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Pre-Medical

Biology

4

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Over the years, **DR. RAKESH TANDON** has won many discrete awards for his contribution, hard work and commitment towards providing patients a new lease of life.Dr. Rakesh Tandon has been awarded by the Medical Council of India, has Dr. B.C.Roy Award for being Eminent Teacher, Gold medal for best thesis in M.D. (Medicine) and many more. Dr. Rakesh Tandon publications are read all over the world because he is not restricted to writing for only Indian audiences. Dr. Rakesh Tandon has authored some well known and bestselling books.

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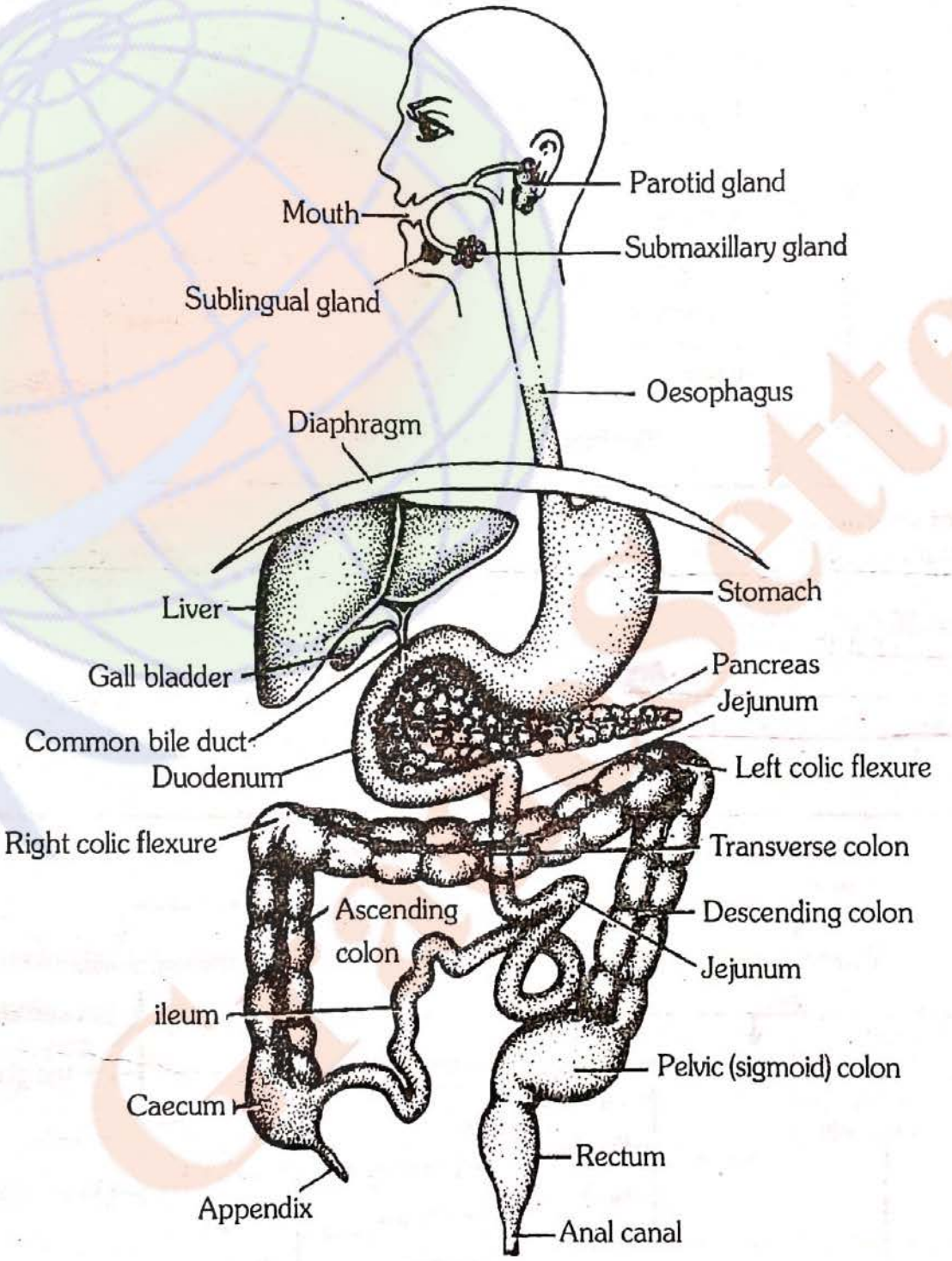
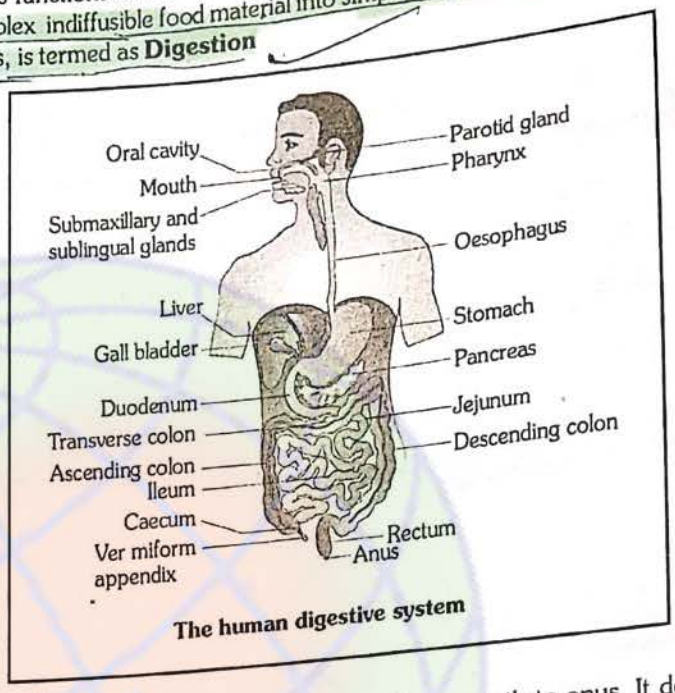
DIGESTION AND ABSORPTION



Digestive tract of man

What is digestion ?

- To perform various functions of the body, energy is required, which is obtained from food. The process of conversion of complex indiffusible food material into simple and diffusible food by mechanical and biochemical (hydrolysis) process, is termed as **Digestion**



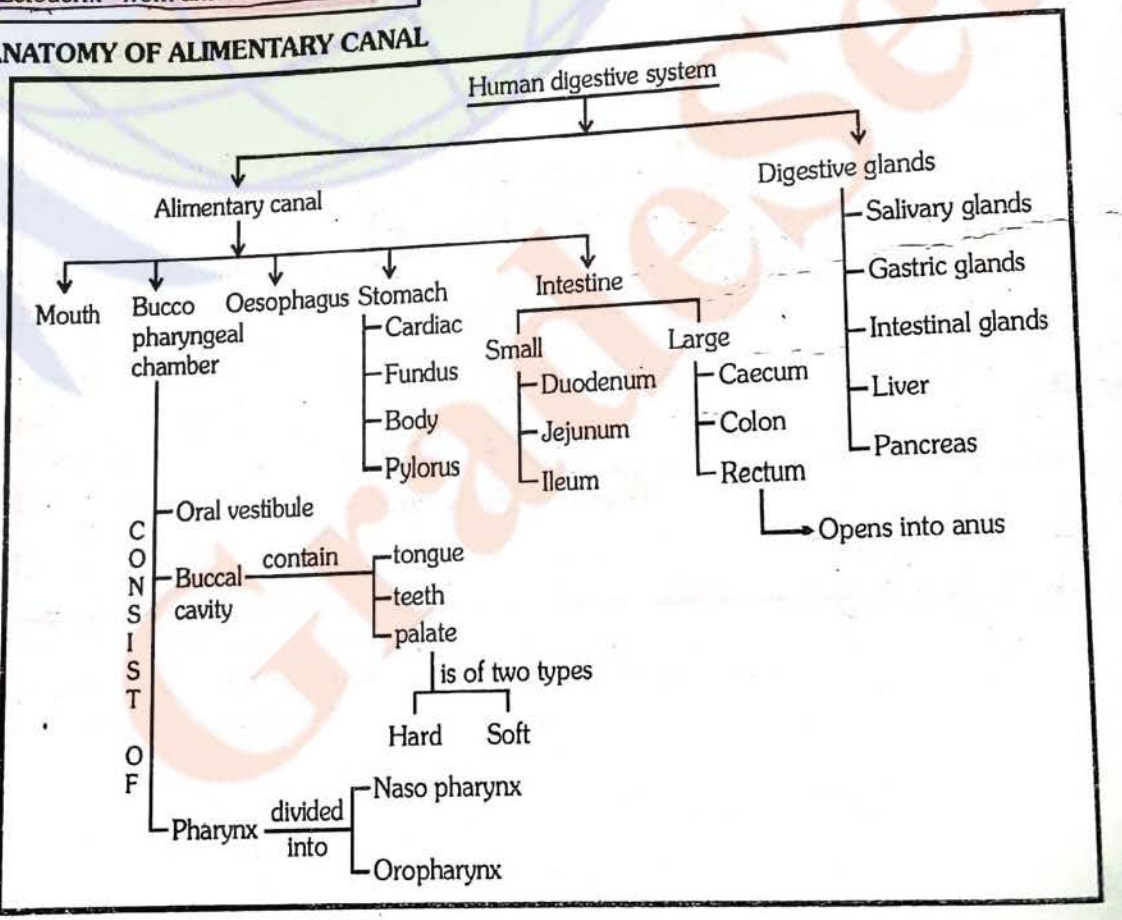
The human digestive system

Origin of alimentary canal

- The alimentary canal is tubular structure which extends from mouth to anus. It develops from ectoderm endoderm.

Ectoderm - upto hard palate
Endoderm - from soft palate to rectum
Ectoderm - from anal canal to Anus

ANATOMY OF ALIMENTARY CANAL



(1) Mouth and Buccopharyngeal Cavity –

Mouth is a horizontal transverse slit like aperture which is surrounded by upper and lower lip. Lips are movable because of presence of muscles called orbicularis oris muscles.

Sebaceous glands are found on the outer part of lip. Serous glands are found on the inner part of lip. Serous glands is the modification of mucus glands. Its secretory substance is watery.

Mouth opens into buccopharyngeal cavity, this cavity is divided into following parts.

(i) Buccal vestibule – The space between the gums and cheeks where the food is stored temporarily.

(ii) Oral cavity – It is inner & central part which is surrounded by upper and lower jaw. Lined by stratified squamous epithelium. It is inner and central part. Upper Jaw is fixed and lower jaw is movable.

The roof of oral cavity is called **Palate**.

Palate is differentiated into two parts :

(i) Hard Palate –

It is the anterior part of the palate. It is made up of maxilla and palatine bone in human.

On the ventral surface of hard palate, some projections or transverse ridges are present which are called **palatine rugae.** These rugae prevent slip out of the food from buccal cavity during mastication. These rugae are well developed in carnivorous animals.

(ii) Soft Palate –

It is the posterior part of palate.

The posterior out growth of soft palate which hangs down in the form of finger like process called as **Uvula** or **Velum palati**. On the dorsal side of uvula internal nasal pores are present.

Uvula or **Velum palati** covers the opening of internal nasal pores during ingestion of food, so food particle can not move inside nasal chamber.

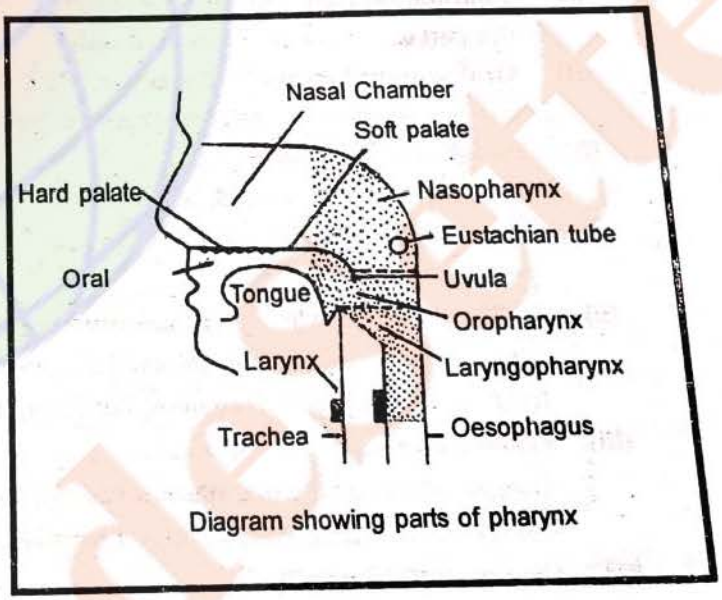


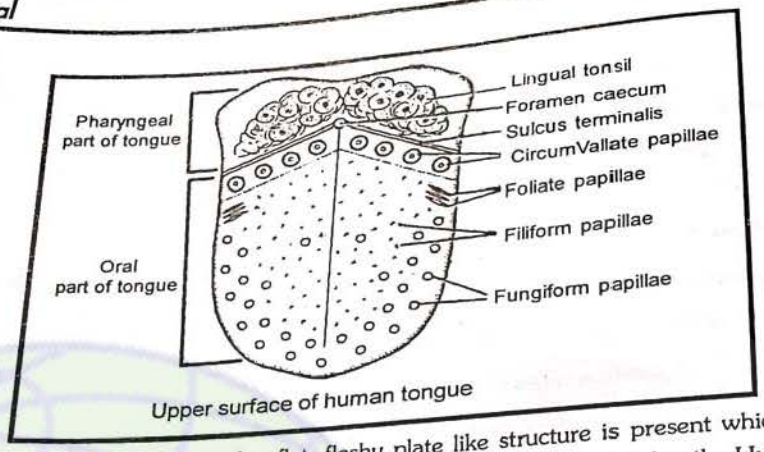
Diagram showing parts of pharynx

One pair of large lymph node is present on the posterolateral surface of soft palate, called as **Palatine tonsil** or **Tonsils**.

Soft palate is situated in the pharynx and is divided into two parts. Upper part of pharynx is called **Nasopharynx** which is related to the nasal chamber. The lower part of pharynx is called **oropharynx** which is related to the oral cavity. One pair of openings of **Eustachian tube** is present in the nasopharynx. This Eustachian tube is related to the middle ear : It maintain air pressure.

Pharynx is the common path for the air and food.

TONGUE :-



Upper surface of human tongue

- On the floor of oral cavity a muscular, flat, fleshy plate like structure is present which is called **tongue**. The anterior part of tongue is free while posterior part of tongue is connected to the Hyoid bone.
- The surface of tongue is connected to the floor of buccal cavity through a very flexible membrane/ligamentous fold called as **Frenulum linguae.**
- On the dorsal surface of tongue, it is divided into two unequal parts by a V shaped sulcus, called sulcus terminalis.

The two limbs of the 'V' meet at a median pit named **Foramen caecum**.

It is divided into two parts –

(I) Pharyngeal part – It is the posterior 1/3 part of the tongue. Many small lymph nodes are present in this part which are called **Lingual tonsil**.

(II) Oral or papillary part – It is anterior 2/3 part of tongue. Four types of papillae are found in this part in which gustatory or taste receptors are present in the form of taste buds with few papilla.

(i) Fungiform Papillae –

It is pink coloured, small & spherical in shape. It is found on the entire surface of tongue but mostly present at the anterior part of tongue. It is attached to tongue with the help of small pedicle. It provides pink colour to the tongue.

(ii) Filliform papillae (Conical papillae) –

They are thread like, white coloured & conical in shape. They are also found on the entire surface of tongue. They are most numerous, but devoid of taste buds.

(iii) Foliate papillae –

They are found on the mid lateral surface of tongue. They are vestigeal in the human. There structure is leaf like present in rabbit and other mammals.

(iv) Circumvallate papillae –

These are largest and least existed papillae (8 to 12). They are large spherical shape papillae which are found near to sulcus terminalis.

Tongue is nonmotile in whale.

Two types of muscles present in tongue :-

Extrinsic muscles :-

- It is found on outer and superficial part of tongue. It helps in outward and inward movement of tongue.

Intrinsic muscles :-

- It is situated in the deep part of tongue. It helps in the change of shape of tongue and sideways movements of tongue.

TEETH

Teeth are **ectomesodermal in origin.**

STRUCTURE OF TEETH

Teeth are differentiated in three parts.

Crown- It is the outer part of the tooth, exposed outside gums.

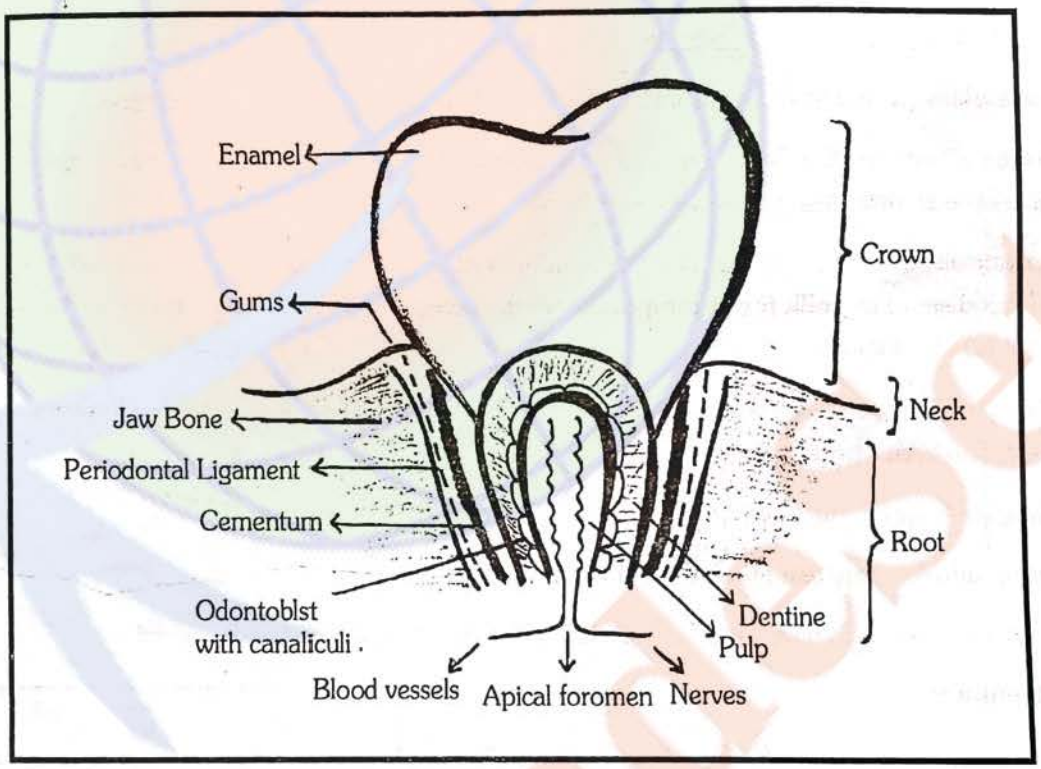
Neck- It is the internal part of the tooth which is embeded inside the gums.

Root- It is the part of tooth that is inserted inside the socket of jaw bone. (Alveoli)

The crown part of the tooth is made up of a very hard substance called the **Enamel**. It is the hardest material in all animals of animal kingdom, because it contain maximum amount of inorganic substances.

Enamel is **ectodermal**. It is secreted by **Ameloblast** cells of the ectoderm. It has maximum amount of inorganic salt (96%) in it. Inorganic salts are mainly found in the form of phosphate and carbonate of Ca, Mg, Na and K. 3% of water is found in the enamel. Along with it Keratin & ossein protein (1%) are also found in teeth. Remaining part of teeth develop from mesoderm of embryo.

Enamel is not present in Sloth and Armadillo.



- Dentine is the main part of tooth. Approximately **69%** inorganic salts are present in dentine where as in cemented layer **65%** is inorganic salt **(62% inorganic salts are present in bones.)**
- Dentine surrounds a cavity called **pulp-cavity.** This cavity contains soft connective tissue, blood capillaries, nerve fibres. Pulp cavity is necessary for the nutrition and survival of the teeth. At the base of pulp-cavity an aperture is present. Through this aperture, blood capillaries and nerve fibres enter inside the teeth. This aperture is called **apical-foramen**.
- A special type of cells form the lining of the pulp-cavity called the **Odontoblast cells**. These cells are the dentine secreting cells. Cytoplasmic process of odontoblasts are embedded into dentine in the form of fine tubule. These processes are called **canaliculi**. These canaliculi secretes dentine. The teeth continue grow till the odontoblast cells remain active. In adults, the pulp-cavity shrinks and the odontoblasts become inactive so the teeth stops to grow.

made up of the cementocytes cells. Between the root and the bones of the teeth, a **membrane** is present.

In rabbit and rat the pulp-cavity of the incisor remains wide throughout their life, so these teeth grow continuously throughout their life span, these type of teeth are called **open rooted teeth**.

