



SNS COLLEGE OF TECHNOLOGY

(AN AUTONOMOUS INSTITUTION)

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Department of Biomedical Engineering

Vision Title 2
Course Name: 19BMT201 Anatomy & Physiology *Vision Title 3*

II Year : III Semester

Unit IV- Digestive System – Absorbtion & Digestion

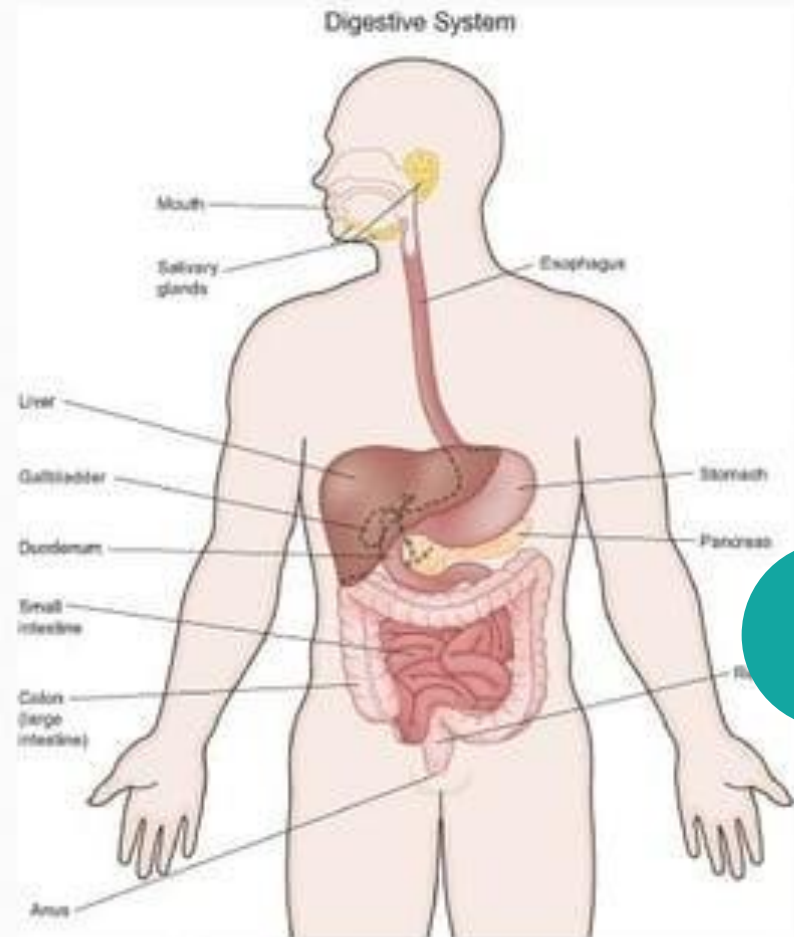
Topic : Heart Conduction system & Cardiac Cycle

