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Digestion and Absorption

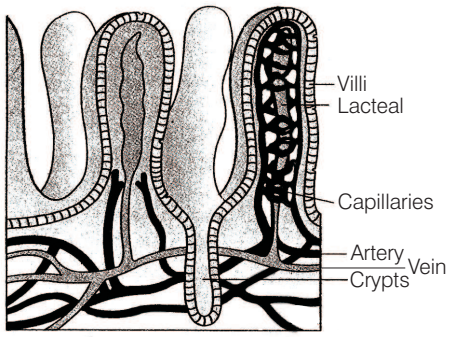
Multiple Choice Questions (MCQs)

Q. 1 Select what is not true of intestinal villi among following

(a) they possess microvilli
(b) they increase the surface area
(c) they are supplied with capillaries and the lacteal vessels
(d) they only participate in digestion of fats

Ans. *(d)* **Intestinal villi** are the numerous small finger-shaped projections which increases the absorptive surface area. They contain abundant blood capillaries and lymph vessels called **lacteals**. They also possess countless minute microvilli which further add to the absorptive surface.

They do not participate in the digestion of fats but helps in their **absorption** and various other food substances such as **water**, **mineral**, **salts**, **amino acids**, **vitamins**, etc.



A section of small intestine mucosa showing villi

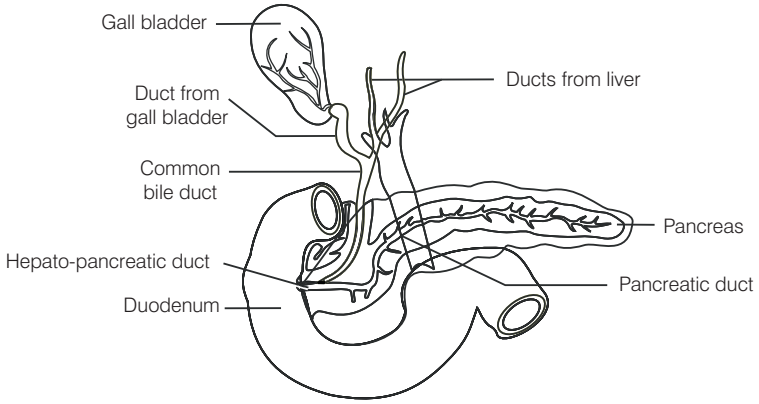
Q. 2 Hepato-pancreatic duct opens into the duodenum and carries

(a) bile
(b) pancreatic juice
(c) both bile and pancreatic juice
(d) saliva

Ans. *(c)* The duct of **gall bladder** along with **hepatic duct** from the liver forms the **common bile duct**. The bile duct and the pancreatic duct open together into the duodenum as a common hepato-pancreatic duct which carries both **bile** and **pancreatic juice**.

Bile is secreted by the hepatic cells of liver and is stored further in a thin muscular sac called **gall bladder**. Secretion of pancreatic juices takes place through the exocrine part of pancreas which consist of round lobules called **acini**.

Saliva is mainly produced by the salivary glands.



The duct system of liver, gall bladder and pancreas

Q. 3 One of the following is not a common disorder associated with digestive system

(a) Tetanus (b) Diarrhoea (c) Jaundice (d) Dysentery

Ans. ***(a)*** **Tetanus** is a medical condition which is characterised by a prolonged contraction of skeletal muscle fibres. Hence, this disorder is not associated with digestive system.

Diarrhoea is the abnormal frequency of bowel movement and increased liquidity of the faecal discharge. The food absorption is highly reduced in diarrhoea.

Jaundice represents one of the symptom of liver malfunctioning in which bile is not excreted properly. Skin and eyes turn yellow due to the excess accumulation of bile pigments in the blood.

Dysentery is the inflammatory disorder of intestine, especially of the colon, resulting in severe diarrhoea containing blood and mucus in the faeces, abdominal pain and fever.

Q. 4 A gland not associated with the alimentary canal is

(a) pancreas (b) adrenal (c) liver (d) salivary glands

Ans. ***(b)*** **Adrenal gland** is not associated with the alimentary canal. This gland is present at the anterior part of each kidney acting as an endocrine gland, involve in regulating body growth and developmental mechanisms.

Pancreas is located posterior to the stomach in the abdominal cavity, it is associated with the secretion of **alkaline pancreatic juices** which are essential in the digestion of starch, protein, fats and nucleic acid. **Pancreas** also produces hormones like glucagon, insulin, somatostatin are involved in glucose metabolism.

Liver is the largest gland of the body lying in the upper right side of the abdominal cavity just below the diaphgram. It is mainly involved in the production of bile which helps in the digestion of fats in small intestine by **emulsification process**.

