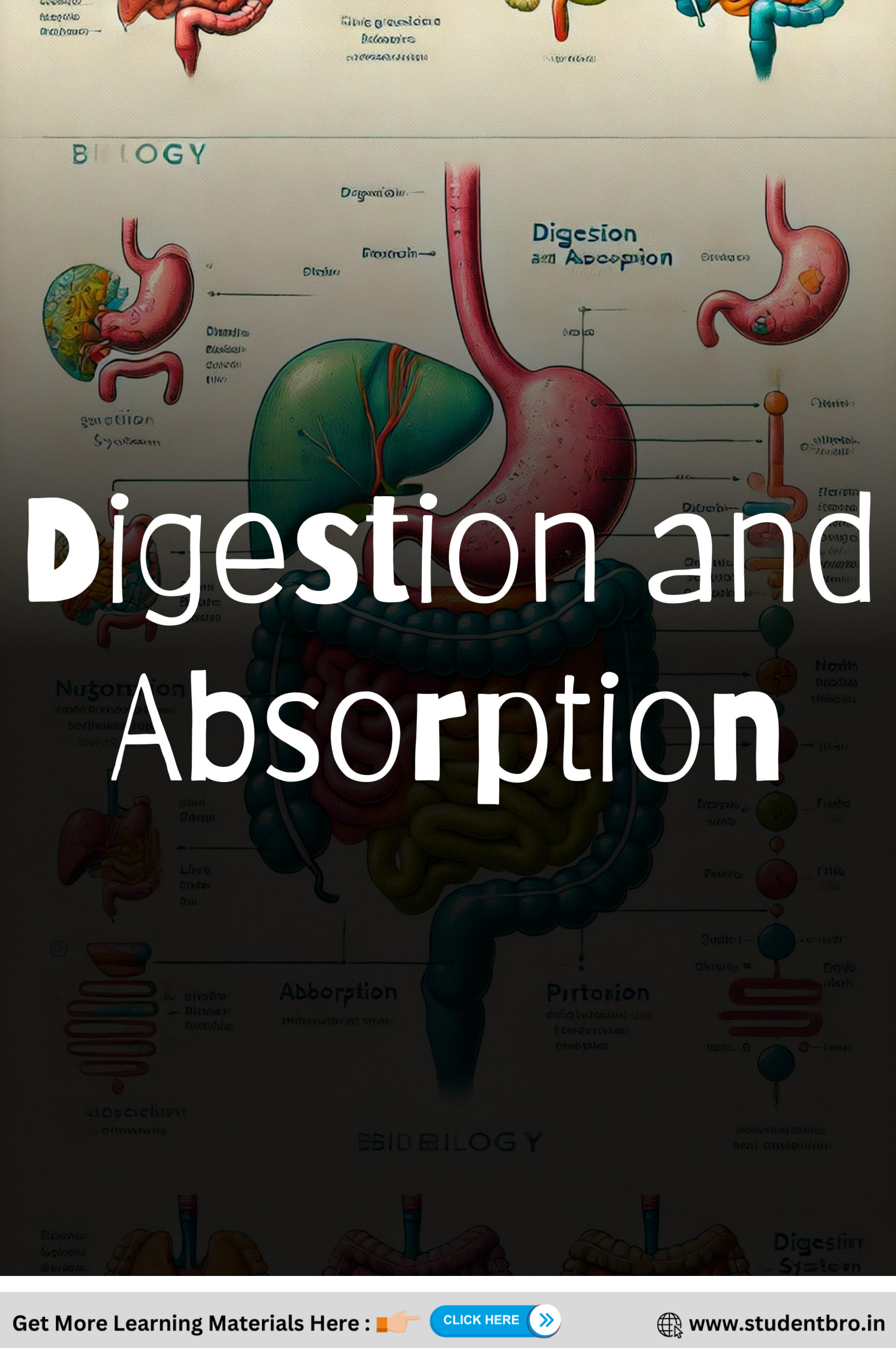
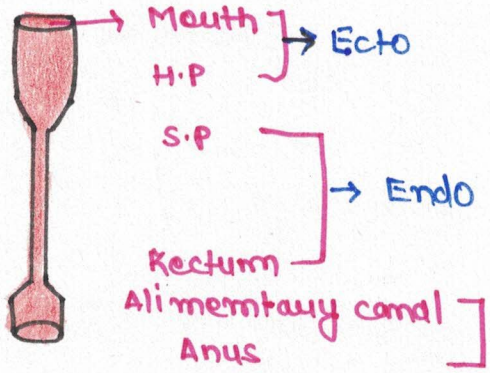


Digestion and Absorption

Digestion and Absorption

- Carbohydrate, fat and proteins → major components of food.
- Vitamins and minerals in small quantity but direct absorb.

