

DIGESTION AND ABSORPTION

○ **Digestion**: The process of conversion of complex food substances to simple absorbable form is called Digestion.

→ Carried out by mechanical and bio-chemical methods.

○ **Digestive System** consist of alimentary canal and associated glands.

ALIMENTARY CANAL

○ Begin with anterior opening — the mouth and opens out posteriorly through Anus.

○ Mouth lead to Oral Cavity.

○ Oral Cavity has teeth and a muscular tongue.

○ **Thecodont**: Tooth is embedded in a socket of jaw bone. This type of attachment is called thecodont.

○ **Diphyodont**: Human being form two set teeth during their life cycle, A set of temporary milk or deciduous teeth replaced by set of permanent

or adult teeth. This type of dentition is called Diphyodont.

- Permanent teeth are four different type.

Incisors [I], Canine [C], Premolars [PM] and Molars [M]

Dental formulae :

I	C	PM	M
2	1	2	3
2	1	2	3

① Surface of teeth is made up of Enamel → Help in mastication of food.

② Tongue : Attached to floor of Oral Cavity by Frenulum

→ Upper surface of tongue has small projection called Papillae which bears taste buds.

③ Oral Cavity Opens into Pharynx

↓
Common passage for Air and food!

① Epiglottis Prevents the entry of food into glottis [Opening of wind pipe] during swallowing.

② Oesophagus is long tube which extends posteriorly and lead to J-shaped structure stomach.

③ **STOMACH**: Located in upper left portion of abdominal cavity.

Has three parts

a. Cardiac: portion into which Oesophagus open

b. Fundic:

c. Pyloric: portion which opens into first part of small intestine.

→ Sphincter [gastro - Oesophageal] regulates the opening of Oesophagus into Cardiac of stomach.

④ **Small intestine**: Distinguishable into three region

a. Duodenum: It is 'U' shaped

b. Jejunum: long coiled middle portion.

c. Ileum: Highly coiled.

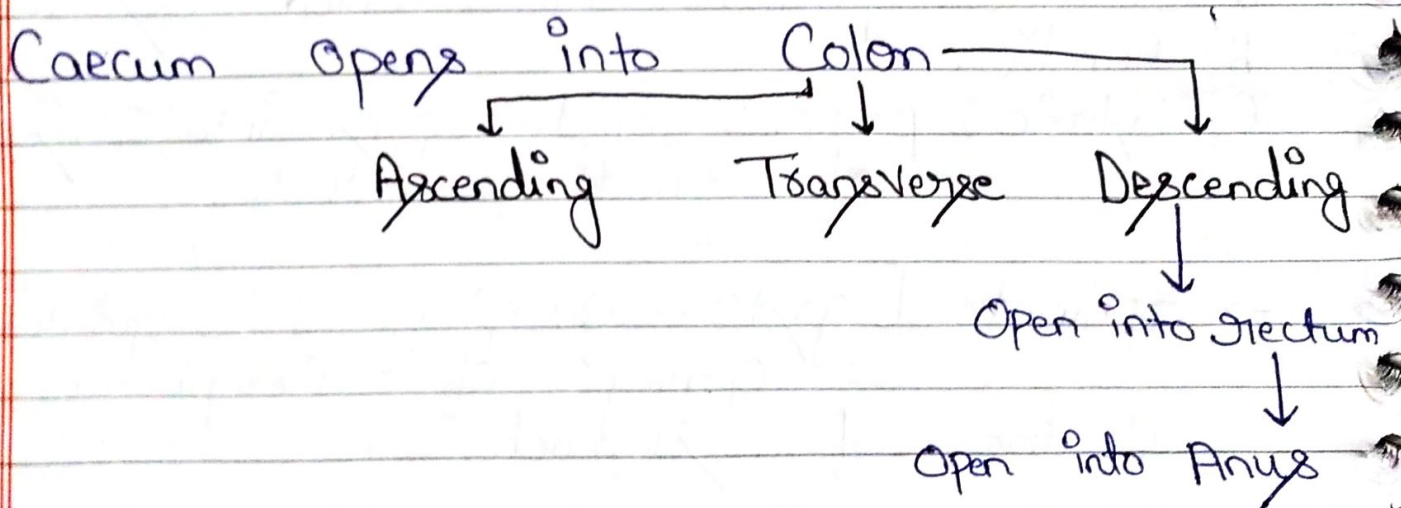
○ Opening of stomach into duodenum is guarded by pyloric sphincter.

