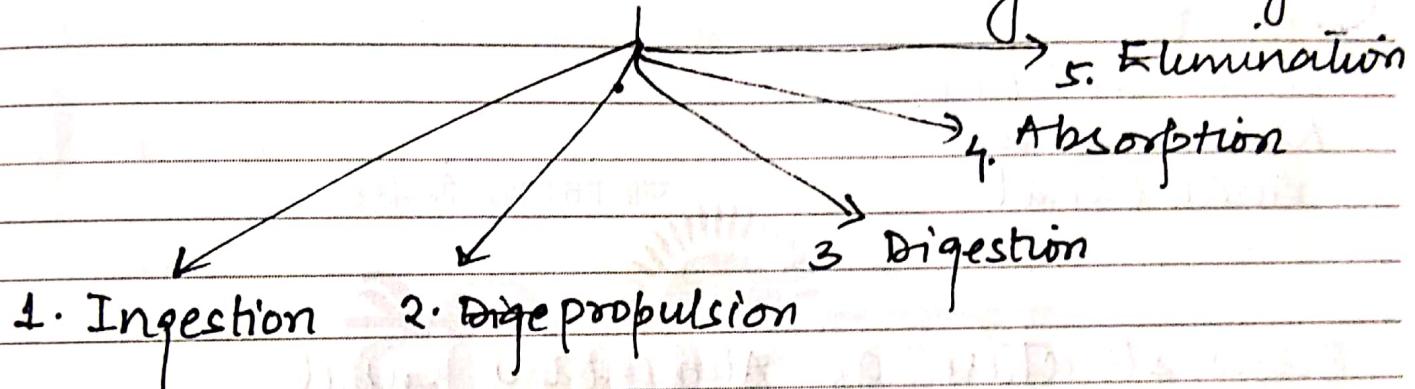


Unit-II Digestive System

→ Digestive System is used for breaking down food into nutrients which then pass into the circulatory system and are taken to where they are needed in the body.

Processes involved in the Digestive System



- Ingestion → taking of food, eating & drinking
- Propulsion → mixing and movement of content in alimentary tract.
- Digestion
 - mechanical breakdown of food (chewing)
 - chemical digestion of food by enzymes
- Absorption → digested food absorbed into the blood and lymph capillaries whereas the food that cannot be digested and absorbed are excreted from the alimentary canal as faeces.

Organs of DS

H- Trish

Notes written

Alimentary tract / GIT

Mouth

Pharynx

Oesophagus

Small intestine with submucosal tract

Stomach

Large intestine

Rectum and

Anal canal

Accessory organs

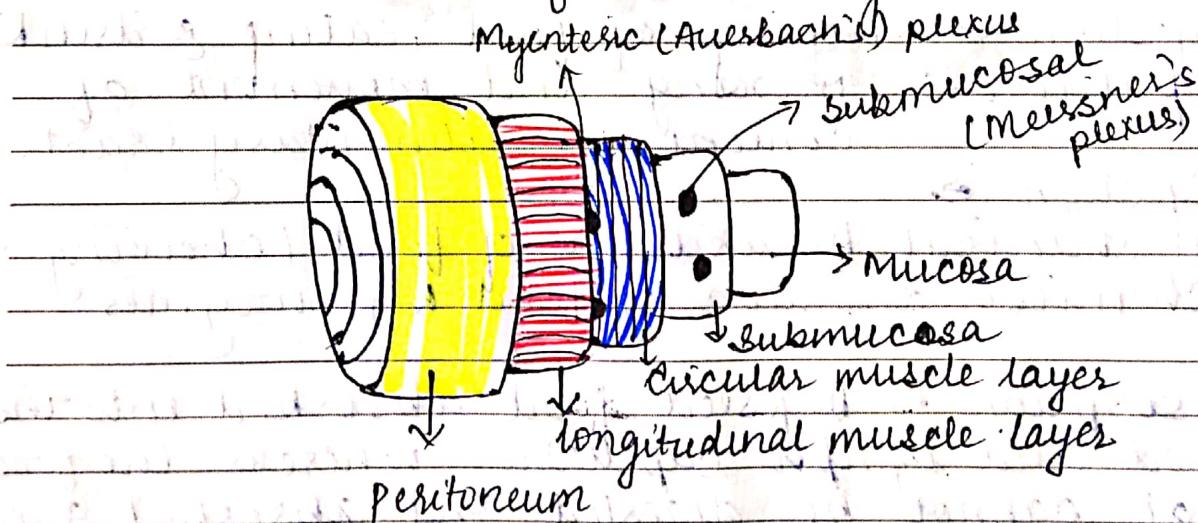
3 pairs of salivary glands

the pancreas

tubes and

submucosal tract

Basic structure of Alimentary canal



1. Adventitia or serosa or peritoneum → outermost layer

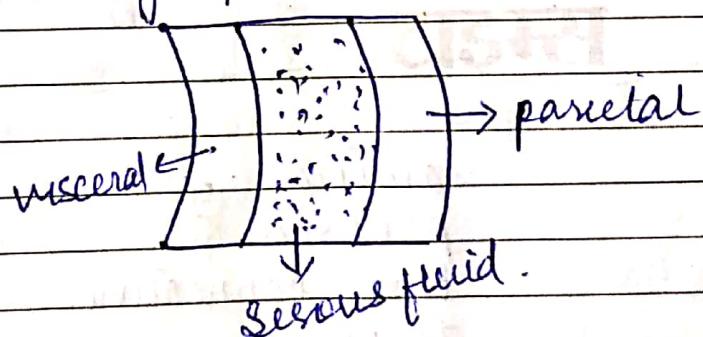
→ peritoneum (largest serous membrane of body)

2 layers

parietal layer
(lines the abdominal wall)

visceral layer
(covers the organs (viscera) within the abdominal & pelvic cavities.)

