Date:

CHAPTER # 01

DIGESTIVE SYSTEM OF MAN

NUTRITION :—

⇒ Sum of all the process involved in the Processing of Nutrients.

→ Catabolism occurs.

NUTRIENTS :—

Any substance that provide necessary elements for growth and metabolism to body.

- → Carbohydrates
- → Proteins
- → Lipids
- → Fats
- → Vitamins
- → Minerals
- → Water

Flash Back!

Metabolism

Anabolism	Catabolism
Small molecule	Large molecule
↓	↓
large molecule	small molecule
[Fussion]	[Fission]

Process through which Nutrients are obtained

i Ingestion (Intake) → ii Digestion (Break Down)

iii Absorption (S. Intestine → Blood) → iv Assimilation.

v Egestion (Removal of Undigested food)

→ Nutrients used by cells

Note :-

Excretion and Egestion are two different process. Egestion mein sirf food disscuss hota he and excretion mein saare waste ka removal

In Stomachs- Obligue Muscles are also Present after Circulatory Muscles

Date 9-July-2015

"DIGESTION"

Basically, digestion is a process in which undiffusible form of food is converted into diffusable form.

"DIGESTIVE SYSTEM"

Consists of long digestive tract / Gastro Intestinal Tract (GIT) / Gut / Alimentary Canal.

↝ Human digestive system consists of tube like structure (i.e have 2 openings ↝ Mouth (Anterior/Rostral) ↝ Anus (Posterior/Distal)

↝ Parts Included

1. Mouth
2. Oral Cavity
3. Oesophagus
4. Stomach
5. Small Intestine
6. Large Intestine.
7. Rectum
8. Anus.

Notes:- GIT is 9m (30 ft) Long.

↝ Glands Included

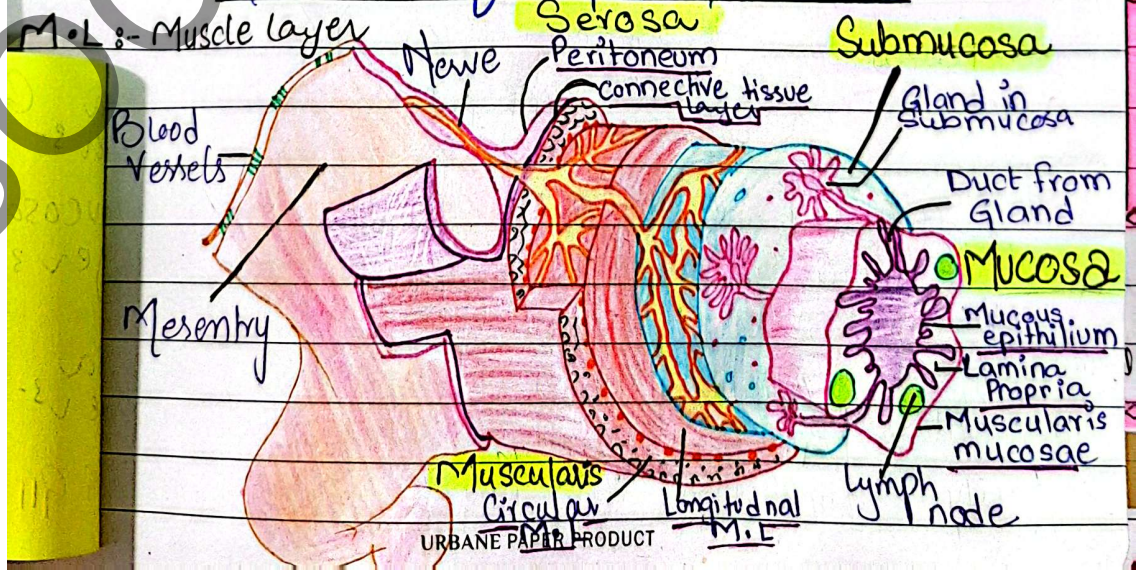
- Slivary Glands
- Gastric Glands
- Intestinal Glands

Associated Organs

- Pancrease
- Liver
- Gall bladder.