Salivary glands are situated just outside the buccal cavity. They discharge their secretions (salivary juices) in the oral cavity, which helps in the mastication of food.

Q. 5 Match the following columns and select the correct among options given

	Column I		Column II
A.	Biomacromolecules of food	1.	Alimentary canal and associated gland
B.	Human digestive system	2.	Embedded in jaw bones
C.	Stomach	3.	Outer wall of visceral organs
D.	Thecodont	4.	Converted into simple substances
E.	Serosa	5.	J-shaped bag like structure

Codes

(a) A-2, B-1, C-5, D-3, E-4 (b) A-4, B-1, C-5, D-2, E-3

(c) A-1, B-2, C-3, D-4, E-5 (d) A-1, B-3, C-2, D-4, E-5

Ans. *(b)* **Biomacromolecules of food** like carbohydrates, fats, proteins and nucleic acid are converted into simpler monomers during the digestion process.

Human digestive system consists of alimentry canal and its associated gland.

Stomach is the widest organ of the alimentry canal. It is a J-shaped bag like structure, and plays an important role in digestion.

Thecodont are teeth that are embedded in the sockets of the jaw bones.

Serosa is an another name for **serous membrane,** forming outer wall of the visceral organs.

Q. 6 Match the following columns.

	Column I		Column II
A.	Duodenum	1.	A cartilaginous flap
B.	Epiglottis	2.	Small blind sac
C.	Glottis	3.	'U' shaped structure emerging from the stomach.
D.	Caecum	4.	Opening of wind pipe.

Codes

(a) A-1, B-2, C-3, D-4 (b) A-4, B-3, C-2, D-1

(c) A-3, B-1, C-4, D-2 (d) A-2, B-4, C-1, D-3

Ans. *(c)* **Duodenum** is a 'U'-shaped structure emerging from the stomach.

Epiglottis is a **cartilaginous flap** that prevents the entry of food into the glottis.

Glottis is the opening of the wind pipe.

Caecum is a small blind sac which hosts some symbiotic microorganisms that helps in the digestion process.

Q. 7 Match the enzyme with their respective substrate and choose the right one among options given

	Column I		Column II
A.	Lipase	1.	Dipeptides
B.	Nuclease	2.	Fats
C.	Carboxypeptidase	3.	Nucleic acids
D.	Dipeptidases	4.	Proteins, peptones and proteoses

Codes

(a) A-2, B-3, C-1, D-4 (b) A-3, B-4, C-2, D-1

(c) A-3, B-1, C-4, D-2 (d) A-2, B-3, C-4, D-1

Ans. ***(d)*** **Lipase** is a fat digestive enzyme.

Nuclease is the enzymes that digest nucleic acid.

Carboxypeptidases are the enzymes involved in the digestion of proteins, peptones and proteases.

Dipeptidases are the enzymes that brake dipeptides into **amino acids**.

Q. 8 Dental formula in human beings is

(a) $\frac{3\,2\,2\,3}{3\,2\,2\,3}$ (b) $\frac{2\,1\,2\,3}{2\,1\,2\,3}$

(c) $\frac{1\,2\,3\,2}{1\,2\,3\,2}$ (d) $\frac{2\,2\,3\,3}{2\,2\,3\,3}$

Ans. ***(b)*** An adult human has 32 permanent teeth which are of four different types, namely **Incisors** (I), **Canine** (C), **Premolar** (PM) and **Molar** (M). Arrangement of teeth in each half of the upper and lower jaw in the order I,C,PM,M is represented by a dental formula, which in humans is $\frac{2\,1\,2\,3}{2\,1\,2\,3}$.

Q. 9 Liver is the largest gland and is associated with various functions, choose one which is not correct.

(a) Metabolism of carbohydrate

(b) Digestion of fat

(c) Formation of bile

(d) Secretion of hormone called gastrin

Thinking Process

Liver is the largest gland of body. It lies in the upper right side of the abdominal cavity just below the diaphragm.

Ans. ***(d)*** Liver is involved in the production of bile (hepatic bile pH is 8.6). Bile helps in the digestion of fats in the small intestine by the **emulsification process** (conversion of large fat droplets into small ones).

Liver also plays a critical role in controlling rate metabolism by maintaining glucose concentration in normal range. Gastrin is secreted by G-cells in pyrolic region of stomach. It stimulates gastric glands to secrete and release gastric juices.