→ peritoneum → closed sac, contains small amount of serous fluid
→ richly supply to blood & lymph vessels
→ prevent local spread of infection (due to lymph nodes)



2. Muscle layer → 2 layers

a. longitudinal muscle layer → outermost

b. circular muscle layer → inner

B/w these 2, a plexus (network) of sympathetic & parasympathetic nerves called

myenteric or Auerbach's plexus.

- Contraction of smooth muscles is called peristalsis.
- Onward movement of the contents in tract controlled by sphincters (thickened rings of circular muscle, act as valves)

Submucosa

- consist of loose connective tissue collagen and some elastic fibres.
- B/w it, are the network of sympathetic and parasympathetic nerves called Meissner's plexus that supply the mucosal lining

Mucosa

mucous membrane



- columnar epithelium (innermost layer)

- functions:- protection, Secretion, Absorption

lamina propria

loose connective tissue

- protects & nourish the inner epithelial layer

muscularis

mucosa

→ thin outer layer of

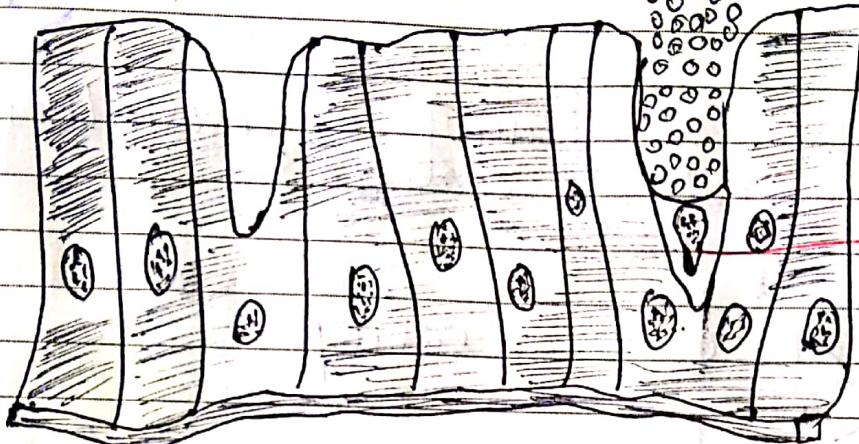
smooth muscle eg: gastric glands, villi

07
007-359

TUESDAY

JANUARY
2020

Mucous membrane



→ Mucus (lubricates the walls of the tract & protects them from digestive system)
→ Goblet mucus

columnar epithelium & goblet cells

Nerve supply

Parasympathetic supply - 1 pair of cranial nerves, the vagus nerves, provides supply to most of the alimentary tract & the accessory accessory organs.

Sacral nerves supply → distal part of tract.

Effects

- ↑ ed muscular activity esp. peristalsis
- ↑ ed glandular secretion

Sympathetic supply :- These form plexus in thorax, abdomen & pelvis from which nerves pass to the organs of the alimentary tract.

→ effect

- ↓ muscular activity e.g. peristalsis
- ↓ glandular secretion

Mouth or Oral cavity

vestibule → oral cavity

(part of the mouth between the gums & the cheeks)

1. Teeth

2. Soft & hard palate
(posterior) Anterior)

3. Uvula

4. palatine tonsil (lymphoid tissue)

5. Tongue

Tongue

→ Mass voluntary muscular structure

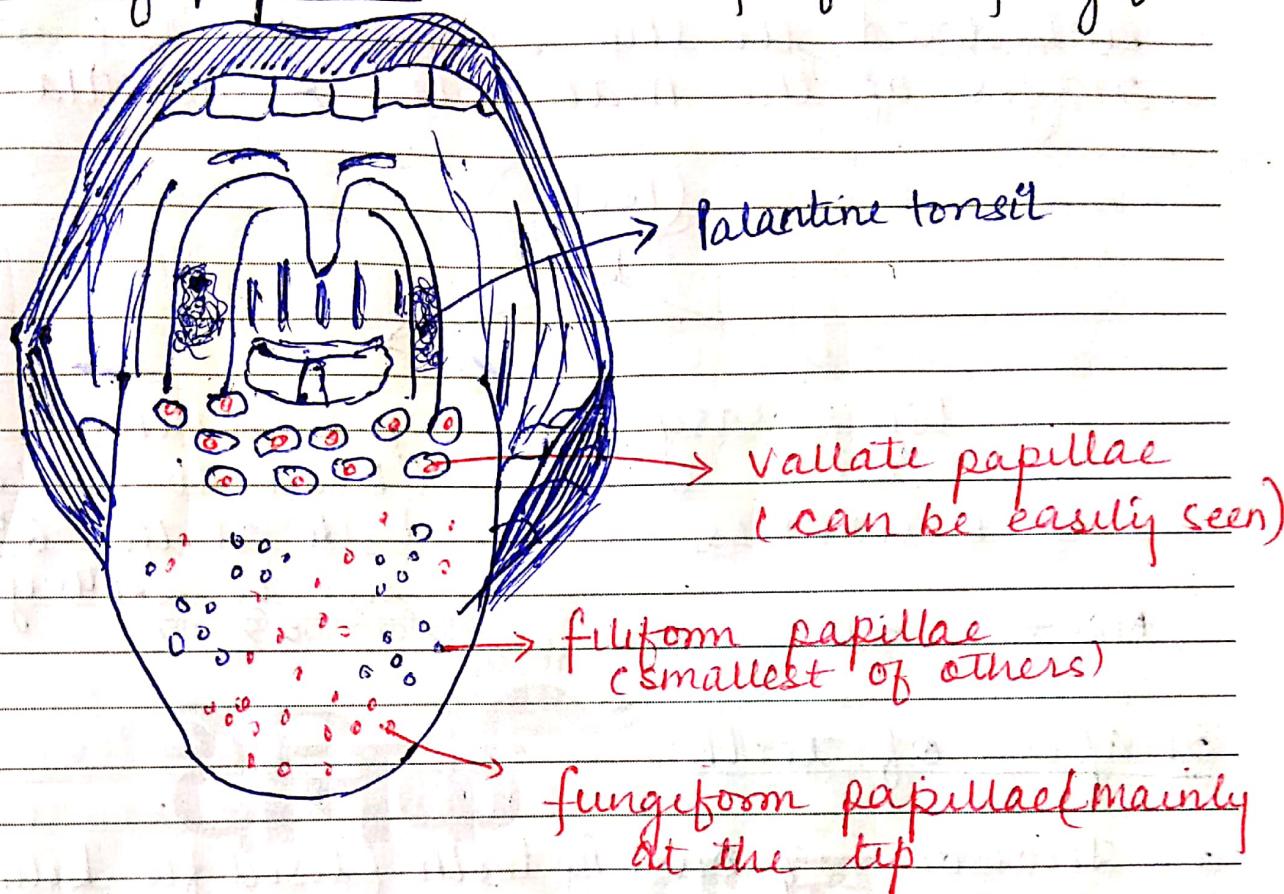
→ consist of papillae (little projections) on the superior surface of tongue, contain sensory receptors for the sense of taste in the taste buds.