Q ~~Liver~~ Bile is Produced in liver and then is Proceeded towards Gall Bladder, from where it is secreated (MCQ)

LAYERS of DIGESTIVE TUBE



— ORAL CAVITY —

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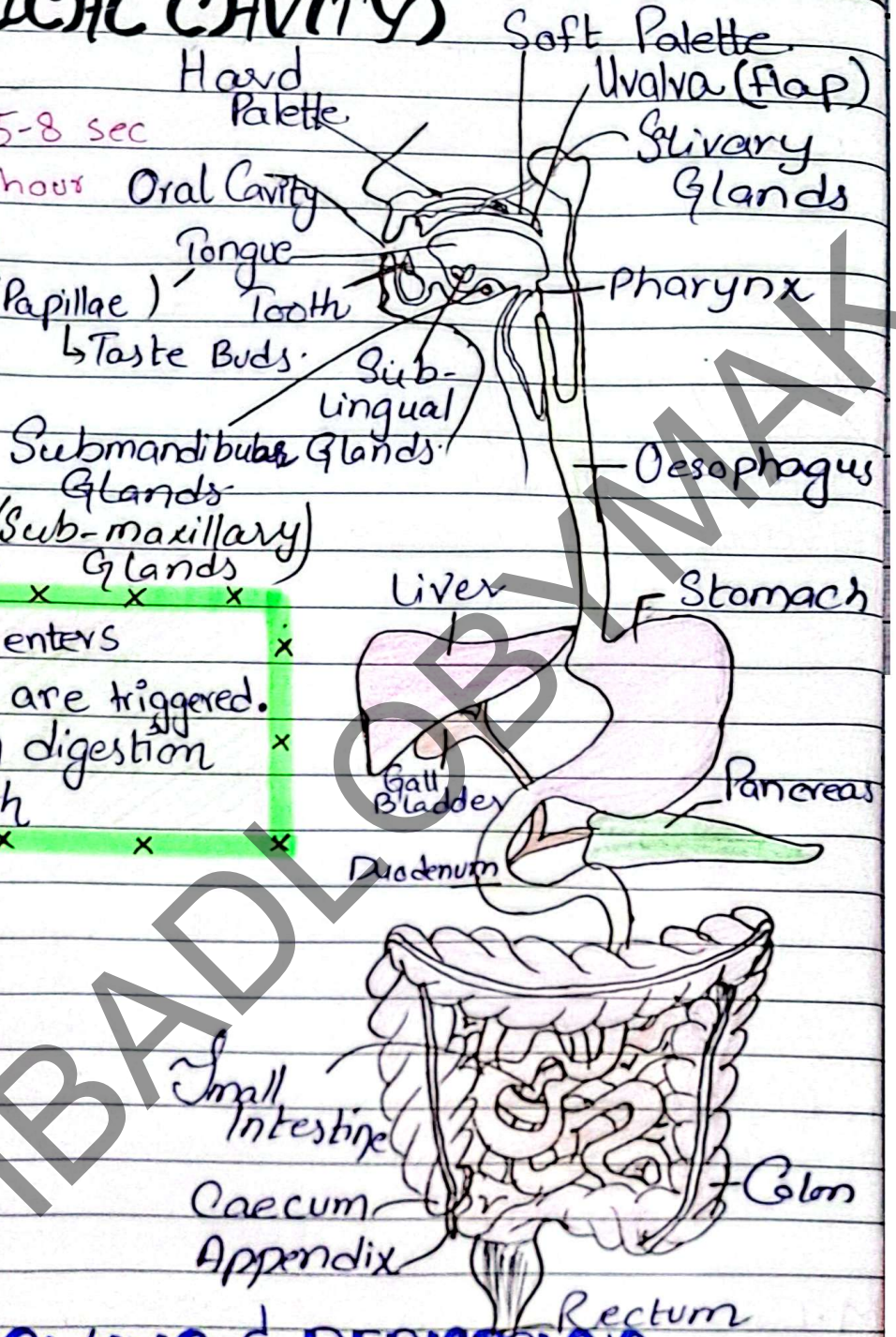
(BUCAL CAVITY)

Oesophagus:- 5-8 sec
Stomach:- 1-2 hour
S.I :- 3-6 hour
L.I :- 12-48 "



=> As the food enters mouth, Glands are triggered.
> Lipids & Starch digestion occurs in mouth

1.2 SWALLOWING & PERISTALSIS

The act of swallowing can be divided into Three Phases

- 1st :- Oral Phase (Voluntary Phase)
- 2nd :- Phayrangeal Phase
- 3rd :- Esophageal Phase (Involuntary Phase)

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In Phase #01
1. Tongue Movement
2. Lip closure

In Phase #02
1. Tounge move upward → Soft Palette moves upward ↓ Uvalva (opening into nasal cavity closes)
2. Tounge moves backward
3. Epiglottis pushed over Lyrnx
4. Opening into trachea closes
5. Oesophageal sphincture opens.