If one incisor of rabbit & rat is broken then the opposite incisor grows continuously, finally the animal neither can close the mouth nor gnaw the food. So the animal dies due to starvation.

Four types of teeth found in mammals are -

Incisor- These are long, chisel like teeth for **gnawing** the food. They are more developed in gnawing animal e.g. Lagmorphs, rodents.

Tusk of elephant are modification of upper Incisor.
Tusk is used to protection from enemies, attack on enemies (not for feeding purpose).

Canines- These are sharp pointed teeth meant for tearing and shreding the food. Canines are most developed in carnivorous animals.

Canines are absent in herbivorous animals e.g. Rabbits do not have canines. In herbivorous, the space of canine in gums is empty and this empty space is called diastema.

Upper canines are modified in tusks in walrus.

Pre molars - These teeth are meant for chewing and crushing of food. They are triangular in shape.

Molars (Cheek teeth) – These also meant for chewing & crushing of food. They are rectangular in shape. Premolar and molar help in the mastication of food.

- In mammals, except Premolar and Last molar, all type of teeth appear twice in life. Teeth which appear during childhood are called **milk teeth/temporary teeth/lacteal teeth/deciduous teeth/primary teeth**. Due to the activity of osteoclast cells milk teeth are shed, then permanent teeth appear.
- When temporary molars shed, their socket are filled by premolar and new socket are formed for permanent molar. This occurs once in life time.
- In frog, only upper jaw has teeth.
- **Hippocampus, tortoise and birds do not have teeth.**

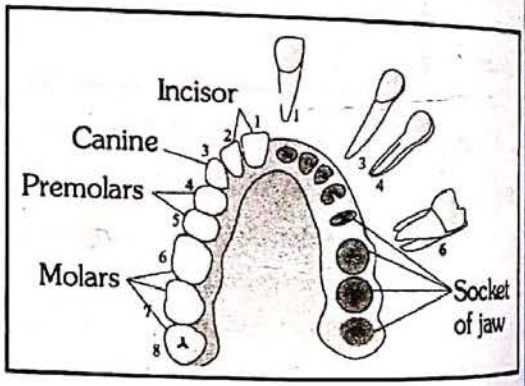
In human beings three basic features of teeth are Thecodont, diphyodont, heterodont

Dental formula :-

Child = $I\frac{2}{2}C\frac{1}{1}PM\frac{0}{0}M\frac{2}{2} = \frac{5}{5}\times 2 = \frac{10}{10} = 20$

17 Yr. old = $I\frac{2}{2}C\frac{1}{1}PM\frac{2}{2}M\frac{2}{2} = \frac{7}{7}\times 2 = 28$

Adult = $I\frac{2}{2}C\frac{1}{1}PM\frac{2}{2}M\frac{3}{3} = \frac{8}{8}\times 2 = \frac{16}{16} = 32$



In humans, premolar teeth appear in the alveoli of molar teeth while permanent molar teeth are developed in new alveoli.

ALIMENTARY CANAL

OESOPHAGUS –

Two apertures are found in central part of Buccopharyngeal cavity.

- Ventral and upper aperture is called **Glottis** which is related to the larynx which is guarded by epiglottis.
- The dorsal and lower aperture is called **gullet** which opens into oesophagus.
- Oesophagus is simple uniform tube which runs downward and pierces the diaphragm and finally opens into stomach that site of piercing on diaphragm is called **hiatus**.
- In oesophagus digestive glands are absent, only mucous glands are present in mucosa and submucosa.
- The length of oesophagus depends on length of neck so the longest Oesophagus is present in Giraffe.

STOMACH

- It is situated on left side of abdominal cavity. **It is the widest part of alimentary canal**. It is a bag like muscular structure J shaped in empty condition.

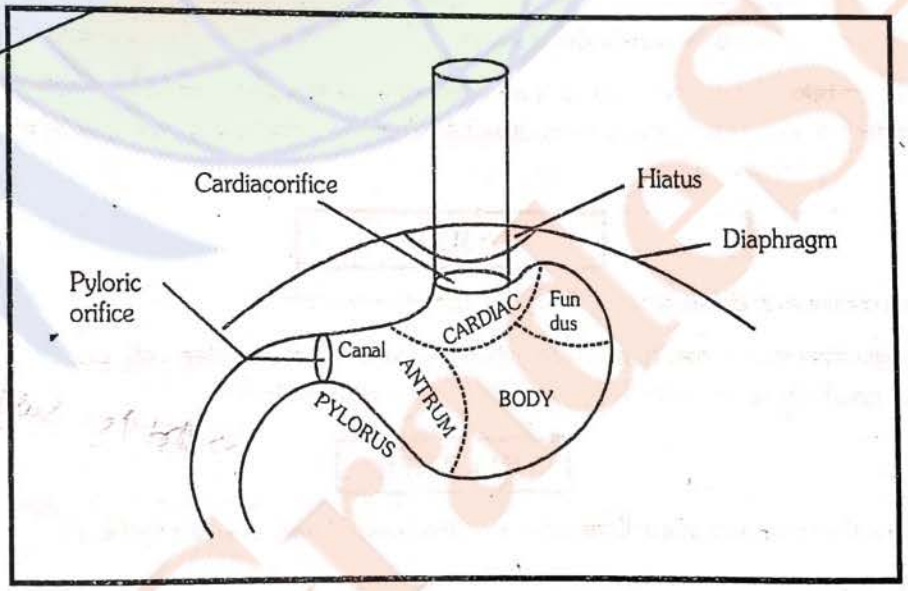
The stomach contains four parts (Cardiac, Fundus, Body, Pylorus).

It has two orifices (opening)

(i) **Cardiac orifice** is joined by the lower end of the oesophagus.

(ii) **Pyloric orifice** opens into the duodenum.

- Stomach is covered by layer of peritoneum. Fat tissues and lymph tissue deposits on the peritoneum. Such type of peritoneum are called Ommentum.
- Left curved surface of stomach is called greater ommentum. Right curved surface of stomach is called lesser ommentum.



Mucous membrane of the stomach is thick. In empty stomach numerous temporary longitudinal folds are found in mucosa of stomach called rugae. They disappear when stomach is distended.

Gastric Glands :- These are numerous microscopic, simple branched tubular glands formed by the invagination of epithelium in the stomach. The following types of cells are present in the epithelium of the gastric glands.

1. Mucous neck cells
2. Entero endocrine cells
3. Oxyntic cells or parietal cells
4. Chief cells or peptic cells or Zymogen cells

Out of these four types of cells, 3 major types of cells are
(a) mucous neck cells (b) oxyntic or parietalcells
(c) Chief cells or peptic cells or zymogencells

INTESTINE

It is divided into two part

(i) Small intestine (ii) Large intestine

SMALL INTESTINE

- Small intestine is differentiated into three part
  (i) Duodenum (25 cm.) (ii) Jejunum (iii) Ileum
- Duodenum is initial part of small intestine. Duodenum is the shortest, widest and the fixed part of the small intestine. It is C/U-shaped.
- For absorption of digested food a very large surface area is required. Therefore some adaptations are present here.
  (a) great length of the intestine.
  (b) The presence of permanent deep folds in mucosa is called **plicae circularlis, valvulae conniventae** or **valves of kerkring,** along with villi and microvilli.

LARGE INTESTINE

- **Large intestine** (Larger in diameter) – Large intestine is differentiated into three parts **caecum, colon** and **rectum**.
- The lower end of the ileum opens on the Posteromedial aspect of the **Ileo-caecal junction**. The Ileocaecal opening is guarded by **Ileocaecal valve**. Caecum is a small blind sac. It is 6 cm long and 7.5 cm broad.
- About 2 cm below the ileocaecal orifice, a worm like structure arises from the caecum called as **vermiform appendix**.It is a vestigeal organ. Caecum is well developed in rabbit and other mammals but is vestigeal in human.

COLON

- Caecum continues in **colon**, which is the middle part of large intestine.
- The longitudinal muscle coat forms three ribbon like bands called **Taeniae coli**. Due to the presence of taeniae, pouch like structure develops in Lumen of colon called as **Haustra**.

RECTUM

- This colon then continues in a uniform tube called **Rectum**. (Storage chamber for faeces)
- Rectum open into a small bag like structure called **anal-canal**.

ANAL – CANAL

- Anal canal opens outside by **anus**. Anus is controlled by anal sphincter.

Two types of anal sphincter are found at the opening of anus..

- Two types of sphincter muscles are found in Anal canal.

Internal Anal sphincter ⟶ Involuntary

External Anal sphincter ⟶ Voluntary

1. Dental form
   (1) 2,1,2,3 / 2,1,2,3
2. In Colon,
   (1) haustr
3. pH of st
   (1) 7
4. Numbe
   (1) 4
5. The ce
   (1) Mu
   (3) HC
6. The s
   (1) La
7. Whi
   (1) F
8. The
   (1)
9. Ty
   (1)
10. P
    (1
11. I
    (
12.
13.

BEGINNERS BOX-1

ANATOMY OF ALIMENTARY CANAL

1. Dental formula of adult man is -
(1) $\frac{2,1,2,3}{2,1,2,3}$ (2) $\frac{2,1,2,3}{2,1,2,2}$ (3) $\frac{2,1,2,3}{2,1,2,4}$ (4) $\frac{2,1,3,2}{2,1,3,2}$

2. In Colon, constrictions of its wall form a series of small pockets called-
(1) haustra (2) crypts of lieberkuhn (3) zymogen cells (4) taenial

3. pH of stomach in human is about-
(1) 7 (2) 3 (3) 8 (4) 11

4. Number of teeth which are monophyodont in man is-
(1) 4 (2) 22 (3) 32 (4) 12

5. The cells of the epithelial lining in the vertebrate stomach are not damaged by HCl because of-
(1) Mucus secretion covering the epithelium (2) Neutrilizatioin of HCl by alkaline gastric juice.
(3) HCl being to dilute (4) Epithelium being resistant to HCl

6. The structure which prevents entry of food into wind pipe during swallowing in mammals is-
(1) Larynx (2) Glottis (3) Epiglottis (4) Pharynx

7. Which of the following is a common passage in swallowing food and breathing-
(1) Pharynx (2) Larynx (3) Glottis (4) Gullet

8. The hardest constituent of the tooth is-
(1) Enamel (2) Dentine (3) Bone (4) Pulp

9. Types of teeth in human -
(1) Thecodont (2) Acrodont (3) Pleurodont (4) Homodont

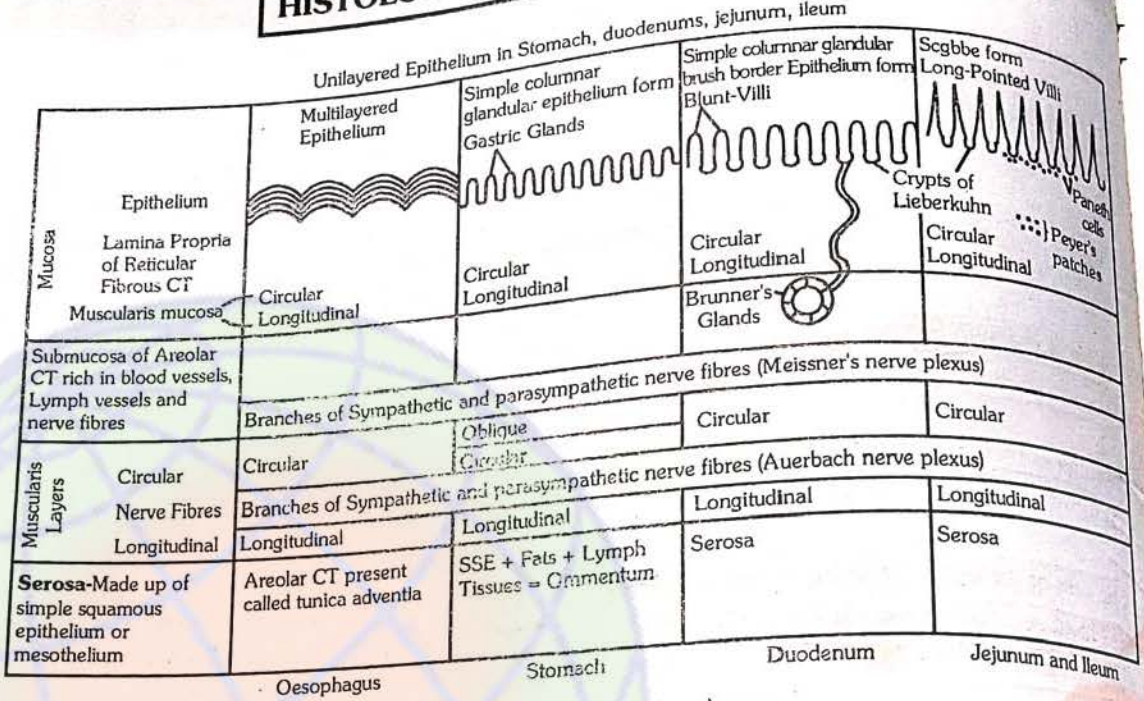
10. Posterior part of soft palate, hangs down in pharynx, called-
(1) Palatine (2) Tonsils (3) Velum Palati (4) Jacobson's organ

11. Nasal chambers and buccal cavity are seperated by-
(1) By uvula (2) By palate (3) By palatine (4) None of these

12. Cheek teeth are-
(1) Inscisors and Canines (2) Canines and Premolars
(3) Premolars and Molar (4) Canines and Molars

13. Presence of water amount in enamel cell is-
(1) 90 - 92 % (2) 75 - 80 % (3) 40 - 50 % (4) ≈ 3 %

HISTOLOGY OF ALIMENTARY CANAL



Wall of alimentary canal is made up of four layer (outer to inner)

(1) Serosa : It is outer most layer of gut (it is called tunica adventitia in oesophagus) serosa is made up o visceral peritoneum while tunica adventitia is made up of white fibrous connective tissue and areola connective tissue.

(2) Muscle layer : It is formed by circular inner layer and longitudinal outer layer of smooth muscle. Thicke layer is found in stomach (maximum peristalsis) and thinest layer in rectum (minimum peristalsis).

(3) Sub mucosa : It is loose connective tissue layer with blood lymph vessels and nerves.

(4) Mucosa : It is the inner most layer of gut which contains the secretory and absorptive cells.

It is differentiated into 3 parts.

Outer part :- Called mucosa muscularis.

- It is made up of longitudinal and circular muscles.
- It has important role in exposing of surface area for the absorption
- They also provide support to the folds of alimentary canal.

Middle part :- It's called lamina propria it contains few modified lymphatic tissue which provides immunity ex peyer's patches .

- It is made up of reticulate and fibrous connective tissue.

Innermost part :- Called mucosal layer.

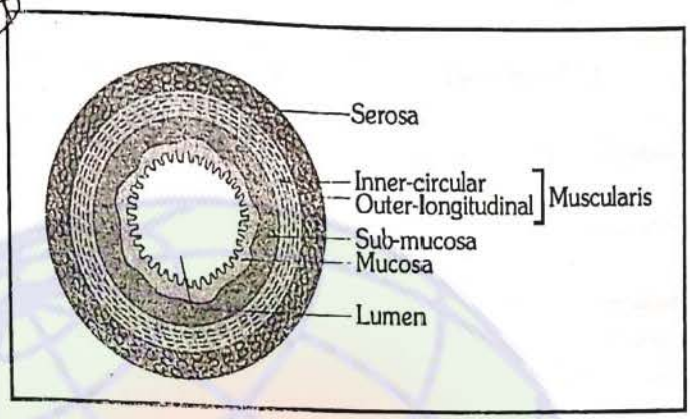
- In oesophagus this layer is made up of non keratinised stratified squamous epithelium.
- Except oesophagus this layer is single layer thick, which is made up of columnar mucous epithelium.
- This layer makes the lining of lumen of Alimentary canal.
- This layer makes the folds of alimentary canal.
- Folds of oesophagus are less developed, where as folds of stomach are finger shaped and develop as gla called gastric gland.
- Folds of small intestine are conical shaped called Villi. Small slit like space is found at the base of villi. Th spaces are called crypts of Lieberkuhn

Villi of duodenum are small blunt.

Villi of Jejunum and Ileum are long and pointed.

Maximum villi are found Jejunum.

N.C.E.R.T



V.I.P

Brunners Gland :-

- They are small spherical multicellular glands.
- They open into crypts of lieberkuhn with the help of fine tubules.
- These glands are found in the submucoa of duodenum. So, they also as Duodenal gland / Submucosal gland
- They synthesize and secrete the non enzymatic alkaline secretion of intestinal juice.

Paneth Cells :- V.V.I.P

- These cells are found in mucosal layer of cypts of lieberkuhn of jejunuem.
- They are unicellular glands.
- They synthesize and secrete Lysozyme and defensin.
- The secretory substances of brunners glands and crypts of Lieberkuhn are combindly called intestinal juice or succus entericus. = Mixture of juice of Brunner's gland + Paneth gland + secretory cell of small intestine + Goblet cell

Peyer's patches :-

- They are small lymph nodes which are found in the mucosa of small intestine (Jejunum and Ileum more in number).
- They are also called intestinal tonsils and provide immunity.

Nerve supply :-

Two types of Nerve plexus are found in muscle of alimentary canal.

Auerbach's Nerve plexus (myentric plexus) this nerve plexus is found between longitudinal muscles and circular muscles, it control muscle contraction ,,it controls Peristalsis

Meissner's Nerve plexus found between circular muscles and sub mucosa but in stomach it is found between oblique muscle & submucosa. ,it control tone and Regulates the Secretion of gland

Composition of saliva :

Salivary glands are not present in whale and frog.

- Water-99.5 %
- Mucus , starch -digesting **Ptyalin enzyme**, lysozyme and thiocyanates and few ions like sodium, potasium, chloride, **IgA** antibody, **urea** and uric acid etc., are present.
- Ptyalin is secreted only by the parotid gland. Lysozyme and Thiocyanates mainly kill bacteria. They also check the growth of bacteria in bucco-pharyngeal cavity.
- Salivation is stimulated by cranial nerve VII & IX. Sympathetic nervous system decreases the secretion of saliva while parasympathetic nervous system increases the secretion of saliva.

HISTOLOGY OF ALIMENTARY CANAL

1. Peyer's patches produce-
(1) Enterokinase (2) Lymphocyte (3) Mucous (4) Trypsin

2. Duodenum has characteristic Brunner's glands which secrete –
(1) Estrogen (2) Prolactin, parathormone
(3) Extradiol, progesterone (4) None

3. Brunner's gland are found in which of the following layers :
(1) Submucosa of stomach (2) Mucosa of ileum
(3) Submucosa of duodenum (4) Mucosa of oesophagus

4. The crypts of lieberkuhn secret :
(1) gastrin (2) rennin (3) cholecystokinin (4) succus entricus

5. Brunner's glands are located in :
(1) Oesophagus (2) Duodenum (3) Intestine (4) Stomach

6. Crypts of Lieber kuhn are present in :-
(1) intestine (2) Stomach (3) oesophagus (4) All of these

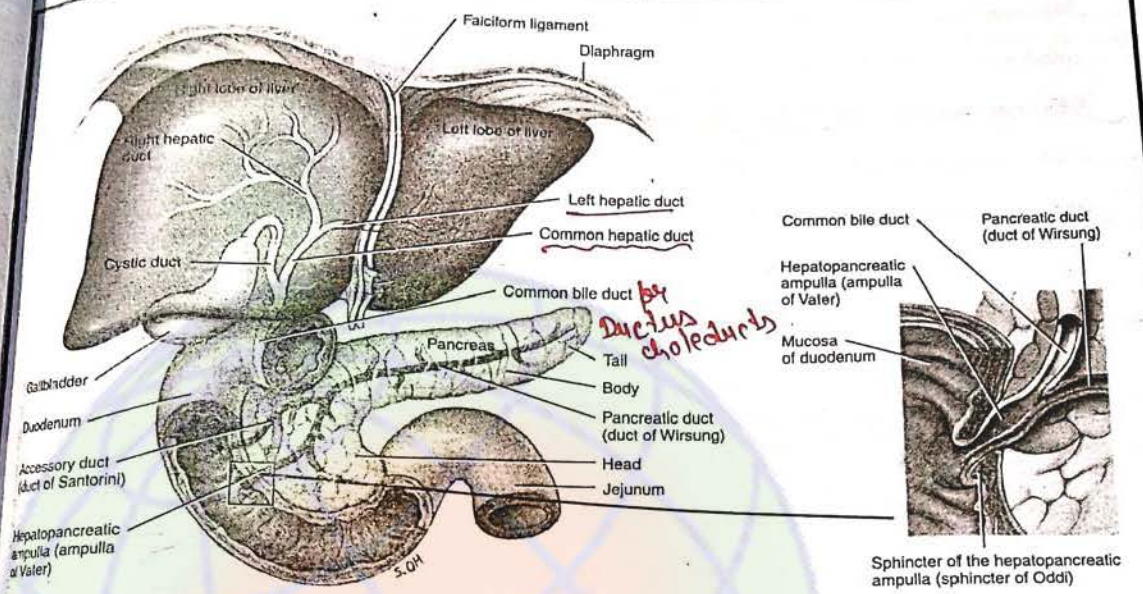
7. **Assertion (A) :** Thick layers of muscles are present in the wall of alimentary canal.
Reason (R) : These muscles help in the mixing of food materials with the enzymes coming from differ glands in the alimentary canal.
(1) Both (A) and (R) are true and the (R) is correct explanation of the (A)
(2) Both (A) and (R) are true but the (R) is not the correct explanation of the (A)
(3) (A) is true statement but (R) is false
(4) Both (A) and (R) are false

SALIVARY GLANDS-

In human 3 pairs of salivary glands are present.

