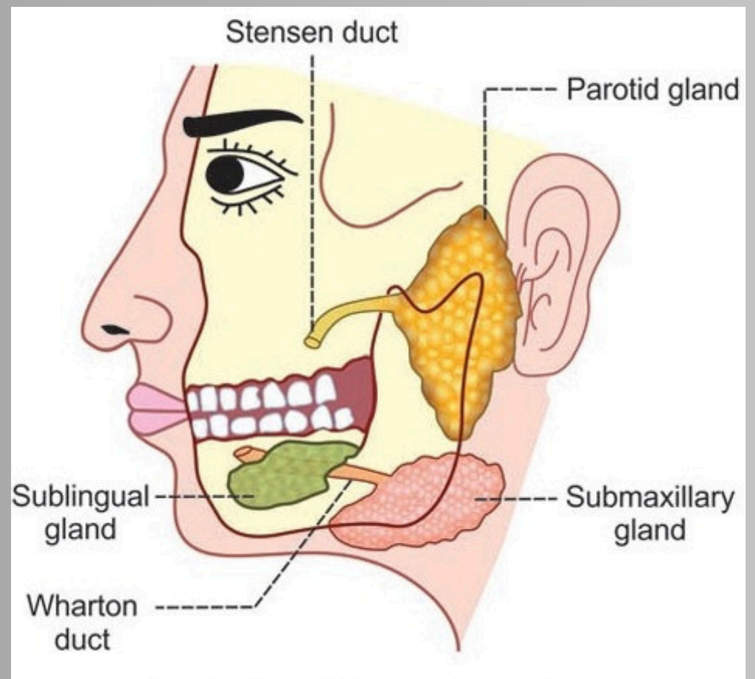
•SALIVARY GLANDS

Major Salivary Glands

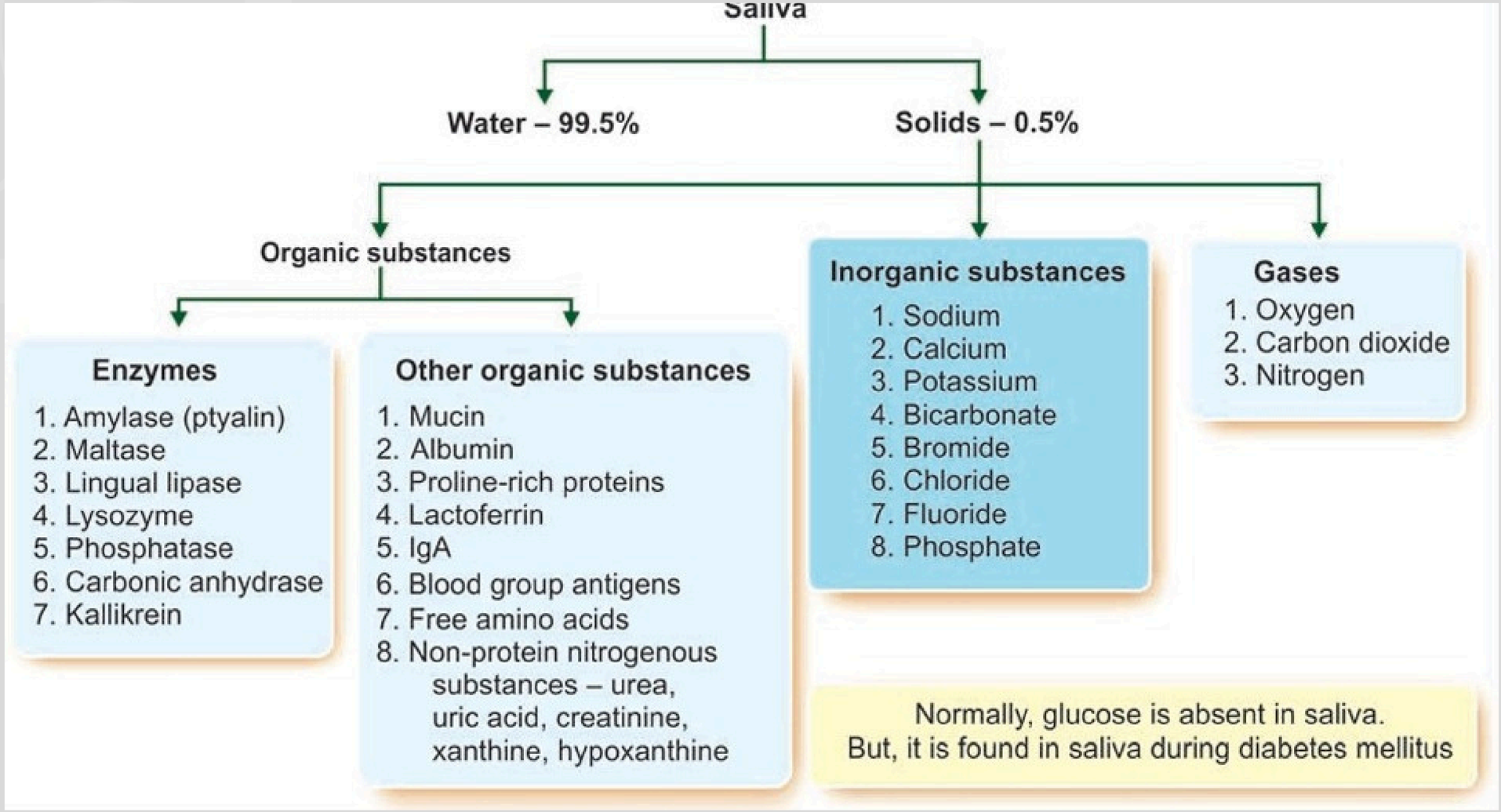
1.Parotid glands.
2. Sab maxillary gland
3. Sab lingual grands

