

Biology

Textbook for Cass XI

16. Digestion and Absorption

Question 1. Choose the correct answer among the following:

- (a) Gastric juice contains
- (i) pepsin, lipase and rennin
 - (ii) trypsin, lipase and rennin
 - (iii) trypsin, pepsin and lipase
 - (iv) trypsin, pepsin and renin
- (b) Succus entericus is the name given to
- (i) a junction between ileum and large intestine
 - (ii) intestinal juice
 - (iii) swelling in the gut
 - (iv) appendix

Answer:

(a): (i) Pepsin, lipase, and rennin

Gastric juice contains pepsin, lipase, and rennin. Pepsin is secreted in an inactive form as pepsinogen, which is activated by HCl. Pepsin digests proteins into peptones. Lipase breaks down fats into fatty acids. Rennin is a proteolytic enzyme present in the gastric juice. It helps in the coagulation of milk.

(b): (ii) Intestinal juice

Succus entericus is another name for intestinal juice. It is secreted by the intestinal gland. Intestinal juice contains a variety of enzymes such as maltase, lipases, nucleosidases, dipeptidases, etc.

Question 2. Match column I with column II

Column I	Column II
(a) Bilirubin and biliverdin	(i) Parotid

(b) Hydrolysis of starch	(ii) Bile
(c) Digestion of fat	(iii) Lipases
(d) Salivary gland	(iv) Amylases

Answer:

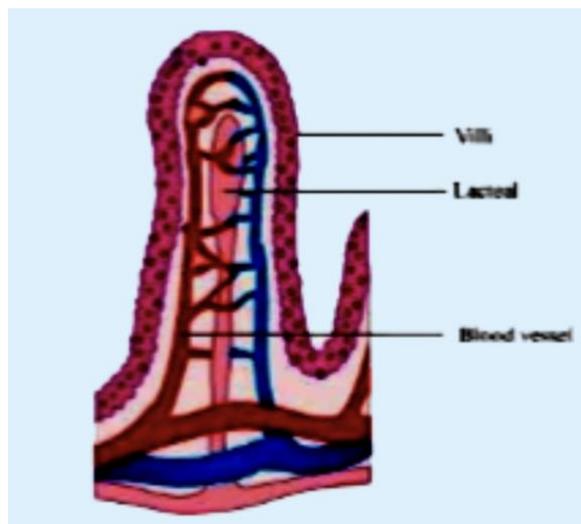
Column I	Column II
(a) Bilirubin and biliverdin	(ii) Bile
(b) Hydrolysis of starch	(iv) Amylases
(c) Digestion of fat	(iii) Lipases
(d) Salivary gland	(i) Parotid

Question 3. Answer briefly:

- (a) Why are villi present in the intestine and not in the stomach?**
- (b) How does pepsinogen change into its active form?**
- (c) What are the basic layers of the wall of alimentary canal?**
- (d) How does bile help in the digestion of fats?**

Answer:

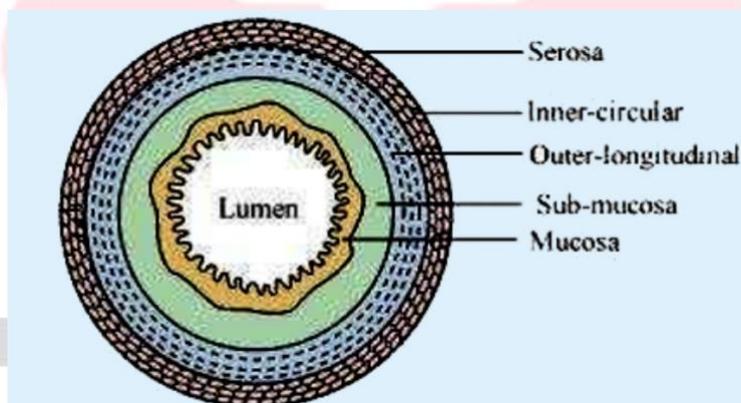
(a) The mucosal wall of the small intestine forms millions of tiny finger-like projections known as villi. These villi increase the surface area for more efficient food absorption. Within these villi, there are numerous blood vessels that absorb the digested products of proteins and carbohydrates, carrying them to the blood stream. The villi also contain lymph vessels for absorbing the products of fat-digestion. From the blood stream, the absorbed food is finally delivered to each and every cell of the body. The mucosal walls of the stomach form irregular folds known as rugae. These help increase the surface area to volume ratio of the expanding stomach.