19BMT201/HAP/Unit 3 /Mrs.J.Jareena /AP/BME



Introduction

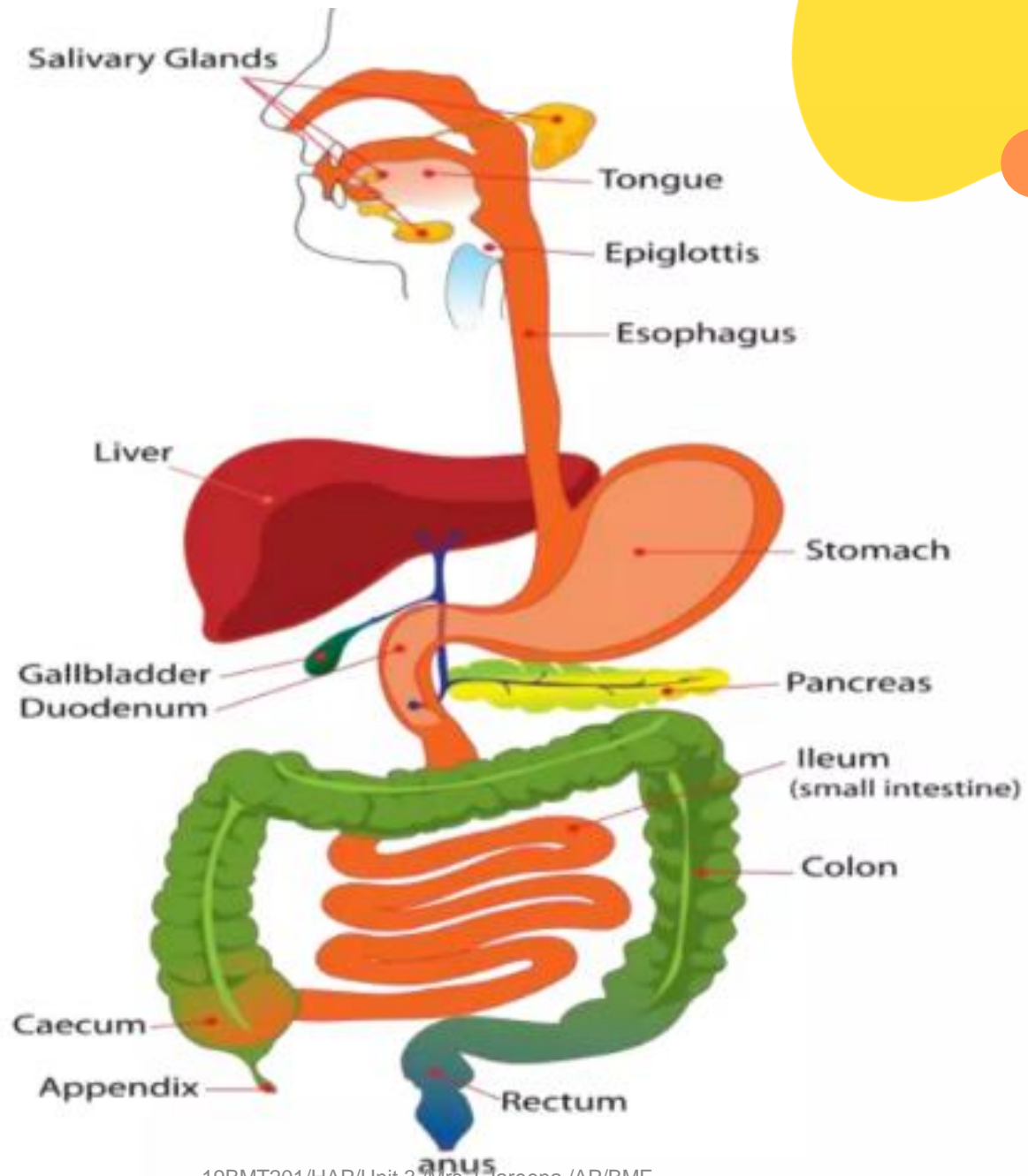
- The digestive system is used for breaking down food into nutrients which then pass into the circulatory system and are taken to where they are needed in the body.





Functions of the Digestive System

- Ingest food
- Break down food into nutrient molecules
- Absorb molecules into the bloodstream
- Rid the body of indigestible remains





Digestion

- Phases Include

1. Ingestion
2. Movement
3. Mechanical and Chemical Digestion
4. Absorption
5. Elimination



Digestion

- Types

- Mechanical (physical)

- Chew (Mastication)
 - Tear
 - Grind
 - Mash
 - Mix

- Chemical

- Enzymatic reactions to improve digestion of

- Carbohydrates
 - Proteins
 - Lipids



Major classes of nutrients

- There are seven nutrients that are classed as essential for good health:
 - Carbohydrates
 - Proteins
 - Fats
 - Fibre
 - Water
 - Vitamins
 - Minerals
- The first three are known as **the macronutrients** and are the major organic nutrients that are broken down for energy during the digestive process. The organic nutrients along with fibre and water are required in substantial quantities. Vitamins and minerals are known as **the micronutrients**, and although they are essential for good health they are required in smaller amounts. These are absorbed in their current state and do not require breaking down with digestive enzymes.