09
009-357

THURSDAY

JANUARY
2020

3 types of papillae : vallate, filiform, fungiform



Blood Supply :-

Atery → Lingual branch of external carotid artery
vein → Lingual vein

Nerves : Hypoglossal
Mandibular
Facial & glossopharyngeal nerves

functions : Chewing (Masturbation)
Swallowing (Deglutition)
Speech & taste

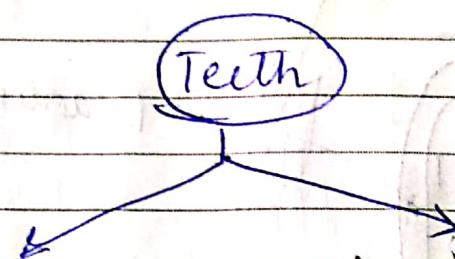
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010-356

FRIDAY

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Teeth

embedded in the sockets of the alveolar ridges of the mandible & maxilla



temporary
or
Deciduous

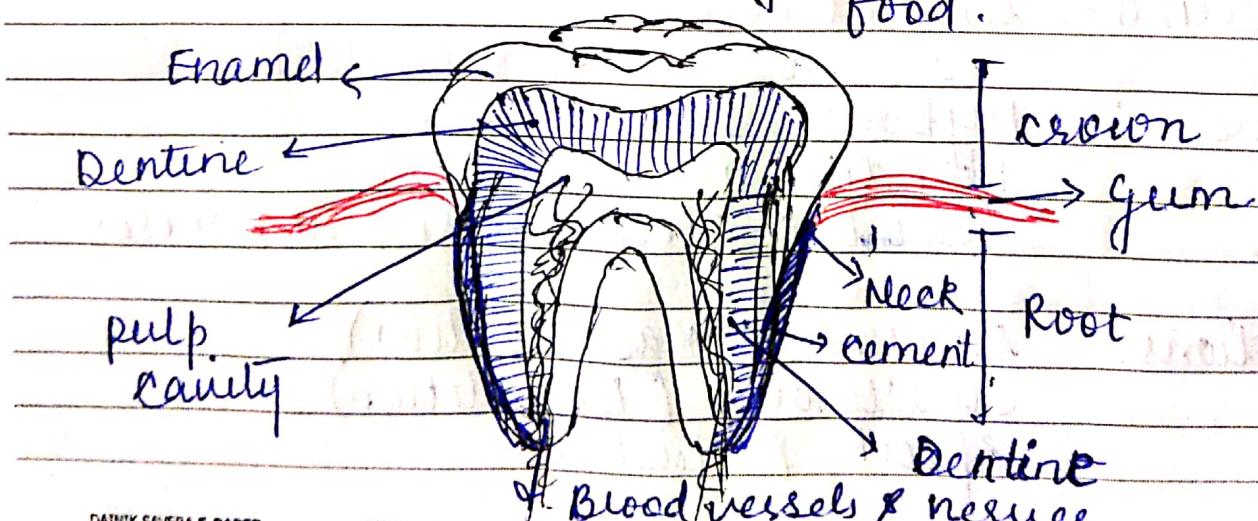
Permanent
(Begin to replace deciduous teeth at the 6th yr of age till to 24th yr)

No. → 20

32

Shapes of teeth

1. Incisor } cutting teeth (used for biting off pieces of food)
2. Canine }
3. premolar }
4. molar } used for grinding or chewing food.



Blood Supply

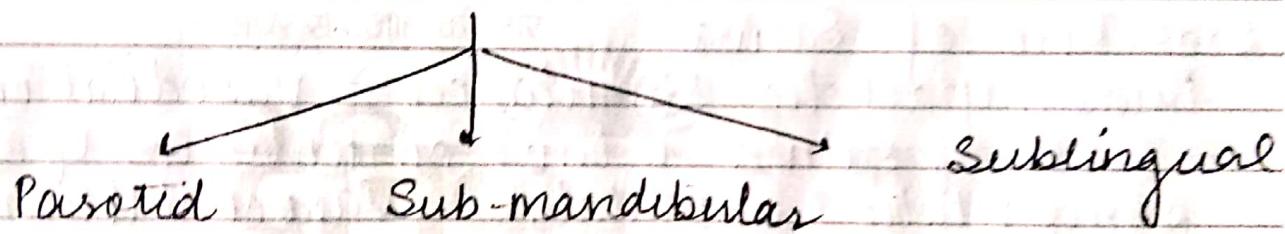
Upper teeth → Maxillary artery & internal jugular veins