Salivary Glands : 3 Pairs				
		Parotid	Submaxillary	Sublingual
1.	Location	Below ear	Jaw angle	Below tongue
2.	Number	1 pair	1 pair	1 pair
3.	Duct	Stenson's duct	Wharton's duct	Duct of Rivinus or Bartholin's duct
4.	Secretion	Saliva + Enzymes	Saliva	Saliva
5.	Special point	Largest salivary gland and viral infection cause Mumps.	Secrete maximum amount of saliva	
			Longest salivary duct	Smallest salivary duct

LIVER



Over view of liver and pancreas

- It develops from **endoderm**. (Weight 1.5 kg). In human it is found in right side of abdominal cavity, below the diaphragm.
- The liver is the largest gland of body.
- It is made up of left and right lobe. Left lobe is smaller than right lobe. Right lobe forms **5/6** of the liver & left lobe forms **1/6** of liver.
- Right and left liver lobes are separate from each other by the **falciform ligament**, (Fibrous C.T.) which is made up of fold of peritoneum.
- Right and left hepatic duct develop from right and left liver lobe. Both these ducts combine to form a **Common Hepatic duct.**
- **Gall bladder** is situated below right lobe of liver. Gall bladder is not present in lemprey, whale and horse.
- Cystic duct of gall bladder is connected to common hepatic duct to form a common bile duct also called **ductus choledocus.**

FUNCTIONS OF LIVER :- (Liver is known as biological and chemical factory of the body).

Most of the biochemical functions of the body are done by the liver.

1. **Secretion & synthesis of bile** - This is the main function of liver. Bile is yellowish-green, alkaline fluid. In bile juice, bile salts, sodium bicarbonate, glycocholate, taurocholate, bile pigments, cholesterol, Lecithin etc. are present.

Bile salts help in emulsification of fats. Bile prevents the food from decomposition. It kills the harmful bacteria.

2. **Carbohydrate Metabolism-** The main centre of carbohydrate metabolism is liver.

Following steps are related with carbohydrate metabolism-

Glycogenesis- The conversion and storage of extra amount of glucose into glycogen from the digested food called glycogenesis. The main stored food in the liver is glycogen.

Glycogenolysis- The conversion of glycogen into glucose again when glucose level in blood falls down is called glycogenolysis.

Gluconeogenesis- At the time of need, liver converts non-carbohydrate compounds (e.g Amino acids, fatty acids) into glucose. This conversion is called gluconeogenesis. This is the neo-formative process of glucose.

Glyconeogenesis : Synthesis of glycogen from lactic acid (which comes from muscles) is called glyconeogenesis.

3. **Storage of fats-** Liver stores fats in a small amount. Hepatic cells play an important role in fat metabolism. The storage of fat increases in the liver of alcohol addict persons (Fatty liver). This stored fat decreases the activity of liver. The damage of liver due to alcohol intake is called Alcoholic Liver cirrhosis.

4. **Deamination and Urea formation-** Deamination of amino acids is mainly done by liver (Amino acid → NH_3). Liver converts ammonia (more toxic) into urea (less toxic) through **ornithine cycle** .

The spoilage of liver, the ammonia level in the animal body increases and ultimately the animal dies.

5. **Purification of blood-** Kupffer cells of liver & splenocytes of spleen are the phagocytic cells, helps in phagocytosis of dead blood cells and bacteria from the blood.

6. **Synthesis of plasma proteins-** Many types of proteins are present in blood plasma. All the proteins except Gama-globulins are synthesized in the liver. Chemically antibodies are gama globulins formed by lymphocyte.

7. **Synthesis of heparin-** Heparin is a natural anticoagulant (mucopolysaccharide).

Some heparin is also formed by basophills (granulated WBC) and mast cells.

8. **Synthesis of Vitamin-A-** The liver changes β-carotene into vitamin -A β- carotene is a photosynthetic pigment which is obtain from yellow part of fruits. It is abundantly found in carrot.

9. Liver stores **vitamins A,D,E,K,B_{12}**

10. **Storage of minerals-** Liver stores iron, copper, zinc, cobalt, molybdenum etc. Liver is a good source of iron.

11. **Haemopoiesis-** The formation of blood cells is called haemopoesis. In embryonic stage R.B.C and WBC are formed by liver

12. **Secretion of enzymes-** Some enzymes are secreted by liver, participate in metabolism of proteins, fats & carbohydrates e.g. Dehydrogenase, cytochrome oxidase etc.

13. Prothrombin and fibrinogen proteins are also formed in hepatic cells. These help in blood clotting.

14. Factors I, II, V, VII , IX and X are formed in liver, which are responsible for blood clotting.

PANCREAS (Sweet bread)

It's develop from **endoderm**, which is soft, lobulated and elongated organ.

It is made up of numerous acini. Acini is a group of secretory cells surrounding a cavity. Each acini is lined by pyramidal shaped cells. These acinar cells secrete the enzyme of pancreatic juice.

Each acini opens into pancreatic ductule. Many pancreatic ductule combine to form main Pancreatic duct **(duct of Wirsung)**. The main Pancreatic duct is join with the bile duct to form the hepatopancreatic ampulla which opens into duodenum. The accessory Pancreatic duct **(duct of Santorini)** opens into duodenum with separate openings located above the opening of major Pancreatic duct.

Some group of endocrine cells are also found in between groups of acini called **islets of Langerhan's**. These islets secrete insulin & glucagon hormone. So this gland is exocrine as well as endocrine (Heterocrine). **Its 99% part is exocrine** while **1% part is endocrine**.

In humans both bile duct and pancreatic duct combine to form common duct called as **Hepato-Pancreatic duct**. The terminal end of common duct is swollen and is called as **Ampulla of Vater** or hepato pancreatic ampulla. Ampulla of Vater opens into middle part of Duodenum and is controlled by **sphincter of Oddi** while bile duct is controlled by **sphincter of Boyden**.

BEGINNERS BOX-3

DIGESTIVE GLANDS

1. Islets of langerhans _____ and are found in _____.
(1) Modified lymph glands, pancreas
(2) Ductless glands, pancreas
(3) Specialized area, pituitary
(4) Small tubules, kidney

2. Ptyalin is secreted by _____ and work in _____ medium.
(1) Stomach, acidic
(2) Salivary gland, alkaline
(3) Pancreas, alkaline
(4) Bile, alkaline

3. In pancreas, pancreatic juice and hormone are secreted by-
(1) Same cells
(2) Different Cells
(3) Same cells at different times
(4) None of these.

4. Largest gland of body -
(1) Pancreas
(2) Duodenum
(3) Liver
(4) Thyroid

5. Insulin is secreted by pancreatic cells-
(1) α-cells
(2) β-cells
(3) Delta cells
(4) Gama cells

6. Which substance of saliva destroy the harmful bacteria-
(1) Cerumin
(2) Chyme
(3) Lysozyme
(4) Secretin

7. Which of the following is not a function of liver :-
(1) Deamination (2) Bile storage
(3) Synthesis of plasma protein (4) Storage of fat soluble vitamin

8. The glucose is converted into glycogen in liver and stored in :
(1) Liver (2) Liver and muscles
(3) Liver and spleen (4) Spleen and muscles

9. Kupffer cells are found in :
(1) Liver (2) Kidney (3) Heart (4) Blood

10. The major site of protein breakdown to form free amino acids, is in the
(1) Kidney (2) Spleen (3) Liver (4) Bone-marrow

PHYSIOLOGY OF DIGESTION

Digestion is divided in two ways-Mechanical digestion and Chemical digestion. Mechanical digestion ta place in mouth and small intestine.

DIGESTION IN ORAL CAVITY

Food enters through mouth food is tasted in oral cavity and mixed with saliva, tongue mixes the food w saliva. This food with saliva is called bolus. This saliva (pH 6.8 – 7.0) contains water (99.5%) and electro (Na^+, K^+, Cl^-, HCO_3^-, Thiocynate).

Mechanical digestion :-

- In mouth teeth, tongue and lips have important role in machanical digestion through the proces chewing or **mastication**.

Chemical digestion :-

- In this type of digestion saliva mix with food particles.
- Saliva contain 99.5% water & 0.5% salts.
- These salts are organic and inorganic type.
- The main salts are mucin, lysozyme, thiocynate and Ptyalin. (Salivary amylase)

Mucin :-

- It is a glycoprotein. It lubricates the food particles. It helps in the swallowing of food.

Lysozyme :-

- It is an enzyme which kills the harmful bacteria. Due to this reason saliva is a antiseptic lotion.

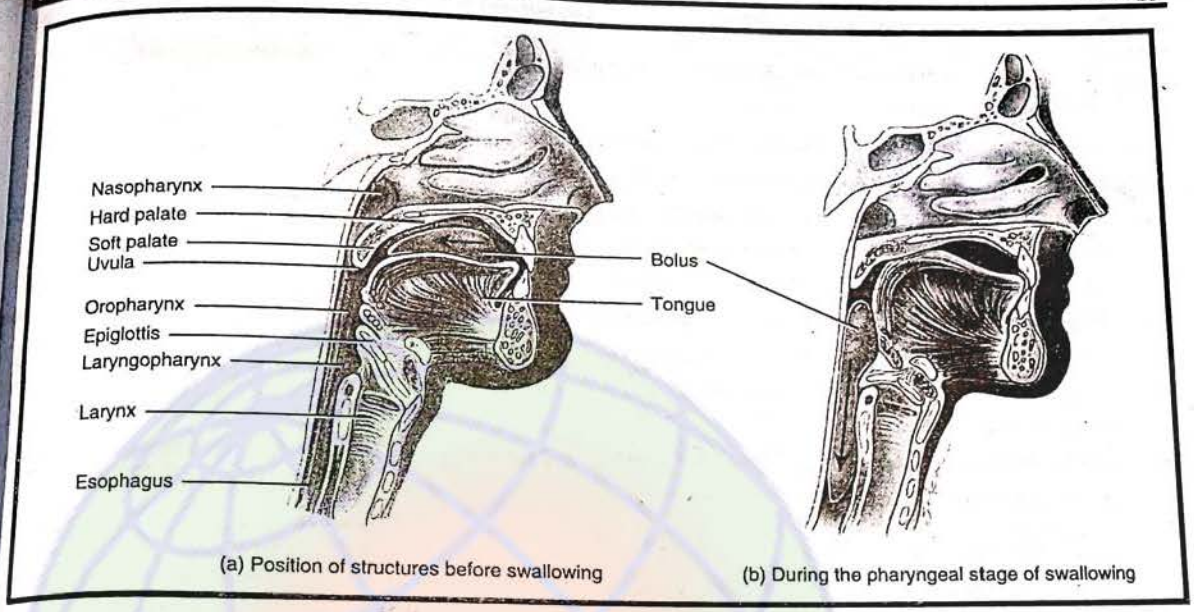
Thiocynate :-

- It is a special salt which kills the harmful bacteria. So it is called bacteriocidal salt.

Ptyalin (Salivary amylase) :-

- Starch $\xrightarrow{\text{Ptyalin}}$ Maltose

Ptyalin is found in human saliva, because human food is mainly made up of starch. Ptyalin digest only r and cooked starch. It does not digest the raw starch, 30% starch in buccal cavity is diagested by ptyalin. Ptyalin is absent in saliva of rabbit and carnivorous animal, because food of rabbit is mainly made up of cellulose whereas carnivore food mainly contain proteins.

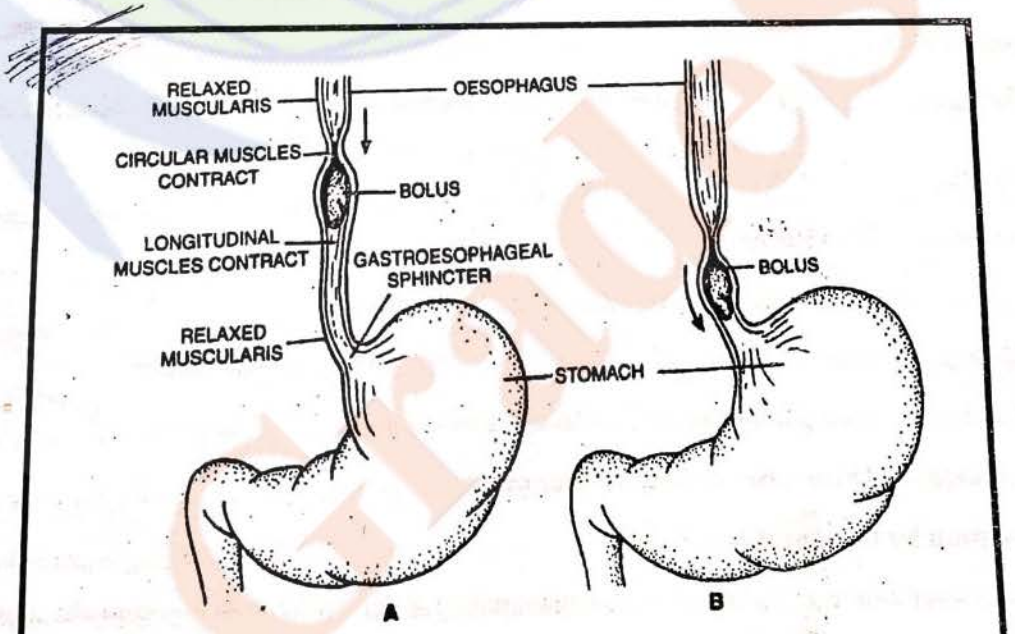


Bolus is pushed inward through the pharynx into the oesophagus this process is called swallowing or deglutition. It is coordinated activity of tongue, soft palate, pharynx and oesophagus.

The tongue blocks the mouth, part of soft palate and uvula close off the internal nasal opening nose and larynx rises so that epiglottis closes off the trachea food move downward into the oesophagus A travelling wave of constrictions called peristalsis pushes the Bolus (food) downward.

Digestive enzymes are absent in Oesophagus but salivary amylase continue to function upto the last of Oesophagus. The cardiac sphincter/ Gastroesophageal sphincter opens allowing the passage of bolus food to the stomach.

Gastroesophageal sphincter normaly remains closed and does not allow food contents of the stomach to move back.



PERISTALSIS IN OESOPHAGUS

DIGESTION OF FOOD IN STOMACH :

When the food enters into stomach G-cells secrete gastrin hormones which stimulate the secretion of gas juice by gastric glands.

Secretion of gastric juice is controlled by nerve, hormones and chemical substances.

Secretion of gastric juice is divided into 3 phases –

1. **Cephalic phase :-** This phase is mediated by parasympathetic nervous system. It is the first of step secretion, stimulated by cranial nerves VII, IX & X. When person see the food then due to optic reflex s amount of gastric juice secretes in the stomach due to sight.
2. **Gastric phase :-** When food enter into stomach then gastric phase is started. When food particles strike to fundic part of stomach then small amount of gastric juice is secreted due to strike reflex action and distenti
   - Gastric juice developes the peristalsis movement in the stomach. Due to peristalsis food particles are rubbe mucosal layer of stomach.
   - Due to rubbing process cells stimulates and secretes gastrin hormone. This hormone powerfully stimulate gastric glands for secretion of gastric juice.

Some drinking substances also stimulates the secretion of gastric juice such a soup, alcohol, caffeine, histamine.These drinking substances and gastric juice stimulate the desire of appetite. So these substances are called Appetiser juice.

3. **Intestinal phase :-** When food reaches at the Ileum then mucosal layer of ileum secretes a chemical stance. Its nature in similar to the histamine or gastrin. This chemical substance goes into stomach thro blood circulation where it stimulates the secretion of gastric juice.

   Its actual cause is yet unknown. But it is believed that this phase starts after 8-10 hour of taking of meal.

Composition of Gastric juice :

Water = 99.5%

HCl = 0.2 - 0.3%

pH = 1.5 to 2.5 (very acidic)

rest = mucus water, HCl and gastric enzymes (Pepsinogen, Prorennin, Gastric Lipase etc.).

Functions of HCl –

1. The main function of HCl (activater) is to convert inactive enzymes (zymogens) into active enzymes.

   $\text{Pepsinogen} \xrightarrow{HCl} \text{Pepsin.}$

   $\text{Prorennin} \xrightarrow{HCl} \text{Rennin.}$

2. It destroys all the bacteria present in the food.
3. HCl stops the action of saliva on food. In stomach, the medium is highly acidic.
4. It dissolves the hard portions of the food and makes it soft.

- Pepsinogen and Prorennin are inactive enzymes.

Digestion by Rennin (Chymosin) -

- Rennin is active in the childhood stage of mammals only. It converts milk into curd like substance (clot the and then digests it. In adult stages, it is inactive.
- Rennin, acts on milk protein **casein.** Casein is a soluble protein.

In presence of Rennin, casein gets converted into insoluble **Ca-paracaseinate**. This process is termed as **Curdling of milk**. After becoming insoluble, milk can remain in the stomach for a longer time. Rennin is absent in human (clotting/coagulation/curdling of milk is done by HCl, pepsin and chymotrypsin in human) .

Digestion by Pepsin-

Inactive pepsinogen on getting proper pH converts into active pepsin.

Proteins $\xrightarrow{\text{Pepsin}}$ Peptones + Proteoses + Peptides.

Digestion by Gastric Lipase-

It converts fats into fatty-acids and glycerols. It is secreted in a less amount so less digestion of fats takes place here.

This lipase acts on emulsified fat and convert it into fatty acid & glycerol. 1% emulsified fat is present in the food.

Peristalsis continues during the process of digestion so the gastric -juice mixes properly with the food. Due to peristalsis the food is converted into a paste. This form of food which is thick, acidic & semidigested in the stomach is called **chyme**.

After short intervals, the pyloric valves keeps on opening and closing so the chyme is fed into the intestine in installments.

DIGESTION OF FOOD IN SMALL INTESTINE-

In small intestine mechanical and chemical digestion occurs.

Mechanical Digestion : Food reaches to different parts of alimentary canal by peristalsis.

Chemical Digestion :

DIGESTION OF FOOD IN DUODENUM - When food leaves the stomach through its pyloric end and enters the duodenum it is called chyme (acidic).

i) **Secretin :-** It is the most important hormone of digestive tract and also first discovered hormone. This hormone stimulates pancreas for synthesis and secretion of non enzymatic part of pancreatic juice. It also stimulates liver for secretion of bile juice and inhibit the gastric juice secretion in stomach and reduce rate of contraction of stomach.

ii) **Pancreozymin-** It stimulates the synthesis as well as secretion of pancreatic-juices.

Secretin promotes the secretion of the non enzymetic part of the pancreatic juice, while pancreozymin promotes the secretion of enzymatic part of the pancreatic juice.

iii) **Hepatocrinin-** It promotes the synthesis and secretion of Bile juice in liver.

iv) **Cholecystokinin-** It stimulates the liver and the Gall-bladder (mainly gall-bladder) to secrete Bile-juice.

v) **Duocrinin :-** It stimulates the Brunner's gland for synthesis and secretion of non enzymatic part of intestinal juice.

vi) **Enterocrinin :-** This hormone stimulated Paneth cells for synthesis and secretion of enzymatic part of intestinal juice.

vii) **Villikinin :-** It stimulates the activity of villi.

viii) **Enterogasterone :-** It inhibits the secretion of HCl in stomach.

ix) **Gastric inhibitory peptide (GIP) :-** In inhibits the secretion of gastrin hormone.

x) **Vasoactive intestinal peptide and somatostatin :-** They inhibits the motivity of stomach.

GIP - glucose dependent insulinotrophic polypeptide – This hormone stimulate insulin secretion and synthesis.

BILE-JUICE

In the middle part of the duodenum bile-juice is secreted. The parenchyma cells of the liver produce bile-ju and it is stored in the Gall- bladder. Bile-juice does not contain any digestive enzyme. Therefore it is not a t digestive juice (Pseudodigestive juice).

Compostion of Bile-juice :- Bile-juice is a greenish (Biliverdin) yellow (Bilirubin) coloured alkaline fluid.

Composition of liver bile.

	Liver bile
pH	8.0
H_2O	98%

organic constituents are bile acid , bile pigment, cholesterol, Lecithin, inorganic constituents Na^+, K^+ etc.

Bile-pigments are the excretory-substances of the liver.

Bile-salts are of two types –

(a) **Inorganic- salts-** Bile-juice contains NaCl, Na_2CO_3, $NaHCO_3$ etc in it. Inorganic salts neutralize acidity of the food and make the medium basic. It is necessary for the medium to become basic beca the pancreatic-juices enzymes can act only in basic -medium.