Ingestion → Digestion → Absorption → Assimilation → Egestion / Defecation

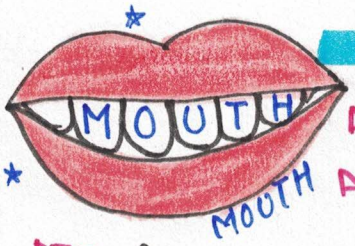


Larger and complex → (Mechanical / Biochemical (Hydrolysis)) → Simpler smaller

DIGESTIVE SYSTEM

Alimentary canal / Gut
Mouth
↓
Buccopharyngeal cavity
↓
Oesophagus
↓
Stomach
↓
Intestine → Small intestine → D, J, Ileum
Intestine → Large intestine → C, C, R
↓
Alimentary canal (Anus)

Digestive Glands
Salivary Gland
Liver
Pancreas
Intestinal glands
Gastric glands.



MOUTH → Slit like aperture surrounded by lips.

→ Orbicularis oris muscles presents.

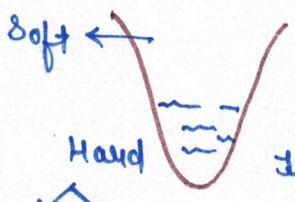
→ Serous or Mucous gland present.

Buccopharyngeal Cavity

BUCCAL VASTIBULE
↓
Space b/w gums and cheek
Also called Tobacco chamber

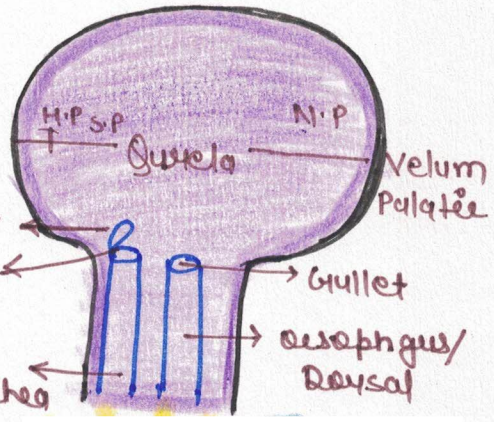
ORAL CAVITY
↓
Tongue, Teeth, Palate

PHARYNX
↓
common pathway for food and air.

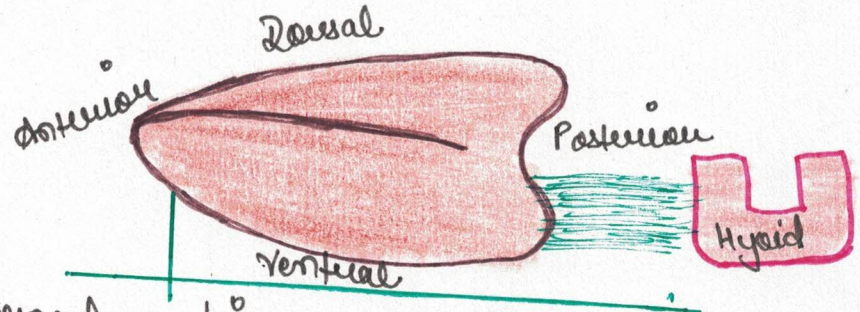


Maxilla Palatile

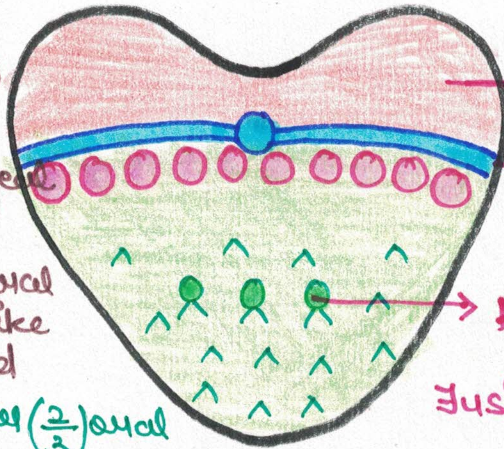
Transverse Ridges
Palatile Rugae

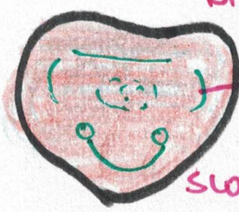


→ Present in oral cavity.

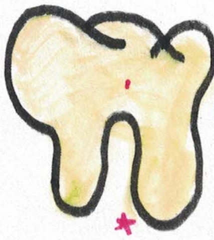


Frenulum Linguae.