Nerve Supply

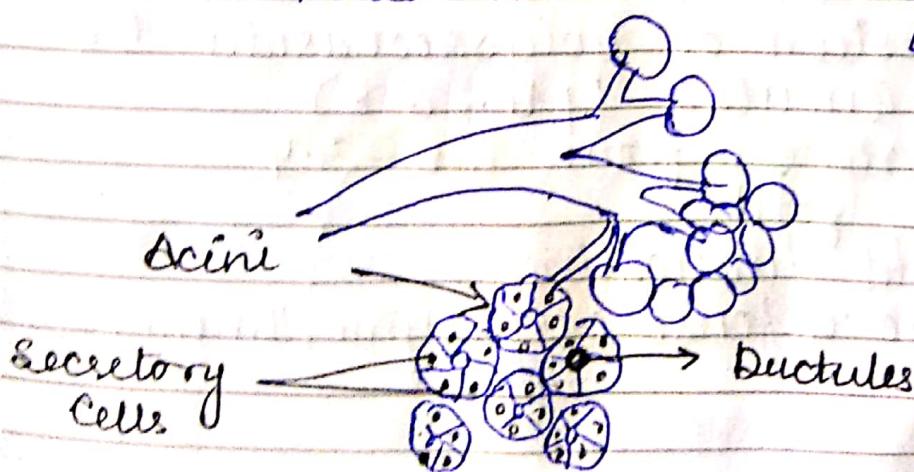
Upper teeth → Maxillary
Lower teeth → Mandibular

Salivary glands

→ Released their secretions into ducts that lead to the mouth.



- These glands are all surrounded by a fibrous capsule
- consist of no. of lobules made up of small acini lined with secretory cells.



BS : Artery External carotid artery and external jugular veins

- Saliva consist of → (1.5 l saliva produced daily)
 - water
 - mineral salts
 - an enzyme: salivary amylase
 - mucus
 - lysozyme
 - Immunoglobulins
 - Blood - Clotting factors

Secretion of Saliva

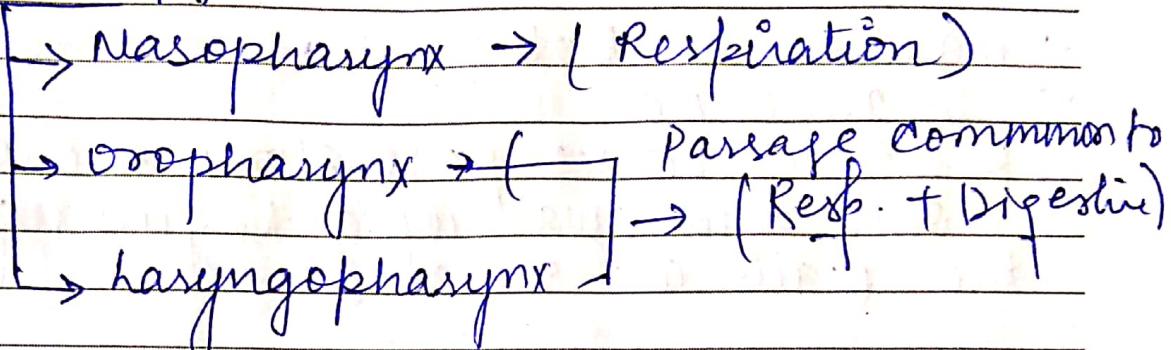
- Parasympathetic stimulation → vasodilation
- excess of saliva + low concentration of enzymes
- Sympathetic stimulation - vasoconstriction
- Small amount of saliva + high content of enzyme & organic substances

functions of saliva

- Chemical digestion of polysaccharides by salivary amylase (pH - 6.8)
- Saliva pH ranges from 5.8 - 7.4
- Lubrication of food
- Cleaning and lubricating
- Non Specific defense (Lysozyme, Immunoglobulins)
- Taste

Pharynx Food passes from the oral cavity into the Pharynx then to oesophagus below.

Pharynx



B.S : - facial arteries and internal jugular veins.

NS : - glossopharyngeal & vagus nerves (parasympathetic)
cervical ganglia (sympathetic)

Oesophagus

- 25 cm long & 2cm in diameter
- muscular tube, has a sphincter (valve) at each end
- help to transport food & fluid
- No absorption takes place in oesophagus

B.S → oesophageal artery, inferior phrenic arteries, left gastric branch of celiac artery.