(b) **Organic- salts-** Organic salts like Na-glycocholate and Na-taurocolate are found in Bile juice. The m function of these salts is the emulsification of fats. Because pancreatic **Lipase** can act only on emulsifi fats.

Bile salts also help in the absorption of fats and fat-soluble vitamins (A,D,E,K) Bile salts combine with fats, cholestrol, phospholipid (lecithin) and these vitamins to form compounds called Micelles. Which are absorbed rapidly. In the form of micelles cholestrol and phospholipid (lecithin) remain soluble.

FUNCTION OF BILE JUICE :

- **Neutralization of HCl.** Its sodium neutralizes HCl of chyme (semifluid food found in the stomach).
- **Emulsification. Sodium glycocholate** and **sodium taurocholate** are bile salts which break the large f droplets into the smaller ones.
- **Absorption of fat and fat-soluble vitamins.** Its salts help in the absorption of fat (fatty acids and glycer and fat-soluble vitaminS (A, D, E and K).
- **Excretion.** Bile pigments (billirubinand biliverdin) are excretory products.
- **Prevention of decomposition.** Bile is alkaline hence it prevents the decomposition of food preventing t growth of bacteria on it.
- **Stimulation of peristalsis.** Bile increases peristalsis of the intestine.
- **Activation of Lipase.** Bile contains no enzyme but activates the enzyme lipase.
- Bile-pigments, cholesterol and Lecithin are the excretory substances found in Bile-juice.
- **Gall-Stone-** Sometimes the passage inside the bile-duct gets blocked or becomes narrow, so the cholester gets deposited or precipitated in the gall-bladder. This is termed as the Gall-stone (cholelithiasis).
- **Obstructive Jaundice -** If the passage of bile is blocked then the amount of bilirubin increases in the bloo So the yellowish colouration of body like skin, cornea and nails appear yellow. Urine also becomes yellow.

PANCREATIC JUICE

- Pancreozymin stimulates the acini and glandular cells so pancreatic juice are secreted.
- The pancreatic-juice is secreted by the exocrine cells of the pancreas.
- Pancreatic juice is highly odouriferous, colourless basic fluid which contains enzymes and salts.

Composition of Pancreatic Juice-

Total amount in man = 1 litre to 1.5 litre/day,

Water = 98%, pH = 7.5-8.3, Salts = 2%

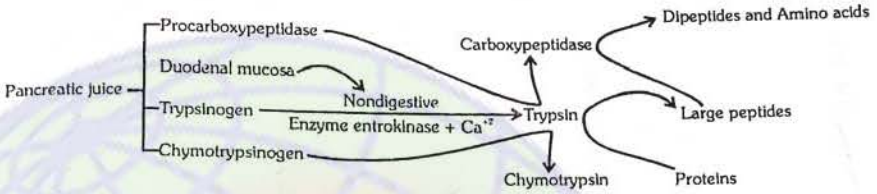
Pancreatic juice contains only inorganic-salts.

The action of enzymes present in the pancreatic juice is as follows-

Pancreatic, α - Amylase : Amylase and Amylopsin dissociates starch into Maltose. Majority of starch breaks up into the duodenum.

$$\text{Starch} \xrightarrow[\text{(Amylopsin)}]{\text{Pancreatic amylase}} \text{Maltose}$$

Protein digestion in duodenum -



Fat digesting enzyme - In pancreatic-juices various Fat-digesting enzymes are found which are collectively called **steapsin**.

(I) Pancreatic Lipase- It converts triglyceride into monoglyceride,fatty acid, glycerol.

(II) Cholesterol esterase- It digests **cholesterol esters**. These esters are made up of cholesterol and fatty-acids Like- **Lanolin**, (cholesterol and Palmitic acid).

(III) Phospholipase- These digest phospholipids.

DNase and RNase - Digestion of DNA and RNA.

In duodenum, digestion of biomacro molecules takes place in the presence of bile juice and pancreatic juice.

DIGESTION IN JEJUNUM AND ILEUM -

These hormones stimulate the crypts of Leiberkuhn to secrete **Succus-entericus** or intestinal juice. This succus entericus mainly contains water (99%) and digestive enzymes (<1%). Intestinal juice act on food.

Succus-entericus mainly contains the following enzymes-

Peptidase or Erepsin - This is a type of **Exopeptidase**. It converts oligopeptides into amino-acids.

Disaccharidases

$$\text{Sucrose} \xrightarrow{\text{Sucrase (Invertase)}} \text{Glucose + Fructose}$$

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

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

Intestinal Lipase- This fat-digesting enzyme converts fats into **fatty-acids and glycerol**.

Nucleotidase and Nucleosidase - These act in the following way:-

(i) $\text{Nucleotides} \xrightarrow{\text{Nucleotidase}} \text{Nucleosides + Phosphate}$

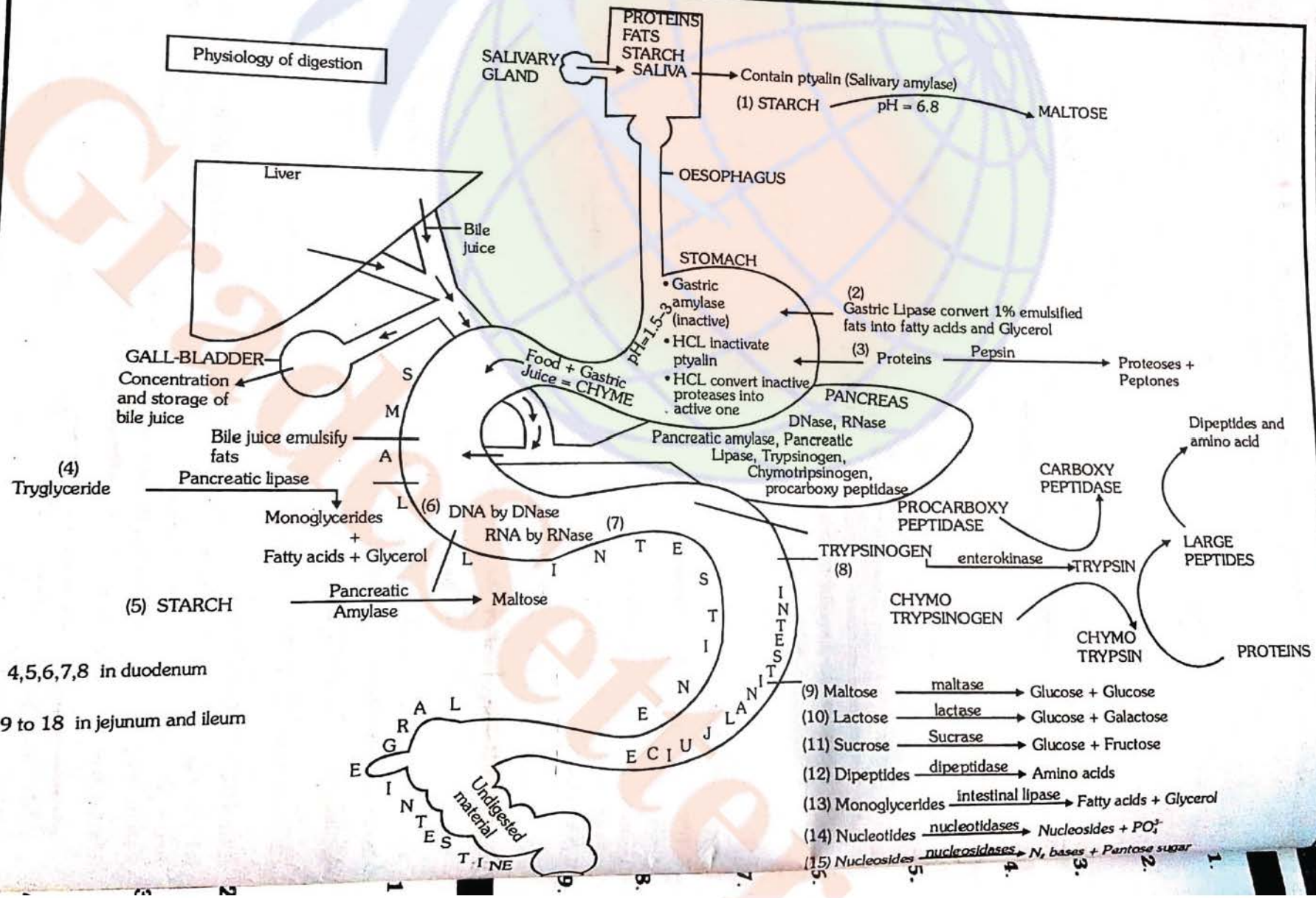
(ii) $\text{Nucleosides} \xrightarrow{\text{Nucleosidase}} \text{Pentose + Nitrogen base}$

DIGESTION IN CAECUM :-

In herbivores, the symbiotic bacteria and protozoans present in the caecum help in digestion of cellulose into glucose. So the digestion of cellulose takes place in caecum by the process of **decomposition**. This **decomposition** process is very slow. So very less amount of cellulose is digested at a time in caecum.

In the last part of the large intestine faeces is temporarily stored.

Maximum digestion of food – Duodenum.
While digestion of food complete in – Ileum.
Maximum absorption of food in – Jejunum.



BEGINNERS BOX-4

PHYSIOLOGY OF DIGESTION

1. Bilirubin and bilivirdin are found in-
(1) Blood (2) Bile (3) Saliva (4) None of these.

2. Casien present in milk,which is -
(1) bacterium (2) sugar (3) protein (4) fat

3. Amylase enzyme acts on the -
(1) Starch (2) Protein (3) Fat (4) Cane sugar

4. The digestion of cellulose in rabbit and other herbivorous mammals takes place in-
(1) Vermiform appendix (2) Colon
(3) Caecum (4) Ileum

5. Peristaltic movements found in different parts of alimentary canal In which one of these there is least peristalsis-
(1) Stomach (2) duodenum (3) rectum (4) Oesophagus

6. Milk protein is curdled into calcium paracaesinate by-
(1) Maltose (2) Rennin (3) Trypsin (4) lactose

7. The enzyme invertase hydrolase-
(1) Glucose into sucrose (2) Sucrose into glucose and fructose
(3) Starch into maltose (4) Starch into sucrose

8. Trypsin is secreted by-
(1) Pancreas (2) Stomach (3) Liver (4) Ileum

9. Proteins are broken down into amino acids in-
(1) Buccal cavity (2) Stomach (3) Intestine (4) Rectum

BEGINNERS BOX-5

PHYSIOLOGY OF DIGESTION

1. Herbivorous animals can digest cellulose because
(1) Their molar and premolar teeth can crush and grind the food.
(2) Bacteria present in their caecum help in digestion of cellulose.
(3) Gastric juice has a digestive enzyme for cellulose digestion.
(4) Alimentary canal is very long.

2. Digestion of carbohydrate is affected by-
(1) Amylopsin (2) Lipase (3) Erepsin (4) Pepsin

3. Ptyalin cannot work in stomach, because it becomes-
(1) Inactive due to HCl (2) Inactive due to Renin
(3) Inactive due to Pepsin (4) None of these

4. What is the important function of bile-
(1) For digestion by emulsification of fats (2) Elimination of excretory products
(3) For digestion by enzymes (4) Coordination of digestive activities

5. Some proteolytic enzymes are-
(1) Trypsin, Erepsin, Pepsin
(2) Amylase, Lipase, Zymase
(3) Ampylopsin, Steapsin, Ptyalin
(4) Urease, Dehydrogenase, Zymase

6. Bacteria entering with contaminated food are killed in stomach by -
(1) Pepsin
(2) Renin
(3) Sodium bicarbonate
(4) HCl

7. Chymotrypsin is-
(1) Proteolytic enzyme
(2) Fat digestive enzyme
(3) Vitamin
(4) Hormone

8. Emulsification of fats by bile takes place in-
(1) Duodenum
(2) Liver
(3) Stomach
(4) Intestine

DIGESTIVE JUICES

Name of the juice	Composition	Functions
• Saliva	• Water (99.5%), Solids (0.5%) • Inorganic and organic salts, - Ptyalin, mucin	• Keeps the mouth moist. • Helps in formation of bolus. • Splits starch in to maltose.
• Gastric Juice	• Water (99.45%), Solids (0.55%) HCl (0.4 – 0.5%) • Inorganic and organic salts, mucin, Enzymes : pepsinogen, rennin, lipase etc	• Protein digestion up to peptone and proteoses • Milk degestion
• Pancreatic juice	• Inorganic and organic constituents, Enzymes : trypsinogen, Chymotrypsinogen, Procarboxy peptidase, nucleases, lipase	• Digestion of carbohydrates, proteins and fats
• Bile Juice	• Inorganic salts, bile salts, bile pigments (Bilirubin, Biliverdin), Cholesterol	• Helpuful in digestion of lipid • Removes the acidity.
• Intestinal juice	• Water 98.5% adn Solid 1.5% Activator : Enterokinase Enzymes : Erepsin, nucleotidases, sucrase, maltase, lactase, lipase.	• Digestion of all type of food.

ABSORPTION OF DIGESTED FOOD

Absorption is the process by which the end products of digestion pass through the intestinal mucosa into blood or lymph. It is carried out by passive, active or facilitated transport mechanisms. Small amounts monosacharides like glucose, amino acids and some of electrolytes like chloride ions are generally absorbed simple diffusion. The passage of these substances into the blood depends upon the concentration gradient However, some of the substances like fructose and some amino acids are absorbed with the help of the ca ions like Na^+. This mechanism is called the facilitated transport.

Transport of water depends upon the osmotic gradient. Active transport occurs against the concentra gradient and hence requires energy. Various nutrients like amino acids, monosacharides like glucose, etc

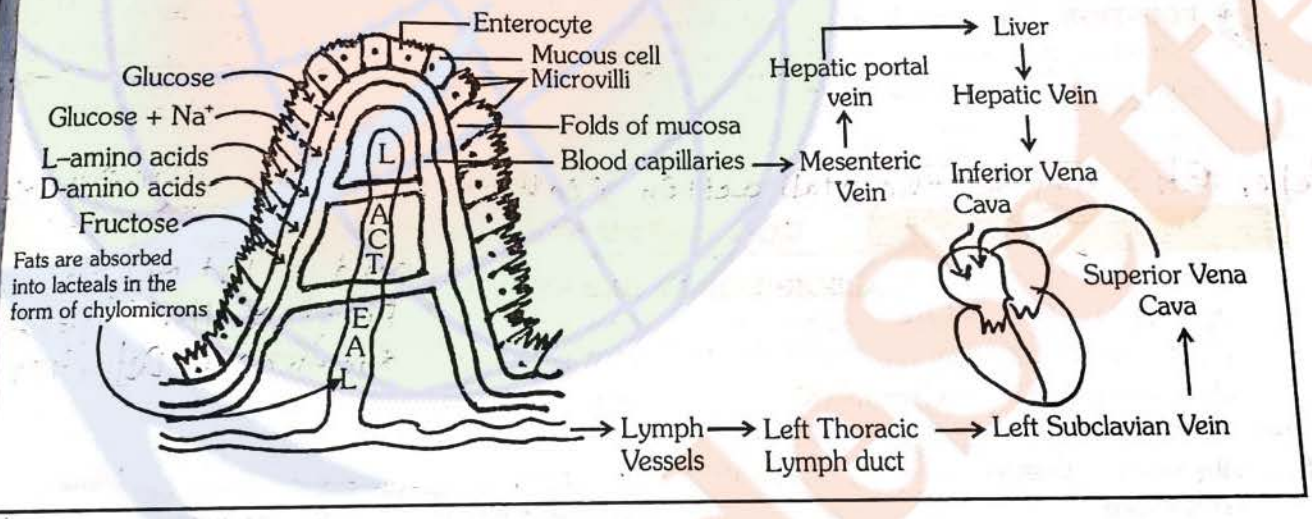
lytes like Na+ are absorbed into the blood by this mechanism. Fatty acids and glycerol being insoluble, cannot be absorbed into the blood. They are first incorporated into small droplets called micelles which move into the intestinal mucosa. They are re-formed into very small protein coated fat globules called the chylomicrons which are transported into the lymph vessels (lacteals) in the villi. These lymph vessels ultimately release the absorbed substances into the blood stream. Absorption of substances takes place in different parts of the alimentary canal, like mouth, stomach, small intestine and large intestine. However, maximum absorption occurs in the small intestine. A summary of absorption (sites of absorption and substances absorbed) is given in

The Summary of Absorption in Different Parts of Digestive System

Mouth	Stomach	Small Intestine	Large Intestine
Certain drugs coming in contact with the mucosa of mouth and lower side of the tongue are absorbed into the blood capillaries lining them.	Absorption of water, simple sugars, and alcohol etc. takes place.	Principal organ for absorption of nutrients. The digestion is completed here and the final products of digestion such as glucose, fructose, fatty acids, glycerol and amino acids are absorbed through the mucosa into the blood stream and lymph.	Absorption of water, some minerals and drugs takes place.

ABSORPTION IN DUODENUM : In duodenum iron and calcium ions are absorbed.

ABSORPTION IN JEJUNUM : Maximum absorption of food takes place in jejunum. (Fats does not follow entero hepatic circulation)



The absorbed substances finally reach the tissues which utilise them for their activities. This process is called assimilation.

The digestive wastes, solidified into coherent faeces in the rectum initiate a neural reflex causing an urge or desire for its removal. The egestion of faeces to the outside through the anal opening (defaecation) is a voluntary process and is carried out by a mass peristaltic movement.

Caloric value :

The amount of heat liberated from complete combustion of 1 gm food in a bomb calorimeter (a closed metal chamber filled with O_2) is its gross calorific value or gross energy value (G.C.V.).

The actual amount of energy liberated in the human body due to combustion of 1 gm of food is the physiologic value (P.V.) of food.

Food substance	G.C.V. (In K.cal/gm)	P.V. In K.cal/gm)
Carbohydrate	4.1	4.0
Protein	5.65	4.0
Fats	9.45	9.0

ASSIMILATION OF FOOD :

(1) **Proteins and amino acids -** Amino acids are not stored in body as they are highly reactive so converted i proteins which are building blocks of body. Excess of amino acids are converted into Glucose by Gluconeogen in liver. NH_3 is removed in this process and step is deamination. Deamination takes place in each and every of body but liver and kidney are chief sites of deamination.

(2) **Carbohydrates**
- Glucose is instant source of energy.
- Glucose ⟶ Glycogen in liver (Glycogenesis) (Glycogen is stored food material
- Whenever required, Glycogen ⟶ Glucose (Glycogenolysis)
- Amino acids and fats ⟶ Glucose in liver (Gluco neogenesis)
- Lactic acid formed in muscles ⟶ Glycogen in liver by Glyconeogenesis

(3) **Fats -**
- Stored in body, help in insulation and thermoregulation.
- Rich source of energy

(4) Minerals, water and vitamins plays vital role in many vital processes of body.

EGESTION : Undigested food material is stored in the form of faecal matter in rectum. Removal of fa matter from body is called egestion. Faecal matter is yellowish brown in color due to the presence of pigments (Stercobilin). These two are formed due to degradation of bile pigments. Foul smell in excreta is to the presence of CH_4, NH_3, indole, scatole, tryphtophan and H_2S.

It is Reflex action due to the Mass action contraction, so that urge Develo and exist out the Fikal matter this is known as the Defikition

BEGINNERS BOX-6

ABSORPTION OF DIGESTED FOOD

1. Amino acids are absorbed in-
(1) Blood capillaries of villi (2) Wall of rectum
(3) lacteals and blood capillaries of villi (4) lacteals of villi

2. Absorption of digested food chiefly occurs in-
(1) Stomach (2) Colon (3) Small Intestine (4) Large Intestine

3. Excess amino acids are deaminated & converted into urea in -
(1) Kidneys (2) liver (3) Spleen (4) Pancreas

4. _____ is the instant source of energy.
(1) Glucose (2) Fructose (3) Galactose (4) Maltose

5. Fats are absorbed in _____
(1) Lacteals in stomach (2) Lacteals in colon (3) Lactelas in jejunum (4) Blood capillaries in deoden

6. Removal of waste from body in the form of undigested food in called
(1) digestion (2) absorption (3) assimilation (4) egestion

DISORDERS OF DIGESTIVE SYSTEM

1. **Kwashiorkor –**

It is a protein deficiency disease. It commonly affects infants and children between **1 to 3 year** of age.