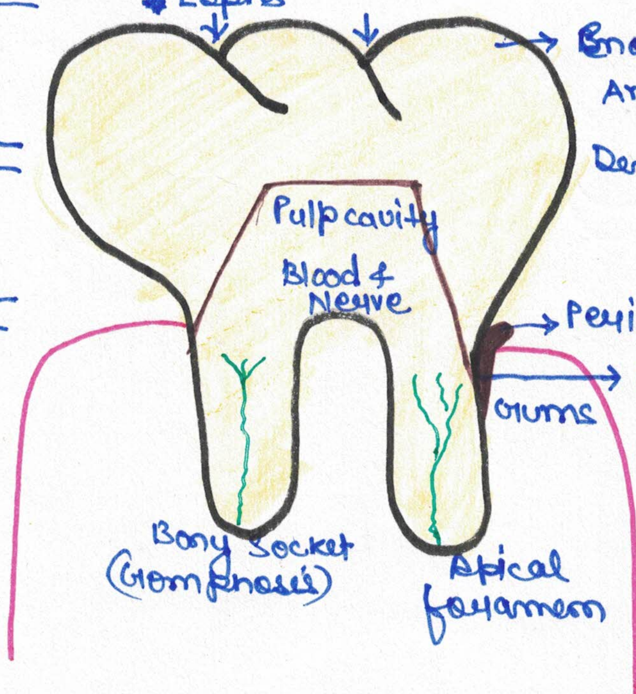


Muscles → Exterinsic → In-out
→ Interinsic → Rolling



Teeth

- Cranial nerve, Dentist Nerve → Trigeminal
- Ectomesodermal.
- Inorganic salts :- Bone < Caementum < Dentine < Enamel
  62-65% 65% 69% 96%



Incisor
chisel
Gnawing

Canine
long & pointed
Tearing
Carnivorous

Premolar
Triangular

Molar
Rectangular

↓
Crown Root ↑, laphs
Mastication

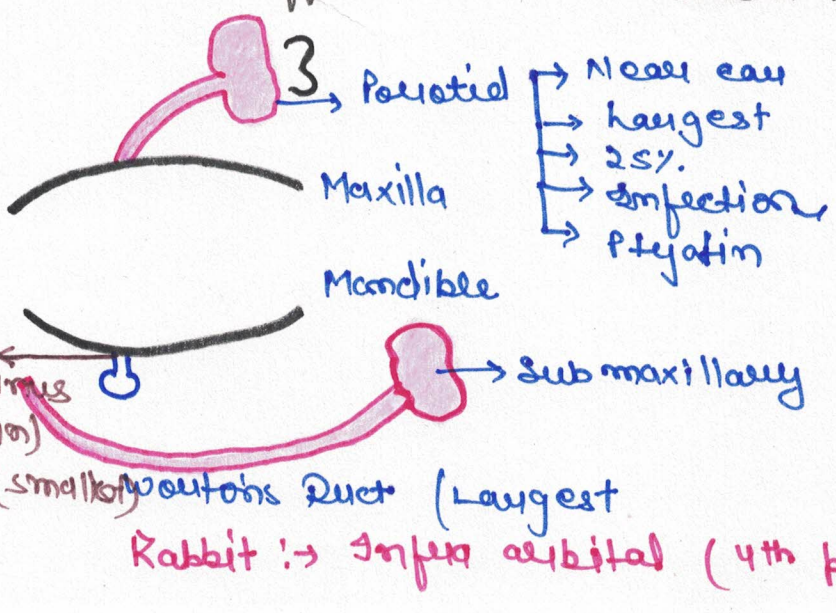
Herbivours → absent
Diastema.

- Acrodont, Pleurodont, Thecodont
- Homodont, Heterodont
- Monophyodont, Diphyodont, Polyphyodont

- CHILD ⇒ $\frac{2102}{2102}$ ⇒ 20
- 17 YEARS ⇒ $\frac{2122}{2122}$ ⇒ 28
- ADULT ⇒ $\frac{2123}{2123}$ ⇒ 32
- RABBIT ⇒ $\frac{2033}{1023}$

Salivary Glands

- Sympathetic Nervous system decreases salivation.
- Parasympathetic Nervous system increases salivation.
- Saliva stimulated by IX & VII cranial Nerve.
  Glossphanyngeal → facial
- Vagus does not affect the salivation.