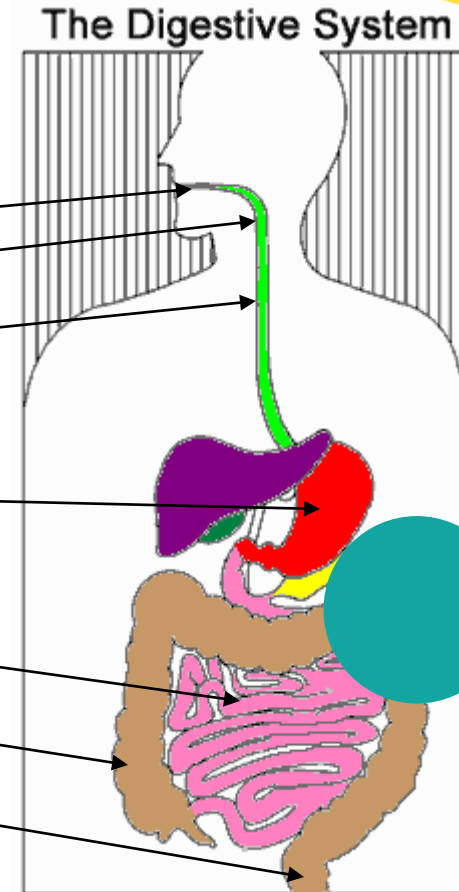
Digestive System Organization

- **Gastrointestinal (GI) tract**

- Tube within a tube
- Direct **link/path** between organs

- **Structures**

- Mouth
- Pharynx
- Esophagus
- Stomach
- Small intestine
- Large Intestine
- Rectum

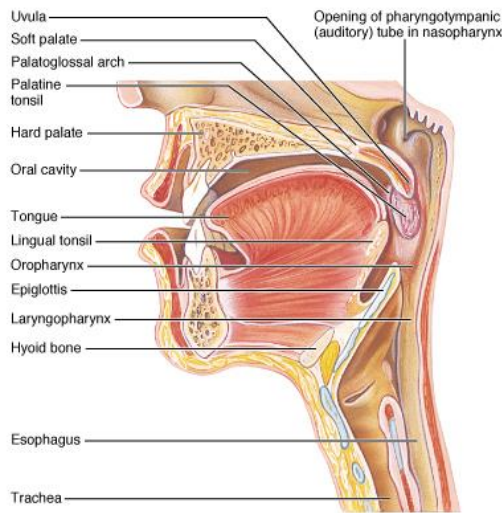




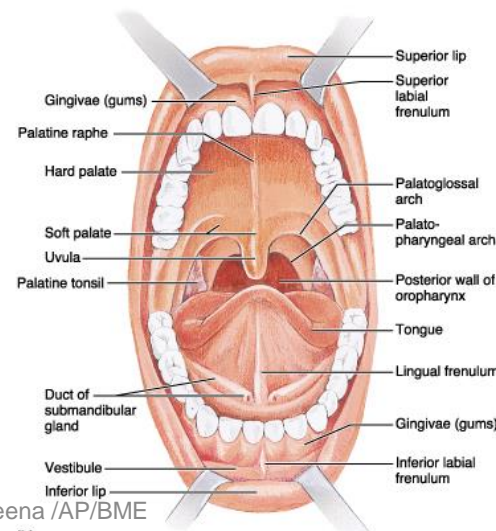
Mouth

- Teeth mechanically break down food into small pieces. Tongue mixes food with saliva (contains amylase, which helps break down starch).

- Epiglottis is a flap-like structure at the back of the throat that closes over the trachea preventing food from entering it. It is located in the Pharynx.



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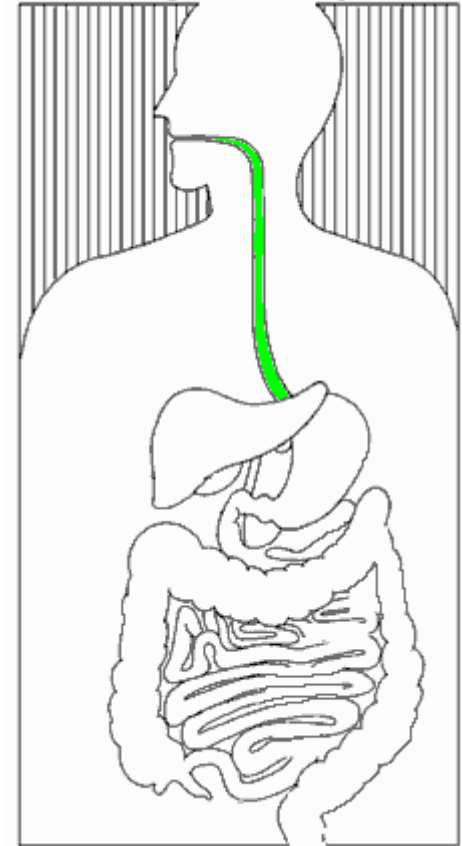
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Esophagus

- Approximately 20 cm long.
- Functions include:
 1. Secrete **mucus**
 2. Moves food from the throat to the stomach using muscle movement called **peristalsis**
- If acid from the stomach gets in here that's **heartburn**.