Minor Salivary Glands

1. Lingual mucus glands
2. Lingual serous glands
3.Buccal Glands or molar glands
4.Labial glands
5.Palatal glands



COMPOSITION OF SALIVA



Contribution by each major salivary gland is: Parotid glands : 25%
Submaxillary glands : 70%
Sublingual glands : 5%.

•REGULATION OF SALIVARY SECRETION

Salivary secretion is regulated only by nervous mechanism. Autonomic nervous system is involved in the regulation of salivary secretion. Salivary glands are supplied by both parasympathetic and sympathetic fibres

•Parasympathatic fibes

Stimulation of parasympathetic fibers of salivary glands causes secretion of saliva with large quantity of water. It is because the parasympathetic fibers activate the acinar cells and dilate the blood vessels of salivary glands

•Sympathetic fibres

Stimulation of sympathetic fibers causes secretion of saliva, which is thick and rich in organic constituents suchas mucus. It is because, these fibers activate the acinar cells and cause vasoconstriction. The neurotransmitter is noradrenaline.

FUNCTIONS OF SALIVA

1.Preparation of food for swallowing

2.Appreciation of taste

3. Digestive function

4. Cleansing and protecting functions

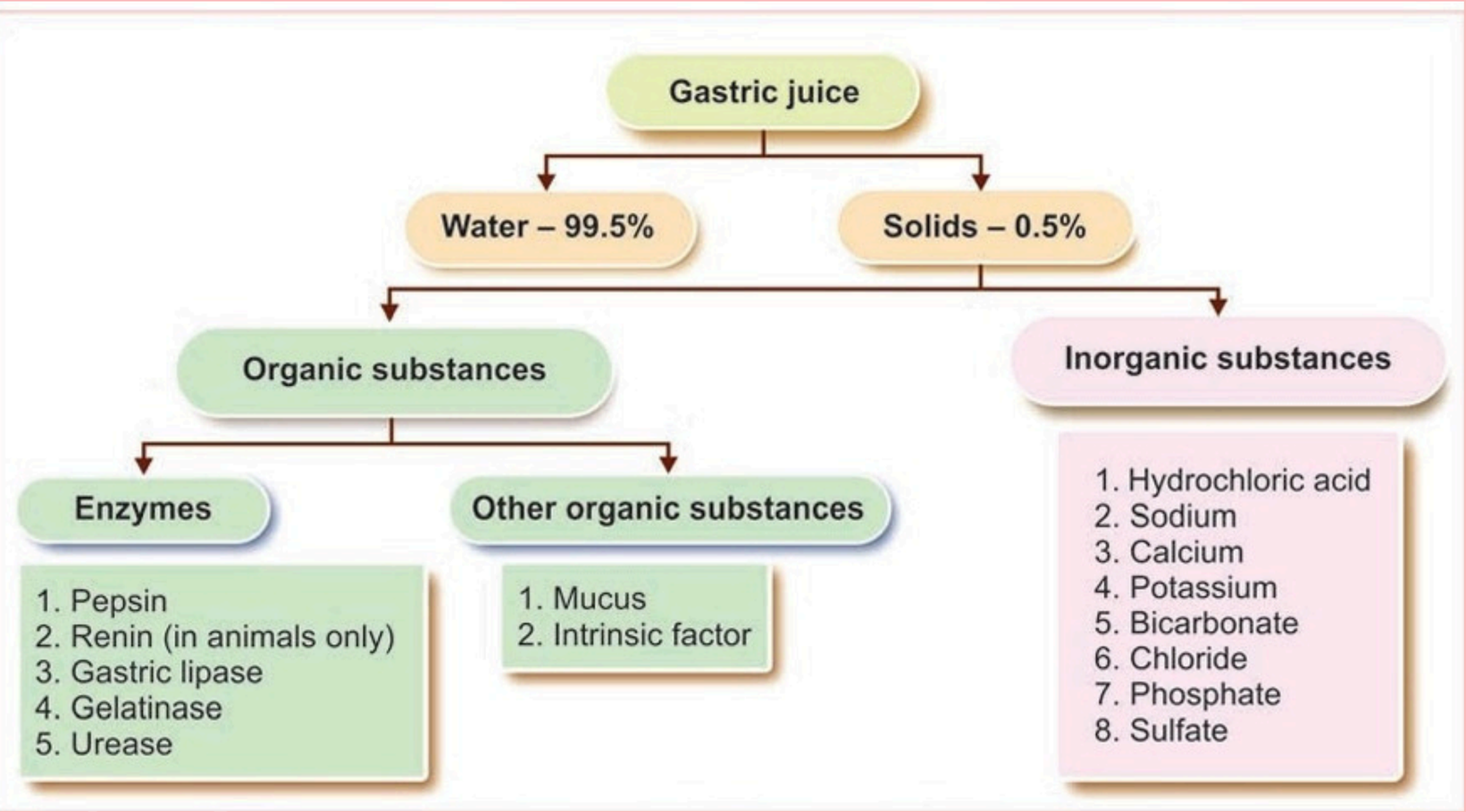
5. Role in speech

6. Excretory function

7. Regulation of body temperature

8. Regulation of water balance

GASTRIC SECRETION



Volume : 1200 mL/day to 1500 mL/day. Reaction : Gastric juice is highly acidic with a pH of 0.9 to 1.2. Acidity of gastric juice is due to the presence of hydrochloric acid. Specific gravity : 1.002 to 1.004

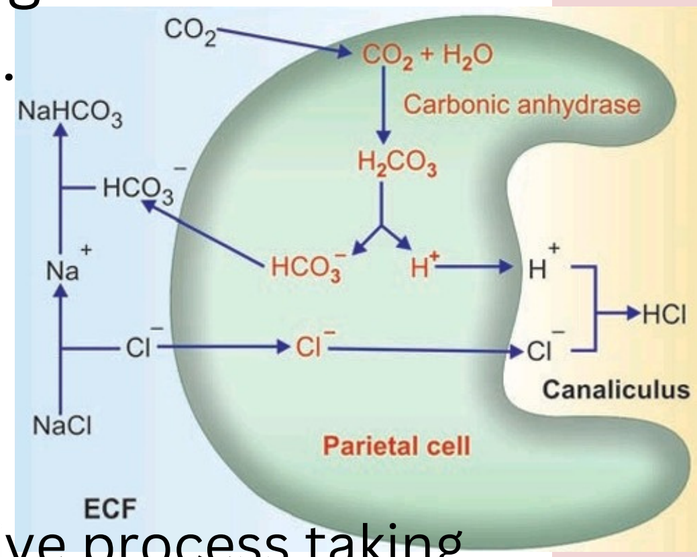
Enzyme	Activator	Substrate	End products
Pepsin	Hydrochloric acid	Proteins	Proteoses, peptones and polypeptides
Gastric lipase	Acid medium	Triglycerides of butter	Fatty acids and glycerols
Gastric amylase	Acid medium	Starch	Dextrin and maltose (negligible action)
Gelatinase	Acid medium	Gelatin and collagen of meat	Peptides
Urase	Acid medium	Urea	Ammonia

Secretion Of Gastric Juice

•Secretion of pepsinogen

•Pepsinogen is synthesized from amino acids in the ribosomes attached to endoplasmic reticulum in chief cells. Pepsinogen molecules are packed into zymogen granules by Golgi apparatus.