→ Azygos and hemiazygous vein, left gastric vein

function of mouth, pharynx & oesophagus

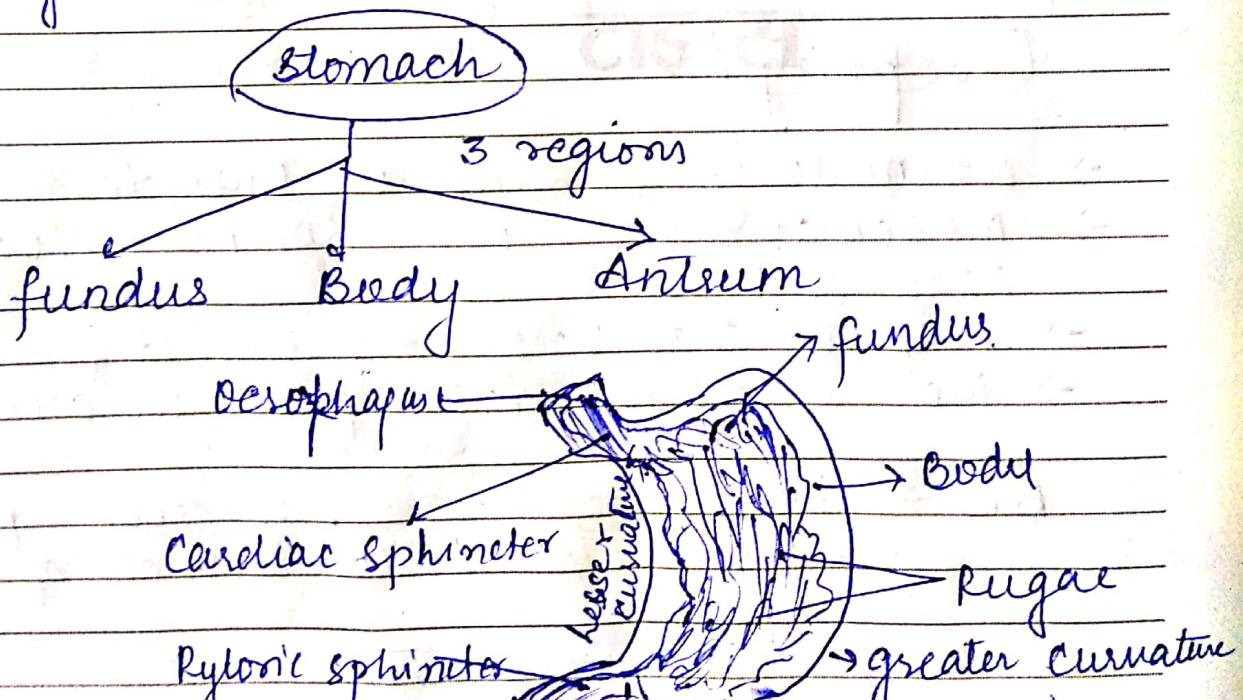
→ formation of Bolus

→ Swallowing

peristaltic waves pass along the oesophagus
only after swallowing begins, otherwise
the walls are relaxed.

Stomach

J shaped dilated portion of the alimentary tract situated in the epigastric, umbilical & left hypochondriac region of the abdominal cavity



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015-351

WEDNESDAY

JANUARY
2020

Walls of the Stomach

→ Muscle layer (3 layer of smooth muscle fibres)

- - Outer layer (longitudinal fibres)
 - Middle layer (circular fibres)
 - Inner layer (oblique fibres)

→ Mucous membrane → numerous gastric glands are situated below the surface.

BS :- left gastric artery & Right gastric artery.
peritoneal vein

functions :-

Gastric juice

stomach size (1.5 l or more)

→ about 2 litres of gastric juice are secreted daily. by

→ It consist of

- water
- mineral salts } secreted by gastric glands
- mucus → secreted by goblet cells
- HCl } secreted by parietal cell
- intrinsic factor
- inactive enzyme precursors → pepsinogens, are activated by pepsin by HCl., begin digestion of proteins (pepsinogen act most effectively at pH 1.5 to 3.5)

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016-350

THURSDAY

JANUARY
2020

→ Intrinsic factor (protein) necessary for the absorption of vitamin B₁₂ from the ileum

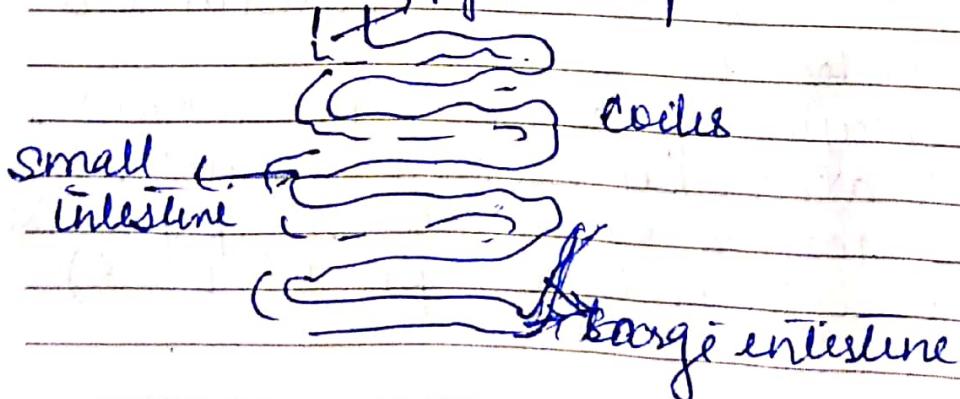
functions of the stomach

- temporary storage allowing time for the digestive enzymes, pepsins, to act
- chemical digestion of protein by pepsin
- churning of food
- Non specific defence against microbes by gastric juice
- preparation of iron for absorption (solubilize it)
- production & secretion of intrinsic factor
- Regulation of passage of gastric contents into the duodenum.
- Secretion of the hormone gastrin.

Small intestine & Digestive tract / Alimentary canal

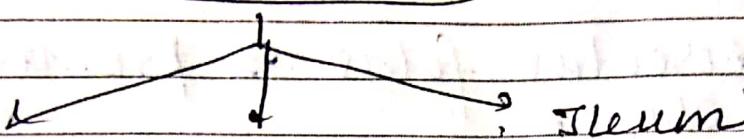
- It lies between the stomach & large intestine
- 90% of the digestion and absorption of food occurs, other 10% taking in
- stomach & large intestine.

pyloric sphincter.



→ 5 metres long, 2.5 cm in diameter.

Small intestine



Quodenum (25 cm long) contains the Hepato pancreatic Ampulla (Bile Duct + pancreatic duct)

Tejunum 2 metres → middle position of the small intestine

Ileum 3 metres long ends terminal section → joins the large intestine by ileocecal Sphincter.

→ opening is guarded by Hepatopancreatic Sphincter (of Oddi)

Structure of Small intestine -

- ⇒ walls of Small intestine composed of 4 layers
 - Epithelium
 - Muscle layers
 - Submucosa
 - Mucosa

Mucosa - surface area of small intestine is greatly increased by permanent circular folds, villi & microvilli.