(b) Pepsinogen is a precursor of pepsin stored in the stomach walls. It is converted into pepsin by hydrochloric acid. Pepsin is activated in the form of pepsinogen.

Pepsinogen (inactive) \rightarrow Pepsin (Active) + Inactive peptide

(c) The walls of the alimentary canal are made up of four layers. These are as follows:



(i) Serosa is the outermost layer of the human alimentary canal. It is made up of a thin layer of secretory epithelial cells, with some connective tissues underneath.

(ii) Muscularis is a thin layer of smooth muscles arranged into an outer longitudinal layer and an inner circular layer.

(iii) Sub-mucosa is a layer of loose connective tissues, containing nerves, blood, and lymph vessels. It supports the mucosa.

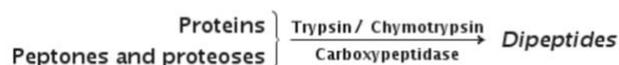
iv. Mucosa is the innermost lining of the lumen of the alimentary canal. It is mainly involved in absorption and secretion.

(d) Bile is a digestive juice secreted by the liver and stored in the gall bladder. Bile juice has bile salts such as bilirubin and biliverdin. These break down large fat globules into smaller globules so that the pancreatic enzymes can easily act on them. This process is known as emulsification of fats. Bile juice also makes the medium alkaline and activates lipase.

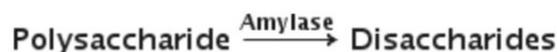
Question 4. State the role of pancreatic juice in digestion of proteins.

Answer: The pancreatic juice has inactive enzymes – trypsinogen, chymotrypsinogen, procarboxypeptidases, amylases, lipases and nucleases.

(i) Proteins, proteoses and peptones in the chyme reaching the intestine are acted upon by the proteolytic enzymes of pancreatic juice.



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



(iii) Fats are broken down by lipases.



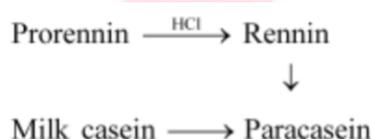
(iv) Nucleases in the pancreatic juice acts on nucleic acids to form nucleotides and nucleosides.



Question 5. Describe the process of digestion of protein in stomach.

Answer: Stomach is the first organ where the digestion of proteins starts while the small intestine is the part where protein digestion ends. Stomach possess gastric glands which secret gastric juices containing enzymes that act on food. Gastric juice mainly contains hydrochloric acid, pepsinogen, mucus, and rennin. Firstly, the food that enters the stomach becomes acidic when it mixes with the gastric juice. The function of these components in protein digestion is as follows:

1. Hydrochloric acid dissolves the food particle and creates an acidic medium inside the stomach. Acidic medium is a pre-requisite for the conversion of inactive enzyme pepsinogen into active pepsin. .
2. Pepsin is a protein-digesting enzyme that converts proteins into proteases and peptides.
3. Rennin which plays an important part in the coagulation of milk is a proteolytic enzyme which is released as prorennin i.e. inactive rennin.



Question 6. Give the dental formula of human beings.

Answer: The dental formula represents the arrangement of teeth in each half of the upper and the lower jaw. The entire formula is multiplied by two to represent the total number of teeth.

The dental formula for milk teeth in humans is: $2102/2102 \times 2 = 20$

Each half of the upper jaw and the lower jaw has 2 incisors, 1 canine, and 2 molars. Premolars are absent in milk teeth hence the zero.

The dental formula for permanent teeth in humans is: $2123/2123 \times 2 = 32$

Each half of the upper jaw and the lower jaw has 2 incisors, 1 canine, 2 premolars, and 3 molars. An adult human has 32 permanent teeth.

Question 7. Bile juice contains no digestive enzymes, yet it is important for digestion. Why?

Answer: Bile juice does not contain any enzyme but it contains bile pigments, bile salts, cholesterol, and phospholipids. The important role played by these enzymes is that it helps in the emulsification of fats where the fat molecules are broken down into small micelles.

Question 8. Describe the digestive role of chymotrypsin. Which two other digestive enzymes of the same category are secreted by its source gland?

Answer: Chymotrypsin is the active form of chymotrypsinogen. It is activated by trypsin. It curdles milk. Nucleases like DNAase and RNAase and pancreatic lipase are other enzymes secreted by the pancreas

Question 9. How are polysaccharides and disaccharides digested?

Answer: The digestion of carbohydrates takes place in the mouth and the small intestine region of the alimentary canal. The enzymes that act on carbohydrates are collectively known as carbohydrases.