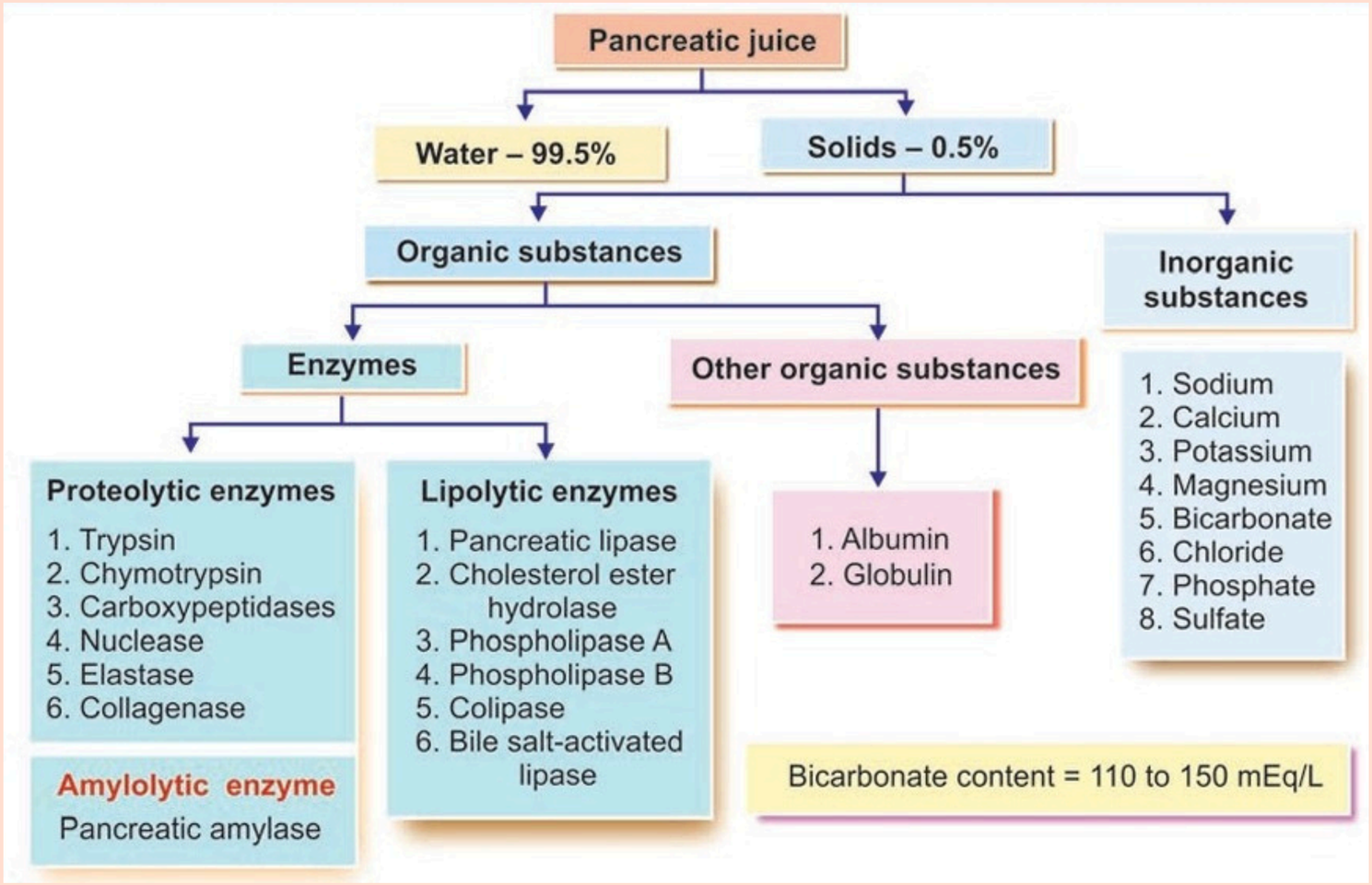
•zymogen granule is secreted into stomach from chief cells, the granule is dissolved and pepsinogen is released into gastric juice.



•SECRETION OF HCL

•According to Davenport theory, hydrochloric acid secretion is an active process taking place in canaliculi of parietal cells in gastric glands. This process obtains energy from oxidation of glucose.

PANCREATIC SECRETION



Volume Reaction : : 500 to 800 mL/day

Highly alkaline with a pH of 8 to 8.3

Specific gravity : 1.010 to 1.018

DIGESTIVE ENZYMES OF PANCREATIC JUICE

Enzyme	Activator	Acts on (substrate)	End products
Trypsin	Enterokinase Trypsin	Proteins	Proteoses and polypeptides
Chymotrypsin	Trypsin	Proteins	Polypeptides
Carboxypeptidases	Trypsin	Polypeptides	Amino acids
Nucleases	Trypsin	RNA and DNA	Mononucleotides
Elastase	Trypsin	Elastin	Amino acids
Collagenase	Trypsin	Collagen	Amino acids
Pancreatic lipase	Alkaline medium	Triglycerides	Monoglycerides and fatty acids
Cholesterol ester hydrolase	Alkaline medium	Cholesterol ester	Cholesterol and fatty acids
Phospholipase A	Trypsin	Phospholipids	Lysophospholipids
Phospholipase B	Trypsin	Lysophospholipids	Phosphoryl choline and free fatty acids
Colipase	Trypsin	Facilitates action of pancreatic lipase	–
Bile-salt-activated lipase	Trypsin	Phospholipids	Lysophospholipids
		Cholesterol esters	Cholesterol and fatty acids
		Triglycerides	Monoglycerides and fatty acids
Pancreatic amylase	–	Starch	Dextrin and maltose