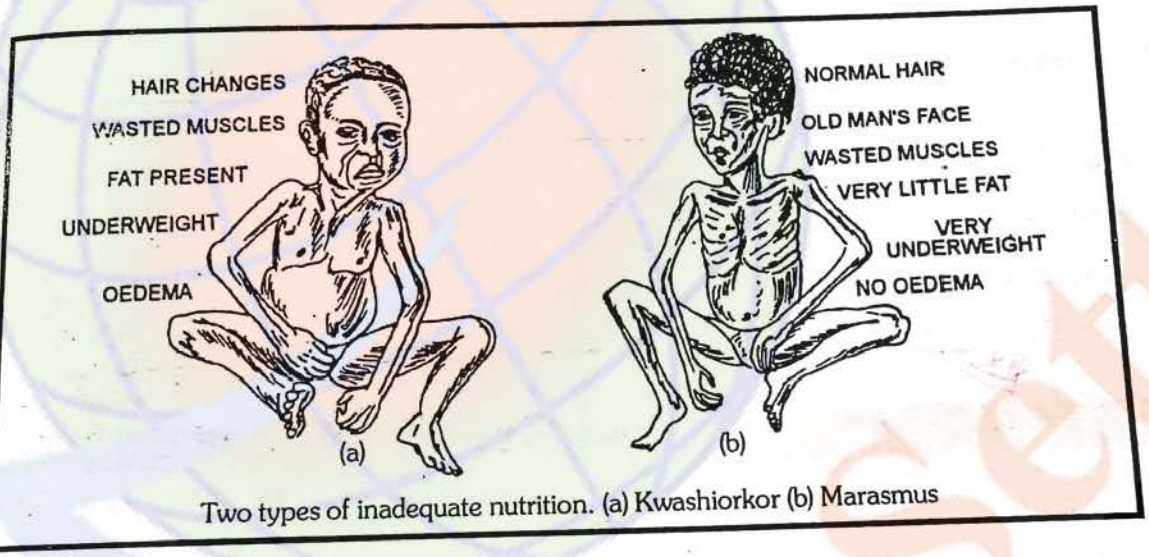
Symptoms – Underweight, stunted growth, poor brain development, loss of appetite, anaemia, **oedema** on lower leg and face.

Cure – Proteins are necessary for growth, repair of tissue and for body defence therefore adequate amount of proteins must be present in the diet.

Daily requirement – 1 gm protein per kg. body weight in adult.

2 gm protein per kg body weight in growing children.

Sources in food – Cereals, pulses, meat, fish, milk, groundnut, peas, leafy vegetables etc.



Two types of inadequate nutrition. (a) Kwashiorkor (b) Marasmus

2. **Marasmus –** It is caused by protein-energy-malnutrition(PEM) or deficiency of protein and total food caloric value. It mainly occur in the age group of **one year** in newly born baby.

Symptoms – Impairs physical growth, subcutaneous fat diseappears, ribs become very prominent, limbs become thin and skin becomes dry, thin & wrinkled. There is **no oedema** on leg and face but loss of weight occurs.

Cure – Diet with adequate proteins and proper caloric value should be given to the infants.

Source in food – Same as kwashiorkor.

3. **Hypercholesterolemia (Overnutrition)** – It is caused due to intake of excess of saturated fat such as butter, ghee, red meat, egg. Cholesterol level in blood rises abnormally (hypercholesterolemia) this may cause thrombosis and heart attack.

4. **Obesity (Overnutrition)** – It is caused by excessive intake of high caloric nutrients such as sugar, ho... saturated fat. Fat accumulates in the tissue. This may cause high blood pressure, diabetes and heart d... Regular exercise and taking of green leafy vegetable are recommended to such persons.

5. **Hypervitaminosis (Overnutrition)** – It is caused by excessive intake of vitamin. Such as excess of vitam... causes deposition of calcium in soft tissue. Excess of vitamin A causes lack of appetite, itching rash etc. Hypervitaminosis of 'D'-Nausea, anorexia, hypercalcaemia, hyperphosphetemia, calcification of soft tis...

6. **Fluorosis** – It is caused by excessive intake of fluorine. It is characterised by mottled (brownish discolour... teeth.

7. The inflammation of the intestinal tract is the most common ailment due to bacterial or viral infections ... infections are also caused by the parasites of the intestine like tape worm, round worm, thread worm, h... worm, pin worm, etc.

8. Jaundice: The liver is affected, skin and eyes turn yellow due to the deposit of bile pigments.

9. ***Vomiting:*** It is the ejection of stomach contents through the mouth. This reflex action is controlled by vomit centre in the medulla. A feeling of nausea precedes vomiting.

10. ***Diarrhoea:*** The abnormal frequency of bowel movement and increased liquidity of the faecal discharg... known as diarrhoea. It reduces the absorption of food.

11. ***Constipation:*** In constipation, the faeces are retained within the rectum as the bowel movements o... irregularly.

12. ***Indigestion:*** In this condition, the food is not properly digested leading to a feeling of fullness. The cause... indigestion are inadequate enzyme secretion, anxiety, food poisoning, over eating, and spicy food

BEGINNERS BOX-7

DISORDERS

1. Kwashiorkar disease is due to deficiency of :
   (1) protein (2) fat
   (3) sugar (4) hormone

2. Continued consumption of a diet rich in butter, red meat and eggs for a long period may lead to :
   (1) vitamin A toxicity (2) kidney stones
   (3) hypercholesterolmia (4) urine laden with ketone bodies

3. Marasmus disease is caused due to :
   (1) Protein deficiency (2) Obesity
   (3) Dwarfism (4) Deficiency of vitamins

Food is one of the basic requirment of all living organisms. The major component of our food are carbohydrates, proteins and fats. Food provides energy and organic materials for growth and repair of tissues. Deficiency of food will will lead to protein energy malnutrition (PEM).
Which one of the following disease is characterized by PEM ?
(a) Marasmus with changes in hair
(b) Kwashiorkar with wasted muscles
(c) Marasmus with old man's face
(d) Marasmus with oedema.
(1) a, b (2) b, c (3) c, d (4) a, b, c

5. Balanced diet is diet rich in carbohydrates, mild in protein and low in fats with essential vitamins and minerals. Deficiency of proteins in diet of a children between age group of 1 to 3 will not lead of following symptoms.
(1) Wasted muscles (2) Oedema (3) Dwarfism (4) Prominent ribs

6. Hypernutrition of which one of the following will read to itching rashes :
(1) Proteins (2) Vitamin-D (3) Fats (4) Vitamin -A

7. Brownish discolouration of teeth is due to :
(1) Hypointake of flourine
(2) Hyperintake of vitamin-C
(3) Hyperintake of flourine
(4) Hypointake of vitamin-C

8. Match the Column I & Column II correctly :

	Column I		Column II
A	Marasmus	(i)	Itiching rashes
B	Kwashiorkar	(ii)	Increase chance of thrombosis
C	Hypercholes terolmia	(iii)	Old man's face
D	Hypervitaminosis-A	(iv)	Oedema

(1) A - (iii), B - (ii), C - (iii), D - (iv)
(2) A - (iii), B - (iv), C - (ii), D - (i)
(3) A - (iii), B - (iv), C - (i), D - (ii)
(4) A - (i), B - (iv), C - (iii), D - (ii)

VITAMINS

- The study of vitamins is called as vitaminology.
- Vitamins were discovered by "Lunin".
- The term "Vitamin" was given by "Funk" and "Hopkins" (B_1 from unpolished rice–1912)
- Vitamins are micronutrients, biological regulators and metabolic regulators (Vitamin theory)
- Vitamins are important to maintain health, but cannot synthesize in the body.
- Earliest known vitamin = vitamin 'C' (James Lind – scottish naval surgeon – 1747)
- Earliest extracted vitamin = Vitamin - B_1

Vitamins are following types –

(1) Fat soluble vitamin → vitamin A, D, E and K
(2) Water soluble vitamin → B Complex and C

Vitamin	Common name	Source	Deficeincy disease	Symptoms	Functions
B_1	**Thiamine**	Wheat, Gram, Peanuts, Yeast, Beans	**Beri-beri/** Polyneuritis/ Cardio vascular atrophy	Loss of appetite, Fatigue, Muscle Atrophy, Paralysis, Cardiomegaly	From coenzymes carbohydrate metabolism help in pentose metabo Co-enzyme of Carboxy and TPP
B_2	**Riboflavin** vitamin-G or Yellow Enzyme	Yeast, Liver Milk, Cheese, Leafy Vegetables and **Intestinal Bacteria**	**Cheilosis,** Glossitis, Keratitis	Eye Inflam-mation and Lip sores	Part of coenzymes (FMN & FAD) in ETS, needed oxidation of ER
B_5	**Pantothenic acid,** Yeast Factor	Yeast Peas, Liver, **Max. in Wheat Honey**	**Burning feet syn-drome**	Abnormal Adrenal functioning, Nerve degeneration	Part of coenzyme A in respiration, require for ne formation, Formation actylcholine, For nor adrenal gland
B_3	**Niacin/** Vitamin 4-D/ PP-Factor	Yeast Gram, Peanuts and Meat	**Pellagera,** Diarrhoea, Dermatitis, Dementia, **Death (4-D Syndrome)**	Scaly skin, Dehydration, Loss of Memory	Part of coenzymes NAD & NADP that acts as hydrog acceptors and donors functioing of gastro-intes tract, and nervous system
B_6	**Pyridoxine**	Meat Milk, Wheat, Liver, Banana	Nausea and Vomiting	Skin lesions, CNS disorders and convoulsions	Part of coenzymes pyrido phosphate require formation of amino acids & glycogen synthesis
B_9	**Folic acid/** Folacin/ Vitamin-M	Liver, Green Vegetables, Banana and Oranges	**Macrocytic anaemia**	Impairment of antibody synthesis and stunted growth Ulceration in mouth	Part of coenzymes in nucl acid (Purine and pyrimidi synthesis and prote synthesis, Erythropoiesis, C division in bone marrow

B_{12}	**Cyano - Cabalamine**	Liver and Eggs Intestinal Bacteria	**Pernicious anaemia**	Large and immature RBC nucleated RBC's without hemoglobin	Coenzymes for nucleic acid synthesis
C	**Ascorbic Acid**	**Amla** Citrus Fruits, Tomatoes	**Scurvy,** Anaemia, Joint pain	**Bleeding Gums,** Loose Teeth, Aneamia and Painfull Swollen joints	Play an important role in **collagen formation,** functioning of Adrenal gland, Anti -oxidant, Erythropoiesis, Absorption of Ca^{+2} and Fe^{+2}
D	**Calciferol** it is Synthesis from Body	Fish Liver oil, Egg Yolk, Milk and Liver	**Rickets** in Children and Ostomalacia in Adults	Weak and Soft bones distorted Skeleton and Poor muscular development	Facilitates Ca and P absorption by intestine
E	**Tocopherol/** Antisterlity/ Beauty Vitamin	Leafy Vegetables, Cereals and Vegetable oils	Macrocytic Anaemia, **Muscular dystrophy**	Destruction of RBC	**Antioxidant** and plays an important role in ETS, **Selenium metabolism,** formation of RNA, DNA and RBC
A	**Retinol**	Yellow and Green Vegetables, Fruits, Milk and Butter	**Nightblindness** (Nyctalopia) **Xeropthalmia** Dermatitis	Keratinisation of skin, respiratory and urinogenital tract	Growth Prevent keratinization of epithelia
K	**Menadione/ Phylloquinone/** Napthoquinone	Leafy Vegetables, Soyabean oil and **Intestinial Bacteria**	**Severe bleeding**	Slow or delayed blood clotting	Synthesis of prothrombin for normal blood clotting, Present in **intestinal bacteria**
H	**Biotin/** Vitamin-B_7/ Antiavidin	Vegatables and Fresh Fruits, Liver, Milk, Eggs	**Dermatitis**	Scaly skin Muscle pain and weakness	Coenzyme in fatty acid synthesis and change of pyruvate into **OAA**

WINNING STROKE

1. Citrin is also known as vitamin 'P' and controls vascular permeability.
2. Vitamin B_{17} – It is recently discovered anticancer vitamin.
3. Vitamin Q – helps in blood clotting.
4. Vita B_{15} – It is also known as pogonic acid, deficiency causes disorder in liver.
5. Antinueritic Vitamins - A, E and C.
6. Nature's most potent antioxidant - vitamin E, which is maximum in liver.
7. Vitamin B_{12} is absent in plants, However it is considered that Spirulina (an alga) contains B_{12}
8. Anticancer vitamins-A, B_{17}, C etc.
9. Certain B-vitamins are coenzymes

BEGINNERS BOX-8

VITAMINS

1. Deficiency of Vitamin A causes -
(1) Retarted growth (2) Scurvy (3) Beri-Beri (4) Rickets

2. Scurvy is a disease caused by -
(1) A virus
(2) Deficiency of Vit E
(3) Deficiency of Vit. C
(4) Deficiency of Vit. D

3. Vitamin necessary for blood clotting -
(1) A (2) E (3) C (4) K

4. Vitamin -K is required for -
(1) Regulation of Ca and P metabolism
(2) Respiration
(3) Carbohydrate metabolism
(4) Synthesis of prothrombin in liver required for blood clotting.

5. Beri-Beri is caused due to-
(1) Defeciency of Vitamin B_1
(2) Defeciency of Vitamin B_2
(3) Defeciency of Vitamin B_{12}
(4) Defeciency of Vitamin C

6. Ascorbic acid is the -
(1) Vitamin A
(2) Vitamin C
(3) Vitamin E
(4) Biotin

Vitamin A from carotene is synthesized in-

(1) Spleen
(2) Skin
(3) Pancreas
(4) Liver

Vitamin promoting wound healing is-

(1) B
(2) A
(3) D
(4) C

Night blindness is caused due to deficiency of Vitamin

(1) B
(2) C
(3) D
(4) A

SUMMARY

The digestive system of humans consists of an alimentary canal and associated digestive glands. The alimentary canal consists of the mouth, buccal cavity, pharynx, oesophagus, stomach, small intestine, large intestine, rectum and the anus. The accessory digestive glands include the salivary glands, the liver (with gall bladder) and the pancreas. Inside the mouth the teeth masticates the food, the tongue tastes the food and manipulates it for proper mastication by mixing with the saliva. Saliva contains a starch digestive enzyme, salivary amylase that digests the starch and converts it into maltose (disaccharide). The food then passes into the pharynx and enters the oesophagus in the form of bolus, which is further carried down through the oesophagus by peristalsis into the stomach. In stomach mainly protein digestion takes place. Absorption of simple sugars, alcohol and medicines also takes place in the stomach.

The chyme (food) enters into the duodenum portion of the small intestine and is acted on by the pancreatic juice, bile and finally by the enzymes in the succus entericus, so that the digestion of carbohydrates, proteins and fats is completed. The food then enters into the jejunum and ileum portions of the small intestine. Carbohydrates are digested and converted into monosaccharides like glucose. Proteins are finally broken down into amino acids. The fats are converted to fatty acids and glycerol. The digested end products are absorbed into the body through the epithelial lining of the intestinal villi. The undigested food (faeces) enters into the caecum of the large intestine through ileo-caecal valve, which prevents the back flow of the faecal matter. Most of the water is absorbed in the large intestine. The undigested food becomes semi-solid in nature and then enters into the rectum, anal canal and is finally egested out through the anus.

Summary of Digestive System

Mouth → Pharynx → Oesophagus → Stomach → Small intestine → Large intestine (colon) → Rectum → Anal canal

Duodenum → Jejunum → Ileum → Ascending → Transverse → Descending

Liver, Gall bladder, Pancreas

NERVOUS SYSTEM

Parasympathetic (Increases secretion of digestive juices)

Sympathetic (Decreases secretion of digestive juices)

Structure

DIGESTIVE SYSTEM

Secretion for Digestion

ENDOCRINE SYSTEM

Gastric movements.

Intestinal Peristalsis

Salivary Secretion	Gastric Secretion	Pancreatic Secretion	Succus Enterius	Bile Secretion
Ptaylin	Pepsin	Chymotrypsinogen,	Erepsin	Emulsifiation of Fats
(Amylase)	Rennin	Trypsinogen,	Dipeptidase	and Absorption of
	Gastric Lipase	Procarboxypeptidase,	Intes tinal lipase	fat-soluble vitamins
	HCl	Elastase	Fats-Fatty acids.	Antiseptic Stimulation
		Amylase	Sucrase,	of peristalisis etc.
		Pancreatic Lipase	Maltase,	
		Nucleases	Lactase,	
			Nucleotideses,	

SALIVARY - GLAND
Secrete Saliva which contain - 99.5% water and 0.5% electrolytes + other substances
- Lysozyme — bactericidal in nature
- Thiocynate

PAROTID - GLAND
- Largest salivary glands
- Viral infection called mumps
- Present near ear

Heterodont

guarded by lips in front.

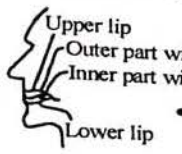
Amylase — Sucrase, — Antiseptic Stimulation

Pancreatic Lipase — Maltase, — of peristalisis etc.

Nucleases — Lactase,

(DNase and RNase) — Nucleotideses,

MOUTH is a transverse slit like aperture guarded by lips in front.



- Lips are movable as orbicularis oris muscles are present.
- Lips are immovable in WHALE and DUCK BILLED PLATYPUS

Heterodont (Different types of teeth are incisors, canines, premolars, molars) (with dental formula 2123/2123)

Diphyodont (Teeth appear twice in life time)

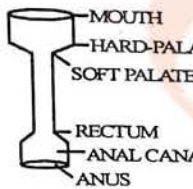
Thecodont (Teeth in sockets)

Consist of hardest substance of animal-enamel (contain maximum amount of inorganic substances)

also contain highly muscular tongue, attached to floor of oral cavity by frenulum. Contain papillia.

Teeth in oral cavity

ORIGIN OF ALIMENTARY CANAL



EPIGLOTTIS (Cartilagenous flap prevent entry of food into Glottis)

Opening of windpipe (Glottis)

PAROTID-DUCT

WHARTON'S DUCT (Longest salivary duct)

PHARYNX

Common passage for food and air

GULLET

Dorsal opening which continues into oesophagus

PAROTID - GLAND

- Largest salivary glands
- Viral infection called mumps
- Present near ear
- Secret ptyalin (Salivary amylase)

SUBLINGUAL GLANDS

- Smallest salivary glands below tongue

SUBMANDIBULAR GLANDS

- Secret maximum saliva

SALIVARY - GLAND

Secrete Saliva which contain - 99.5% water and 0.5% electrolytes + other substances

- Lysozyme, Thiocynate — bactericidal in nature
- Glycoprotein mucin-lubricate food particles
- Salivary amylase

STARCH (30%) → Maltose + dextrin

SALIVA + FOOD = BOLUS

- Ptyalin is not present in saliva of rabbit because its food mainly contain cellulose
- Ptyalin is not present in carnivores as their food mainly contain protein

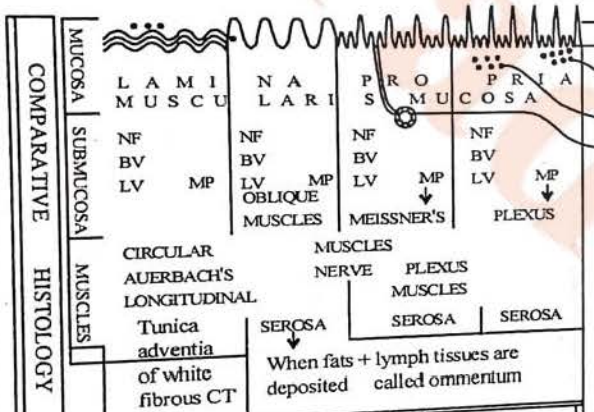
GASTRIC JUICE

Consists of 99.5% water + 0.2% to 0.3% HCl + rest other (enzymes, hormones, mucus)

Three phases of release of Gastric juice are :-

1. Cephalic phase - Parasympathetic nerves ↑ secretion of Gastric juice and sympathetic nerves ↓ secretion of gastric juice. Secretion of gastric juice is mediated by VII, IX, X Cranial nerves
2. Gastric phase
3. Intestinal phase

COMPARATIVE HISTOLOGY OF ALIMENTARY CANAL



Villi

Crypts of Lieberkuhn

Panethcells

Peyers patches

Brunner's glands

- GASTRIC GLANDS
- MULTILAYERED EPITHELIUM

Blunt Villi are in duodenum whereas long and pointed in jejunum and ileum

OESOPHAGUS

- Digestive glands are absent but starch continue to digest upto the last end of oesophagus. Salivary amylase is inactivated by HCl in stomach
- Length of oesophagus depend on length of neck of organism
- Longest oesophagus is in Giraffe
- Food move downward due to regular contraction and relaxation of oesophagus called peristalsis