(i) Digestion in the mouth:

As food enters the mouth, it gets mixed with saliva. Saliva – secreted by the salivary glands – contains a digestive enzyme called salivary amylase. This enzyme breaks down starch into sugar at pH 6.8.

Starch $\xrightarrow{\text{pH 6.8}}$ Salivary amylase Maltose + Isomaltose + Limit dextrins

Salivary amylase continues to act in the oesophagus, but its action stops in the stomach as the contents become acidic. Hence, carbohydrate-digestion stops in the stomach.

(ii) Digestion in the small intestine:

Carbohydrate-digestion is resumed in the small intestine. Here, the food gets mixed with the pancreatic juice and the intestinal juice. Pancreatic juice contains the pancreatic amylase that hydrolyses the polysaccharides into disaccharides.

(Polysaccharides) Starch \rightarrow Disaccharides ; Amylase catalyses this reaction.

Similarly, the intestinal juice contains a variety of enzymes (disaccharidases such as maltase, lactase, sucrase, etc.). These disaccharidases help in the digestion of disaccharides. The digestion of carbohydrates is completed in the small intestine.

Maltose \rightarrow 2Glucose ; Maltase catalyses this reaction.

Lactose \rightarrow Glucose + Galactose ; Lactase catalyses this reaction.

Sucrose \rightarrow Glucose + Fructose ; Sucrase catalyses this reaction.

Question 10. What would happen if HCl were not secreted in the stomach?

Answer: Hydrochloric acid is essential to make the medium acidic which allows inactive enzyme pepsinogen to be converted into pepsin. Pepsin plays an important role in the digestion of proteins. Moreover, it also kills various microbes which may be present in food. These actions would not be possible in the absence of hydrochloric acid.

Question 11. How does butter in your food get digested and absorbed in the body?

Answer: Digestion of Butter: Butter is a fat product. It gets digested in the small intestine by the action of bile juice. The bile juice secreted by the liver contains bile salts such as bilirubin and biliverdin which break down large fat globules into smaller globules so that the pancreatic enzymes can easily act on them. This process is known as emulsification of fats. Bile juice also activates lipases. Then, the pancreatic lipase present in the pancreatic juice and the intestinal lipase present in the intestinal juice hydrolyse the fat molecules into triglycerides, diglycerides, monoglycerides, and finally into the

simplest form, glycerol which gets diffused into the blood and from the blood stream, to each and every cell of the body.

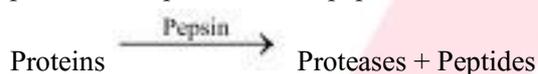
Question 12. Discuss the main steps in the digestion of proteins as the food passes through different parts of the alimentary canal.

Answer: The digestion of proteins begins in the stomach and is completed in the small intestine. The enzymes that act on proteins are known as proteases.

(i) Digestion in the stomach:

The digestive juice secreted in the gastric glands present on the stomach walls is called gastric juice. The main components of gastric juice are HCl, pepsinogen, and rennin. The food that enters the stomach becomes acidic on mixing with this gastric juice.

The acidic medium converts inactive pepsinogen into active pepsin. The active pepsin then converts proteins into proteases and peptides.



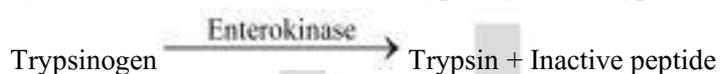
The enzyme rennin plays an important role in the coagulation of milk.

(ii) Digestion in the small intestine:

The food from the stomach is acted upon by three enzymes present in the small intestine – pancreatic juice, intestinal juice (known as succus entericus), and bile juice.

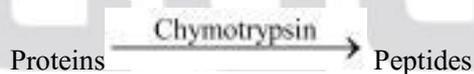
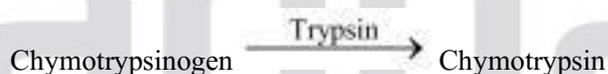
Action of pancreatic juice

Pancreatic juice contains a variety of inactive enzymes such as trypsinogen, chymotrypsinogen, and carboxypeptidases. The enzymes are present in an inactivated state. The enzyme enterokinase secreted by the intestinal mucosa activates trypsinogen into trypsin.



The activated trypsin then activates the other enzymes of pancreatic juice.

Chymotrypsinogen is a proteolytic enzyme that breaks down proteins into peptides.



Carboxypeptidases act on the carboxyl end of the peptide chain and help in releasing the last amino acids.