→ Permanent circular folds → Promote mixing of chyme

→ Villi as tiny finger like projections 0.5 to 1 mm long

→ Microvilli (1 um long)

Structure of villi consist of :-

→ Goblet cells → secrete mucus

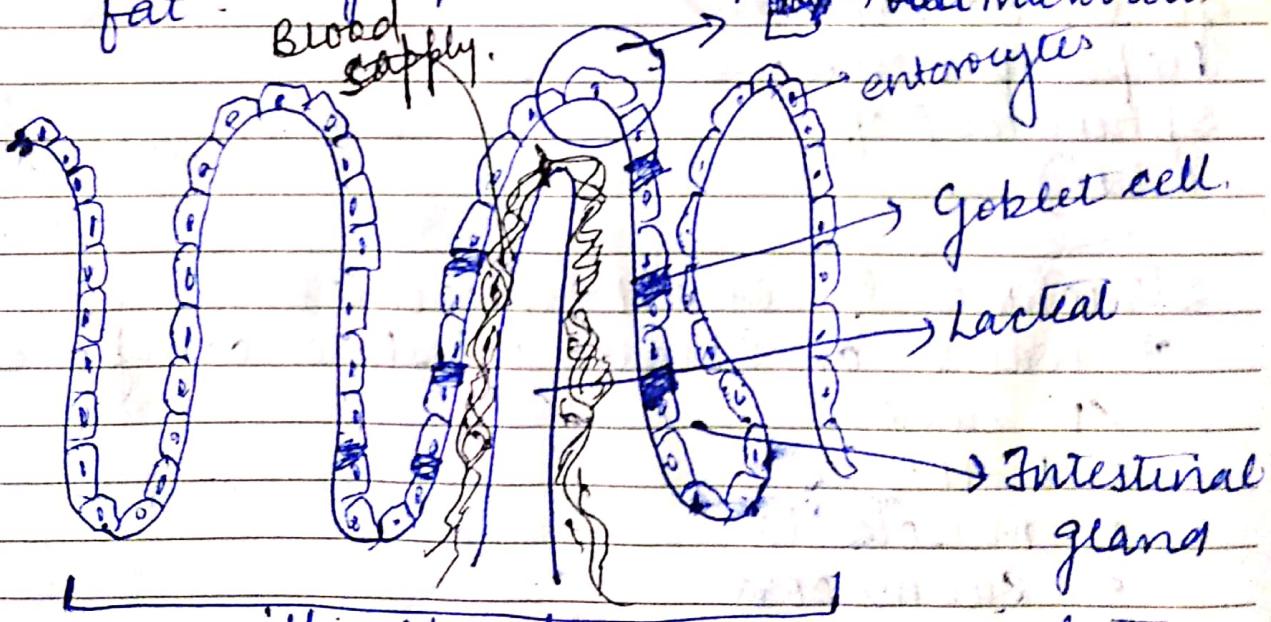
→ Enterocytes → Absorption of nutrients

→ Intestinal gland → secrete intestinal juices

→ Solitary lymphatic follicles

→ Aggregated lymphatic follicles → Peyer's patches

→ Lacteals (lymphatic capillaries) → absorbed fat



villi structure in small intestine

BS :- Superior mesenteric artery 8
Superior mesenteric vein

- Intestinal juice (1500 ml) consist of → pH (7.8-8)
- Water
- Mucus
- Mineral salts → sucrase, maltase & lactase

functions of small intestine

- peristalsis for onward movement of food
- Secretion of intestinal juice
- chemical digestion of carbohydrate, proteins & fats in enterocytes by pancreatic enzyme. → pH 8

pancreatic juice enters the duodenum at the hepatopancreatic sphincter & consist of

- water
- Mineral salts
- enzymes
 - amylase → Digestion of carbohydrate.
 - lipase → Digestion of fats
- inactive enzyme precursors
 - trypsinogen
 - chymotrypsinogen } activated by enterokinase (Digest protein)
 - procarboxypeptidase

→ protection against infection by microbes by lymph follicles.



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020-346

MONDAY

JANUARY
2020

- secretion of hormone cholecystokinin (CCK) and secretin (stimulate pancreatic juice secretion) by endocrine cells in the walls of duodenum
- Absorption of Nutrients

Bile - secreted by liver, enter in duodenum by Hepatopancreatic sphincter.

- Also stored in gall bladder
- pH \rightarrow 8
- 500 - 1000 ml daily.
- consist of water, mineral salts, mucus, Bile salts, Bile pigments mainly bilirubin & cholesterol.

functions of Bile:

- emulsify fats in small intestine.
- Excretion
 - | Break down

stercobilin Bilirubin \longrightarrow urobilinogen
(colour &
deodorises faeces)

(excreted in
urine)

Food Reaches to

Duodenum



Release of cholecystokinin & secretin



contraction of Gall Bladder



Release of Bile & pancreatic juice
in to the duodenum.