Cardiac/Gastrooesophagial sphincter

Cardiac orifice

Cardiac part

Fundus part

Pyloric sphincter

Pyloric Orifice

CANNAL LINE — Lesser curvature

BODY — GREATER CURVATURE With Greater Omentum

Stomach consist of → Gastric Glands

Consist of 4 types of cells

- Mucous cells — secrete → mucus - protect inner lining of stomach by action of HCl
- Enteroendocrine cells
  - G-cells → Gastrin - stimulate the secretion of gastric juice
  - D-cells → Somatostatin
  - EC-cells → Serotonin - Vasoconstrictor; Histamine - Vasodilator
- Parietal cells (Oxyntic cells) → Castle Intrinsic Factor - helps in absorption of vitamin B_{12}; HCl (pH = 2 to 3) - (1) inactivate ptyaline (2) Kill bacteria present in bolus (3) Convert inactive enzymes into active enzymes (4) Provide acidic medium in stomach (5) Softens food particles
- (Peptic cells) Chief cells (Zymogen cells) → Gastric emylase (negligible role in starch digestion); Gastric lipase - convert 1% emulsified fats already present in our food into fatty acids and glycerol
- Pepsinogen → Pepsin → Proteins → Proteoses + Peptones + Peptides
- Prorennin (In infants) — HCl → Rennin → Soluble milk protein casein → Insoluble Ca-paracaseinate

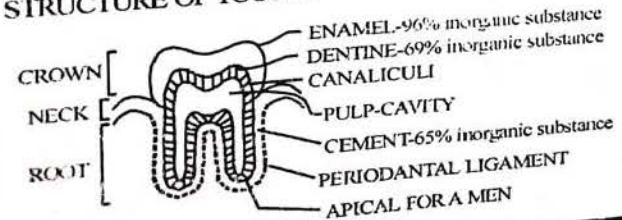
DUODENUM — Smallest Part-25 cm

Jejunum

Ileum

Opens on posteriomedial aspect of caecum

STRUCTURE OF TOOTH :-



ANSWER KEY

BEGINNER'S BOX-1

Que.	1	2	3	4	5	6	7	8	9	10
Ans.	1	1	2	4	1	3	1	1	1	3
Que.	11	12	13							
Ans.	2	3	4							

BEGINNER'S BOX-2

Que.	1	2	3	4	5	6	7			
Ans.	2	4	3	4	2	1	2			

BEGINNER'S BOX-3

Que.	1	2	3	4	5	6	7	8	9	10
Ans.	2	2	2	3	2	3	2	2	1	3

BEGINNER'S BOX-4

Que.	1	2	3	4	5	6	7	8	9	
Ans.	2	3	1	3	3	2	2	1	3	

BEGINNER'S BOX-5

Que.	1	2	3	4	5	6	7	8		
Ans.	2	1	1	1	1	4	1	1		

BEGINNER'S BOX-6

Que.	1	2	3	4	5	6				
Ans.	1	3	2	1	3	4				

BEGINNER'S BOX-7

Que.	1	2	3	4	5	6	7	8		
Ans.	1	3	1	2	4	4	3	2		

BEGINNER'S BOX-8

Que.	1	2	3	4	5	6	7	8	9	
Ans.	1	3	4	4	1	2	4	4	4	

ANATOMY OF ALIMENTORY CANAL, DIGESTIVE GLANDS, HISTOLOGY OF ALIMENTARY CANAL

1. In which animal tongue control the temperature-
(1) Rabbit (2) Dog
(3) Man (4) Cow

2. Enamel of teeth is secreted by :-
(1) Ameloblast (2) Odontoblast
(3) Osteoblast (4) Osteoclast

3. Dental formula of adolescent human being before seventeen year:-
(1) $\frac{2122}{2122}$ (2) $\frac{2123}{2123}$
(3) $\frac{2102}{2102}$ (4) $\frac{2023}{1023}$

4. How many teeth in man grows twice in life :
(1) 32 (2) 28
(3) 20 (4) 12

5. In human teeth, which help in cutting
(1) Canine (2) Incisor
(3) Molar (4) Premolar

6. Molars and Premolars are modified for :
(1) Crushing (2) Tearing
(3) Peristalsis (4) Cutting

7. Pulp cavity of teeth is lined by :
(1) Odontoblast (2) Chondroblast
(3) Osteoblast (4) Amyloblast

8. The longitudinal muscular folds of inner wall of stomach are called :
(1) Papilla of vater (2) Rugae
(3) Villi (4) Fissure

9. Glisson's capsule is associated with :
(1) liver
(2) pancreas
(3) lungs
(4) kidney
(5) adrenal glands

10. Indentify the false statement :
(1) oesophagus does not secrete any enzyme
(2) gall bladder is absent in horse
(3) human teeth are thecodont
(4) there are two pairs of salivary glands in humans

11. Identify the false statement ?
(1) bile is secreted by gall bladder
(2) fundic stomach is the site of digestion
(3) parietal cell lie in wall of stomach
(4) bile is secreted by liver

12. In mammals the teeth are
(a) of different types
(b) embedded in the cuplike socket in the jaw bones
(c) only two sets, present throughout life
The condition are referred as :
(1) heterodont, thecodont, diphyodont
(2) thecodont, heterodont, diphyodont
(3) diphyodont, thecodont, heterodont
(4) heterodont, diphyodont, thecodont
(5) thecodont, diphyodont, heterodont

13. Find out the correct match :

Column I	Column II
A. Hepatic lobule	i. Sub mucosal glands
B. Brunner's glands	ii. Base of villi
C. Crypts of lieberkuhn	iiii. Glisson's capsule
D. Sphincter of Oddi	iv. Gall bladder
E. Cystic duct	v. Hepatopancreatic duct
	vi. Serous glands

	A	B	C	D	E
(1)	iii	vi	ii	v	iv
(2)	v	ii	iii	vi	i
(3)	iii	i	ii	v	iv
(4)	iv	vi	v	ii	i
(5)	iv	ii	vi	v	iii

14. Gall bladder is found :
(1) below right lobe of liver
(2) below left lobe of liver
(3) in between the two lobes of liver
(4) third lobe of liver

15. Bile can be prevented to release into the duodenum by :-
(1) pyloric valve
(2) sphincter of oddi
(3) cardiac sphincter
(4) sphincter of Boyden

16. It is a correct dental formula for the child falling under age group 5-6 years :-
(1) i = 2/2, c = 1/1, pm = 0/0, m = 2/2
(2) i = 2/2, c = 1/1, pm = 2/2, m = 3/3
(3) i = 1/1, c = 2/2, pm = 2/2, m = 3/3
(4) i = 2/2, c = 2/2, pm = 1/1, m = 3/3

PHYSIOLOGY OF DIGESTION

17. Enzyme present in saliva is :
(1) Maltase (2) Ptyalin
(3) Sacrase (4) Invertase

18. Maximum digestion of food take place in –
(1) Stomach (2) Jejunum
(3) Colon (4) Duodenum

19. Absence of which of these in bile will make fat digestion difficult-
(1) Cholesterol (2) Salts
(3) Pigment (4) Acids

20. Pancreatic juice is released into-
(1) Duodenum (2) Ileum
(3) Stomach (4) Jejunum.

21. The three secretions meeting the food in small intestine are-
(1) Bile juice, pancreatic juice and intestinal juice
(2) Pancreatic, intestinal and gastric juice
(3) Bile, pancreatic and gastric juice
(4) Bile, gastric juice and Saliva.

22. Which one of the following hormone inhibits the secretion of gastric juice-
(1) Gastrin (2) Secretion
(3) CCK (4) Enterogastrin

23. The enzyme that catalyse the changing of emulsified oils to fatty acids and glycerol is-
(1) Pepsin (2) Lipase
(3) Amylase (4) Sucrose

24. Point out the odd one-
(1) Rennin (2) Secretin
(3) Calcitonin (4) Oxytocin

25. Which one is not an enzyme of digestive system-
(1) Enterokinase (2) Amylase
(3) Trypsin (4) Enterogastrin

26. Secretin stimulates the production of
(1) Saliva (2) Gastrin
(3) Bile (4) Pancreatic juice

27. The cells in the wall of intestine are stimulated to produce secretin by-
(1) Cholecystokinin (2) Bile juice
(3) Acid in chyme (4) Gastrin

28. Pancreatic lipase acts upon-
(1) Glycogen
(2) Triglycerides
(3) Disacharides
(4) Polypeptides

29. Amount of fat increases in the body due to excess intake of-
(1) Vitamins (2) Minerals
(3) Carbohydrates (4) None of these

30. Bile is formed in-
(1) Gall bladder (2) Liver
(3) Spleen (4) Blood

31. Cholecystokinin is secretion of
(1) Duodenum that causes contraction of gall bladder
(2) Goblet cells of ileum stimulates secretion of cus entricus
(3) Liver and controls secondary sex character
(4) Stomach that stimulates pancreas to rele juice

32. Enzyme trypsinogen is changed to trypsin by-
(1) Gastrin (2) Enterogastrone
(3) Enterokinase (4) Secretin

33. Castle's intrinsic factor is connected with inter absorption of
(1) Pyridoxine (2) Riboflavin
(3) Thiamine (4) Cobalamine

34. Aminopeptidase, a digestive enzyme produces-
(1) Dipeptides (2) Smaller peptides
(3) Peptones (4) Amino acids

35. Highest BMR occurs in-
(1) Elephant (2) Rabbit
(3) Human (4) Whale

36. Maximum number of enzymes occur in-
(1) Omnivorous (2) Herbivores
(3) Carnivores (4) None of the abo

37. Cholesterol is synthesized in-
(1) Brunner's gland (2) Liver
(3) Spleen (4) Pancreas

38. Excessive intake of alcohol caused-
(1) Jaundice (2) Dermatitis
(3) Liver cirrhosis (4) Lung Fibrosis

39. Rennin acts on-
(1) Milk changing casien into calcium paracasein at 7.2 - 8.2 PH
(2) Proteins in stomach
(3) Fat in intestine
(4) Milk changing casien into calcium paracasein at 1-3 PH

40. Inhibition of
creatic and
(1) Gastrin
(2) Enteroc
(3) Gastri
pancreozy
(4) Secret
enter

41. Muscular
(1) Circul
(3) Chev

42. Hormo
juice is-
(1) Ente
(3) Duo

43. Huma
(1) Gly
(3) De

44. Pepsi
(1) Lo
(3) Cl

45. Muc
(1) S
(3) L

46. Cep
(1)
(3)

47. La
(1)
(3)

48. W
g
(1
(2
(3
(

49.

40. Inhibition of gastric and stimulation of gastric, pancreatic and bile secretion are controlled by-
(1) Gastrin, secretin, Enterokinin and CCK
(2) Enterogastrin, gastrin, pancreozymin and CCK
(3) Gastrin, Enterogastrone, CCK and pancreozymin
(4) Secretin, Enterogastrone, Secretion and enterokinin

41. Muscular contraction of Alimentary canal are-
(1) Circulation (2) Deglutition
(3) Chewing (4) Peristalsis

42. Hormone which control the secretion of intestinal juice is-
(1) Enterogastrine (2) Enterocrinin
(3) Duo-crinin (4) Both (2) and (3)

43. Human is unable to digest dietary :-
(1) Glycogen (2) Glucose
(3) Dextrin (4) Cellulose

44. Pepsinogen is converted to pepsin by:-
(1) Low pH (2) Trypsinogen
(3) Chymotrypsin (4) Enterokinase

45. Mucus is secreted by the :-
(1) Stomach (2) Duodenum
(3) Large intestine (4) All of the above

46. Cephalic phase of gastric secretion is mediated by
(1) Neurohormone (2) Parasympathetic
(3) Sympathetic (4) Gastrin

47. Lactose composed of :-
(1) Glucose + galactose (2) Glucose + fructose
(3) Glucose + glucose (4) Glucose + mannose

48. Which of the following stimulates the secretion of gastric juice :-
(1) Gastrin
(2) Enterogasterone
(3) Secretin
(4) Hepatocrinin

49. If for some reason the parietal cells of the gut epithelium become partially non-functional, what is likely to happen ?
(1) The pH of stomach will fall abruptly
(2) Steapsin will be more effective
(3) Proteins will not be adequately hydrolysed by pepsin into proteoses and peptones
(4) The pancreatic enzymes and specially the trypsin and lipase will not work efficiently

50. In stomach after physical and chemical digestion food is called:-
(1) Chyme (2) Chyle
(3) Amino acid (4) Bolus

51. A person who is eating rice. His food contains
(1) Cellulose (2) Starch
(3) Lactose (4) Protein

52. In mammals milk is digested by action of-
(1) Rennin (2) Amylase
(3) Intestinal bacteria (4) Invertase

53. Hydrolytic enzymes which does not act on low pH are called as :-
(1) Protease (2) α–Amylase
(3) Hydrolases (4) Peroxidase

54. A Rabbit eats a lot of gram. Then its digestion starts in :–
(1) Mouth (2) Stomach
(3) Duodenum (4) Ileum

55. Which of the following is a dissacharide :
(1) Glucose (2) Fructose
(3) Sucrose (4) Galactose

56. If all the peptide bonds of protein are broken, then the remaining part is :-
(1) Amide (2) Oligosaccharide
(3) Polypeptide (4) Amino acid

57. Hydrolysis of lipid yields :-
(1) Fats
(2) Fatty acids and glycerol
(3) Mannose and glycerol
(4) Maltose and fatty acid

58. Which of the following vessel in rabbit starts with capillaries and ends in capillaries :
(1) Pulmonary artery (2) Renal vein
(3) Hepatic portal vein (4) Renal artery

59. Glucose and galactose unite to form
(1) Maltose (2) Sucrose
(3) Isomaltose (4) Lactose

60. Injury to vagus nerve in humans is **not** likely to affect –
(1) Gastrointestinal movements
(2) Pancreatic secretion
(3) Cardiac movements
(4) Tongue movements

61. Gastric enzyme pepsin reacts only in acidic medium with in a limited pH concentration. It varies:
(1) 1.20 to 1.80 (2) 1.00 to 1.50
(3) 2.00 to 2.50 (4) 1.50 to 2.60

62. Stomach in vertebrates is the main site for digestion of :
(1) Proteins (2) Carbohydrates
(3) Fats (4) Nucleic acids

63. The chief function of bile is to :
(1) Digest fat by enzymatic action
(2) Emulsify fats for digestion
(3) Eliminate waste products
(4) Regulate digestion of proteins

64. The toxic substance are detoxicated in the human body by :
(1) Lungs (2) Kidneys
(3) Liver (4) Stomach

65. Function of HCl in stomach is to :
(1) Activate trypsinogen to trypsin
(2) Facilitate absorption of food
(3) Dissolve enzymes
(4) Activate pepsinogen to pepsin

66. The end product of carbohydrate metabolism is:
(1) CO_2 and H_2O (2) NH_3 and CO_2
(3) NH_3 and H_2O (4) CO_2

67. In rabbit, the digestion of cellulose takes place in
(1) Colon (2) Ileum
(3) Caecum (4) Rectum

68. The muscular contraction in the alimentary canal is known as :
(1) Systole (2) Diastole
(3) Peristalsis (4) Metachronal

69. End products of protein hydrolysis are :
(1) Mixture of amino acids
(2) Sugars
(3) Peptides
(4) 25 amino acids

70. Ptyalin is an enzyme of
(1) Salivary juice
(2) Pancreatic juice
(3) Instestinal juice
(4) None of these

71. The hormone 'secretin' stimulates secretion of
(1) Pancreatic juice (2) Bile juice
(3) Salivary juice (4) Gastric juice

72. This gastrointestinal hormone stimulates secretion
(1) Gastrin (2) CCK
(3) Secretin (4) GIP

73. Dipeptides are converted into amino acids in presence of :
(1) Lipase (2) Amylase
(3) Nuclease (4) Dipeptidase

74. Secretion of gastric juice is controlled by
(1) Gastrin (2) Chloecystokinin
(3) Enterogastrin (4) None of these

75. Succus entericus is also called :
(1) Gastric juice (2) Intestinal juice
(3) bile juice (4) Saliva

76. Just as hydrochloric acid is for pepsinogen, so is the
(1) haemoglobin to oxygen
(2) enterokinase to typsinogen
(3) bile juice to fat
(4) glucagon to glycongen

77. What is the function of globlet cells :
(1) Production of enzyme
(2) Production of mucin
(3) Production of hormone
(4) Production of HCl

78. Where the lysozymes are found :
(1) In saliva and tears both (2) In tears
(3) In saliva (4) In mitochondria

79. The hormone which lowers the secretion of chloric acid and gastric juice is :
(1) Secretin (2) Enterogastrone
(3) Enterokinin (4) Gastrin

80. Which of the following is different from others
(1) Gastrin (2) Ptyalin
(3) Glucagon (4) Secretin

81. Trypsin differs from pepsin because it digests
(1) Carbohydrate in alkaline medium in stomach
(2) Protein, in alkaine medium in stomach
(3) Protein, in acidic medium of stomach
(4) Protein, in alkaine madium in duodenum

82. Pancreatic juice is :
(1) alkaline in nature
(2) Acidic in nature
(3) enzymatic in nature
(4) Both acidic and alkaline in nature

83. Bilirubin and Biliverdin are present in :
(1) Pancreatic Juice (2) Saliva
(3) Bile juice (4) Intestinal juice

84. The amount of gastric juice secreted per day from man's stomach is about :
(1) 500 ml. to 1000 ml (2)2000 ml to 3000 ml
(3) 100 ml to 500 ml (4) 10 ml to 15 ml

85. The function of enterogasterone hormone is :
(1) to control excretion
(2) to inhibit gastric juice secretion
(3) regulate the absorption of food
(4) to stimulate gastric glands to release gastric juice

86. What is the common passage for bile and pancreatic juices
(1) Ampulla of Vater (2) Ductus Choledochus
(3) Duct of Wirsung (4) Duct of Santorini

87. Pepsinogen is secreted from :
(1) argentaffin cells (2) goblets cells
(3) chief cells (4) parietal cells

88. Cells of the pancreas is not digested by their own enzymes because :
(1) enzymes are secreted in inactive form
(2) cells are lined by mucous membrane
(3) enzymes are released only when needed
(4) none of the above

89. Secretin :
(1) Stimulates enzymes secretion by pancreas, inhibits acid secretion in stomach, stimulates gall bladder
(2) Stimulates bicarbonate secretion by pancreas, inhibits acid secretion in stomach, stimulates bicarbonate secretion by liver
(3) Stimulates acid secretion in stomach, potentiates action of CCK, inhibits intestinal movement
(4) Stimulates gall bladder, inhibits acid secretion in stomach, stimulates bicarbonate secretion by pancreas

90. In horses, rabbits, hares, the cellulose get digested in :-
(1) rumen (2) caecum
(3) stomach (4) appendix

91. Bile salts help in :-
(1) digestion of fats
(2) emulsification of fats
(3) absorption of fats
(4) both absorption and digestion of fats

92. Digestion of protein is completed in :
(1) Stomach
(2) Duodenum
(3) Ileum
(4) Duodenum and ileum

93. Enterogastrone is :
(1) Hormone secreted by mucosa
(2) Enzyme secreted by mucosa
(3) Hormone secreted by duodenal mucosa
(4) Secreted by endocrine gland related to digestion

94. Part of bile juice useful in digestion is :
(1) Bile salt (2) Bile pigment
(3) Bile matrix (4) All of them

95. Bile secretion is proportional to the concentration of :
(1) Protein (2) Fat
(3) Carbohydrate (4) None of these

96. Secretion of pancreatic juice is stimulated by :
(1) Gastrin
(2) Secretin
(3) Enterogastrone
(4) Enterokinase

97. From which of the following pepsin is secreted :
(1) Lungs
(2) Stomach
(3) Salivary gland
(4) Sebaceous gland

98. Secretin hormone stimulates :
(1) Gastric glands
(2) Pancreas
(3) Gall bladder
(4) Crypts of Lieberkuhn

99. pH of gastric juice is :
(1) 2 (2) 4 (3) 6 (4) 8

100. Which of the following hormone helps in secretion of HCl from stomach ?
(1) renin (2) gastrin
(3) secretin (4) somatomedin

101. Pancreatic juice contain bicarbonate which is secreted by :
(1) paneth cells (2) goblet cell
(3) kupffer's cell (4) aciner cell

102. Which of the following hormones help in contraction of gall bladder ?
(1) gastrin (2) secretin
(3) cholecystokinin (4) insulin

103. [illegible] ...etes the hormone secretin?
(1) stomach (2) oesophagus
(3) illeum (4) duodenum

104. Carbohydrate digestion occurs first in which structure?
(1) mouth (2) intestine
(3) stomach (4) none of these

105. Enzyme pepsin acts in :
(1) acidic medium in the pancreas
(2) acidic medium in the stomach
(3) intestine
(4) mouth

106. Which of the following is called pseudo digestive juice ?
(1) Saliva (2) Bile juice
(3) Gastric juice (4) Intestinal juice

107. Secretion of pancreatic juice is stimulated by :
(1) gastrin (2) secretin
(3) enterogastron (4) enterokinase

108. Digestive enzymes are :
(1) hydrolase (2) oxido-reductase
(3) transferase (4) none of these

109. Pepsinogen is secreted by :
(1) chief-cells (2) oxyntic cells
(3) mast cells (4) parietal cells

110. Prorennin is secreted by :
(1) zymogen cells (2) sertoli cells
(3) islets of langerhans (4) hepatacytes

111. Fint out the correctly matched pair :
(1) Pepsinogen → Zymogenic cells
(2) HCl → Goblet cells
(3) Mucous → Oxyntic cells
(4) Pancreatic → Salivary glands
(5) Ptyalin → Acinar cells