MECHANISM OF PANCREATIC SECRETION

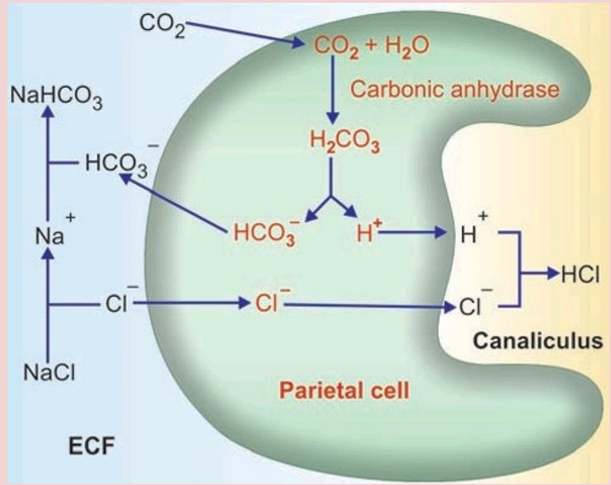
•Secretion Of Pancreatic Enzymes

•Pancreatic enzymes are synthesized in ribosomes, which are attached to the endoplasmic reticulum of acinar cells in pancreas.

•The raw materials for the synthesis of pancreatic enzymes are the amino acids, which are derived from the blood. After synthesis, the enzymes are packed into different zymogen granules by Golgi apparatus and stored in cytoplasm.

•SECRETION OF BICARBONATE IONS

•Bicarbonate ions of pancreatic juice are secreted from the cells of pancreatic ductules and released into the pancreatic duct.



FUNCTION OF PANCREAS

- The pancreas is involved in blood sugar control and metabolism within the body.
- Pancreas is a dual organ having two functions, namely endocrine function and exocrine function. Endocrine function is concerned with the production of hormones. The exocrine function is concerned with the secretion of digestive juice called pancreatic juice.

•FUNCTIONS OF PANCREATIC JUICE

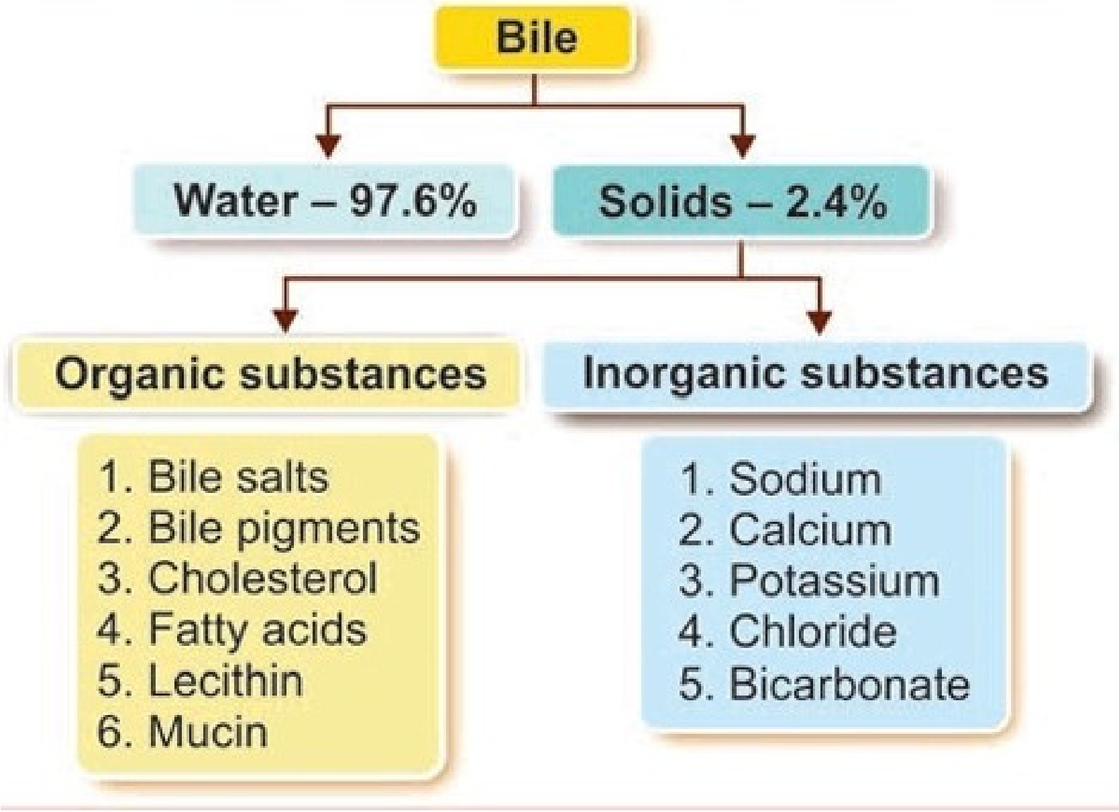
1. DIGESTIVE FUNCTION OF PANCREATIC JUICE

- Pancreatic juice mainly acts on digestion of proteins and lipids. It also has mild digestive action on carbohydrates.