Q. 10 Mark the right statement among the following

(a) Trypsinogen is an inactive enzyme

(b) Trypsinogen is secreted by intestinal mucosa

(c) Enterokinase is secreted by pancreas

(d) Bile contains trypsin

Ans. ***(a)*** **Trypsinogen** is an inactive pencreatic enzyme that is activated, by enterokinase, enzyme secreted by intestinal mucosa. Active form of trypsinogen is called trypsin, which in turn activates other enzymes present in the pancreatic juice.

Very Short Answer Type Questions

Q. 1 The food mixes thoroughly with the acidic gastric juice of the stomach by the churning movements of its muscular wall. What do we call the food then?

Ans. The food is stored in stomach for 4-5 hours, and it gets thoroughly mixed with the acidic gastric juice of stomach by the churning movements of its muscular wall. The food at this stage is called as **chyme**.

Q. 2 Trypsinogen is an inactive enzyme of pancreatic juice. An enzyme, enterokinase, activates it. Which tissue/cells secrete this enzyme?/How is it activated?

Thinking Process

Secretion of pancreatic juice takes place through the exocrine part of pancreas. The juice contains inactive enzymes i.e., ***trypsinogen, chymotrypsin, procarboxypeptidase, amylase, lipases*** *and* ***nucleases****.*

Ans. **Trypsinogen** is activated to trypsin by the enzyme **enterokinase**. This enzyme is secreted by the **intestinal mucosa**.

Q. 3 In which part of alimentary canal does absorption of water, simple sugars and alcohol takes place?

Ans. The absorption of **water, simple sugars**, **alcohol** and some lipid soluble drugs take place by the **stomach wall**.

Q. 4 Name the enzymes involved in the breakdown of nucleotides into sugars and bases?

Ans. The enzymes **nucleotidases** and **nucleosidases** are involved in the breakdown of nucleotides into sugars and bases.

$$\text{Nucleotides} \xrightarrow{\text{Nucleotidases}} \text{Nucleosides} \xrightarrow{\text{Nucleosidases}} \text{Sugars} + \text{Bases}$$

Q. 5 Define digestion in one sentence.

Ans. The process of conversion of complex food substances to simple absorbable forms by mechanical and biochemical methods is called **digestion**.

Q. 6 What do we call the type of teeth attachment to jaw bones in which each tooth is embedded in a socket of jaws bones?

Ans. The type of attachment where teeth are embedded in the socket of jaw bone is called **thecodont**.

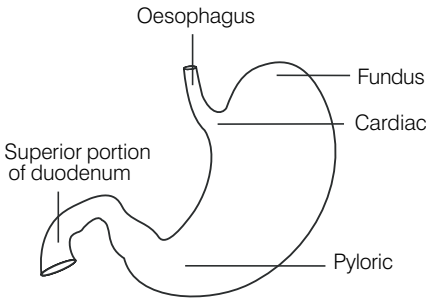
Q. 7 Stomach is located in upper left portion of the abdominal cavity and has three major parts. Name these three parts.

Ans. *The three major parts of stomach are*

(a) **Cardiac** into which the oesophagus opens.

(b) **Fundus** which is commonly filled with air or gases.

(c) **Pylorus** which opens into small intestine (posterior part of stomach).



Outline structure of stomach

Q. 8 Does gall bladder make bile?

Ans. **Gall bladder** is not associated with the bile formation rather it is involved in the storage of bile. Bile is secreted from the hepatic cells of the liver.

Q. 9 Correct the following statements by deleting one of entries (given in bold).

(a) Goblet cells are located in the intestinal mucosal epithelium and secrete **chymotrypsin/mucus.**

(b) Fats are broken down into di-and monoglycerides with the help of **amylase/lipases.**

(c) Gastric glands of stomach mucosa have **oxyntic cell/chief cells** which secrete HCl.

(d) Saliva contains enzymes that digest **starch/protein**

Ans. **(a)** Goblet cells are located in the intestinal mucosal epithelium and secrete **mucus**.

(b) Fats are broken down into di and monoglycerides with the help of **lipases**.

$$\text{Fats} \xrightarrow{\text{Lipases}} \text{Diglycerides} \longrightarrow \text{Monoglycerides.}$$

(c) Gastric glands of stomach mucosa have oxyntic cells which secrete HCl

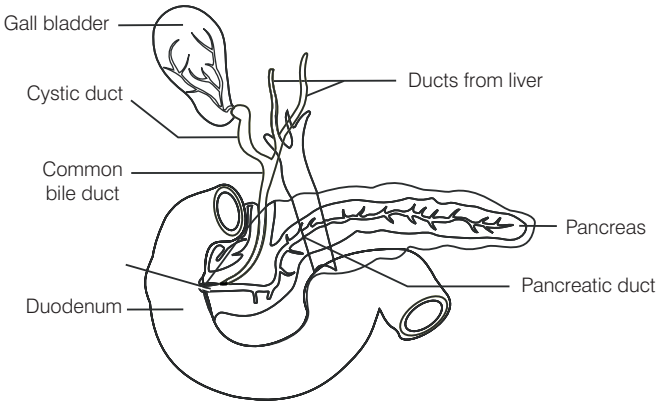
(d) Saliva contains enzymes that digest **starch**.