The Digestive System

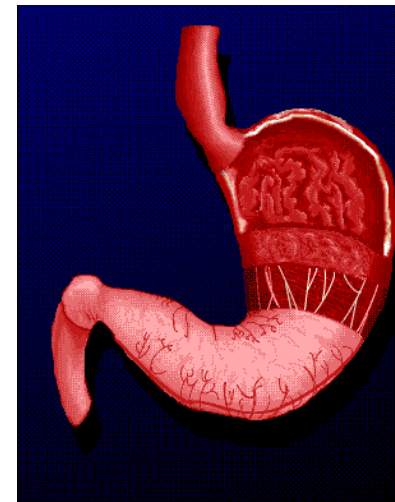
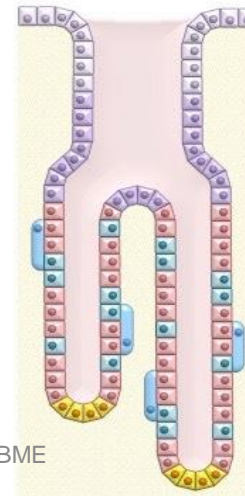




Stomach

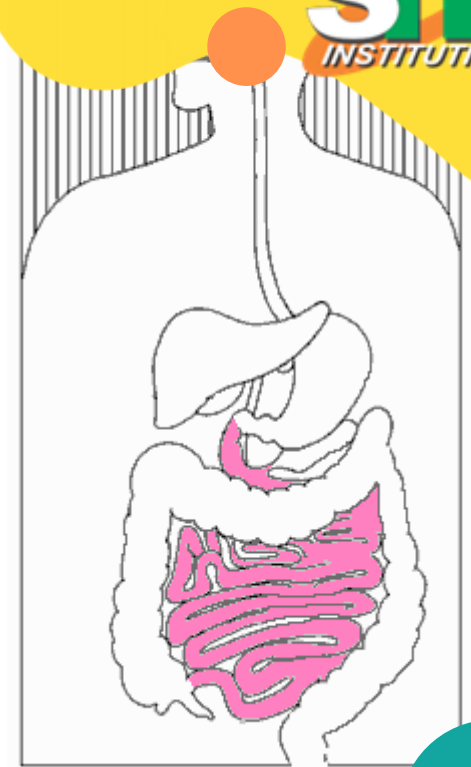
- J-shaped muscular bag that stores the food you eat, breaks it down into tiny pieces.
- Mixes food with **Digestive Juices** that contain enzymes to break down **Proteins and Lipids**.
- **Acid (HCl)** in the stomach Kills Bacteria.
- Food found in the stomach is called Chyme.
- About 2.5 litres of gastric juice are produced daily.

Cell Types	Substance Secreted
Goblet cells	Mucus (protects stomach lining)
Parietal cells	Gastric acid (e.g. hydrochloric acid)
Chief cells	Pepsinogen (protease precursor)
D cells	Somatostatin (inhibits acid secretion)
G cells	Gastrin (stimulates acid secretion)