2. DIGESTION OF PROTEINS

- Major proteolytic enzymes of pancreatic juice are trypsin and chymotrypsin. Other proteolytic enzymes are carboxypeptidases, nuclease, elastase and collagenase.

COMPOSITION OF BILE



Volume : 800 to 1,200 mL/day

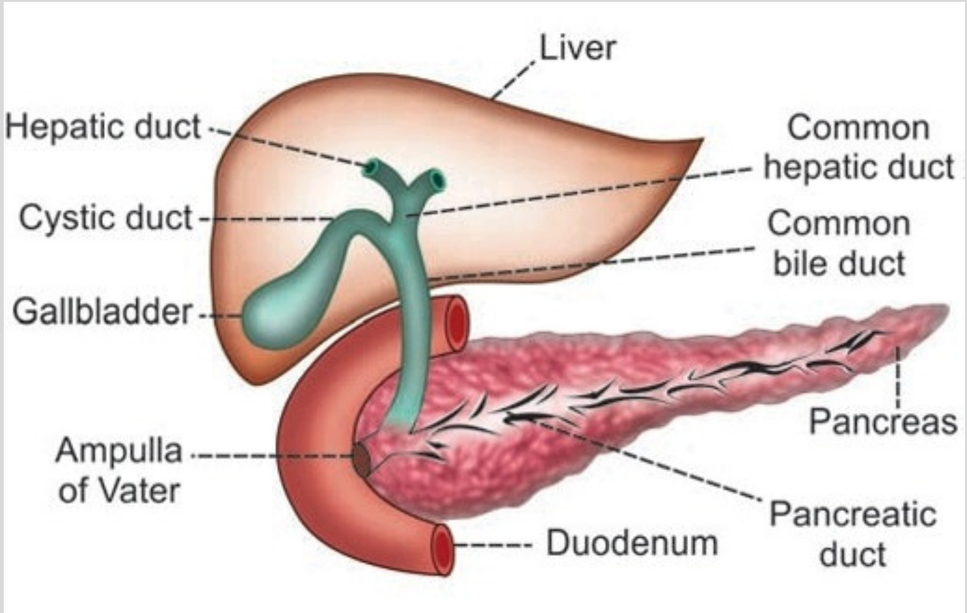
Reaction : AlkalinepH : 8 to 8.6

Specific gravity : 1.010 to 1.011 Color : Golden yellow or green.

SECRETION AND STORAGE OF BILE

•Bile is secreted by hepatocytes. The initial bile secreted by hepatocytes contains large quantity of bile acids, bile pigments, cholesterol, lecithin and fatty acids. From hepatocytes, bile is released into canaliculi.

•From here, it passes through small ducts and hepatic ducts and reaches the common hepatic duct. From common hepatic duct, bile is diverted either directly into the intestine or into the gallbladder.



Regulation Of Bile Secretion

Bile secretion is a continuous process though the amount is less during fasting.Secretion of bile from liver and release of bile from the gallbladder are influenced by some chemical factors.

1.Cholerestics

Substances which increase the secretion of bile from liver are known as choleretics. Effective choleretic agents are: i. Acetylcholine ii. Secretin iii. Cholecystokinin iv.Acid chyme in intestine v. Bile salts.

2.Cholagogues

Cholagogue is an agent which increases the release of bile into the intestine by contracting gallbladder.

Common cholagogues are: i. Bile salts ii. Calcium iii. Fatty acids iv. Amino acids v. Inorganic acids

3.Hydrocholeretic Agents -causes the secretion of bile from liver+Water&less solid.

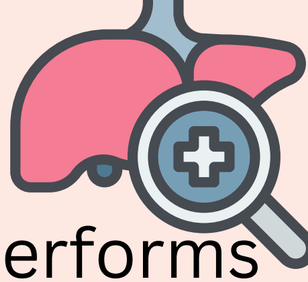
4. Digestion of carbohydrates

•Pancreatic amylase is the amylolytic enzyme present in pancreatic juice. Like salivary amylase, the pancreatic amylase also converts starch into dextrin and maltose.