$$\text{Starch} \xrightarrow[\text{pH 6.8}]{\text{Salivaryamylase}} \text{Maltose} + \text{Isomaltose} + \alpha\text{–dextrins}$$

Short Answer Type Quesations

Q. 1 What is pancreas? Mention the major secretions of pancreas that are helpful in digestion.

Ans. The **pancreas** is a compound (both exocrine and endocrine) elongated organ situated between the limbs of 'U' shaped duodenum.



Diagrammatic representation of pancreas

Internal structure of pancreas consist of two parts, *i.e.,* the exocrine and endocrine part.

(i) **Exocrine part** consists of rounded lobules called acini that are involved in the secretion of alkaline pancreatic juice of pH 8.4. The pancreatic juice is mainly involved in the digestion of starch, proteins, fats and nucleic acids.

(ii) **Endocrine part** is involved in the secretion of hormones like, insulin and glucagon that regulate glucose metabolism.

Q. 2 Name the part of the alimentary canal where major absorption of digested food takes place. What are the absorbed forms of different kinds of food materials?

Ans. **Small intestine** is the principle organ for the absorption of nutrients. The process of digestion complete here only and the final products of digestion are absorbed through the mucosa into the blood stream.

The absorbed form of different food materials are

Food Material	Absorbed Form
Carbohydrate	Glucose
Protein	Amino acid
Fat	Fatty acid

Q. 3 List the organs of human alimentary canal and name the major digestive glands with their location.

Ans. **Human digestive system** consists of two main parts, alimentary canal and digestive glands.

Alimentary canal comprises of following parts

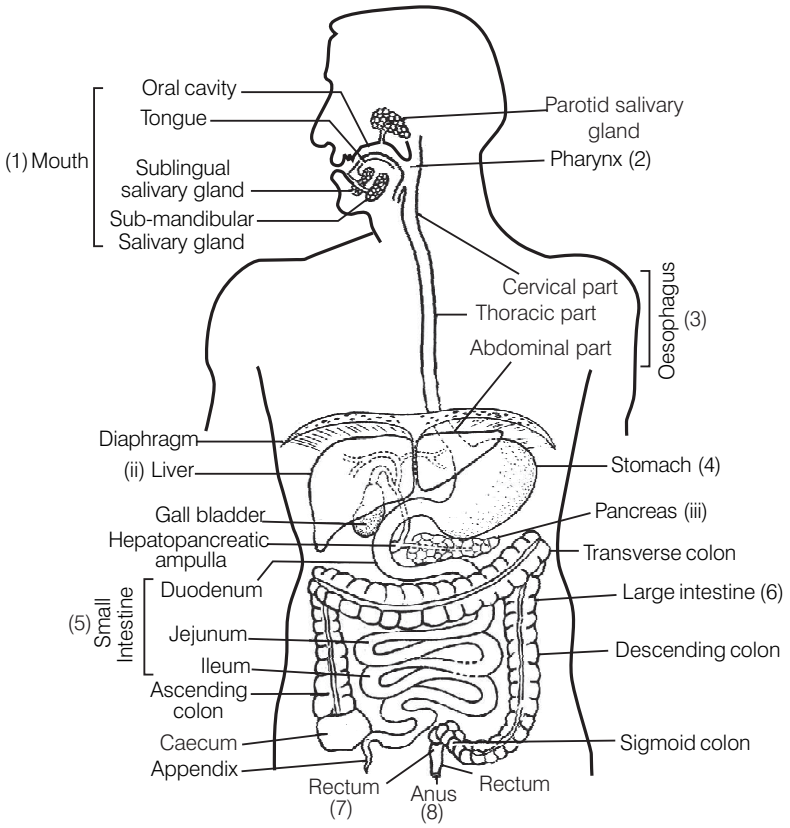
(i) Mouth (ii) Pharynx (iii) Oesophagus
(iv) Stomach (v) Small intestine (vi) Large intestine
(vii) Rectum (viii) Anus

Digestive glands include

(i) **Salivary glands** are situated just outside the buccal cavity and secrete salivary juice into it.