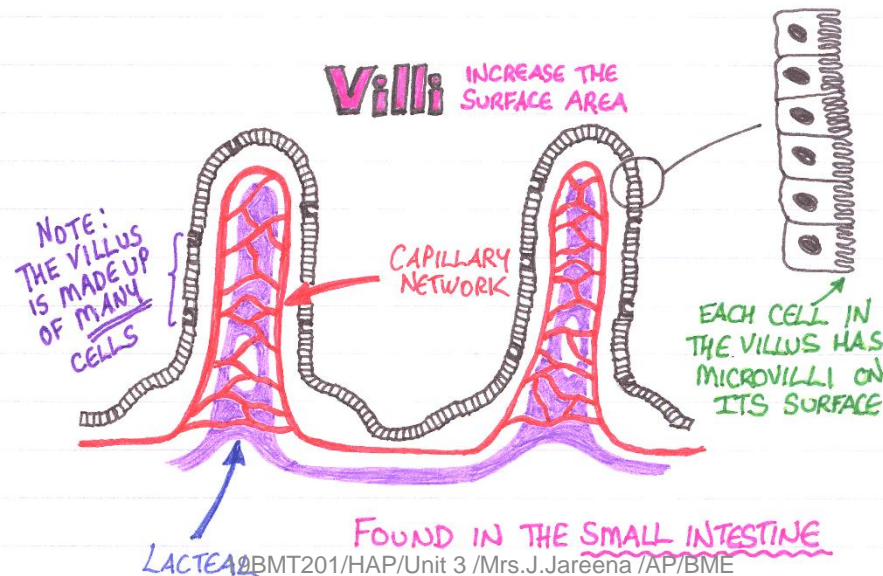




Small Intestine



- Small intestines are roughly **7** meters long
- Lining of intestine walls has finger-like projections called **villi**, to increase surface area.
- The villi are covered in **microvilli** which further increases surface area for absorption.





Mechanical digestion in the small intestine

- **Movement of the chyme** (partly digested food) back and forth within the small intestine, without any real forward movement, is called segmentation, controlled by the autonomic nervous system along with peristalsis
- **chyme** moves along the small intestine at approximately **1cm a minute**.
- The chyme is mixed with the gastric juices and brought into contact with the submucosa (cells of the small intestine) **for absorption**.



Chemical digestion in the small intestine

- About 3 litres of intestinal juices are secreted daily by the small intestine in response to the presence of acidic chyme entering from the stomach. The pH in the small intestine is slightly alkaline, which enhances enzyme function.

- Composition of intestinal juices

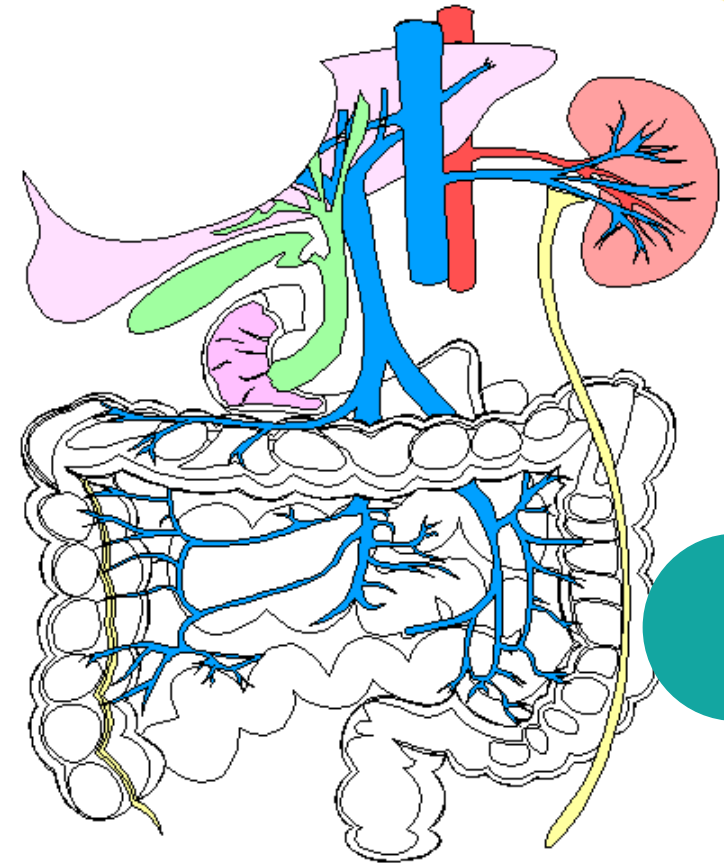
- water
- mucus
- mineral
- salts
- enzymes

- The main contributor to chemical digestion in the small intestine is from a **pancreatic juice secreted by the pancreas** and **bile secreted by the gall bladder**
- **Proteins** (polypeptides) are converted to amino acids by the pancreatic **protease enzymes** trypsin and chymotrypsin.
- **Digestible carbohydrates** (starches) are transformed into monosaccharides by the action of amylase.
- **Fats** are converted to fatty acids and monoglycerides by **lipase**, assisted by bile.