5. Neutralizing action of Pancreatic juice

•When acid chyme enters intestine from stomach, pancreatic juice with large quantity of bicarbonate is released into intestine. Presence of large quantity of bicarbonate ions makes the pancreatic juice highly alkaline. This alkaline pancreatic juice neutralizes acidity of chyme in the intestine. Neutralizing action is an important function of pancreatic juice because it protects the intestine from the destructive action of acid in the chyme.

FUNCTION OF LIVER



Liver is the largest gland and one of the vital organs of the body. It performs many vital metabolic and homeostatic functions,

1.METABOLIC FUNCTION

•Liver has maximum metabolic reactions such as metabolism of carbohydrates, proteins, fats, vitamins and many hormones are carried out.

2.STORAGE FUNCTION

•Many substances like glycogen, amino acids, iron, folic acid and vitamins A, B12 and D are stored in liver.

3.SECRETION OF BILE

•Liver secretes bile which contains bile salts, bile pigments, cholesterol, fatty acids and lecithin. The functions of bile are mainly due to bile salts. Bile salts are required for digestion and absorption of fats in the intestine. Bile helps to carry away waste products and breakdown fats.

4.EXECRETORY FUNCTION

•Liver excretes cholesterol, bile pigments, heavy metals (like lead, arsenic), toxins, bacteria and virus (like that of yellow fever) through bile.

5.HEAT PRODUCTION

•Enormous amount of heat is produced in the liver because of metabolic reactions. Liver is the organ where maximum heat is produced.

6.HEMOLYTIC FUNCTION

•The senile RBCs after a lifespan of 120 days are destroyed by reticuloendothelial cells (Kupffer cells) of liver.

7. DEFENSIVE AND DETOXIFICATION FUNCTIONS

•Reticuloendothelial cells (Kupffer cells) of the liver play an important role in the defense of the body. Liver is also involved in the detoxification of the foreign bodies(Bacteria, harmful substances.)

FUNCTIONS OF SMALL INTESTINE

1.DIGESTIVE FUNCTION

•Enzymes of succus entericus act on the partially digested food and convert them into final digestive products. Enzymes are produced and released into succus entericus by enterocytes of the villi.

2.HORMONAL FUNCTION

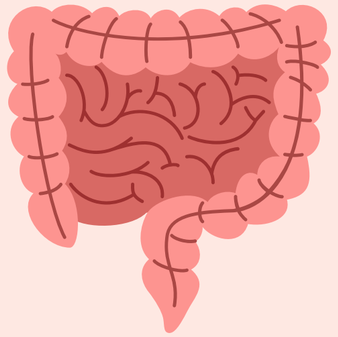
•Small intestine secretes many GI hormones such as secretin, cholecystokinin, etc. These hormones regulate the movement of GI tract and secretory activities of small intestine and pancreas

3.ACTIVATOR FUNCTION

•Enterokinase present in intestinal juice activates trypsinogen into trypsin. Trypsin, in turn activates other enzymes (

4.HYDROLYTIC FUNCTION

•Intestinal juice helps in all the enzymatic reactions of digestion.



5.PROCTECTIVE FUNCTION

•Mucus present in the succus entericus protects the intestinal wall from the acid chyme, which enters the intestine from stomach; thereby it prevents the intestinal ulcer.

6.ABSORPTIVE FUNCTIONS

•Presence of villi and microvilli in small intestinal mucosa increases the surface area of mucosa. This facilitates the absorptive function of intestine.

•Digested products of foodstuffs, proteins, carbohydrates, fats and other nutritive substances such as vitamins, minerals and water are absorbed mostly in small intestine. From the lumen of intestine, these substances pass through lacteal of villi, cross the mucosa and enter the blood directly or through lymphatics.

FUNCTIONS OF LARGE INTESTINE

1.ABORSRTIVE FUNCTION

•Large intestine plays an important role in the absorption of various substances such as: i. Water ii. iii. Electrolytes Organic substances like glucose i v. Alcohol v. Drugs like anesthetic agents, sedatives and steroids.

2.FORMATION OF FECES

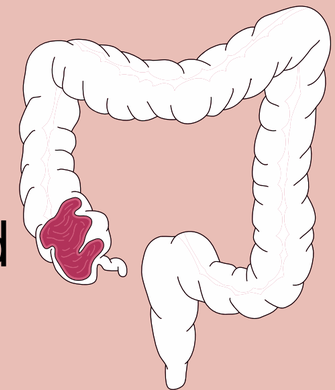
•After the absorption of nutrients, water and other substances, the unwanted substances in the large intestine form feces. This is excreted out.

3.EXCRETORY FUNCTION

•Large intestine excretes heavy metals like mercury, lead, bismuth and arsenic through feces.

4.SECRECTORY FUNCTION

•Large intestine secretes mucin and inorganic substances like chlorides and bicarbonates.