(ii) **Liver** is the largest gland in the body, situated in the abdominal cavity just below the diaphgram and has two lobes. It secreates bile which helps in the digestion of fats.

(iii) **Pancreas** is the compound organ situated between the limbs of U-shaped duodenum acting as endocrine and exocrine organ. The exocrine portion secretes pancreatic juice where endocrine portion secretes hormones like insulin and glucagon.



Human digestive system

Q. 4 What is the role of gall bladder? What may happen if it stops functioning or is removed?

Ans. **Gall Bladder** is a pear-shaped sac-like structure, that is attached to the posterior surface of the liver by a **connective tissue**. The bile secreted by the hepatic cells of liver, passes through the hepatic ducts and gets stored and concentrated in the gall bladder.

Non-functioning and removal of gall bladder would be bile to simply run in the continuous stream from the liver into the intestine. It would not be as concentrated as the bile started in gall bladder actually is. The body gradually adjust to it but a low fat diet is recommonded because fat digestion is significantly reduced after gall bladder removal.

Q. 5 Correct the statements given below by the right option shown in the bracket against them.

(a) Absorption of amino acids and glycerol takes place in the (small intestine/ large intestine).

(b) The faeces in the rectum initiate a reflex causing an urge for its removal (neural/ hormonal).

(c) Skin and eyes turn yellow in infection (liver/stomach).

(d) Rennin is a proteolytic enzyme found in gastric juice in (infants/ adults).

(e) Pancreatic juice and bile are released through (intestine pancreatic/ hepato-pancreatic duct).

(f) Dipeptides, disaccharides and glycerides are broken down into simple substances in region of small intestines (jejunum/ duodenum).

Ans. **(a)** Absorption of amino acids and glycerol takes place in the small intestine.

(b) The faeces in the rectum initiate a neural reflex causing an urge for its removal.

(c) Skin and eyes turn yellow in liver infection.

(d) Rennin is a proteolytic enzyme found in infants gastric juice.

(e) Pancreatic juice and bile are released through hepato-pancreatic duct.

(f) Dipeptides, disaccharides and glycerides are broken down into simple substances in the region of small intestine called duodenum.

Q. 6 What are three major types of cells found in the gastric glands? Name their secretions.

Thinking Process

These are numerous microscopic, tubular glands formed by the epithelium of the stomach.

Ans. *Gastric glands process three major types of cells namely*

(i) **Mucous neck cells** (Goblet cells) These cells are present throughout the epithelium of gastrointestinal tract and are involved in the secretion of mucus.

(ii) **Peptic or Chief cells** (Zymogenic cells) These cells are usually basal in location and are involved in the secretion of gastric digestive enzymes such as proenzymes **pepsinogen** and **prorennin**.

(iii) **Parietal or oxyntic cells** These cells are large and most numerous present on the side walls of the **gastric glands**. They are involved in the secretion of HCl and Castlis Intrinsic Factor (CIF). (factor essential for the absorption of vitamin-B_{12} in ileum).

Q. 7 How is the intestinal mucosa protected from the acidic food entering from stomach?

Ans. The mucus secreted by the goblet cells along with the bicarbonates from the pancreas play an important role in **lubrication** and **protection** of the mucosal epithelium from excoriation by the highly concentrated hydrochloric acid.

Q. 8 How are the activities of gastro-intestinal tract regulated?

Ans. The activities of the **Gastro-Intestinal Tract** (GIT) are under **neural** and **hormonal** control for proper coordination amongst different parts. The gastrointestinal tract is innervated by intrinsic nerves as well as by **extrinsic nerves**.

The intrinsic neural system, also called the **enteric neural system** consists of (i) **Meissner's plexus** situated in the submucosa and (ii) **Auerbach's plexus** situated in the muscular layer. The enteric neural system controls most of the gastrointestinal functions like secretion and motility.

The extrinsic innervation of the gut consists of **parasympathetic** and **sympathetic nerves** which can modify the activity of intrinsic neural system in response to reflex activity initiated by GIT or from other body parts.

The sight, smell and the presence of food in the oral cavity can stimulate the secretion of the **saliva** through vagus nerve. Gastric and intestinal secretions are also stimulated by **neural signals**. The muscular activity of different parts of the alimentry canal can also be moderated by neural mechanisms, both local and through CNS.

Hormonal control of the secretions of digestive juice is carried out by the local hormones produced by the **gastric** and **intestinal mucosa**. These include gastrin (stimulate release of gastric juice), enterogastrone (inhibits gastric secrection and motility), secretin (decreases gastric secretion), duodocrinin (stimulate Brunner's gland) etc.

