Subject – Biology Class- 12 Topic – Digestive system in Human

23 Aug 19.

Digestive System Of Human...

★ Ques / Ans :-

1. Where are Kupffer cells present?
In the liver between sinosoids.

2. What is the function of Vitamin 'K'?
Function of Vitamin 'K' (Naphthoquinone) is the formation of prothrombin formation of blood clot.

3. In which organ synthesis and storage of glycogenesis is carried out?
Liver

4. Which disease is caused due to Vitamin 'D'?
Vitamin 'D' (Calciferol) → Rickets in children and Osteomalacia in adults.

5. Write the name of the disease caused due to PEM?
Disease caused due to Protein Energy Malnutrition (PEM)
- Mineral deficient disease.
- Vitamin deficient disease.

6. Where do absorption of digested fats take place?
Large Intestine.

7. Name the vitamins which can be synthesized by human ?
Vitamin 'A', 'D', 'K', 'B12'.

8. Write human dental formula.
Human dental formula = $\left[I = \frac{2}{2}, C = \frac{1}{1}, PM = \frac{2}{2}, M = \frac{3}{3}\right] \times 2$

9. What is bolus?
Saliva moistens and lubricates the food, with the aid of a slippery substance called mucin, making swallowing easier as well as dissolving some of the food and allowing it to be tasted. This semi-solid food is known as bolus.

10. Which glands are called Brunner's glands?
Duodenum has coiled sub-mucous gland, called as Brunner's gland, which produce a mucus rich, alkaline secretion in order to neutralize the acidic content of chyme.

11. What do you mean by Payer's patches?
Payer's patches are generally found in the ileum region of the small intestine. They form an important part of immune system by monitoring intestinal bacteria populations and preventing the growth of pathogenic bacteria in the intestines.

12. What is sphincter's oddi?
At the junction of the bile duct, pancreatic

duct and duodenum, there is a small smooth muscle sphincter called the "Sphincter of Oddi".

13. Write any three functions of liver?

- Liver plays an important role in carbohydrate metabolism where hepatic cells conduct glycogenesis (converting glucose into glycogen) & glycogenolysis (breaking glycogen down to glucose).
- The liver cells also synthesize glucose from fatty acid, amino acid, etc. This process is called gluconeogenesis.
- Liver also helps in storage of glycogen, iron & vitamin A, B_{12} D.

14. What is emulsification? What is its importance?
Bile salts and lacithin molecules have one part polar and the other non-polar. The non polar part gets dissolved in the surface of fat globules and the polar part remains soluble in ~~water~~ present in food. Due to this activity the surface tension of fat globules decreases. Resulting, the big fat globules break down in small (1 μm diameter) fat globules. This activity is known as emulsification. Enzymes actively react on emusified fats.

Fats + Bile $\xrightarrow{\text{Emulsification}}$ Emulsified fat

15 What is chylomicrons?

In the cell fatty acids and monoglycerides enters the smooth endoplasmic reticulum and synthesize new triglycerides. The triglycerides molecules are surrounded by protein. Such lipo-protein globules are known as chylomicron.

6. What is kwashiorkor disease?
Kwashiorkor —: This disease is caused due to highly deficient protein food. Children of age group 1-3 years getting less than one gram per kg body weight are suffering from this disease.
Important Symptoms —
1. Loss of weight, irritating mood and appetite.
2. Skin becomes black and belly comes out.
3. Body swells and has enlarged liver.
4. Hair become thin in 1 year or less aged children due to deficiency of protein, fats and carbohydrates.
Cure —
- The child suffering from kwashiorkor needs adequate amount of proteins.

- What is marasmus disease?
Marasmus —: It is caused due to the deficiency of carbohydrates, fats and proteins. It usually affects infants below the age of one year.
Main Symptoms —
Weight of Weight (loss of weight upto 60% in child is common weight at this age).
Less attractive, dry and wrinkled face with eyes.