Small Intestine

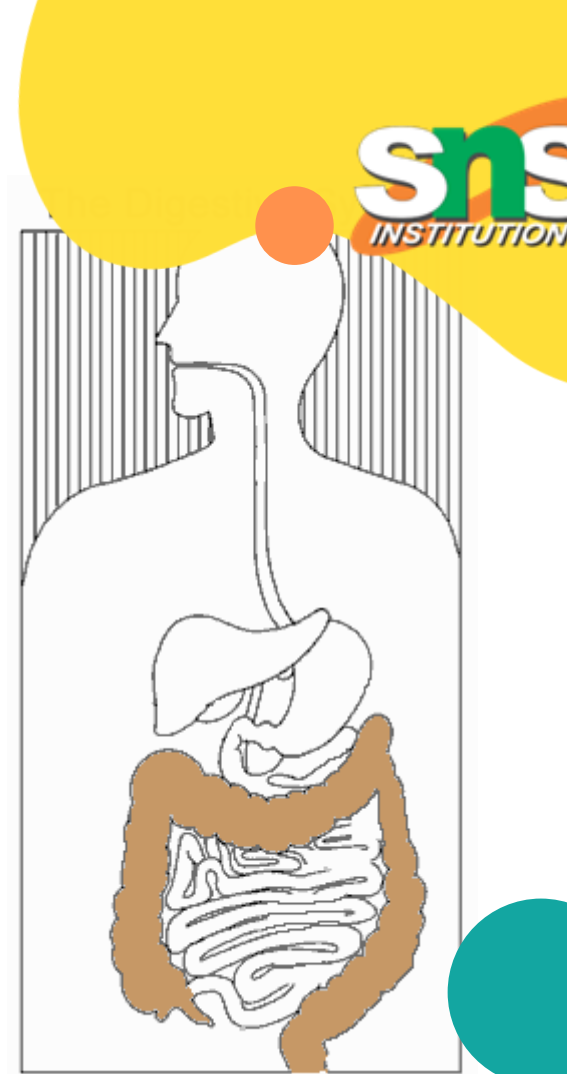
- Nutrients from the food pass into the **bloodstream** through the small intestine walls.
- Absorbs:
 - 80% ingested water
 - Vitamins
 - Minerals
 - Carbohydrates
 - Proteins
 - Lipids
- Secretes **digestive enzymes**





Large Intestine

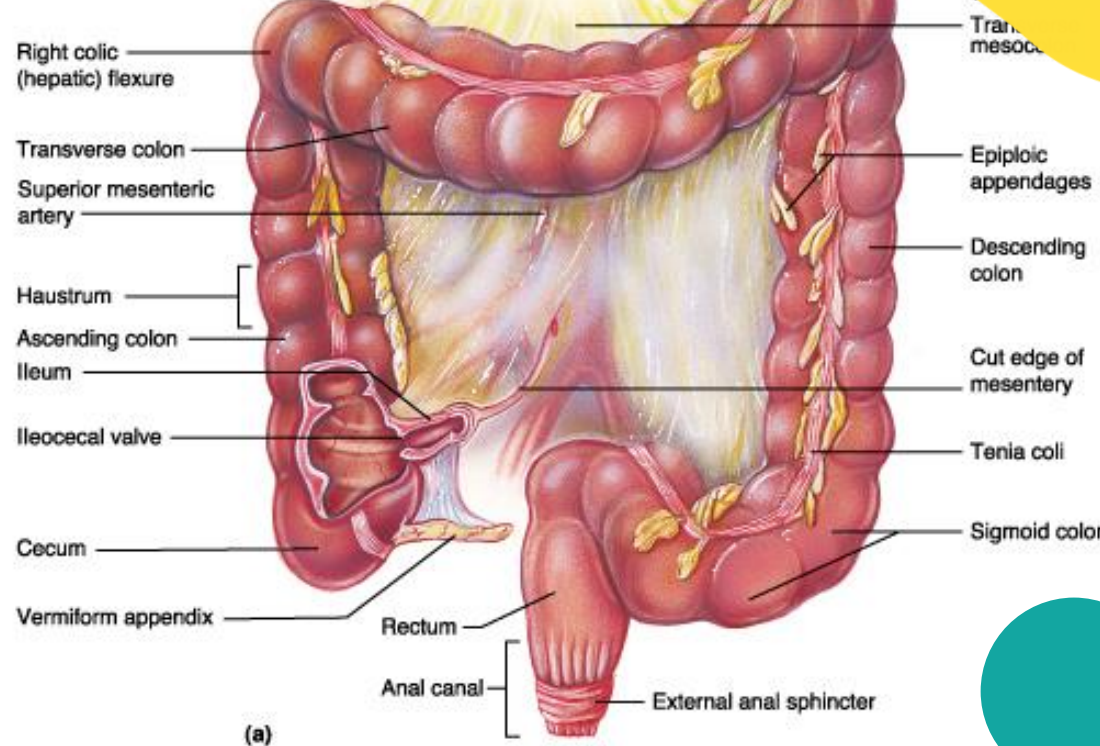
- About **1.5 meters** long
- Accepts what small intestines don't absorb
- **Rectum** (short term storage which holds feces before it is expelled).