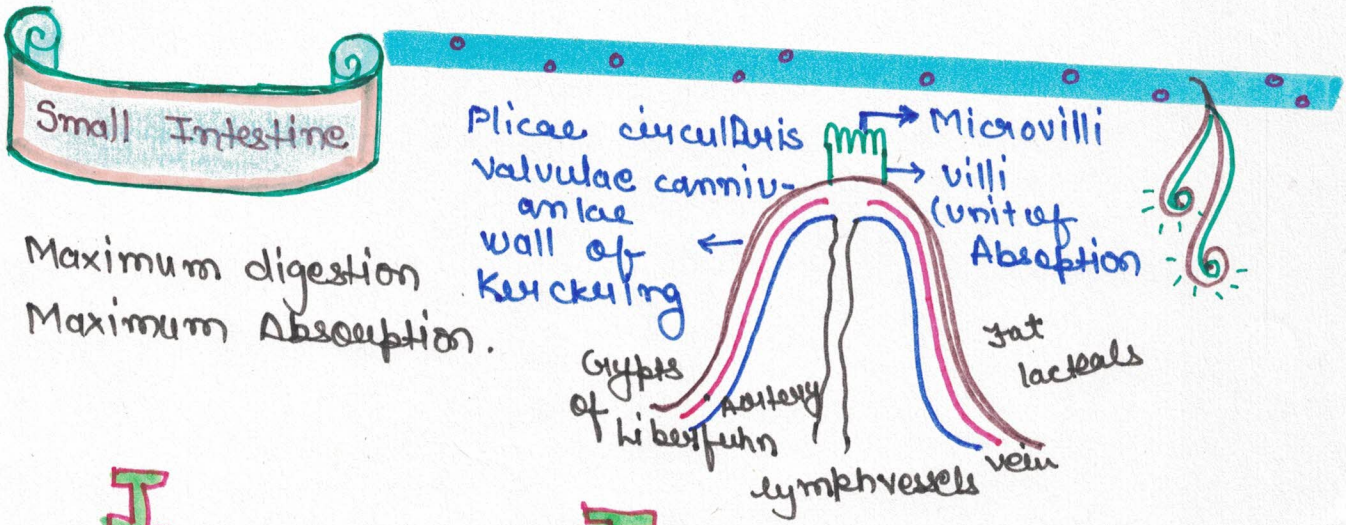


- 1500 ml per day.
- PH 6.8
- If person taking more lime juice (acidic) digestion of carbohydrate effected.
- 99.5% water

  ✚

  Other → Lysozyme, thiocynate
  IgA
  Mucus
  Electrolytes
  Urea and uric acid
  Ptyalin enzyme
- Ptyalin Enzyme

  Starch 30% Cooked —(Salivary Amylase / Ptyalin Activation Cl⁻)→ Maltose + α-Destrin



Maximum digestion
Maximum Absorption.

I

- 2 m
- Pair's patches present (RFCT)
- Digestion of protein completed
- Absorption of $Vit\ B_{12}$ and Bile salt

J

- 1 m
- well developed villi
- Maximum absorption

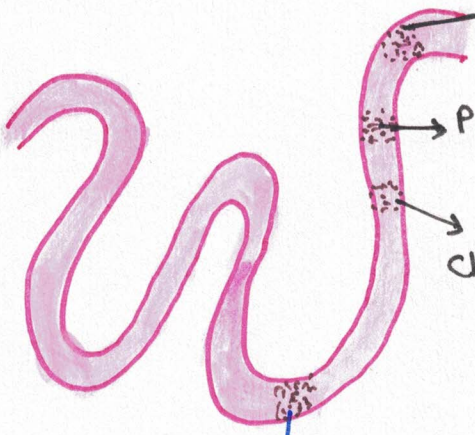
D

- 25cm
- Retroperitoneal
- wider
- C - shape
- Maximum digestion.

Large Intestine

- Shorter in length but wider

Gastric Glands



- Mucus neck cell → Mucus, Bicarbonate → Protect from acid (excoriation)
- Parietal/oxyntic → HCl (Inactive → Active); Castle → Intrinsic factor → Absorption of Vit B_{12}
- Chief/Peptic/zymogen → Pepsinogen —HCl→ Pepsin; Rennin —HCl→ Renin; Gastric lipase
  - Renin → Casein (Milk solute fixation)
  - Casein —Ca^{2+}→ Paracasinate → Calcium Para-casein (insoluble curdling of Milk)

Enteroendocrine / Argentaffin

- G-cells: Gastrin, stimulatory
- D-cells: Somatostatin, inhibitory
- Enterochromaffin (ECL)
  - Histamine: Vasodilator
  - Serotonin: Vasoconstrictor.

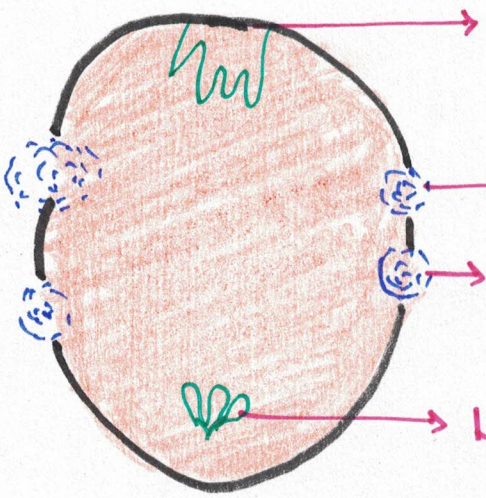
STOMACH / GASTOR

- J- shape
- Widest part of alimentary canal
- In empty condition temporary folds are present.
  → Gastric Rugae
- Temporary store the food (4 to 5 hrs)
- Thickest muscular layer for churning movement.
- Oblique muscles present.

Gastric Juice

- Simple branched tubular.
- 1500 - 2500 ml per day, PH - 1.8 (1.5 - 2.5) (Highly acidic)
- Composition :→ 99.5% of water + 0.2 - 0.3% HCl +
  - other → CIF
    Mucus
    Bicarbonate
    Enzymes (Pepsinogen, Prorennin, Lipase)