In Phase #03
1. Peristalsis → food is pushed down.

→ Page #10

Peristalsis
- → Characteristic movement of GIT
- → Moves Food in Anterograde (Forward Direction) (mouth → Anus)
- → Rythemic wave like movement.
- → Each region of GIT shows its own peristalsis.

Mechanism:
Take place by Alternative contraction and relaxation in circular and longitudnal muscles, of GIT.
(Both Muscles are Antagonastic to each other)

when:
Circular muscle Contracts and longitudnal muscle relax.
→ GIT narrowing occurs

Pair in which 2 muscles are complementory to each other, i.e, one relax and other one contracts.

GIT widening

when;
Circular muscle relax and longitudnal muscle Contracts

Point to Ponder!
Q Where do peristalsis occurs ther than GIT?
1) Ureter
Carries urine from kidney to urinary bladder
2) Carries Bile from liver and gall bladder in Deudenum.

HUNGER PANS!
After 12-14 hours of fasting Peristalsis starts again w/o swallowing

Esophagus & Stomach

Date:

OESOPHAGUS

→ Location :-
- In centre of the chest
- Behind trachea
- Infront of vertebral column
- In MEDIASTINUM

→ Size :-
- 25 cm length
- 1.5-2 cm diameter

→ Diagram :-

Oesophagus is just a pathway, no digestion occurs here

Upper Oesophageal Sphincter

→ Tilted near diaphram.

heart

Lower Oesophageal Sphincter

→ Also called as Cardiac Sphincter, because its present near heart.

Prevents stomach acid and digestive juices from getting into oesophagus

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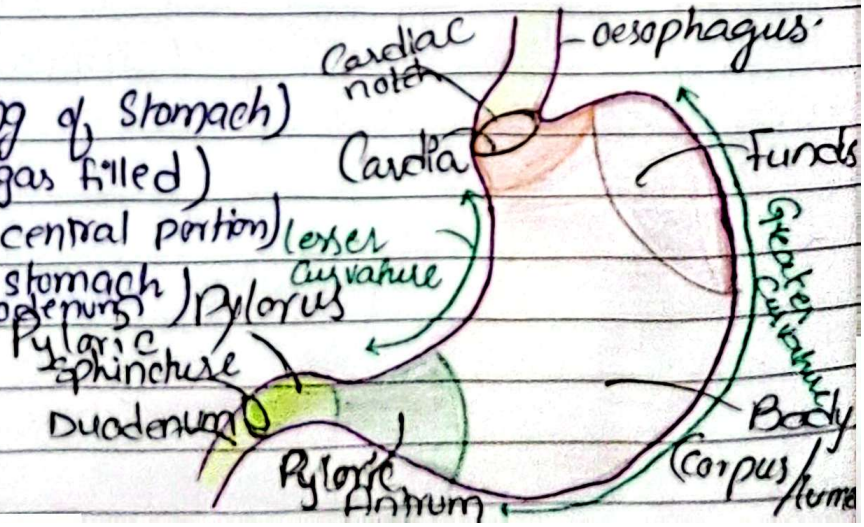
Relax (open) — Normally, It is closed, opens only when senses food

STOMACH

Divisions
- Cardia (opening of Stomach)
- Fundus (Often gas filled)
- Body (large central portion)
- Pylorus (Connect stomach and Duodenum)



Date:

General Info:-

→ Muscular Bag → Second site of Digestion
→ J-Shaped
→ Provide temporary storage of food.