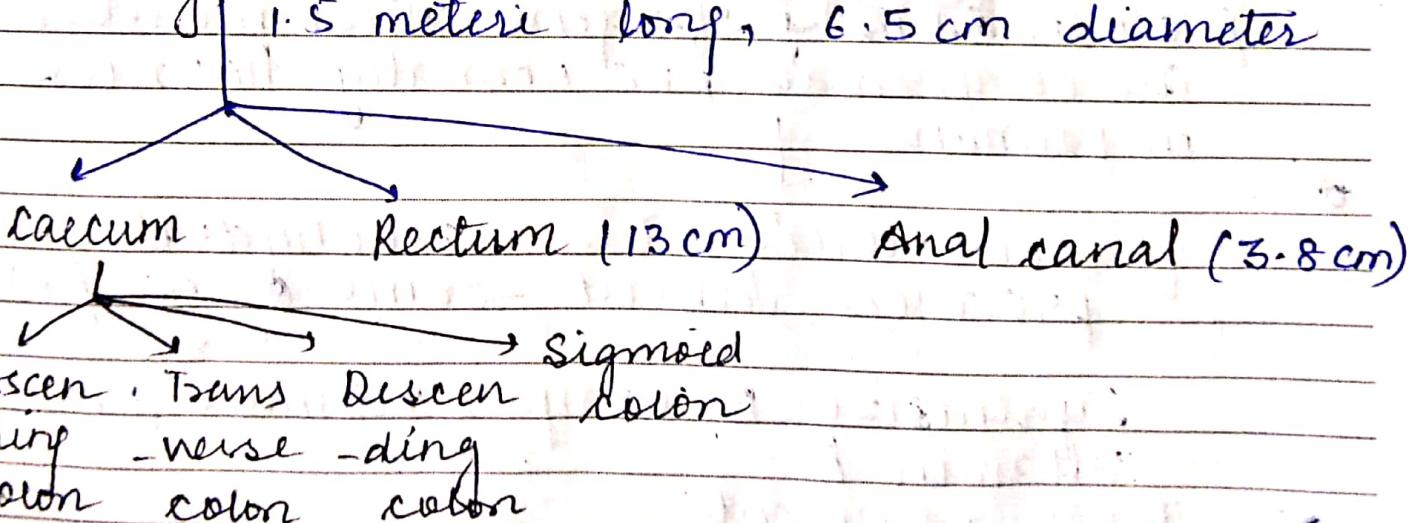
Digestion



Absorption

Large intestine :

1.5 meters long, 6.5 cm diameter



Attached to the caecum is a twisted, coiled tube measuring about 8 cm in length called Appendix or vermiform appendix.

structure

- All 4 layers present
- Mucosa



No folds or villi

crypts → consist large no. of goblet cells that secrete mucus for protection & lubrication.

functions -

→ Absorption

→ Microbial Activity → include *E. coli*, *Enterobacter aerogenes*, *Streptococcus faecalis* & *Clostridium perfringens*. These microbes are commensals, i.e. normally harmless in human.



ferment undigestible carbohydrates produces about 500 ml of gas/day

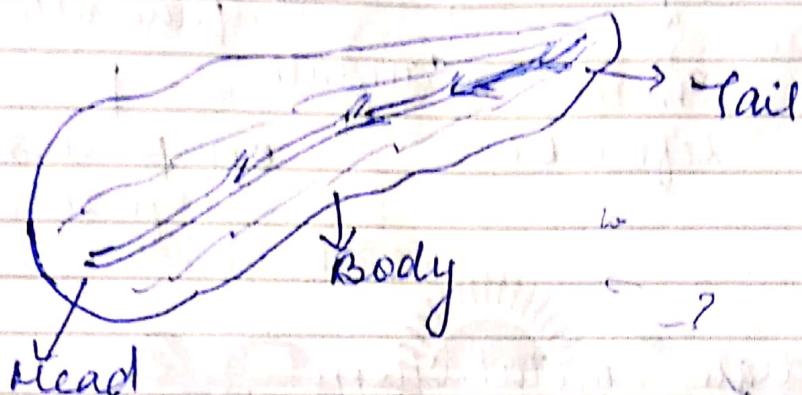
Synthesize B complex vitamins & most vitamin K

→ Mass movement

→ Defaecation

Pancreas : Pancreas is a pale grey gland weighing 60 grams.

- 12 to 25 cm long
- situated in the epigastric and hypochondriac regions of the abdominal cavity.



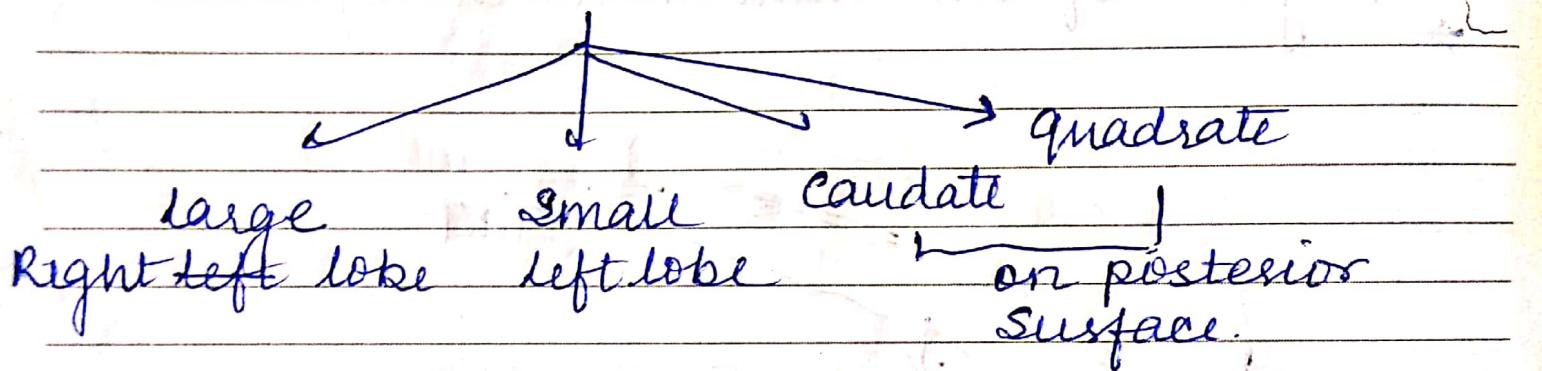
→ Pancreas is both an exocrine and endocrine gland.

Exocrine pancreas → consist of a large number of lobules made up of small alveoli, the walls of which consist of secretory cells.
→ to produce pancreatic juice containing enzymes that digest carbohydrates, proteins & fats.

Endocrine pancreas consist of specialised cells called the pancreatic islets (of Langerhans). It secretes hormones insulin & glucagon.

Liver :- largest gland of the body weighing 1 - 2.3 kg.