○ Ileum opens into large intestine.

○ Large intestine: Consist of Caecum, Colon and Rectum.

→ Caecum is small sac which host some symbiotic micro organism.

Appendix: Vestigial Organ, arises from the Caecum.



○ Alimentary Canal has four layers

- (i) Serosa [ii] Muscularis
- (iii) Sub-mucosa [iv] Mucosa

- [i] Serosa : Outermost layer.
Made up of Mesothelium
- [ii] Muscularis : Formed by Smooth muscles.
Arranged into an inner Circular
and Outer longitudinal layer.
- [iii] Sub-mucosal : Formed by loose Connective
tissue Containing nerve, blood
and lymph Vessels.
- In Duodenum, glands are present in
sub-mucosa

[iv] Mucosa : Inner most layer. lining the
lumen of alimentary Canal.

→ forms irregular fold in stomach and small
finger like folding Called Villi in
small intestine.

→ Cells lining the Villi produce microscopic
projection Called microvilli.

→ Mucosal Epithelium has goblet cells which
secrete mucus that help in lubrication.

DIGESTIVE GLANDS

Include salivary glands, the liver and the pancreas.

○ Salivary glands

→ Produce saliva by three pairs of salivary gland.

→ The parotids [cheek], the sub-maxillary/sub-mandibular [lower jaw] and sub-linguals [below tongue].

○ Liver

→ Largest gland of body.

→ Situated in abdominal cavity, and has two lobes.

→ Hepatic lobules are structural and functional unit, containing hepatic cells arranged in form of cords.

→ Each lobule is ~~connected~~ covered by connective tissue sheath called Glisson's Capsule.

→ Bile secreted by hepatic cells passes through hepatic ducts and is stored and concentrated in a thin muscular sac called gall bladder.

→ Duct of gall bladder along with hepatic duct from liver form the common bile duct.

→ Bile duct and pancreatic duct open together into duodenum as common Hepato-pancreatic duct. which is guarded by a sphincter called Sphincter of Oddi.

Pancreas

→ Elongated organ of 'U' shaped situated b/w limbs of duodenum.

→ Both exocrine and endocrine organ.

→ Exocrine portion secretes alkaline pancreatic juice containing enzymes.

→ Endocrine portion secretes hormones, Insulin and glucagon.

DIGESTION OF FOOD

① Buccal System perform two major functions
Mastication of food and facilitation
of swallowing.

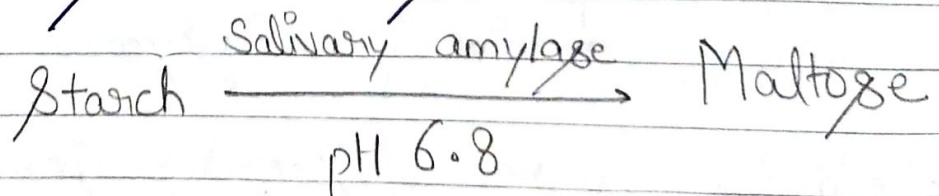
② Mucus in saliva helps in lubricating
and adhering the masticated particles
in bolus.

③ Bolus conveyed into pharynx and open
into Oesophagus by Peristalsis.

④ Saliva contain electrolyte [Na^+ , K^+ , HCO_3^-]
and Enzyme salivary amylase and
lysozyme.

⑤ Chemical process of digestion initiated
in Oral cavity by salivary amylase.

⑥ Salivary amylase hydrolysed 30% of
starch is Maltose



⑦ Lysozyme present in saliva act as
antibacterial agent that prevent infection.

① Gastric gland have three major ~~function~~ Cells.

(i) Mucus neck cell secrete mucus.