Q. 9 Distinguish between constipation and indigestion. Mention their major causes.

Ans. **Constipation** is characterised by small amounts of hard, drybowel movements usually fever than three times a week. In constipation, the faeces are retained within the rectum as the bowel movement occurs irregularly. The causes for constipation involve water deficiency, lack of roughage in diet, spasm of colon, lack of exercise, emotional stress and certain drugs.

Indigestion is the condition in which the food is not properly digested leading to a feeling of fullness. The cause of indigestion are inadequate enzyme secretion, anxiety, food poisoning, over eating and spicy food consumption.

Q. 10 Describe the enzymatic action on fats in the duodenum.

Ans. Fats are broken down by lipases with the help of bile into di and monoglycerides and further into fatty acids and glycerol in the duodenum *The reaction involved in this process are as follows*

$$\text{Fats} \xrightarrow{\text{Lipases}} \text{Diglycerides} \longrightarrow \text{Monoglycerides}$$

$$\text{Di and Monoglycerides} \xrightarrow{\text{Lipases}} \text{Fatty acids} + \text{Glycerol.}$$

Long Answer Type Questions

Q. 1 A person had roti and dal for his lunch. Trace the changes in those during its passage through the alimentary canal.

Thinking Process

Carbohydrates, fats, proteins *and* ***nucleic acids*** *occur in food in the form of large and complex insoluble macromolecules or polymers. When these polymers are made to react with water in the presence of enzymes, they break down into simpler monomers. This process is called digestion.*

Ans. 1. **Digestion of Roti** (Carbohydrates)

(a) **Digestion of Carbohydrates in the Oral Cavity**

In oral cavity, the roti is mixed with saliva. The saliva contains an enzyme salivary amylase (ptyalin) which converts starch in roti into maltose, isomaltose and small dextrins called α-dextrin. 30% of starch is hydrolysed in the oral cavity.

$$\text{Starch} \xrightarrow[\text{pH 6–8}]{\text{Salivary Amylase}} \text{Maltose} + \text{Isomaltose} + \alpha\text{-Dextrin}$$

(b) **Digestion of Carbohydrates in the Small Intestine**

The passage of party digested roti from oral cavity to oesophagus and then to stomach is regulated by peristalsis (the successive waves of muscular contraction in oesophagus). The stomach stores the food for 4-5 hours. The gastric juice does not contain carbohydrate digesting enzyme.

The partially digested food is now called as **chyme.** In intestine, following action occurs.

(i) **Action of Pancreatic Juice** Carbohydrates in the chyme are hydrolysed by pancreatic amylase into disaccharides.

$$\text{Polysaccharides (starch)} \xrightarrow{\text{Amylase}} \text{Disaccharides}$$

(ii) **Action of Intestinal Juice** Intestinal juice contain maltase, isomaltase, sucrase (invertase), lactase and α-dextrinase.These enzymes act on food converting it into simpler compounds like glucose, fructose, galactose, etc.

$$\text{Maltose} \xrightarrow{\text{Maltase}} \text{Glucose} + \text{Glucose}$$

$$\text{Isomaltose} \xrightarrow{\text{Isomaltase}} \text{Glucose} + \text{Gucose}$$

$$\text{Sucrose} \xrightarrow{\text{Sucrase}} \text{Glucose} + \text{Fructose}$$

$$\text{Lactose} \xrightarrow{\text{Lactase}} \text{Glucose} + \text{Galactose}$$

$$\alpha\text{–Dextrins} \xrightarrow{\alpha\text{-dextrinose}} \text{Glucose}$$

2. **Digestion of Protein**

Proteins are made up of amino acids. So proteins are broken down to amino acid during the process of digestion.

Saliva does not contain any protein digesting enzyme. So, its digestion in stomach.

(a) **Digestion of Protein in Stomach** The stomach normally stores food for 4-5 hours. The gastric glands of the stomach secrete gastric juice. It contains HCl, proenzymes like- pepsinogen and prorennin. *Various reactions in stomach are discussed below*

$$\underset{\text{(proenzyme)}}{\text{Pepsinogen}} \xrightarrow{\text{HCl}} \text{Pepsin}$$

$$\text{Proteins} \xrightarrow{\text{Pepsin}} \text{Peptones and proteoses}$$

$$\underset{\text{(Proenzyme)}}{\text{Prorennin}} \xrightarrow{\text{HCl}} \text{Rennin}$$

(b) **Digestion of Protein in Small Intestine**

(i) **Action of Pancreatic Juice** The enzymes trypsinogen, chymotrypsinogen and procarboxypeptidase in pancreatic juice are all concerned with the protein digestion.