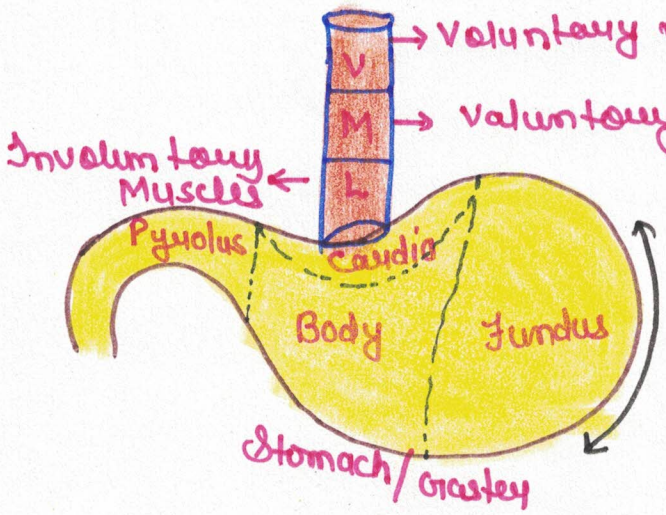
Waldey's Ring



- → Pharyngeal tonsil
- → Eustachian tube (tubal tonsil)
- → Palate tonsil
  tonsilitis → tonsalactomy
- → Lingual tonsil

Oesophagus

- Dorsally present tube like structure.
- Long oesophagus present in giraffe.
  Length of neck ∝ Length of oesophgus.
- No digestion, no absorption, but peristalsis movement.



→ Voluntary muscles

→ Voluntary muscles + involuntary muscles

Involuntary Muscles ←

Lower sphinder / cardiac sphicher

Greater curvature
Omentum
(Fat)

CAECUM

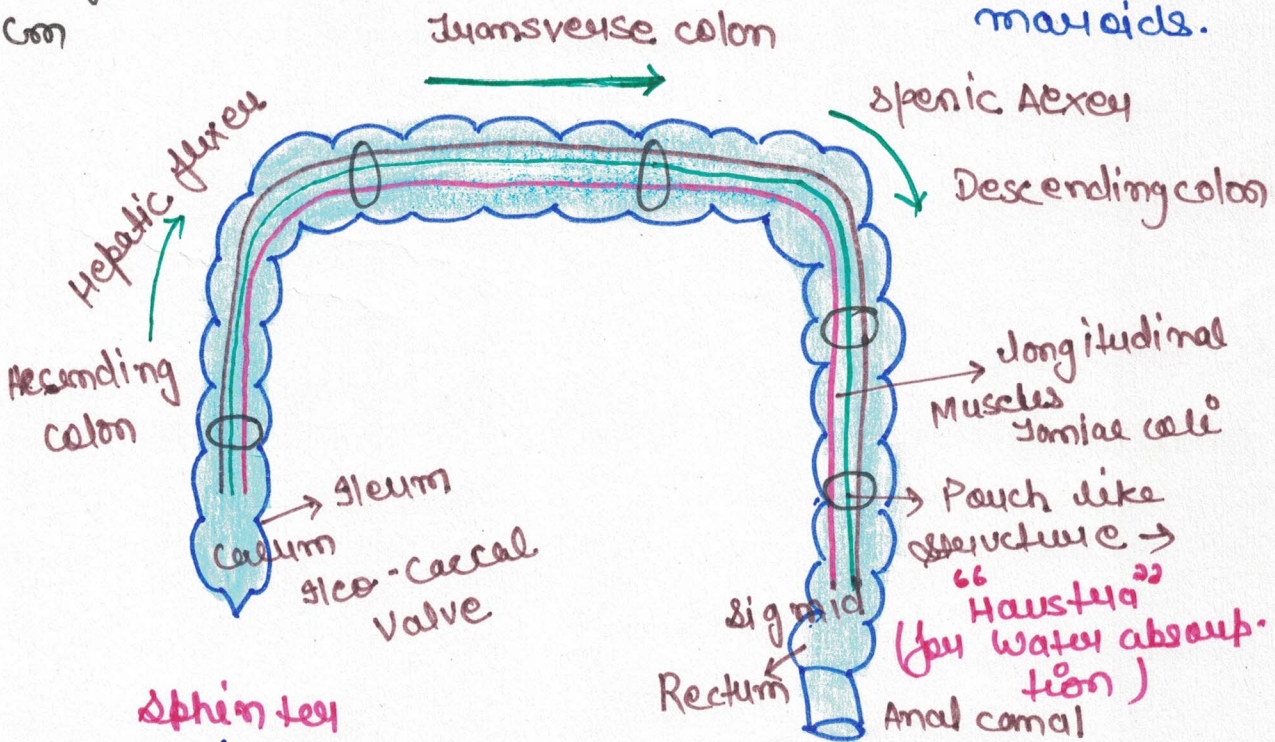
- Blind sac
- Symbiotic microorganism present
- well developed cellular digestion
- Vermiform appendix vestigeal in human
- 6 cm

COLON

- 100 cm but at the time of autopsy 150 cm
- Haustra present for water absorption.