(ii) Peptic or Chief Cells secrete Pepsinogen

(iii) Parietal or Oxyntic Cells secrete HCl and intrinsic factor [for absorption of B_{12}].

② Food mixes with acidic gastric juice of stomach and is called Chyme.

③ Pepsinogen On exposure to HCl converted into pepsin [active enzyme]

④ Pepsin Convert protein into proteoses and peptones [peptides]

⑤ Optimal pH for pepsin is 1.8.

⑥ Mucus and bicarbonates play important role in protection of mucosal epithelium from excoriation by HCl.

⑦ Rennin enzyme found in gastric juice of Infant, which help in digestion of milk protein.

⑧ Lipases also secreted by gastric gland.

- ① Bile, Pancreatic juice released into small intestine.
- ② Pancreatic juice contain inactive Enzyme. Trypsinogen, Chymotrypsinogen, lipases, nucleases, Procarboxypeptidases.
- ③ Trypsinogen activated by Enzyme Enterokinase → secreted by intestinal mucosa into active Trypsin
- ④ Bile contain bile pigment [bilirubin and bili-verdin] bile salt, phospholipid but no Enzyme.
- ⑤ Bile help in Emulsification of fats i.e breakdown of fats into very small micelles.
- ⑥ Secretion of brush border cell of mucosa alongwith secretion of goblet cells constitute intestinal juice or Succus entericus.
- ⑦ Contain a variety of Enzymes like Disaccharidases, dipeptidases, lipases nucleosidases etc.

○ Proteins, Proteoses and peptones in Chyme reaching the intestine are acted upon by enzyme of pancreatic juice.

Protein
Peptones
Proteoses } $\xrightarrow{\text{Trypsin / Chymotrypsin}}$ Dipeptides
 $\xrightarrow{\text{Carboxypeptidase}}$

Polysaccharides [starch] $\xrightarrow{\text{Amylase}}$ Disaccharides

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

Nucleic acids $\xrightarrow{\text{Nucleases}}$ Nucleotides \longrightarrow Nucleosides

○ Final steps in digestion occur close to mucosal epithelial cells of Intestine.

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

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

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

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

Nucleoside $\xrightarrow{\text{Nucleosidases}}$ Sugar + Bases.

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

① Breakdown of biomacromolecules mentioned above Duodenum region of small intestine.

② Simple substance formed are absorbed in jejunum and ileum region.

③ Undigested and Unabsorbed substance are pass to large intestine.

④ Function of large intestine are:

[i] Absorption of some water, minerals and certain drug.

[ii] Secretion of mucus help in adhering the waste and particle together and lubricating it for easy passage.

⑤ Undigested, Unabsorbed substances called Faeces enters Caecum of large intestine through ileo - Caecal Valve. which prevent backflow of faecal.

ABSORPTION OF DIGESTED PRODUCTS

- ① Small amount of monosaccharides like glucose, amino acid and electrolyte like chloride ion are absorbed by simple Diffusion.
- ② Substance like fructose and some amino acid are absorbed by Facilitated transport with the help of Na^+ .
- ③ Transport of Water and Various Nutrients like amino acid, monosaccharides like glucose and electrolyte like Na^+ are absorbed by Active transport.
- ④ Fatty acid and glycerol being insoluble Cannot be absorbed into blood.
 - They are first incorporated into small droplets called micelles which move into intestinal mucosa
 - They are re-formed into very small protein coated fat globules called the Chylomicrons which are transported into lymph vessels in Villi.

- ① These lymph vessels ultimately release the absorbed substance into the blood stream.

DISORDERS OF DIGESTIVE SYSTEM

1. **Jaundice**: Liver is affected, skin and eyes turn yellow due to the despoite of bile pigments.

2. **Vomiting**: It is the ejection of stomach content through mouth.

- Control by vomit centre in medulla

3. **Diarrhea**: Abnormal frequency of bowel movement and increased liquidity of faecal discharge.

- ① Reduce Absorption of Food.

4. **Constipation**: The faeces are retained within rectum as bowel movement occur irregularly.

5. **Indigestion**: Food is not properly digested leading to a feeling of fullness. This cause of indigestion are Anxiety, Food poisoning, Over eating.