Chime:-
Bolus when digested in stomach is called Chime

Location:-

→ Present in left upper Quadrant
→ Just below diaphram
Anterior end connected with Oesophagus
Posterior end connected with Duodenum

Medial Curvature (Lesser Curvature)
Lateral Curvature (Greater Curvature)

GREATER CURVATURE

It form long, Convex and lateral border of stomach
It arises from cardiac notch and arches backward and passes inferiorly to the left.
It curves to the right as it continues medialy to reach the pyloric end.

LESSER CURVATURE

Shorter, concave, medial side/suface of Stomach

WALLS OF STOMACH

Stomach wall resembles with GIT wall, And the only difference is the addition of Oblique layer in Muscularis, above Circular muscles

Due to Mucus, secreated by Mucosa, HCl in stomach, donot digest Stomach wall.
Glands are present in Mucosa, so secreation occurs from there.

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The epithilial cells of ~~cells~~ can be divided into 4 main types:-

① Surface Mucous cells

Secrete mucous to protect the stomach from HCl.

(The remaining 3 are in gastric gland)

② Parietal cell / Oxyntic cells

Produce HCl & Intrinsic factors (Glycoproteins)

③ Chief / zymogen cells

Secreate pepsinogen

④ Endocrine cells

Release Gastrin (Hormone) into blood.

Note that Gastrin is a Gastric secretion but not the part of Gastric Juice.

FUNCTIONS OF STOMACH

① FUNCTIONS of DIVISION of STOMACH

(i) Cardiac Region

→ Recieve food from esophagus

→ Prevents back flow of food (Through Cardiac. S)

(ii) Fundus

→ Contains gas bubble through swallowing of air

(iii) Body / Corpus

→ Main site for mixing of food with gastric juices

→ Secrete enzymes like pepsin & HCl for digestion

(iv) Pyloric Region

→ Pyloric Antrum :- Digestion & mxtr of Chyme

→ Pyloric Canal :- Push food into Pyloric Sphincture → S-I

② Main Function of Stomach.

① Mechanical Digestion:-

↳ By means of mixing / churning Waves

Bolus → Chyme (Thick liquid)

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Q Justify Why Mechanical Digestion occurs at greater rate in stomach?

Stomach layers are basically specialized, because they hv 3 layers of smooth Muscles

DIGESTION
→ In Oral Cavity
Carbohydrates & Lipids
→ Stomach
Proteins (Protien → Peptide bonds)
→ Small Intestine
All Bio elements.

(ii) Chemical Digestion (Enzymatic Digestion)
↳ By Means of Gastric Juices,
Secreted by Gastric glands and released in the lumen of stomach.

Q Why Stomach Cant digest carbohydrate?
Because slivary Amylase denatures in Acidic Medium.

Q Why Stomach Ulcers occurs?
Due to Excessive secreation of HCl

ROLE OF THE NERVOUS SYSTEM AND GASTRIN HORMONE ON THE SECRETION OF GASTRIC JUICE

⇒ 2-3 liters of Gastric juice produced Daily

① Nervous System.

i- When one intakes the food, Brain recieves sensory signals.

ii- Medulla part of brain influence the secretion of Gastric Juices in stomach, as a Result.

iii- When Stomach recieves message from Brain through Nerves, a chemical Acetylcholine is

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Produced. (-i-) This chemical actually increases the activity of Parietal cells, which are used in the production of HCl (-ii-). It also stimulate the secretion of Gastrin Hormone from Endocrine cells. Gastrin also stimulate parietal cells which produce gastric juice/HCl.

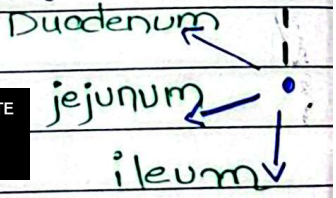
⇒ Peristaltic waves (less frequent) are more stronger than mixing waves And force the Chyme to move into duodenum through Mild tonic contraction.

Mild Tonic Contractions are low intensity continious muscle contractions that occurs even when the muscle is at rest.