RECTUM

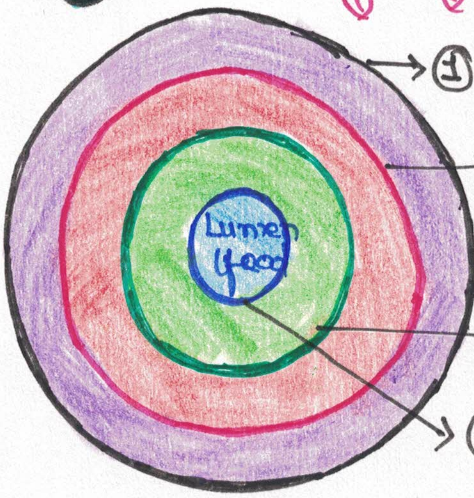
- Least peristalsis (thin muscular layer so temporary store the faecal matter
- Enlargement of rectal vein → Piles or Haemaroids.



Sphincter

Inner involuntary — outer voluntary.

Histology of Alimentary Canal



① Serosa (Viseral peritoneum S.S.E)

② Muscle
- → Longitudinal Muscle
- → Circular Muscle

③ Sub Mucosa (Areolar connective tissue)

④ Mucosa
- Muscle
- → Lumina Project Mat
- → Epithelium - columnar epithelium

Except :→ Oseophagous (Non keratinised stratified squamas epithelum)

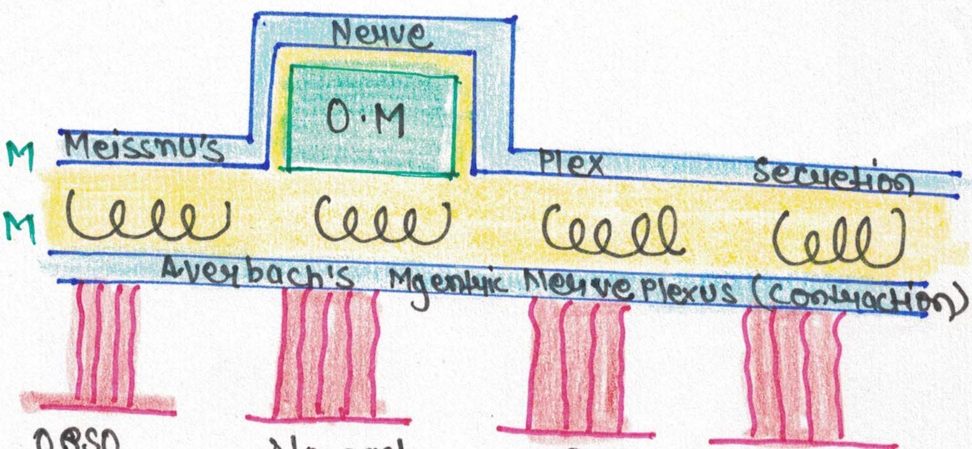
④ Mucosa
- Epithelium
- L.P (MALT)
- Muscles