Action of bile juice

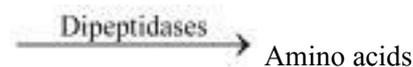
Bile juice has bile salts such as bilirubin and biliverdin which break down large, fat globules into smaller globules so that pancreatic enzymes can easily act on them. This process is known as

emulsification of fats. Bile juice also makes the medium alkaline and activates lipase. Lipase then breaks down fats into diglycerides and monoglycerides.

Action of intestinal juice

Intestinal juice contains a variety of enzymes. Pancreatic amylase digests polysaccharides into disaccharides. Disaccharidases such as maltase, lactase, sucrase, etc., further digest the disaccharides.

The proteases hydrolyse peptides into dipeptides and finally into amino acids.



Pancreatic lipase breaks down fats into diglycerides and monoglycerides.

The nucleases break down nucleic acids into nucleotides and nucleosides.

Question 13. Explain the term thecodont and diphyodont.

Answer: Thecodont: It refers to a type of dentition in which the teeth are embedded in the deep sockets of the jaw bone. This type of dentition is common in mammals.

Diphyodont: It refers to a specialised kind of dentition in which two successive sets of teeth are developed during the lifetime of the organism. The first set of teeth is deciduous and the other set is permanent. The deciduous set of teeth is replaced by permanent adult teeth. This type of dentition can be seen in humans.

Question 14. Name different types of teeth and their number in an adult human.

Answer: There are four different types of teeth in an adult human. They are as follows:

(i) Incisors: The eight teeth in the front are incisors. There are four incisors each in the upper jaw and the lower jaw. They are meant for cutting.

(ii) Canines The pointy teeth on either side of the incisors are canines. They are four in number, two each placed in the upper jaw and the lower jaw. They are meant for tearing.

(iii) Premolars They are present next to the canines. They are eight in number, four each placed in the upper jaw and the lower jaw. They are meant for grinding.

(iv) Molars They are present at the end of the jaw, next to the premolars. There are twelve molars, six each placed in the upper jaw and the lower jaw.

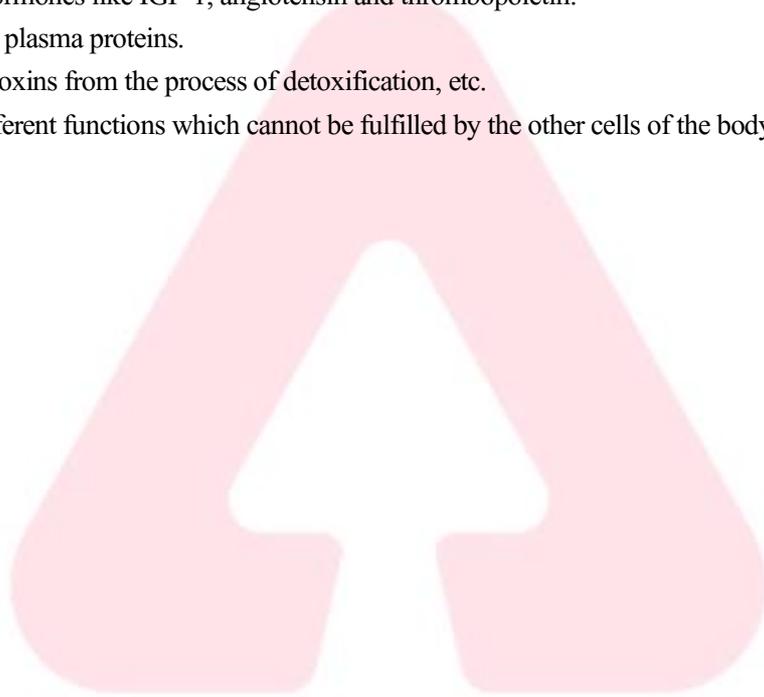
Hence, the dental formula in humans is $2123 \cdot 2/2123 = 32$. This means each half of the upper jaw and the lower jaw has 2 incisors, 1 canine, 2 premolars, and 3 molars. Hence, an adult human has 32 permanent teeth.

Question 15. What are the functions of liver?

Answer: The liver is considered as the largest organ in the human body. There are hepatic cells which are arranged in cords. These cells are responsible for various functions. Some of the functions are as followed:

- Production of bile which helps in emulsification of the fats for digestion.
- Storage of glucose in the form of glycogen.
- Destruction of the RBCs after completion of their life span.
- produce hormones like IGF-1, angiotensin and thrombopoietin.
- Synthesise plasma proteins.
- Removes toxins from the process of detoxification, etc.

There are many different functions which cannot be fulfilled by the other cells of the body.



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