MOVEMENTS OF GIT

•DEGLUTION

•Deglutition or swallowing is the process by which food moves from mouth into stomach.

•STAGES OF DEGLUTION

•Deglutition occurs in three stages:

I. Oral stage, when food moves from mouth to pharynx

ii.Pharyngeal stage, when food moves from pharynx to esophagus.

iii.Esophageal stage, when food moves from esophagus to stomach.

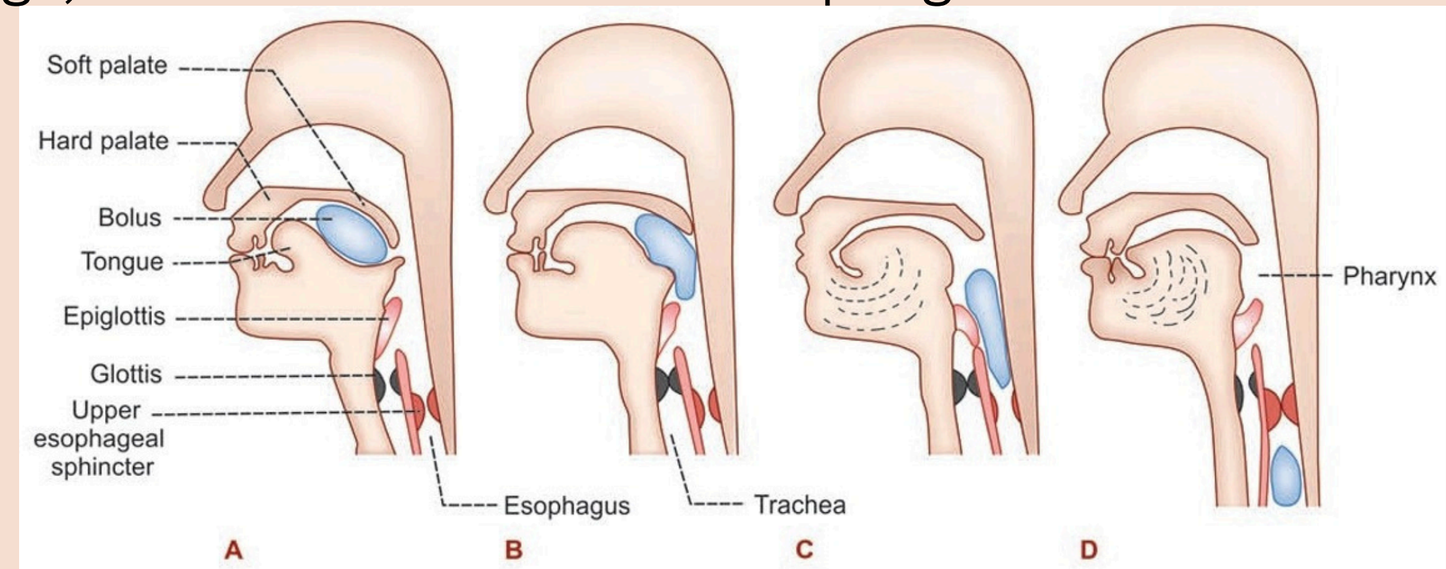


FIGURE 43.1: Stages of deglutition. **A.** Preparatory stage; **B.** Oral stage; **C.** Pharyngeal stage; **D.** Esophageal stage.

PERISTALSIS

•Peristalsis means a wave of contraction, followed by the wave of relaxation of muscle fibers of GI tract, which travel in aboral direction (away from mouth).

•When bolus reaches the esophagus, the peristaltic waves are initiated. Usually, two types of peristaltic contractions are produced in esophagus.
1. Primary peristaltic contractions 2. Secondary peristaltic contractions.

•Primary Peristalsis

When bolus reaches the upper part of esophagus, the peristalsis starts. This is known as primary peristalsis.After origin, the peristaltic contractions pass down through the rest of the esophagus, propelling the bolus towards stomach.

•Secondary Peristalsis

•If the primary peristaltic contractions are unable to propel the bolus into the stomach, the secondary peristaltic contractions appear and push the bolus into stomach.After origin these contractions prouduce positive pressure.

DEFECATION

•Voiding of feces is known as defecation. Feces is formed in the large intestine and stored in sigmoid colon. By the influence of an appropriate stimulus, it is expelled out through the anus. This is prevented by tonic constriction of anal sphincters, in the absence of the stimulus.

•DEFECATION REFLEX

. •The desire for defecation occurs when some feces enters rectum due to the mass movement. Usually, the desire for defecation is elicited by an increase in the intrarectal pressure to about 20 to 25 cm H2 O. Usual stimulus for defecation is intake of liquid like coffee or tea or water. But it differs from person to person.

THANK YOU