Payer's Patches
contestinal tonsil

B.G — Brunner's gland

③ Sub Mucosa — Blood and Nerve supply

② Muscles
- → C.M
- → L.M



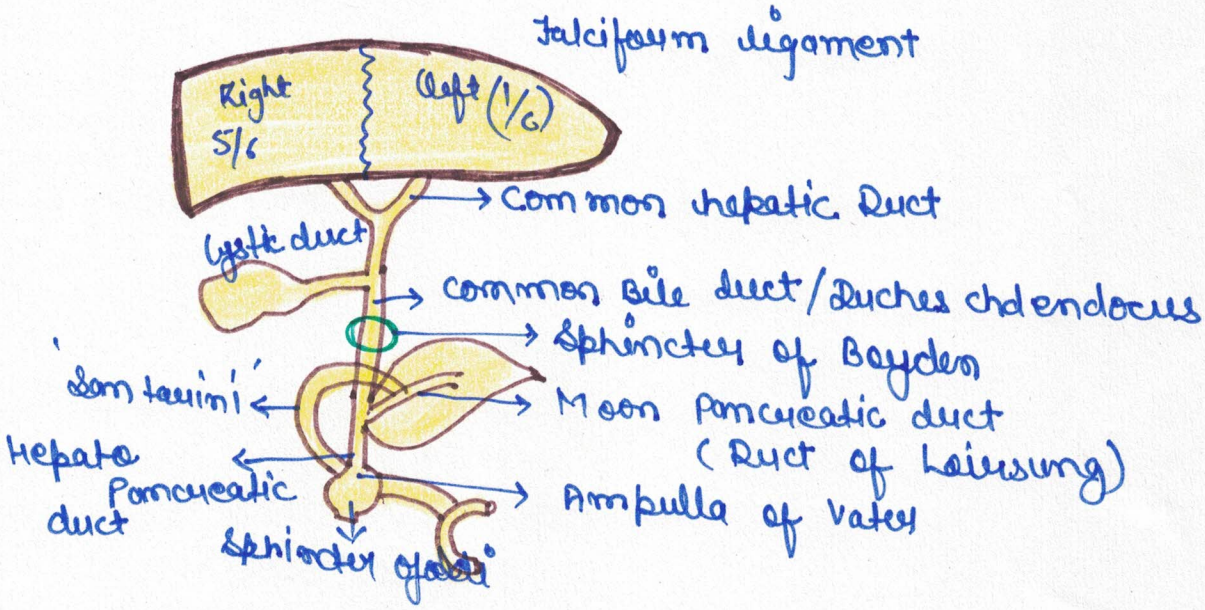
① Serosa

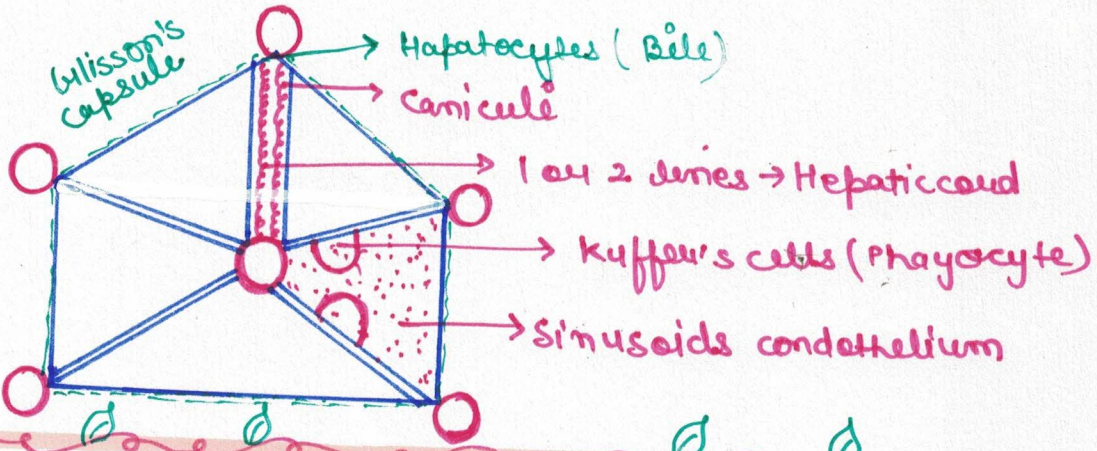
Liver

- Endodermal, 1.2 to 1.5 Kg wt. of the body
- Hepatos, Largest gland of the body
- Largest internal organ of the body
- Biochemical lab of the body
- Busiest organ of the body

Gall Bladder

- Bellow the Right lobe of the liver
- Synthesis of bile in liver but store and concentrated in gall bladder.
- Contraction in smooth muscle of gall bladder is stimulated by CCK
- If Gall bladder removed digestion of fat is effected.
- Cholelithiases ⇒ store in gall bladder mainly because of cholesterol.
- Lobule ⇒ Structural and functional unit of Lives.





Hepatic artery (oxygenated)

Hepatic Portal vein Deoxygenated

Hepatic Bile → Duct

Portal triad

Hepatic artery + Hepatic portal vein

Sinusoids

↓

Central (lobular) Vein

↓

Hepatic Vein

↓

Inferior Vena cava

↓

Right artery

Carbohydrate Metabolism

Fatty acid, amino acid → Glucose ⇌ Glycogen [Liver, Muscles]

Liver

STORE

Vit. A, D, K, E, B_{12} Minerals, Cu, Mo, Zn, Fe small amount of fat. Fat ↑ → Fatty liver

SYNTHESIS

- Polypeptide (except globulin)
- Clotting factor
- Vittelogenesis (Yolk)
- Haemo
- Bile synthesis
- Detoxification
- Deammination (Kidney also)
- B carotene → Vit A
- Heparin (Anticoagulant)

BILE JUICE

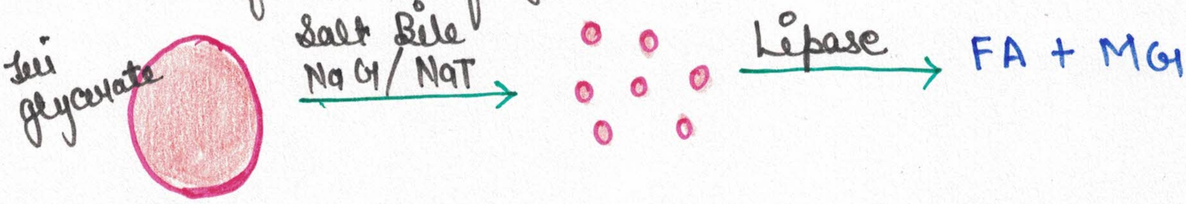
- Enzymes are absent so not a true digestive juice.
- 500 ml per day
- 7·4 – 7·6 pH
- Yellowish green, viscous, alkaline fluid

COMPOSITION :→ 98% water + Lectinin in cholesterol + Bile Pigment + Bile salt

- Inorganic: NaCl, $NaHCO_3$ → Alkaline
- organic: Na^+ Glycoxolate, Na] Emulsification of fat.

FUNCTION

- Prevent the food from decomposition
- Activation of lipase, Neutrilise the acidity and provide alkaline medium
- Emulsification of fat.