Some reactions are given below

$$\text{Trypsinogen} \xrightarrow{\text{Enterot kinase}} \text{Trypsin}$$

$$\text{Proteins} \xrightarrow{\text{Trypsin}} \text{Dipeptides}$$

$$\text{Chymotrypsinogen} \xrightarrow{\text{Trypsin}} \text{Chymotrypsin}$$

$$\text{Peptones} \xrightarrow{\text{Chymotrypsin}} \text{Dipeptides}$$

$$\text{Procarboxypeptidase} \xrightarrow{\text{Trypsin}} \text{Carboxypeptidases}$$

$$\text{Proteoses} \xrightarrow{\text{Carboxypeptidases}} \text{Dipeptides}$$

(ii) **Action of Intestinal Juice** Intestinal juice contain enzymes enterokinase, amino peptidase and dipeptidase and their *actions are given below*

$$\text{Peptides} \xrightarrow{\text{Amino peptidase}} \text{Amino acid}$$

$$\text{Dipeptides} \xrightarrow{\text{Dipeptidase}} \text{Amino acid}$$

The macromolecules that are broken down into simpler components are the products of roti and dal (carbohydrates and proteins) which are further absorbed by the villi in intestine and the rest undigested food is removed in the form of faeces.

Q. 2 What are the various enzymatic types of glandular secretions in our gut helping digestion of food? What is the nature of end products obtained after complete digestion of food?

Ans. Among various enzymatic secretions, gastric juice is released in stomach whereas the bile, pancreatic juice and the intestinal juice are the secretions released into the small intestine. Pancreatic juice and bile are released through the hepato-pancreatic duct. Gastric juice contains hydrochloric acid and proenzyme - pepsinogen and prorennin. HCl maintains a strongly acidic pH which converst these proenzymes into pepsin and rennini (in infants) respectively. These enzymes act on proteins and convert them into simpler form, peptones.

The pancreatic juice contains inactive enzymes trypsinogen, chymotrypsinogen, procarboxypeptidases, amylases, lipases and nucleases.

Trypsinogen is activated by an enzyme, enterokinase, (secreted by the intestinal mucosa) into active trypsin, which in turn activates the other enzymes in the pancreatic juice. The bile released into the duodenum contains bile pigments (billirubin and billiverdin), bile salts, cholesterol and phospholipids but no enzymes.

Bile helps in emulsification of fats, *i.e.,* breaking down of the fats into very small micelles. Bile also activates lipases. The secretions of the brush border cells of the mucosa along with the secretions of the goblet cells constitute the intestinal juice or succus entericus.

This juice contains a variety of enzymes like disaccharidases (*e.g.,* maltase), dipeptidases, lipases, nucleosidases, etc. The mucus along with the bicarbonates from the pancreas protects the intestinal mucosa from acid as well as provide an alkaline medium (pH 7.8) for enzymatic activities. Sub-mucosal glands (Brunner's glands) also help in this process.

Various reactions involved in this process are as follows

(i) $\text{Pepsinogen} \xrightarrow{\text{HCl}} \text{Pepsin}$

$\text{Proteins} \xrightarrow{\text{Peptine}} \text{Peptones}$

(ii) $\text{Peptones} \xrightarrow[\text{Carboxypeptidase}]{\text{Trypsin/Chymotrypsin}} \text{Dipeptides}$

$\text{Dipeptides} \xrightarrow{\text{Dipeptidases}} \text{Amino acids}$

(iii) $\text{Carbohydrates} \xrightarrow{\text{Amylase}} \text{Disaccharides}$

Maltose $\xrightarrow{\text{Maltase}}$ Glucose + Glucose

Lactose $\xrightarrow{\text{Lactase}}$ Glucose + Galactose

Sucrose $\xrightarrow{\text{Sucrase}}$ Glucose + Fructose

(iv) Fats $\xrightarrow[\text{Hydrolysed}]{\text{Lipases}}$ Diglycerides $\longrightarrow$ Monoglycerides

Di and Monoglycerides $\xrightarrow{\text{Lipases}}$ Fatty acids + Glycerol

(v) Nucleic acids $\xrightarrow{\text{Nucleases}}$ Nucleotides

Nucleosides $\xrightarrow{\text{Nucleosidases}}$ Sugars + Bases

Q. 3 Discuss mechanisms of absorption.

Thinking Process

Absorption is the process by which the end products of digestion pass through the intestinal mucosa into the blood or lymph, It is carried out by passive, active or facilitated transport mechanism.