112. Among mammals, a significant role in the digestion of milk is played by :
(1) Rennin (2) Invertase
(3) Amylase (4) Intestinal bacteria

113. Secretin and cholecystokinin are digestive hormones. They are secreted in :
(1) Oesophagus (2) Ileum
(3) Duodenum (4) Pyloric stomach

114. Which one of the following is the correct ma[tching] of the site of acion on the given substrate, th[e en]zyme acting upon it and the end product :
(1) Small intestine : proteins $\xrightarrow{\text{pepsin}}$ amino a[cids]
(2) Stomach : fats $\xrightarrow{\text{lipase}}$ micelles
(3) Duodenum : tryglycerides $\xrightarrow{\text{trypsin}}$ monoglycerides
(4) Small intestine : starch $\xrightarrow{\alpha\text{-amylase}}$ disacch[aride] (malt[ose])

115. What will happen if the secretion of parietal [cells] of gastric glands is blocked with an inhibitor :
(1) In the absence of HCl secretion in ac[tive] pepsinogen is not converted into the ac[tive] enzyme pepsin
(2) enterokinase will not be released from [the] duodenal mucosa and so trypsinogen is [not] converted to trypsin
(3) Gastric juice will be deficient in chymosin
(4) Gastric juice will be deficient in pepsinogen

116. Medium in which pepsin active is :-
(1) acidic (2) neutral
(3) isotonic (4) alkaline

117. Which part of our body secretes the hormo[ne] secretin ?
(1) Ileum (2) Stomach
(3) Duodenum (4) Oesophagus

118. Which one of the following enzymes carries [out] the initial step in the digestion of milk in human
(1) Pepsin (2) Rennin
(3) Lipase (4) Trypsin

119. Another substance of the category of glucose, [su]crose and maltose is-
(1) Myoglobin
(2) Starch
(3) Amino acids
(4) Haemoglobin

ABSORPTION – ASSIMILATION – EGESTION

120. Glycogen is stored in-
(1) Blood (2) Liver
(3) Lungs (4) Kidney

121. Lacteals take part-
(1) Digestion of milk
(2) Absorption of fat
(3) Digestion of lactic acid
(4) None of the above

122. Fatty acids and glycerol are first absorbed by-
(1) Lymph vessels (2) Blood
(3) Blood capillaries (4) Hepatic portal Vein

123. Which of the following is absorbed in ileum-
(1) Fat (2) Bile salts
(3) Vit-K (4) Glucose

124. Which food substance is absorbed during digestion-
(1) Carbohydrates (2) Proteins
(3) Vitamins (4) Fats

125. During prolonged fasting-
(1) First fats are used up, followed by carbohydrate from liver and muscles, and protein in the end
(2) First carbohydrate are used up, followed by fat and proteins towards end
(3) First lipids, followed by proteins and carbohydrates towards end.
(4) None of the above

126. During rest, metabolic requirements are minimum. This is indicated by-
(1) Pulse
(2) Breathing
(3) O_2 intake and CO_2 output
(4) All the above

127. Glucose is transported to cell by :-
(1) Na^+ Symport (2) K^+ Symport
(3) Na^+ Antiport (4) K^+ Antiport

128. Water absorption is mainly occur in :-
(1) Colon (2) Intestine
(3) Gastrium (4) Appendix

129. Which of the following is absorbed in proximal intestine :-
(1) Iron (2) sodium
(3) Bile salts (4) Vitamin B_{12}

130. Substances which are not related with hepatic portal circulation :-
(1) L-Amino acid (2) Fatty acid
(3) Glucose (4) Fructose

131. Fully digested food reaches to liver by
(1) Hepatic portal vein (2) Hepatic artery
(3) Hepatic vein (4) All the above

132. Parathormone influences calcium absorption in the small intestine by regulating the metabolism of
(1) Vitamin C
(2) Vitamin D
(3) Vitamin B_6
(4) Enterogasterone

133. The organ in human body where glycogenolysis takes place?
(1) muscles (2) liver
(3) small intestine (4) kidney

134. Gluconeogenesis is :
(1) formation of ammonia from glucose
(2) breakdown of glucose
(3) formation of glycogen
(4) formation of glucose from sources other than carbohydrate

135. Protein are mainly required in the body for-
(1) Growth (2) Repair
(3) Both of these (4) None of these

136. In mammals carbohydrate are stored in the form of-
(1) Lactic acid in muscles
(2) Glycogen in liver and muscles
(3) Glucose in liver and muscles
(4) Glycogen in liver and spleen

DISORDERS

137. Jaundice is a disorder of :
(1) Skin and eyes
(2) Digestive system
(3) Circulatory system
(4) Excretory system

138. Osteomalacia occurs due to the deficiency of :
(1) Vitamin A (2) Vitamin B
(3) Vitamin C (4) Vitmina D

139. Protein deficiency leads to :
(1) kwashiorkar (2) marasmus
(3) cretinism (4) both (1) and (2)

140. A patient is generally advised to specially, consume more meat, lentils, milk and eggs in diet only when the suffers from :
(1) Kwashiorkar (2) Rickets
(3) Anaemia (4) Scurvy

141. Fluoride pollution mainly affects :
(1) Brain (2) Heart
(3) Teeth (4) Kidney

VITAMINS

142. Which of the following vitamins are fat soluble?
(1) A, B, C, K
(2) A, B, D, E
(3) A, D, E, K
(4) A, D, C, K

143. Vitamin B_{12} consists of which type of mineral ?
(1) Co (2) Ni
(3) Fe (4) None of these

144. The deficiency of which vitamin causes Keratomalacia?
(1) Vitamin K
(2) Vitamin D
(3) Vitamin A
(4) Vitamin E

145. Which of the following is a water soluble vitamin?
(1) Vitamin A (3) Vitamin D
(2) Vitamin B (5) Vitamin K
(4) Vitamin E

146. Which of the following is a fat-soluble vitamin and its related deficiency disease?
(1) Retinol : Xerophthalmia
(2) Cobalamine : Beri beri
(3) Calciferol : Pellagra
(4) Ascorbic acid : Scurvy

147. It is present in rod cells and useful in night vision :
(1) vitamin K (2) melanin
(3) rhodopsin (4) vitamin C

148. Deficiency of it, causes loss of appetite, mental confusion, fatigue and muscle depreciation ;
(1) Vitamin K (2) Vitamin C
(3) Thiamine (4) Riboflavin

149. Vitamin D is produced in human body by :-
(1) skin (2) nerves
(3) muscles (4) none of these

150. The beri-beri is a paralytic disease caused by the deficiency of Vitamin B_1 (thiamine). It was discovered by :-
(1) Funk (2) Stanley
(3) Eizkan (4) G.E. Foxon

151. Which of one is correctly matched ?
(1) Vitamin B - Calciferol
(2) Vitamin A - Thiamine
(3) Vitamin D - Riboflavin
(4) Vitamin E - Tocopherol

152. Which of the following are fat soluble vitamins ?
(i) Retinol (ii) Calciferol
(iii) Tocopherol (iv) Riboflavin
Answer codes :
(1) i and ii are correct (2) ii and iv are correct
(3) i and iii are correct (4) i, ii and iii are correct

153. Carrot is rich in
(1) Vitamin K (2) Vitamin D
(3) Vitamin A (4) Vitamin E

154. Which of the following is not a source of vit A?
(1) Apple
(2) Yeast
(3) Carrot
(4) Mango

155. Deficiency of it causes loss of appetite, mental confusion, fatigue and muscle depreciation ;
(1) Thiamine (2) Riboflavin
(3) Vitamin C (4) Vitamin K

156. Consider the following statements :
A. The antipellagra vitamin is nicotinamide, present in milk, yeast, meat and leafy vegetables
B. Crypts, of Lieberkuhn are present in the
C. Steapsin is the pancreatic amylase
(1) A and B correct (2) B and C correct
(3) A and C incorrect (4) A adnd C correct
(5) B and C incorrect

157. Cod and shark liver oil is a source of :
(1) energetic nutrients
(2) protective nutrients
(3) constructive nutrients
(4) energetic and constructive nutrients
(5) protective and constructive nutrients

158. A person deficient in Rhodopsin (visual pigment) should take-
(1) Tomatoes (2) Radish
(3) Carrot (4) Guavas

159. Rickets is caused by the deficiency of-
(1) Vit A (2) Vit C
(3) Vit D (4) Vit B

160. Which vitamins are water soluble-
(1) Vit B & C (2) Vit A & C
(3) Vit C & D (4) Vit A & B

161. Which is the source of Vit C-
(1) Banana (2) Potato
(3) Orange (4) Mango

162. Which disease is caused due to the prolonged deficiency of Nicotinic acid-
(1) Pellagra (2) Rickets
(3) Scurvy (4) Beri-Beri

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3. Pernicious anaemia is caused due to deficiency of vitamin-
(1) C
(3) B_{12}

4. A person with
(1) Milk
(3) Lemons

5. Rickets is dise
(1) Infective d
(2) Deficiency
(3) Commun
(4) Inheritabl

6. Thiamine is
(1) Vit B_2
(3) Vit B_1

7. Vit D is als
(1) Calcifer
(3) Retinol

8. The mine
body may
(1) Iodine
(3) Calciu

9. Deficien
(1) Scur
(3) Slow

10. Which
(1) Vit I
(2) Vit
(3) Thi
(4) Nia

11. Bow-
of Vit
(1) D
(3) B

12. Beri-
caus
(1) E
(3) I

13. Vit
(1)
(2)
(3)
(4)

163. Pernicious anaemia is caused by deficiency of vitamin-
(1) C (2) B_1
(3) B_{12} (4) B_6

164. A person with bleeding gums should daily take-
(1) Milk (2) Carrots
(3) Lemons (4) Butter

165. Rickets is disease of which category-
(1) Infective disease
(2) Deficiency disease
(3) Communicable disease
(4) Inheritable disease

166. Thiamine is another name for-
(1) Vit B_2 (2) Vit A
(3) Vit B_1 (4) Vit B Complex

167. Vit D is also called-
(1) Calciferol (2) Ascorbic acid
(3) Retinol (4) Folic Acid

168. The mineral element whose deficiency in human body may leads to goitre is-
(1) Iodine (2) Fluorine
(3) Calcium (4) Sodium

169. Deficiency of Vit E brings about-
(1) Scurvy (2) Beri- Beri
(3) Slow clotting of blood (4) Impotence

170. Which pairing is not correct-
(1) Vit D -Rickets
(2) Vit K - Sterlity
(3) Thiamine - Beri-Beri
(4) Niacin - Pellagra

171. Bow - shaped legs in children are due to deficiency of Vitamin-
(1) D (2) A
(3) B (4) C

172. Beri-Beri, Scurvy and Rickets are respectively caused by deficiency of -
(1) B, D & C (2) B, C & D
(3) D, B & A (4) A, D & C

173. Vit K is a required for-
(1) Change of Prothrombin to thrombin
(2) Synthesis of Prothrombin
(3) Change of Fibrinogen to Fibrin
(4) Formation of thromboplastin

174. Which of the following pair is characterised by swollen lips, thick pigmented skin of hands and legs and irritability-
(1) Thiamine - Beri-Beri
(2) Protein - Kwashiorkor
(3) Nicotinamide- Pellagra
(4) Iodine - goitre

175. Dermatitis, diarrhoea and dementia are seen in deficiency of :-
(1) Thiamine (2) Riboflavin
(3) Niacin (4) Foliate

176. Which of the following vitamin is an main antioxidant
(1) A (2) B_6
(3) C (4) E

177. β - Carotene is :-
(1) Preformed Vit. A (2) Provitamin A
(3) Synthetic Vit. A (4) None

178. The vitamin that is useful in cancer is vitamin :-
(1) A (2) B_{17}
(3) C (4) All of these

179. Vitamin which induces maturation of R.B.C.:-
(1) B_1 (2) A
(3) B_{12} (4) D

180. Pantothenic acid & Biotin associated with:
(1) Vitamin D (2) Vitamin B complex
(3) Vitamin K (4) Vitamin E

181. Which one is wrong pair :-
(1) Scurvy – Vitamin C
(2) Rickets – Vitamin D
(3) Night blindness (Xerophthalmia) – Vitamin A
(4) Beriberi – Vitamin K

182. Which one correctly matched :-
(1) Vit. E – Tocoferole
(2) Vit. D – Riboflavin
(3) Vit. B – Calciferole
(4) Vit. A – Thiamine

183. Continuous bleeding from an injured part of body is due to deficiency of :-
(1) Vitamin–A (2) Vitamin –B
(3) Vitamin–K (4) Vitamin–E

184. Which one of the following pairs is not correctly matched :-
(1) Vitamin C — Scurvy
(2) Vitamin B_3 — Pellagra
(3) Vitamin B_{12} — Pernicious anaemia
(4) Vitamin B_6 — Beri-beri

185. Vitamin–C is :-
(1) Ascorbic acid (2) Citric acid
(3) Phosphoric acid (4) Glutamic acid

186. Which one of the following is the correct matching of a vitamin, its nature and its deficiency disease :
(1) Vitamin K–Fat soluble–Beri–Beri
(2) Vitamin A–Fat soluble–Beri–Beri
(3) Vitamin K– Water soluble–Pellagra
(4) VitaminA – Fat soluble–Night blindness

187. Scurvy disease is due to the :
(1) Presnce of h-factor in blood
(2) Deficiency of vitamin E
(3) Virus
(4) Deficiency of vitamin C

188. The chemical name of vitamin D is :
(1) Riboflavin (2) Ascorbic acid
(3) Niacin (4) Calciferol

189. Which of the following vitamin synthesised in animal body by bacteria ?
(1) B_1 (2) A
(3) E (4) D

190. Vitamin-C is mainly helpful in :
(1) Growth of bones
(2) Formation of connective tissue
(3) Treatment of anaemia
(4) Formation of visual pigment

191. Which of the following does not belong to vitamin B group :
(1) Riboflavin (2) Nicotin
(3) Cyanocobalamine (4) Tocopherol

192. Deficiency of which vitamin causes night blindness:
(1) Vitamin C (2) Vitamin B
(3) Vitamin A (4) Vitamin D

193. Certain B vitamins are:
(1) Enzymes (2) Co-enzymes
(3) Hormone (4) Digestive substance

194. Deficiency of thiamine causes :
(1) Beri-beri (2) Rickets
(3) Caries (4) Pellagera

195. Vitamin C is helpful in the :
(1) Formation of visual pigment
(2) Growth of bones
(3) Treatment of pernicious anaemia
(4) Wound healing

196. In adults the deficiency of vitamin D causes
(1) Rickets
(2) Beri-beri
(3) Scurvy
(4) Osteomalacia

197. Riboflavin is :-
(1) Vitamin C (2) Vitamin D
(3) Vitamin B_2 (4) Vitamin B_{12}

198. Larger and fragile RBC with less haemogl due to the deficiency of :-
(1) Factor III
(2) Cephalin
(3) Hageman factor
(4) Castle's intrinsic factor

199. Pernicious anaemia is :-
(1) death of WBC
(2) low RBC count
(3) lack of RBC maturation
(4) destruction of young RBC

200. Which one is correctly matched ?
(1) Vitamin E — Thiamine
(2) Vitamin A — Calciferol
(3) Vitamin D — Riboflavin
(4) Vitamin B_1 — Tocopherol
(5) Vitamin B_{12} — Cyanocobalamine

201. Vitamin B_{12} is available to ruminants by :-
(1) plants
(2) animals
(3) microorganisms is caecum
(4) all of the above

202. Vitamins produced by symbiotic intestinal ba include :
(1) E (2) D
(3) B and K (4) A and B

203. Match the following :-

Set I	Set II
A Naphthoquinone	i. Amino acid metabolism
B Niacin	ii. Osteomalacia
C Ascorbic aicd	iii. Matrix of cartilage
D Calciferol	iv. NAD
E Thiamine	v. Prothrombin

(1) A = v, B = iii, C = ii, D = iv, E = i
(2) A = v, B = iii, C = ii, D = iv, E = i
(3) A = v, B = iv, C = iii, D = ii, E = i
(4) A = iii, B = v, C = iv, D = ii, E = i

204. Liver is able to manufacture vitamin:
(1) A (2) B
(3) K (4) D

EXERCISE-I (Conceptual Questions)

ANSWER KEY

Que.	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Ans.	2	1	1	3	2	1	1	2	1	4	2	1	3	1	2
Que.	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30
Ans.	1	2	4	2	1	1	4	2	1	4	4	3	2	3	2
Que.	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45
Ans.	1	3	4	1	2	1	2	3	4	2	4	4	4	1	4
Que.	46	47	48	49	50	51	52	53	54	55	56	57	58	59	60
Ans.	2	1	1	3	1	2	1	2	2	3	4	2	3	4	4
Que.	61	62	63	64	65	66	67	68	69	70	71	72	73	74	75
Ans.	4	1	2	3	4	1	3	3	1	1	1	4	4	1	2
Que.	76	77	78	79	80	81	82	83	84	85	86	87	88	89	90
Ans.	2	2	1	2	2	4	1	3	2	2	1	3	1	2	2
Que.	91	92	93	94	95	96	97	98	99	100	101	102	103	104	105
Ans.	2	3	3	1	2	2	2	2	1	2	4	3	4	1	2
Que.	106	107	108	109	110	111	112	113	114	115	116	117	118	119	120
Ans.	2	2	1	1	1	1	1	3	4	1	1	3	2	2	2
Que.	121	122	123	124	125	126	127	128	129	130	131	132	133	134	135
Ans.	2	1	2	3	2	4	1	2	1	2	1	2	2	4	3
Que.	136	137	138	139	140	141	142	143	144	145	146	147	148	149	150
Ans.	2	2	4	4	1	3	3	1	3	2	1	3	3	1	1
Que.	151	152	153	154	155	156	157	158	159	160	161	162	163	164	165
Ans.	4	4	3	2	1	5	5	3	3	1	3	1	3	3	2
Que.	166	167	168	169	170	171	172	173	174	175	176	177	178	179	180
Ans.	3	1	1	4	2	1	2	2	3	3	4	2	4	3	2
Que.	181	182	183	184	185	186	187	188	189	190	191	192	193	194	195
Ans.	4	1	3	4	1	4	4	4	1	2	4	3	2	1	4
Que.	196	197	198	199	200	201	202	203	204						
Ans.	4	3	4	3	5	3	3	3	1						

EXERCISE-II (Previous Year Questions)

AIIMS 2006

1. Which one of the following pairs of the kind of cells and their secretion is correctly matched :-
(1) Oxyntic cells – a secretion with pH between 2.0 and 3.0
(2) Alpha cells of Islets of Langerhans – that decreases blood secretion sugar level
(3) Kupfer cells – a digestive enzyme that hydrolyses nucleic acids
(4) Sebaceous glands – a secretion that evaporates for cooling

AIPMT 2007

2. Which one of the following is a fat-soluble vitamin and its related deficiency disease ?
(1) Calciferol – Pellagra
(2) Ascorbic acid – Scurvy
(3) Retinol – Xerophthalmia
(4) Cobalamine – Beri-beri

AIPMT 2008

3. Which one of the following is the ***correct matching*** of the site of action on the given substrate, the enzyme acing upon it and the end product ?
(1) *Small intestine*: Proteins $\xrightarrow{\text{Pepsin}}$ Amino acids
(2) *Stomach* : Fats $\xrightarrow{\text{Lipase}}$ micelles
(3) *Duodenum* : Triglycerides $\xrightarrow{\text{Trypsin}}$ monoglycerides
(4) *Small intestine* : Starch $\xrightarrow{\alpha\text{ Amylase}}$ Disaccharide (Maltose)

4. What will happen if the secretion of parietal cells of gastric glands is blocked with an inhibitor ?
(1) In the absence of HCl secretion, inacitve pepsinogen is not converted into the active enzyme pepsin
(2) Enterokinase will not be released from the duodenal mucosa and so trypsinogen is not converted to trypsin
(3) Gastric juice will be deficient in chymosin
(4) Gastric juice will be deficient in pepsinogen

AIPMT 2009

5. Which one of the following pairs of components in humans reaches the stomach undigested?
(1) Starch and cellulose
(2) Protein and starch
(3) Starch and fat
(4) Fat and cellulose

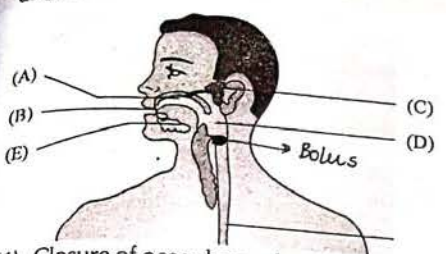
6. A young infant may be feeding entirely on m milk which is white in colour but the stools the infant passes out is quite yellowish. Wha yellow colour due to ?
(1) Pancreatic juice poured into duodenum
(2) Intestinal juice
(3) Bile pigments passed through bile juice
(4) Undigested milk protein casein

7. Which is true about gastric glands ?
(1) Peptic cells secrete pepsin
(2) Oxyntic cells secrete HCl and castle's factor, those are responsible for vit B_{12} absorption.
(3) Mucous cells secrete mucous and intri factor responsible for vit B_{12} absorptio
(4) Pepsinogen digests protein into pepto proteoases.