- Mixed gland

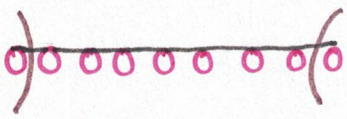
Exocrine	Endocrine
Duct	Ductless
99%	1%
Acini of Pancreas → Enzyme. Mainly Proteniecious	Islands of Langerhans → Hormones

PANCREATIC JUICE

- 1500 ml per day
- 7.5 to 8.3 pH
- Colourless, Highly odouriferous, alkaline fluid
- Mucious and bicarbonate (non-enzymatic).
- Enzymate part is stimulated by → CCK and Ach

Pancreatic Enzymes

Protease :- Breaks peptide Bond



Exo

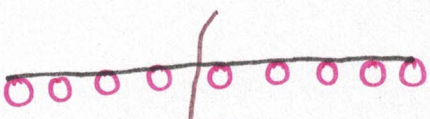
large peptide → Amino acid

Aminopeptidase

Dipeptidase } → Trypsin

Tripeptidase }

Carboxy peptidase



Endo

Peptones + Protease

Pepsin

Trypsin

Chymotrypsin

Elastase

- For carbohydrate → P α-Amylase (Pancreatic α-Amylase)
- For lipid → Lipase (Pancreatic Lipase

Phospholipase

Collectively called stepsin

- For Protein → Trypsinogen —(Enterokinase / Enteropeptidase)→ Trypsin
- Chymotrypsinogen → Chymotrypsin
- Procarboxypeptidases (Inactive) —Trypsin→ Carboxypeptidase (active)
- For Nucleic Acid → Nuclease
- 98% water + 2% others

INTESTINAL JUICE / SUCCUS → Entericus

- For carbohydrate → Disaccharidase (Like Maltase)
- For Fats → Intestinal Lipase
- For Protein → Enterokinase (activator), Dipeptidase, tripeptidase, aminopeptidase.
- For Nucleic acid → Nucleotidase and Nucleosidase

PHYSIOLOGY OF DIGESTION

- Activity of GIT under the nervous and of hormonal control for proper co-ordination.
- In oral cavity
- Taking of food → Ingestion
- Chewing with the help of Premolars and Molars
- Food + Saliva ⇒ Bolus → Oesophagus → Stomach
- 30% cooked starch —salivary Amylase→ Maltose + α-Dextrin

??? If person taking only carbohydrate in diet the composition of bolus.

Ans⇒ 70% Maltose + 30% α-Dextrin

In Stomach

Bolus + Gastric Juice —(oblique muscles / churning movement)→ Chyme

Protein —Pepsin→ Peptones + Proteans

Casein —Rennin (Imparts curding of milk)→ Calcium para casinate

Triglyceride —[illegible]→ Fatty acid + Monoglyceral

In Intestine

Chyme (1·8) —Segmentation→ Bile alkaline(≈7·8)→Chyle

Carbohydrate = Starch —Pancreatic Amylase→ Maltose + α-Dextin

Protein —Trypsin→ Peptones + Proteones

Fat → Triglyceride —Bile Emulification→ Fatty acid

Nucleic Acid —Nuclease→ Nucleotides

Intestinal Juice / Succus entericus

Maltose + α-Dextine —Maltase / Dextrinase→ Glucose

Sucrose —Sucrase→ Glucose + Fructose

Lactose —Lactase→ Glucose + Galactose

Proteones + peptones —Di/tri/ amino→ Amino Acid

Pancreatic lipase / Intestinal lipase → Monoglycerol + Fatty acid

Nucleotides —Nucleotidase→ Nucleosides —Nucleosidase→ Nitrogen Base + Sugar

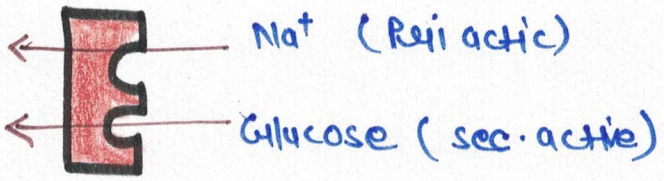
ABSORPION

ACTIVE

Without ATP against the concentration gradient

L-amino acid, Galactose, Na^+

Glucose

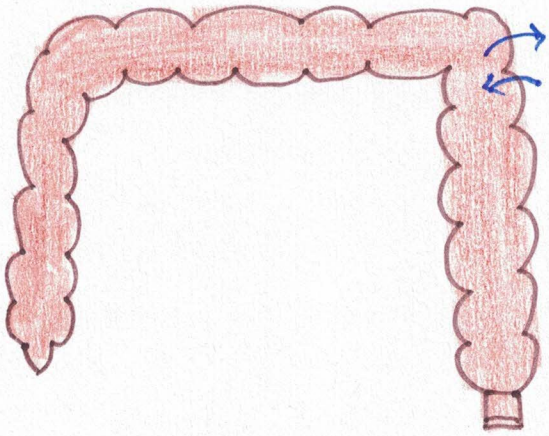


PASSIVE

without ATP

Assimilation – Utilisation of absorbed substances

Defaecation



Egestion/ Defaction

↓

Max Peristalsis

↓

Yellowish Pigment

↓

Stercobilin

Smell → H_2S, Cly, Indole

ABSORPION OF FAT

Bile Salt + Fatty acid + Mono glycerats.

↓

water soluble (Micelle)