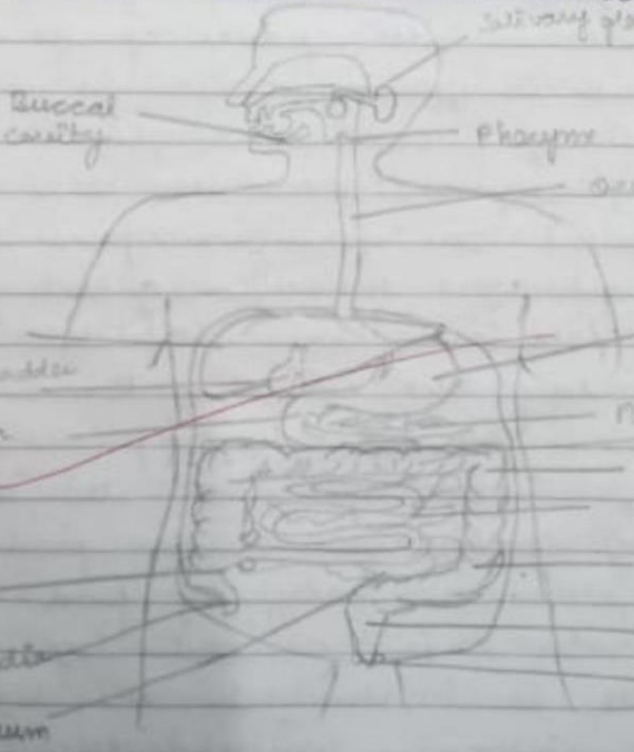
3. Thin muscles, weak legs and arms, ribs are seen from outside.
4. Oedema and skin pigmentation are absent.
5. Retarded physical and mental growth.

Cure —

The child suffering from Marasmus needs adequate amount of proteins, fats and carbohydrates.

1B. Describe different parts of alimentary canal with the help of a diagram.

Alimentary canal is a long continuous tube extending from mouth to anus. It is a blind and coiled muscular tube like structure. It is about 4.5 m long in humans, and after death it becomes 7-8 m due to relaxation.



Arranged sequentially, it includes the following parts: (i) mouth (ii) buccal cavity (iii) pharynx (iv) Oesophagus (v) stomach (vi) small intestine (vii) large intestine (viii) rectum (ix) anus.

Mouth and Buccal Cavity — Mouth is a slit like aperture encircled by upper and lower lip. It opens into buccal cavity. The roof of the buccal cavity is called palate. At the back to the floor of the buccal cavity, there is a muscular organ called tongue.
The mouth is surrounded by a non-movable upper and a movable lower jaw. There are teeth in both jaws, which mechanically break down food into smaller pieces.
Pharynx — The middle part of buccal cavity and oesophagus is pharynx. This is a common passage for digestive and respiratory systems. Posterior to pharynx, there are two openings — glottis and gullet. The pharynx opens into the tube like oesophagus through gullet.
Oesophagus — It is a muscular tube which is nearly 30 cm long. The walls of the oesophagus from the lumen outwards comprises mucosa, sub mucosa, muscularis and tunica adventitia. Oesophagus, by peristalsis sends food from pharynx to stomach. Entry of food in the respiratory tract is checked by epiglottis.
Stomach — It is located in the left upper part of the abdomen immediately below the

diaphragm. Oesophagus enters the abdominal cavity piercing the diaphragm and opens into ~~sma~~ stomach. Stomach is a part just like muscular bag. There are three part - (i) fundus part (ii) cardiac part and (iii) pyloric part. The walls of ~~o~~ the stomach consist of four layers, are named, mucosa, sub-mucosa, muscularis externa, and the serosa.

The mucosa consists mainly of the gastric glands ~~that~~ secrete the digestive juices. Mucosa protects the stomach from self digestion. The sub-mucosa supports the mucosa and allows it to move in a flexible manner during peristalsis. There are three types of ~~gla~~ gastric glands, distinguised from one another by location and type of secretion. The cardiac gastric glands are located ~~at~~ the beginning of the stomach; the intermediate, or true, gastric glands in the central stomach areas; and the pyloric glands in the terminal stomach portion. The intermediate gastric glands produce most of the digestive substances secreted by the stomach. Parietal, or oxyntic cells occur throughout the length of the gland and are responsible for the production of hydrochloric acid, which is necessary to activate the other enzymes.