Large Intestine

- Functions
 - Bacterial digestion
 - Ferment carbohydrates

- Absorbs more **water**
- Concentrate **wastes**

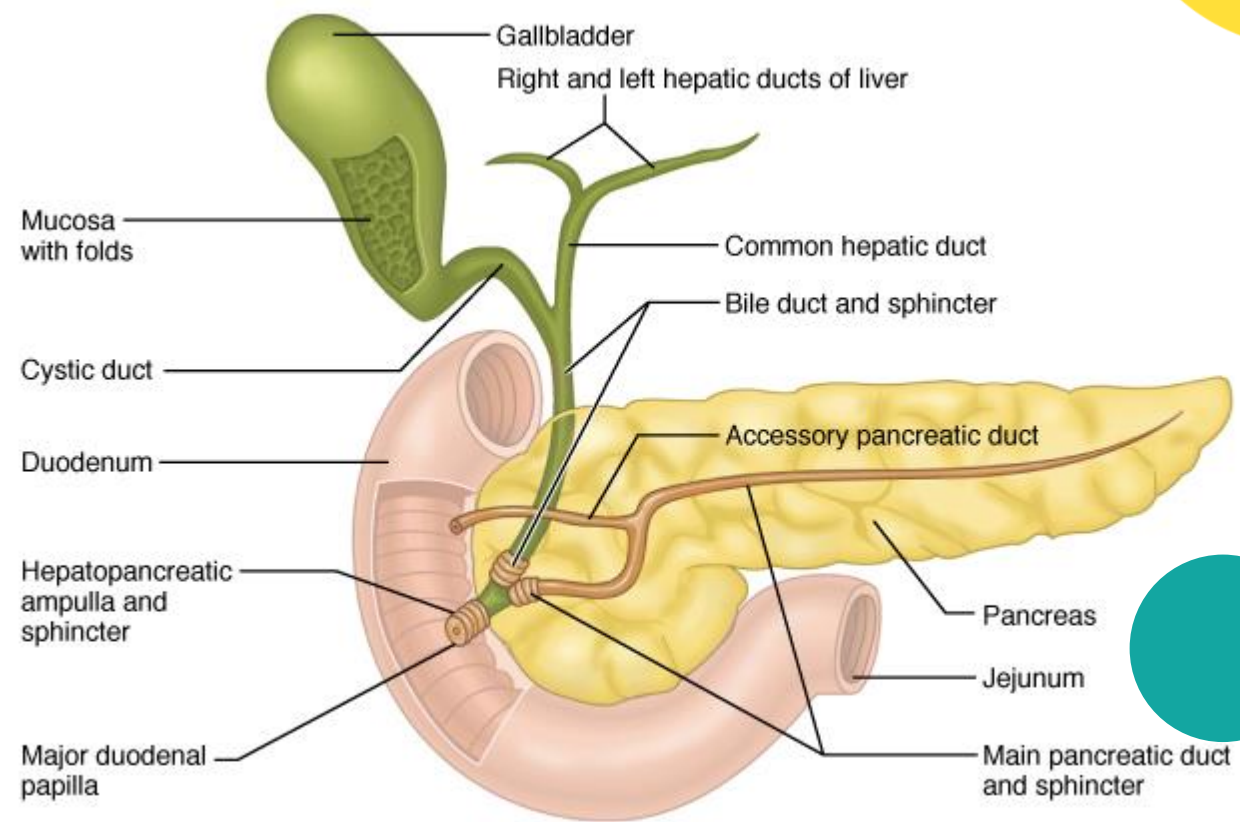


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Accessory Organs The Glands

- Not part of the path of food, but play a critical role.
- Include: Liver, gall bladder, and pancreas