AIIMS 2011

8. A young person is suffering from cancer in to His tongue is completely removed, then wh the following situation will describe the perso he will not be able to-
(1) Taste sweet & salty.
(2) Not able to taste sweet, but able to taste s
(3) Perceive the odour of rose but not able t sweet and salt.
(4) Taste sweet and salty, but not perceive odour of rose.

What is the real sense inflected in the given diagram ?



(1) Closure of oesophagus for the entry of food in stomach
(2) Closure of trachea by epiglottis for preventing food to enter in it
(3) Movement of bolus in trachea
(4) Movement shown is a reflex action

AIPMT 2014

10. The initial step in the digestion of milk in humans is carried out by ?
(1) Lipase (2) Trypsin
(3) Rennin (4) Pepsin

AIPMT 2015

11. Gastric juice of infants contains :-
(1) nuclease, pepsinogen, lipase
(2) pepsinogen, lipase, rennin
(3) amylase, rennin, pepsinogen
(4) maltase, pepsinogen, rennin

NEET-I 2016

12. In the stomach, gastric acid is secreted by the :-
(1) gastrin secreting cells
(2) parietal cells
(3) peptic cells
(4) acidic cells

13. Which of the following guards the opening of hepatopancreatic duct into the duodenum ?
(1) Semilunar valve (2) Ileocaecal valve
(3) Pyloric sphincter (4) Sphincter of Oddi

NEET-II 2016

14. Which hormones do stimulate the production of pancreatic juice and bicarbonate?
(1) Cholecystokinin and secretin
(2) Insulin and glucagon
(3) Angiotensin and epinephrine
(4) Gastrin and insulin

AIIMS 2016

15. Pancrease secretes :-
(1) Steroid hormones only
(2) Protenacious hormones only
(3) Both steriods and peptide hormones
(4) None of these

16. Choleocystokinin (CCK) helps in secretion of :-
(1) Alkaline buffer
(2) Pancreatic enzymes
(3) Gastric secretion
(4) Water and bicarbonate ions

EXERCISE-II (Previous Year Questions) ANSWER KEY

Que.	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Ans.	1	3	4	1	4	3	2	3	4	3	2	2	4	1	2
Que.	16														
Ans.	2														

EXERCISE-III (Analytical Questions)

EXERCISE-III(A) (NCERT BASED QUESTIONS)

1. Which nutrients can be absorbed as such in a digestive tract ?
(1) Carbohydrates, Vitamins, Lipids
(2) Lipids, Water, Vitamins
(3) Water, Minerals, Vitamins
(4) Vitamins, Water, Proteins

2. By which process complex food stuffs become simplified ?
(1) Assimilation (2) Digestion
(3) Excretion (4) Metabolism

3. Which type of enzymes take part in digestion ?
(1) Hydrolases (2) Oxido-reductases
(3) Synthetases (4) Isomerases

4. X - is a statement and Y - is a reason. Give your opinion of the following.
X - Absorption takes place only in a small intestine.
Y - It is due to intestinal juice.
(1) X - is false, Y - is also false
(2) X - is true, Y - is true
(3) X - is false, Y - is true
(4) X - is true, Y - is false

5. The type of attachment of teeth in a socket of jaw bone is called...
(1) Heterodont (2) Diphyodont
(3) Homodont (4) Thecodont

6. How many milk teeth are present in a child?
(1) 32 (2) 20 (3) 16 (4) 40

7. How many permanent teeth are present in each jaw of human being ?
(1) 08 (2) 32 (3) 20 (4) 16

8. The dental formula of an adult man is...
(1) $\frac{2321}{2321}$ (2) $\frac{1632}{1632}$ (3) $\frac{2123}{2123}$ (4) $\frac{3216}{3216}$

9. How many type of papilla usually found on a tongue of man.
(1) 3 (2) 2 (3) 4 (4) 16

10. Which is the Largest salivary gland in man ?
(1) Parotid
(2) Sub mandibular
(3) Sublingual
(4) None of these

11. In which organ of alimentary canal bile & pancreatic ducts open together ?
(1) Fundus of Stomach (2) Ileum
(3) Duodenum (4) Caecum

12. The innermost layer of alimentary canal is ca
(1) Serosa (2) Mucosa
(3) Sub-mucosa (4) Muscularis

13. Which is the largest gland in a human body
(1) Parotid gland (2) Pancreas
(3) Liver (4) Gastric gland

14. Hepatic cells secrete bile but it stores in to organ ?
(1) Urinary bladder (2) Pancreas
(3) Duodenum (4) Gall-bladder

15. Which gland is known as exocrine as w endocrine gland ?
(1) Pancreas (2) Salivary gland
(3) Liver (4) Pituitary

16. In which juice ptyalin is present ?
(1) Succus entericus (2) Saliva
(2) Gastric juice (4) Pancreatic juic

17. In which organ of alimentary canal digestio absorption of chyme take place ?
(1) Stomach (2) Small intestine
(3) Large intestine (4) Anal canal

18. Which organ is known as a largest chemical f of the body ?
(1) Pancreas (2) Stomach
(3) Liver (4) Duodenum

19. In which organ of digestive tract starch is hydr in maltose ?
(1) Mouth (2) Stomach
(3) Small intestine (4) Liver

20. By which enzyme trypsinogen activated ?
(1) Ptyalin
(2) Enterokinase
(3) Chymotrypsinogen
(4) Chymotrypsin

21. Generally due to irregular meals, tension, a and emotional stress, which disorder occur digestive system ?
(1) Vomiting (2) jaundice
(3) Peptic ulcer (4) Diarrhoea

Which of the follow duodenum of small
(1) Dipeptides → A
(2) Maltose → Glu
(3) Triglycerides →
(4) Lactose → Glu

Consider the foll histological layers the answer from
(a) serosa, musc
(b) serosa, subn
(c) mucosa, sut
(d) mucosa, mu
(1) sequence a
(3) sequence a

Pepsin differs
(1) Proteins i
(2) Proteins i
(3) Proteins
(4) Proteins

Consider th select the op only :-
(a) the ston
(b) Intestin
(c) Mixture
(d) Pancre digest
(1) State
(3) State

Identify carbohy

LACTOS

GALAC

1	La
2	Li
3	A
4	A

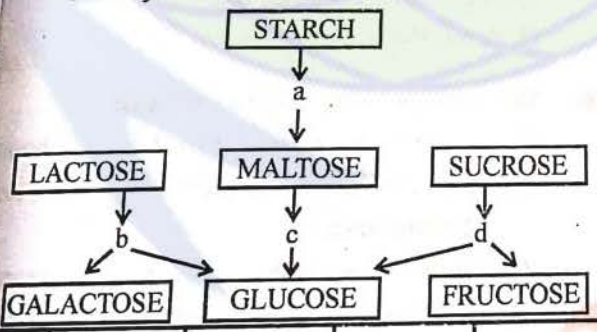
22. Which of the following reaction takes place in duodenum of small intestine :-
(1) Dipeptides → Amino acids
(2) Maltose → Glucose + Glucose
(3) Triglycerides → Monoglycerides + Fatty acid + glycerol
(4) Lactose → Glucose + Glucose

23. Consider the following sequences ('a' to 'd') of histological layers of alimentary canal and select the answer from the options given below. :-
(a) serosa, muscularis, submucosa, mucosa
(b) serosa, submucosa, muscularis, mucosa
(c) mucosa, submucosa, muscularis, serosa
(d) mucosa, muscularis, submucosa , serosa
(1) sequence a and d (2) sequence b and c
(3) sequence a and c (4) sequence b and d

24. Pepsin differs from trypsin in that it digest :-
(1) Proteins in acidic medium in stomach
(2) Proteins in alkaline medium in intestine
(3) Proteins in acidic medium in intestine
(4) Proteins in alkaline medium in stomach

25. Consider the following four statements (a-d) and select the option which includes all the correct ones only :-
(a) the stomach stores food for 30 minutes only
(b) Intestinal juice is also called succus entericous
(c) Mixture of food with saliva is called bolus
(d) Pancreatic juice contain digestive enzymes for digestion of proteins only.
(1) Statements a,c,d (2) Statements b,c
(3) Statements a,b,d (4) Statement d only

26. Identify enzymes a, b, c and d in the digestion of carbohydrates :-



	a	b	c	d
1	Lactase	Amylase	Lactase	Invertase
2	Lipase	Lactase	Maltase	Invertase
3	Amylase	Lactase	Maltase	Sucrase
4	Amylase	Lactase	Maltase	Lipase

27. Match the following -

(a)	Goblet cells	(i)	Enterogastrone
(b)	Zymogen cells	(ii)	Mucus
(c)	Paneth cells	(iii)	Prorennin
(d)	Oxyntic cells	(iv)	Saliva
		(v)	Enzymes of intestinal juice
		(vi)	HCl

(1) a-ii, b-iii, c-v, d-vi (2) a-iii, b-ii, c-vi, d-v
(3) a-iv, b-iii, c-i, d-ii (4) a-ii, b-iii, c-i, d-iv

28. Brunner's glands synthesise and secrete :-
(1) Enzymatic part of pancreatic juice
(2) Nonenzymatic part of intestinal juice
(3) Nonenzymatic part of pancreatic juice
(4) Enzymatic part of intestinal juice

29. Which of the following is the correct sequence of digestion & absorption of fats ?
(1) Fats ⟶ Fatty acids & glycerol ⟶ Micelle ⟶ Chylomicron ⟶ Blood capillaries
(2) Fats ⟶ Fatty acids & glycerol ⟶ Chylomicron ⟶ Micelle ⟶ Blood capillaries
(3) Fats ⟶ Fatty acids & glycerol ⟶ Chylomicron ⟶ Micelle ⟶ Lymph capillaries
(4) Fats ⟶ Fatty acids & glycerol ⟶ Micelle ⟶ Chylomicron ⟶ Lymph capillaries

EXERCISE-III(B) (ANALYTICAL QUESTIONS)

30. Match the following :

Coloum I	Coloum II
(A) Salivary gland	(i) Trypsinogen
(B) Stomach	(ii) Bile pigments
(C) Pancreas	(iii) Saliva
(D) Intestine	(iv) Erepsin
(E) Gall bladder	(v) Gastric juice

(1) A-v, B-iii, C-i, D-ii, E-iv
(2) A-iii, B-v, C-i, D-iv, E-ii
(3) A-iv, B-iii, C-ii, D-i, E-v
(4) A-ii, B-v, C-i, D-ii, E-iv

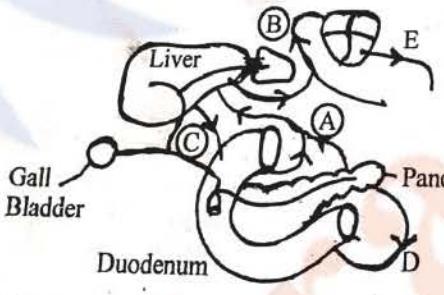
31. Find out the correct match from the following table :-

	Column-I	Column-II	Column-III
A	Goblet cells	Mucus	Prevent mucosa layer from damage of HCl
B	Lysozyme	Saliva	Antibacterial agent
C	Saliva	Subparotid gland	Secrete salivary amylase
D	Oxyntic cells	HCl	Stimulate gastric lipase

(1) Only 'A' (2) A and B
(3) Only C (4) C and D

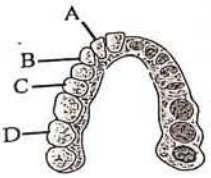
32. Which of the following statements is/are incorrect regarding digestion and absorption of food in human beings :-
(a) About 90% of starch is hydrolysed by salivary amylase in our oral cavity
(b) Entero-endocrine cells in our stomach secrete the proenzyme trypsinogen
(c) Vitamin-D is produced in human body in skin
(d) Bile salts act as activator of pancreatic lipase
(1) Two, a and b
(2) Two, a and c
(3) Two, a and d
(4) Three, a, b and d

33. The diagram given below shows how substances enter into the liver and comes out from the liver. They are labelled as A,B,C,D and E
Which one of the following labelling is the correct one :-



(1) 'A' is hepatic portal vein, 'E' is aorta
(2) 'C' is intestinal vein, 'E' is aorta
(3) 'B' is hepatic portal vein, 'D' is pancreatic artery
(4) 'D' is hepatopancreatic vein, 'E' is aorta

34. Identify A, B, C and D and choose correct regarding their number in complete jaw :



	A	B	C	
(1)	Incisor-2	Canine-2	Premolar-2	Mola
(2)	Incisor-4	Canine-4	Premolar-8	Mola
(3)	Incisor-4	Canine-2	Premolar-4	Mola
(4)	Incisor-2	Canine-1	Premolar-2	Mola

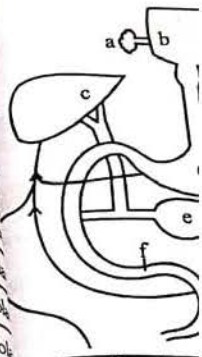
35. Identify the correct match from the colu and III.

	Column-I		Column-II		Colum
A	Salivary gland	a	Lacteal	i	Emulsifica of fat
B	Villi	b	Goblet cells	ii	Wharton
C	Intestinal epithelium	c	Bile juice	iii	Absorptio fat
D	Liver	d	Sub maxillary gland	iv	Mucus

(1) A-d-i, B-a-iii, C-b-iv, D-c-ii
(2) A-d-ii, B-a-iii, C-b-iv, D-c-i
(3) A-a-ii, B-d-iv, C-b-iii, D-c-i
(4) A-b-i, B-a-ii, C-c-iii, D-d-iv

36. Read the following statements (A-D)
(A) The stomach stores the food for 4-5
(B) The food mixes throughly with the intestinal juice
(C) Trypsinogen is activated by an enz enterogastrone, secreted by the inte mucosa
(D) Renin is enzyme found in gastric juice of which helps in digestion of milk prote
How many of the above statements are w
(1) Four (2) One
(3) Two (4) Three

37. Match the columns a
Column 'A'



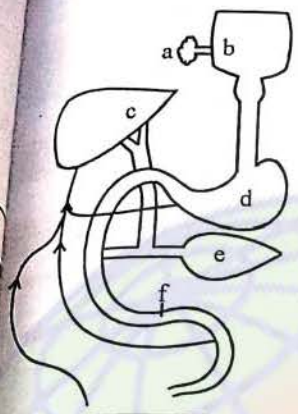
	a	b
(1)	u	v
(2)	z	
(3)	z	
(4)	z	

EXER

ne.	1
ns.	3
ne.	1
ns.	2
ue.	3
ns.	

37. Match the columns and choose the correct answer

Column 'A'

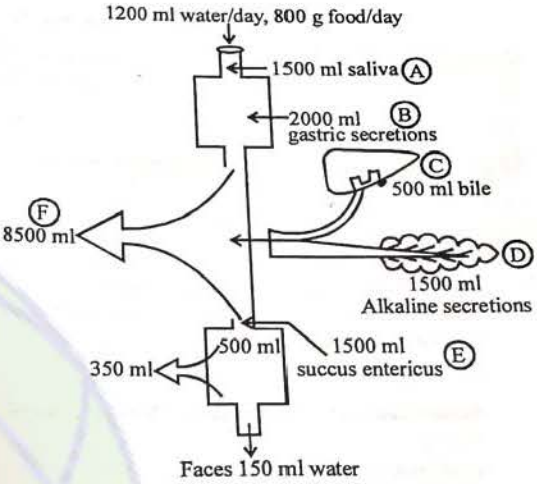


Column 'B'

u. Bile juice
v. Ptyalin
w. Trypsinogen
x. Emulsification of fats
y. HCl and pepsin
z. Salivary gland

	a	b	c	d	e	f
(1)	u	v	w	x	y	z
(2)	z	v	u	y	w	x
(3)	z	v	u	y	x	w
(4)	z	v	u	x	w	y

38.



In the above figure observe the manner of digestion and answer the following questions picking from A to F

(i) This is the largest gland of the body.
(ii) Maximum food is absorbed by hepatic portal system
(iii) This juice is rich in ptyalin to digest cooked starch.
(iv) Secretion of pancreas to digest lipids
(v) This secretion has strongest proteolytic enzyme pepsin.

	i	ii	iii	iv	v
(1)	C	F	A	B	D
(2)	C	F	B	A	D
(3)	C	F	A	D	B
(4)	C	F	B	D	A

EXERCISE-III (Analytical Questions)

ANSWER KEY

Que.	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Ans.	3	2	1	1	4	2	4	3	3	1	3	2	3	4	1
Que.	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30
Ans.	2	2	3	3	2	1	3	3	1	2	3	1	2	4	2
Que.	31	32	33	34	35	36	37	38							
Ans.	2	1	1	3	2	4	2	3							

EXERCISE-IV (Assertion & Reason)

Directions for Assertion & Reason questions

These questions consist of two statements each, printed as Assertion and Reason. While answering these Questions you are required to choose any one of the following four responses.

(A) If both Assertion & Reason are True & the Reason is a correct explanation of the Assertion.

(B) If both Assertion & Reason are True but Reason is not a correct explanation of the Assertion.

(C) If Assertion is True but the Reason is False.

(D) If both Assertion & Reason are false.

1. ***Assertion :-*** Bile helps in emulsification of fats.
Reason :- During emulsification fat is brokendown into fatty acid and glycerol.
(1) A (2) B (3) C (4) D

2. ***Assertion :-*** Acid which reach intestine does not damage it.
Reason :- The mucous along with the bicarbonates from the pancreas protects the in testinal mucosa.
(1) A (2) B (3) C (4) D

3. ***Assertion :-*** Food is get well decorated before serving in restaurants.
Reason :- It stimulates secretion of saliva and gastric juice.
(1) A (2) B (3) C (4) D

4. ***Assertion :-*** Fats are transported into the lacteals in the villi.
Reason :- Fatty acids are insoluble in water.
(1) A (2) B (3) C (4) D

5. ***Assertion :*** Maximum absorption of food occur in jejunum
Reason : Villi & microvilli abundantly present in small intestine
(1) A (2) B (3) C (4) D

6. ***Assertion :*** The second largest digestive gland in our body is pancreas
Reason : Pancreas function both as an exocrine & endocrine gland
(1) A (2) B (3) C (4) D

7. ***Assertion :*** Bile juice is stored mainly in the gall bladder.
Reason : Gall bladder is necessary for digestion
(1) A (2) B (3) C (4) D

8. ***Assertion :*** Small intestine is very long and has plica circularis & villi
Reason : All these increase internal surface area of small intestine for efficient food absorption.
(1) A (2) B (3) C (4) D

9. ***Assertion :*** The alcohol in alcohol addict p is converted into protein in the liver
Reason : Liver cell can produce protein alcohol by fermentation
(1) A (2) B (3) C (4) D

10. ***Assertion :*** Vitamins are not essential for h life.
Reason : Vitamin does not regulate metab
(1) A (2) B (3) C (4) D

11. ***Assertion :*** G - cells of gastric gland se intrinsic castle's factor.
Reason : This factor help in vitamin B_2 absor
(1) A (2) B (3) C (4) D

12. ***Assertion :*** The second largest digestive g in our body is liver.
Reason : Liver functions as an endocrine g
(1) A (2) B (3) C (4) D

13. ***Assertion :*** Removal of gall baldder does the protein digestion.
Reason: Bile juice break the peptide bon
(1) A (2) B (3) C (4) D

14. ***Assertion :*** Gastric glands occur throughou alimentary canal
Reason : Gastric juice inhibits movement of through the alimentary canal
(1) A (2) B (3) C (4) D

15. ***Assertion :*** Faeces are brown coloured
Reason : Faeces contain brown pigment na stercobilin formed by break down of bile pig
(1) A (2) B (3) C (4) D

16. ***Assertion :*** Small intestine is very short an longitudinal fold
Reason : All these decreases the internal su area of small intestine for food absorption
(1) A (2) B (3) C (4) D

17. ***Assertion :*** Vitamins are essential for healt
Reason : Vitamins regulate metabolism
(1) A (2) B (3) C (4) D

8. ***Assertion :*** In hu occurs in duodenum.
Reason : Ampula o
(1) A (2) B

EXER

ue.	1
ns.	3
ue.	1
ns.	4

18. ***Assertion :*** In human, maximum digestion occurs in duodenum.
Reason : Ampula of vater opens in duodenum.
(1) A (2) B (3) C (4) D

19. ***Assertion :*** Chief cells of gastric gland secrete castle's intrinsic factor.
Reason : This factor help in vita. B_2 absorption.
(1) A (2) B (3) C (4) D

20. ***Assertion :*** Bile is not a true digestive juice.
Reason : Bile juice lacks digestive enzymes
(1) A (2) B (3) C (4) D