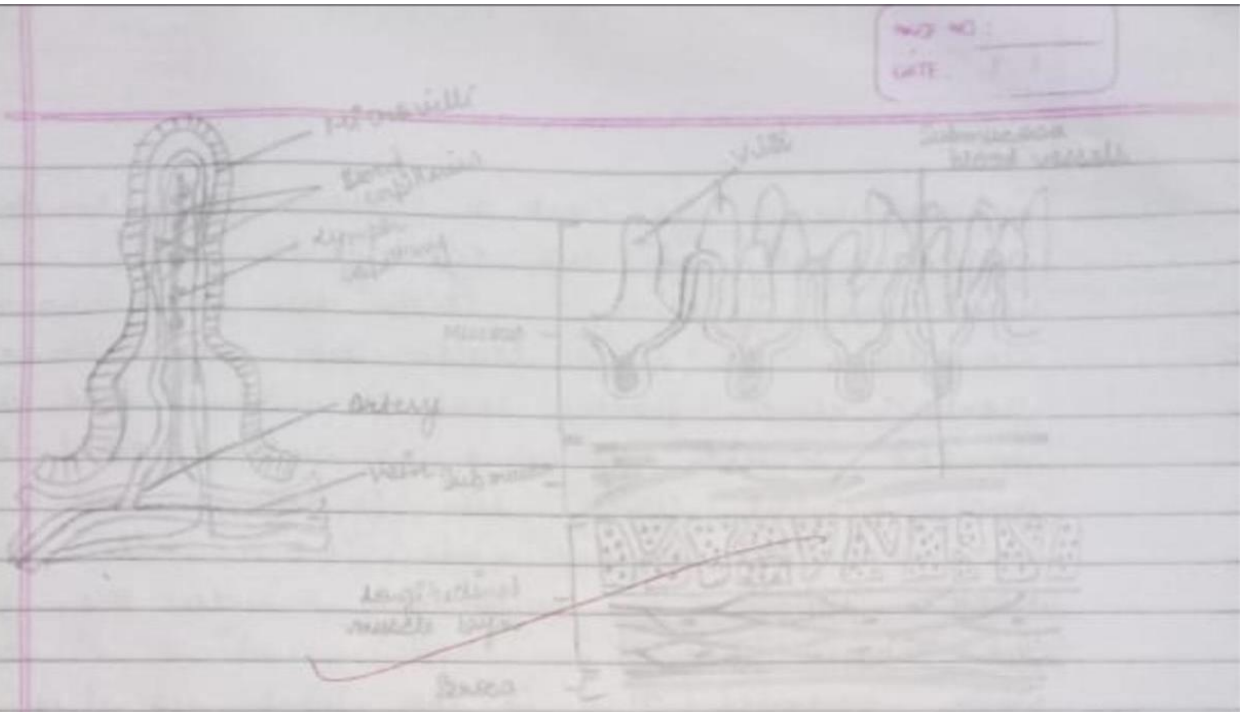
Small Intestine — Stomach opens by pyloric into small intestine. It is about 6.7 to 7.6 m (22 to 25 feet) long, highly convulated, and

contained in the central and lower abdominal cavity. The first section of this is nearly 25 cm and 'U' shaped known as duodenum. Ducts from liver, gall bladder and pancreas enter the duodenum. The middle or second part of small intestine is about one meter in length and is coiled. This region is called jejunum. The last section is nearly 75 m in the length, much coiled and is known as ileum.

Large Intestine — The last section of alimentary canal is large intestine. Its diameter is more. Its length is nearly 1.5 m. ~~known~~ as residual part. The large intestine has three parts — caecum, colon & rectum. Caecum joins the small and large intestine at its joint. It known as residual part. A finger like closed oblongation is present on the end of caecum, which is nearly 1 cm in diameter and 6 cm long, and is known as vermiform appendix.

Colon is divided into three parts — ascending, transverse and descending, which then leads to rectum.

Rectum and Anus — The last part of large intestine is rectum which opens outside by anus. Anus has two valves — internal value, which is smooth and external valve, which is made of striped muscles.



19. Describe human tooth with the help of a diagram.

Human dentition is heterodont as they have different kinds of teeth. In each half of the upper jaw and the lower jaw has 2 incisors, 1 canine, 2 premolars and 3 molars. Thus, an adult human has 32 permanent teeth. The configuration of teeth is expressed in terms of dental formula.

Human's dental formula =

$$\left[I\ \frac{2}{2},\ C\ \frac{1}{1},\ PM\ \frac{2}{2},\ M\ \frac{3}{3} \right] \times 2$$

Human teeth are diphyodont as they are formed twice in life time. The first dental set is known as milk teeth and the other set is called permanent teeth. The milk teeth are 20. They are replaced by permanent teeth at the age of 6-7. Permanent teeth are 32

in number. The last 4 molars (wisdom teeth) appear only at the age of 18.