- situated in the upper part of the abdominal cavity
- The liver is enclosed in a thin inelastic capsule & a layer of peritoneum.
- Liver has 4 lobes



functions :-

1. Carbohydrate metabolism
2. fat metabolism
3. protein metabolism
 - Deamination of amino acids
 - Transamination
 - Synthesis of plasma proteins & most blood clotting factors from amino acids
4. Breakdown of erythrocytes & defence against microbes - carried out by phagocytic hepatic macrophages (Kuffer cells) in the sinusoids.
5. Detoxification of drugs and noxious substances
6. Inactivation of hormones
7. Production of heat
8. Secretion of bile

1. Storage :- → glycogen, fat-soluble vitamins A, D, E & K
iron, copper, some water-soluble vitamins
eg vitamin B₁₂

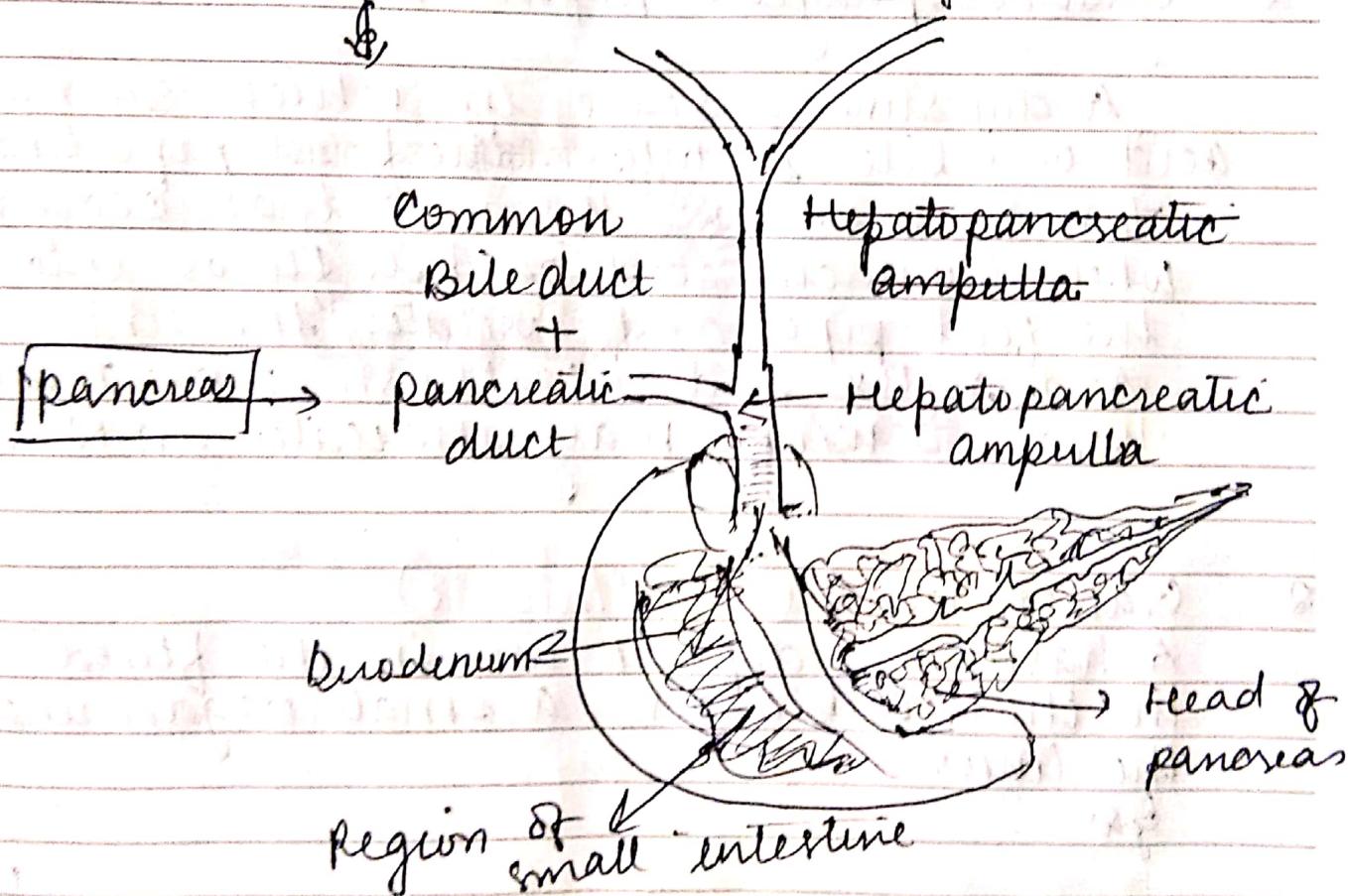
Bile Ducts :-

Rt. & Lt. Hepatic duct

↓
form common
Hepatic duct

Gall Bladder

↓
+ Cystic duct



Gall bladder is a pear shaped sac attached to the posterior surface of the liver by connective tissue

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026-340

SUNDAY

JANUARY
2020

functions of gall bladder -

- Reservoir of Bile
- Concentration of the bile by up to 10 to 15 fold by absorption of water
- Release of stored Bile -

Disorders of GIT

1. Gastroesophageal Reflux Disease (GERD)

A digestive disease in which stomach acid or bile irritates the food pipe lining. This is a chronic disease that occurs when stomach acid or bile flows into the food pipe, and irritates the lining. Acid reflux and heartburn more than twice a week may indicate GERD.

2. Gallstones ('cholithiasis')

A hardened deposit within the fluid in the gallbladder, a small organ under the liver.
eg:

3. Celiac disease - An immune reaction to eating gluten, a protein found in wheat, barley & rye.

Over time, the immune reaction to eating gluten creates inflammation that damages the small intestine's lining, which prevents absorption of some nutrients.

4. Ulcerative colitis

5. Irritable Bowel disease

6. Hemorrhoids

7. Diverticulitis

8. Anal Fissure