- Do you know!
- If we donot intake anything and just through the sense of sight, our body responds in a way that it initiates this whole Process

~ SMALL INTESTINE ~

↝ Longest Part of GIT
↝ Most of the Digestion takes place
↝ About 6 m long



DUODENUM

L> 20-25 cm >length
L> 8-10 inch
L> C-shaped L> Surrounds head of Pancrease
L> Starts from Pyloric Sphincture

Pancreatic Juice (Produce in Pancrease)(Exocrine cells)
↝ Slightly Alkaline (PH=8) (Works in duodenum)
↝ Enzymes (i-Pancreatic amylase · ii-Pancreatic Lipase · iii-Trypsinogen · iv-Chymotrypsinogen)
↝ Composition:
① Water & Mucous (lubrication)
② Sodium bi carbonate & other salts (Provide basic Medium)
③ Enzymes

Date: _____

① Carbohydrases

PANCREATIC AMYLASE also called as AMYLOPSIN

↓ (converts)

Starch/Glycogen ⟶ Maltose.

② Proteases — Secreated by duodenal wall.

- ⊙ Trypsinogen ⟶ Trypsin (Enterokinase)
- ⊙ Chymotrypsinogen ⟶ Chymotrypsin [Trypsin]
- ⊙ Procarboxypeptidase ⟶ Carboxypeptidase [Trypsin]

③ Lipases

PANCREATIC LIPASE (Lipds) ⟶ Fatty Acid/Glycerols

④ NUCLEASES

- ⊙ DNAses [Converts] DNA to Deoxyribonucleotides
- ⊙ RNAses [Converts] RNA to Ribo-nucleotide

FUNCTIONS OF PROTEASES

TRYPSIN
large polypeptdies → Peptones

CHYMOTRYPSIN
large polypeptides → Peptone

PROCARBOXYPEPTIDASE
Peptones → Dipeptides

Bile Juice

~> Produced in Liver
~> Found in Duodenum
~> Stored in Gall Bladder
~> Composition
① NO enzymes
② Bile salts ⟶ Emulsification of Lipids
(Brk down of large lipids)
↓
(small Lipid Granules)

JEJUNUM AND ILEUM

↳ 2.5 m long (Jejunum), 3.5 m long (Ileum)
↳ Enzymes ↳ Now here Chyme is converted to CHYLE

① Amino peptidase (Polypeptide → dipeptides)
② Erepsin (Peptides ⟶ Amino acids)
③ Maltase (Maltose ⟶ Glucose)
④ Sucrase (Sucrose ⟶ Glucose/fructose)
⑤ Lactase (Glucose ⟶ Galactose)

} Intestinal Enzymes

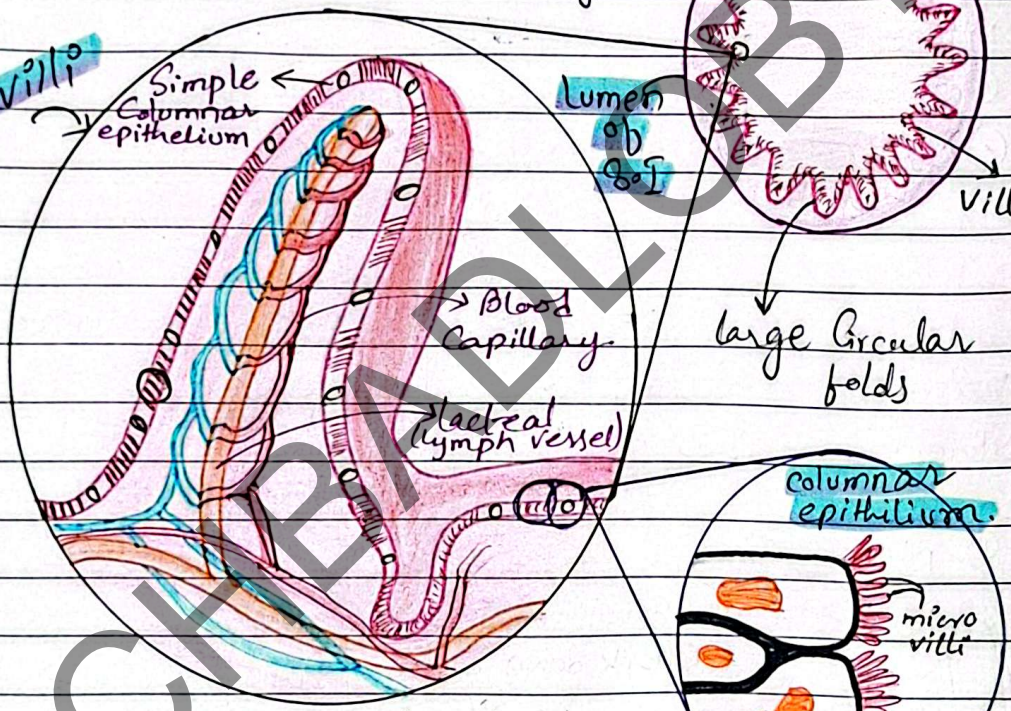
Date:

- Bolus :- Partially digested food of oral Cavity (oval lump)
- Chyme :- 3- " " " " Stomach " (Soft Paste)
- Chyle :- Watery Emulsion.

ABSORPTION OF DIGESTIVE PRODUCTS

① Ileum is the major site of nutrients absorption

② Villi → 0.5 - 1.5 mm length



→ large circular folds
→ villi
micro villi

these 3 increase the SA ← Surface are of S.I

	Pepsin		Trypsin
(-i-)	Pepsinogen	Origin	Trypsinogen
(-ii-)	HCl/Hyd. present	Activation	Enterokinase
(-iii-)	Pepsin	Site of Secretion	Pancrease
(-iv-)	Stomach	Site of action	Duodenum
(-v-)	Stomach (2) low pH	Working env.	high pH (8)

1505

Date: 22nd July

Absorption of Carbohydrates AND PROTIENS

Principle components of food	Digested Products
Carbohydrates	Monosaccharides
Protiens	Amino Acids
Lipids	Glycerol / Fatty Acid / Cholestrol
Nucleic Acid	Nucleotides / Nucleosides

Initially, the Digested products of Carbohydrates, Protiens and small amount of Nucleic acid enters into (i) epithelial cells of Villi → then into (ii) the blood vessels of Villi → (iii) Small veins of intestine → (iv) Hepatic portal vein → (v) liver → (vi) Hepatic portal vein → (vii) Inferior vena cava → (viii) heart → (ix) Distributed throughout the body

Absorption Of Lipids

(i) Firstly, fatty acid and glycerol/cholestrol mix with bile salts to form ⇒ (ii) Micelles then they ⇒ (iii) enter into epithelial cells of Villi ⇒ then (iv) protiens are also mixed with them ⇒ (v) to form Lipo protiens (VLDL) (Chylomicrone) ⇒ now this mixture (vi) enters into lacteal ⇒ and then (vii) Chylomicrones

Imp!-
Mostly, the digested products enter from S.I → Villi through Diffusion, in very rare cases Active transport occurs!

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of this mixture combine with lymph protien (LDL) => Now they (viii) enter into thoracic lymphatic Duct. => then (ix) to Subclavian vien (vein coming back from shoulders and arms) => from there (x) into Superior Vena cava => (xi) to the heart (from it will either go to liver or Fat cells)

Chylomicrone

Chylomicrone is a special type of lipo protien in which there is 99% lipid and 1% Protien.

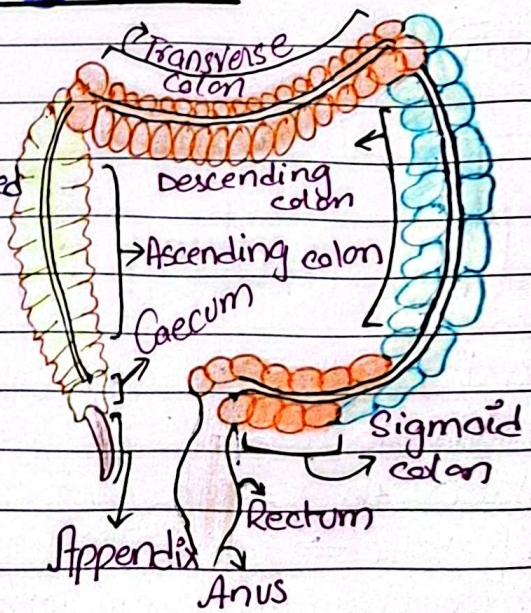
(xii)

- Lipo-Protiens
  - HDL — High Density Lipo-Protien
  - LDL — low Density Lipo-Protien
  - VLDL — Very low Density Lipo-Protien

LIVER [If it is to be used] → Glucose, Bile Salts.