Ans. **Mechanism of absorption for different molecules is as follow**

(i) Small amounts of **monosaccarides** like **glucose**, **amino acids** and some **electrolytes like chloride ions** are generally absorbed by simple diffusion. *The passage of these substances into the blood depends upon the concentration gradient*

(ii) Fructose and some amino acids are absorbed with the help of carrier ions like Na^+. This mechanism of transport is called **facilitated transport** or **active transport.**

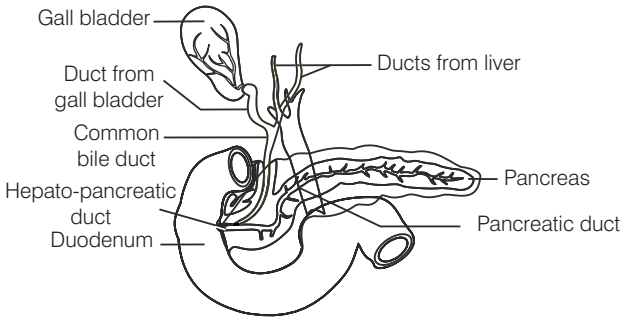
(iii) Transport of water depends on **osmotic gradient**.

(iv) Fatty acids and glycerol being **insoluble,** cannot be absorbed into the blood. They are first incorporated into **micelles** (smalll droplets) which move into intestinal mucosa.

Further, they are reformed into protein coated **fat globules** called **chylomicrons** which are transported to the lymph vessels in the villi. These lymph vessels ultimately release the absorbed substances into the blood stream.

Q. 4 Discuss the role of hepato-pancreatic complex in digestion of carbohydrate, protein and fat components of food.

Ans. This bile duct (from gall bladder and liver) and the pancreatic duct (from pancreas) releases pancreatic juice and bile into the duodenum through the common hepato-pancreatic duct which is guarded by a sphincter called sphincter of Oddi.



The duct system of liver, gall bladder and pancreas

The pancreatic juice contains inactive enzymes, *i.e.,* **trypsinogen**, **chymotrypsinogen**, **procarboxypeptidase**, **amylase**, **lipases** and **nucleases**.

The action of hepato-pancreatic secretion on digestion on carbohydrate, proteins and fats are summarised below

(i) Carbohydrates in the chyme are hydrolysed by pancreatic amylase into disaccharides.

Polysaccharides (starch) $\xrightarrow{\text{Pancreatic amylase}}$ Disaccharides

(ii) Fats are broken down by lipases with the help of bile into di and monoglycerides.

$$\text{Triglycerides} \xrightarrow{\text{Bile}} \text{Emulsified triglycerids} \xrightarrow{\text{Lipase}} \text{Diglycerides} \longrightarrow \text{Monoglycerides}$$

(iii) Proteins in the chyme reaching the intestine are acted upon by the proteolytic enzymes of pancreatic juice.

$$\begin{matrix}\text{Proteins}\\ \text{Peptones}\\ \text{Proteoses}\end{matrix} \xrightarrow[\text{Carboxy peptidase}]{\text{Trypsin/Chymotrypsin}} \text{Dipeptides}$$

Q. 5 Explain the process of digestion in the buccal cavity with a note on the arrangement of teeth.

Ans. The buccal cavity performs two major functions *i.e.*, *mastication of food and facilitation of swallowing*

Firstly, food gets mixed with saliva which softens and lubricates the food and cheuring process breaks the food into smaller pieces.

Buccal cavity is also involved in the digestion of same food components.

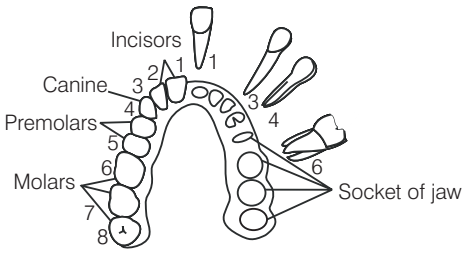
Digestion of carbohydrates starts in the buccal cavity. The food is mixed with saliva which contains salivary anylase. This enzyme converts starch into maltose, isomaltose and α –dextrins. 30% of the starch in food is hydorlysed in the buccal cavity.

$$\text{Starch} \xrightarrow[\text{anylase}]{\text{Salivany}} \text{Maltose} + \text{Isomaltose} + \alpha\text{–dextrins}$$

Saliva do not any protein or fat digesting anzyme. Therefore, their digestion do not occur in the oral cavity.

The oral cavity has a number of teeth and a muscular tongue. Each tooth is embedded in a socket of jaw bone.

This type of attachement is called thecodont. The human have two sets of teeth a temporary and a permenant. This type of denotation is called diphyodont. *The arrangement of teeth is illustrated below.*



Arrangement of different types of teeth in the jaws on one side the sockets on the other side