Structure of teeth — Teeth are very hard structures. In each tooth there are three parts: lower part that remain fixed in in the socket of bone is called root. It anchors the tooth in its bony socket and is normally not visible. The middle part is neck, which is embedded inside the gums. The upper part is crown, which is covered with enamel. This is the part usually visible in the mouth. Enamel is the hardest substance in the body. The formation of a tooth is by bone like hard dentine. It forms the bulk of the tooth and can be sensitive if the protection of the enamel is lost. The tooth has a pulp cavity in the central part. This is contains odontoblast, blood vessels and nerve fibre. There is a pore in the basal part which is called apical pore. Through this pore blood and neural conduction is given to the tooth. Due to the activity of odontoblast, the size of the tooth increases. Generally after a particular age this becomes inactive and the development of teeth stops. Odontoblasts secrete dentine.

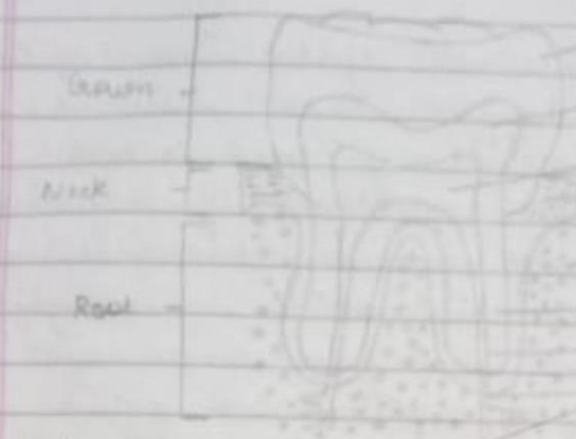


Fig :- Structure of Teeth

20. Where and how the absorption of digested food takes place in human ?

Absorption in different parts of alimentary canal.

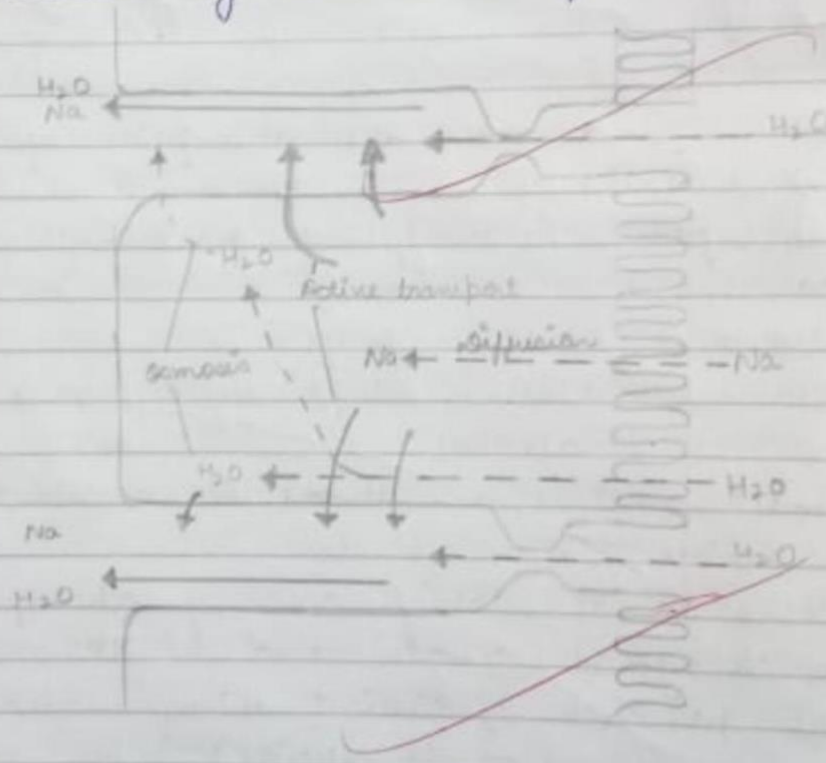
- Mouth – certain drugs
- Stomach – Water, simple sugars, some drugs and alcohol.
- Small Intestine – Almost all nutrients including minerals, vitamins etc.

Ileum is the chief area of absorption due to its great length and coiled nature and the presence of villi (which increases the surface area of absorption).

- Large Intestine – Water, some minerals and some drugs.