FAT CELLS [If it is to be stored] fat cells are also called as Adipose cell/ ADIPOSE TISSUES.

LARGE INTESTINE



=> At Caecum S.I & L.I meet
=> Junction b/w ileum & L.I is ileocecal Junction and is guarded by ileocecal sphincture.
=> Appendix ⟶ 9 cm long
=> Colon ⟶ 1.5 m long

FUNCTIONS Of L.I

1. Absorb Water & Electrolytes
2. " Vitamins
3. Reduce acidity
4. Protect from Infections.

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ABSORB WATER AND ELECTROLYTES

L.I's Proximal's half functions to reabsorb some of the water and electrolytes, making stool solid

ABSORB VITAMINS

Bacterias in large intestine help in the production of vitamins, especially vitamin K and Biotin.

Reduce Acidity

Mucosa secretes Bi carbonates for nutralization

Protection from Infections.

Mucosal Barrier [illegible], Protects from microbial infections and invasions

DEFAECATION

Expelling faeces from GIT through Anus.

In Infants (1st week of life)

→ Involuntary

Shortly after feeding, anal sphincture relaxe

In Adults

→ Initiate this reflex by contracting Abdominal muscles

Peristaltic waves stimulated ← (when rectum filled) → Moves faeces into rectum → internal + Anal Sphincture relax → faeces out of the body

STORAGE AND METABOLIC ROLE OF LIVER

Larger Right lobe, Smaller left lobe

=) lobules in lobe connect bile ducts

=) Recieves oxygenated blood from Hepatic Artery

=) " Nutrients rich blood " " vein.

Lec #11 complete
Day #17

Date:

Bile:- • Excretion of Liver.
• helps carry away waste products from liver

→ All the blood passes through liver, either, it's secreated from small intestine or Stomach.
→ liver is like a main hub, where more than 500 Vital functions are identified
↳ It process the blood passing through it, and creates nutrients
↳ Metabolization & detoxification of drugs
When the liver break downs harmfull products its by-products are either secreated into Blood, or bile.
→ Bile by-products enters S.I and leave body through it, in form of faeces.
→ Blood by-Products are filtered through kidney & leave body in form of Urine.

COMPOSITION AND ROLE OF BILE

STORAGE

→ Location:-
→ Size:- Inferior to the surface of liver
8 cm (long), 4 cm (wide)
→ Connected to bile duct by Cystic duct
→ Function:-
Stores gall bladder.

COMPOSITION

→ Contains no digestive enzyme
→ Consists of Water + Bile salts.

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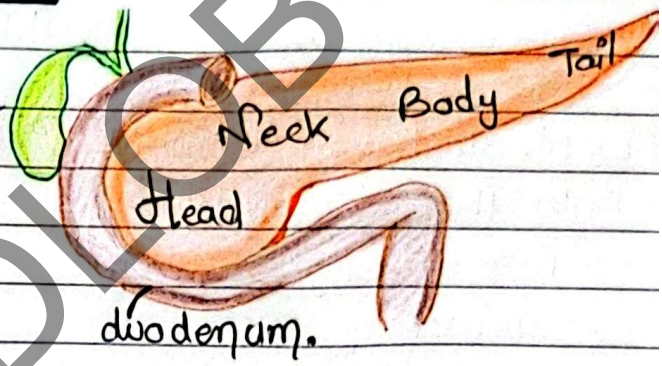
ROLE of BILE

→ Bile helps in fat emulsification. Then on this emulsified enzyme 'lipase' acts.

→ Liver conjugates bilirubin and secretes it into bile, then,

→ From intestine, its secreted in the form of 'Stercobilin' and i.e. through urine in form of 'Urobilin'

"PANCREAS"



→ Composed of Endocrine and Exocrine glands.

→ Body located ... to the top of Superior mesenteric vessels (Intestinal vessels)

PANCREASE

i-) As endocrine glands

Consists of islets of Langerhans, which produces hormones such as Insulin, Glucagon etc.

ii-) As exocrine glands.

Main secreations:- Pancreatic Juices. Main enzymes:- trypsin, chymotrypsin, Carboxypeptidase