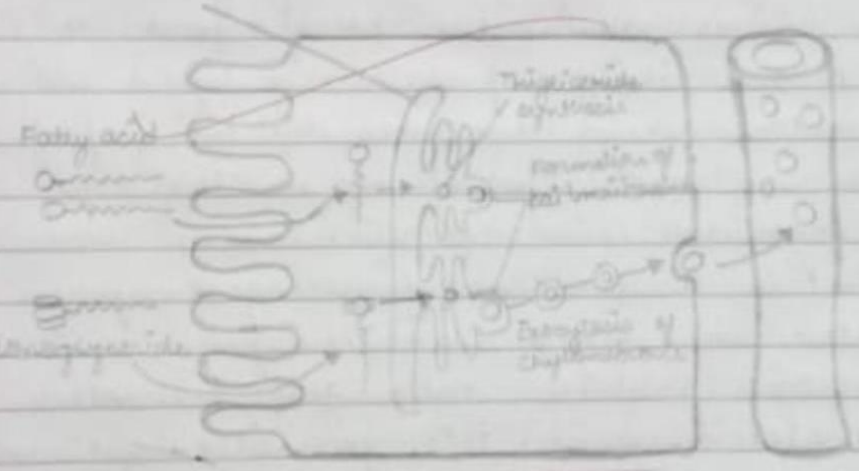
Ileum is the chief area of absorption due to its great length and coiled nature and the presence of villi. The microvilli present

on the cells of mucosal epithelium together form the brush border. Each villi has a central lymph capillary and blood capillaries. The main products of digestion mainly absorbed are monosaccharaides (glucose, glactose, fructose), amino acids, monoglycerides and fatty acids.
Main methods of absorption are active transport and diffusion. Amino acid and glucose are absorbed by active transport into blood.



- Fats are absorped in the form of fatty acids, monoglycerides and cholesterol by diffusion into lymph. Villi has important role in the absorption. During fat digestion, fats are hydrolysed into fatty acids and glycerol.

However, since these are water insoluble, they cannot be directly absorbed by blood. Hence, they are first incorporated into small droplets called micelles and then transported into villi of the intestinal mucosa. They are then reformed into small microscopic particles called chylomicrons, which are small, protein-coated fat globules. These chylomicrons are transported to the lymph vessels in the villi. From the lymph vessels, the absorbed food is finally released into the blood stream and from the blood stream, to each and every cell of body.



21. Describe the digestion in detail.

(a) Digestion in buccal cavity — In the buccal cavity, saliva is mixed with food. The presence of a digestive enzymes, known as amylase, in saliva allows chemical digestion of starch to begin. Starch present in food is hydrolyzed

into maltose and α-limit dextrin. Bicarbonate ions of saliva neutralizes the acid present in food.

Starch $\xrightarrow[\text{pH 6-8}]{\text{Salivary Amylase}}$ Maltose + Dextrin (Disaccharide)

(b) Digestion in stomach — The semi-digested food gets mixed with acidic gastric juices by churning movement of muscular wall and is called chyme at this stage.
Gastric juice contains HCl, renin, mucose, pepsinogen and a little gastric lipase. Because of HCl, gastric juice is highly acidic (pH 1-2). This lowers down the pH of food. At this low pH, activity of salivary lipase stops. Hydrochloric acid dissolves the bits of food and creates an acidic medium so that pepsinogen is converted into pepsin.
Pepsin is a protein-digesting enzyme. It is secreted in its inactive form called pepsinogen, which then gets activated by hydrochloric acid. HCl provides optimum pH of 1.2 to 1.8 for protein.

Pepsinogen $\xrightarrow{HCl}$ Pepsin
(Inactive) (active)

The activated pepsin then converts proteins into proteases and peptides.

Proteins $\xrightarrow{\text{Pepsin + HCl}}$ Proteases + Peptone + Polypeptide

Gastric lipase is a weak enzyme for digestion of food. It go digests fats incompletely. It digests tributyrene (Fat present in butter) into fatty acids. After the digestion in stomach food converts into chyme.

Milk fat + gastric lipase → fatty acids + glycerol

HCl is strong acid but it does not harm the walls of stomach, because there is a thick covering of mucous on the inner wall of stomach.

(c) Digestion in small intestine — In the small intestine – pancreatic juice (pH 8.8), intestinal juice (known as succus entericus – pH 8.3), and bile juice (pH 8.0) are present.
The digestion of food is nearly completed in duodenum while absorption is completed rest in the part of intestine. Bile salts (bile acid of sodium, potassium salt) and lecithin are important for the emulsification of fats.

Fats + Bile $\xrightarrow{\text{Emulsification}}$ Emulsified fat.

Pancreatic juice contains a variety of inactive enzymes such as trypsinogen, chymotrypsinogen and carboxypetidases. The enzymes play an important role in the digestion of proteins.

Tripsinogen ⟶ trypsin
(inactive) (Active)

Chymotrypsinogen
Pro carboxy peptidase —Trypsin— Chymotrypsin
Carboxypeptidase

Proelastase
(Inactive)
Elastase
(Active)

Proteoses, Peptones —Trypsin, Chymotrypsin, pH=7— small polypeptides

Polypeptides
Tripeptides & Dipeptides

Small polypeptides —Carboxypeptidase, pH=7— Amino acids
Dipeptides

Lipase enzyme in the pancreatic juice is in small amount. It digests triglycerides present in food, with a few minutes.

Emulsified fat (Triglyceride) —lipase, pH=7— Fatty acids and 2-monoglycerides

Cholesterol esterase hydrolase and phospholipase gradually hydrolyses cholesterol esters and phospholipids acid respectively and separate fatty acids from them.
The enzymes present in enterocytes of small intestine carry out digestive activities as follows.
These enzymes are bonded on the outer surface of microvilli and hydrolyse the food coming in contact with it before absorbing it.

Sucrose	Sucrase pH 8.5	Glucose + Fructose
Maltose	Maltase pH 8.5	Glucose + Glucose
Lactose	Lactase pH 8.5	Glucose + Galactose
α-Limit dextrin	α Limit dextrinase pH 8.5	Glucose
Polypeptides	Amino Peptidase pH 8.5	Dipeptides and amino acids
Dipeptides	Dipeptidase pH 8.5	Amino acids
Triglycerides (Emulsified)	Intestinal lipase pH 8.5	Fatty acids & 2-monoglycerides

Q2. Explain the Digestive Glands.

Digestive Glands : They secrete digestive juices. It includes salivary glands, gastric glands, intestinal glands, pancreas and liver.

1. Salivary glands — In humans, three pairs of salivary glands open into the mouth. They are parotid (largest salivary gland), sub-maxillary (sub mandibular) and Sub lingual. The saliva secreted from these glands comes in the buccal cavity - pH of saliva is 6.8. It contains water, ptyalin or an amylase, lysozyme, mucous and sodium chloride, potassium bicarbonate etc. Ptyalin is a digestive enzyme that catalyses the hydrolysis of starch into maltose and dextrin.

It kills the bacteria present in mouth.

2. Liver :- This is the largest digestive gland in human. It is about 1.2 to 1.5 kg in a healthy human. Liver has two main lobes - right lobe and left lobe. In addition to these, three more lobes called quadrate and caudate lobes. On the lower surface of the right lobe, there is a thin walled sac like, green coloured gall bladder.

The hepatic ducts coming out of both the liver lobes join together and form a common hepatic duct. Hepatic duct and cystic duct join together to form a common bile duct. It is also called ductus choledochus. The common bile duct opens in the proximal arm of duodenum. Just near the duodenum, the bile and pancreatic ducts join to form hepatopancreatic duct. The opening of hepato-pancreatic duct in the duodenum is guarded by sphincter of Oddi. Sphincter of Oddi regulate the flow of digestive juices into the second part of duodenum. Each liver lobe is formed of many hepatic lobules. These are the functional units of liver. The hepatic lobule is made of hepatocytes. There are narrow spaces in between the rows of hepatocytes. In these spaces discontinuous endothelium cells are situated and are known as sinusoids. In b/w the lobules, on their corners branches of hepatic artery hepatic portal vein and bile duct together form portal Triad.

3. Pancreas – It is the second largest digestive gland of human body. It is found in between the two arms of duodenum. It is a cream-coloured mixed gland, i.e. it has both exocrine and endocrine parts. It originates from embryonic endoderm.

Two types of group of cells are found in pancreas.

(i) Acini – This is exocrine group of cells which is found in between the connective tissue. It secretes alkaline pancreatic juice, which contains inactive enzymes (trypsinogen, chymotrypsinogen and procarboxypeptidases), amylases, lipases and nucleases.

(ii) Islets of Langerhans – These are endocrine groups of cells, which are found in the middle a some places between group of acini cells. Each islets of Langerhans consists of three types of cells, which secrete hormones into the circulating blood.

A Alpha cells (α) – They produce glucagon hormone, which convert glycogen into glucose in the liver.

B Beta cells (β) – They produce ~~glucagon~~ insulin hormone, which converts glucose into glycogen in the liver and the muscels.

C. Gama or delta cells (γ or δ cells) – They secrete somatostatin, gastrin and serotonin hormones.