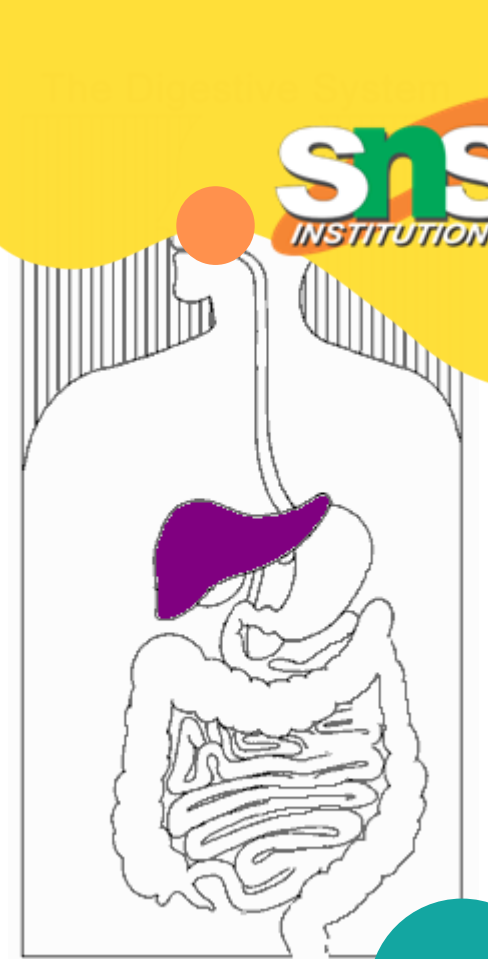
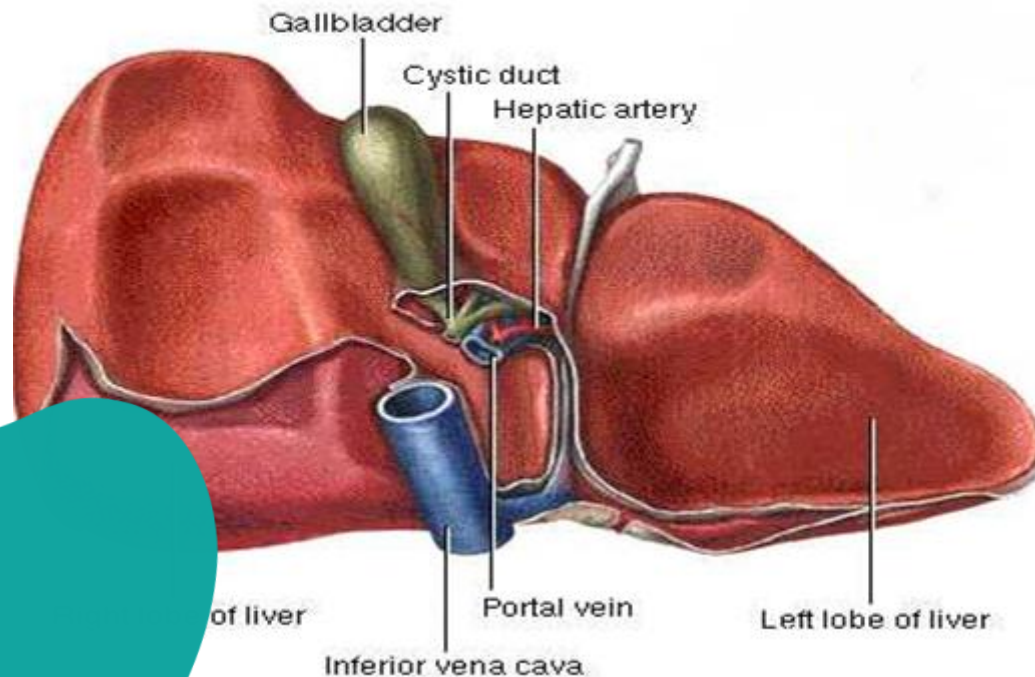


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Liver

- Directly affects digestion by producing **bile**
 - Bile helps digest **fat**
 - filters out **toxins** and waste including **drugs** and **alcohol and poisons**.





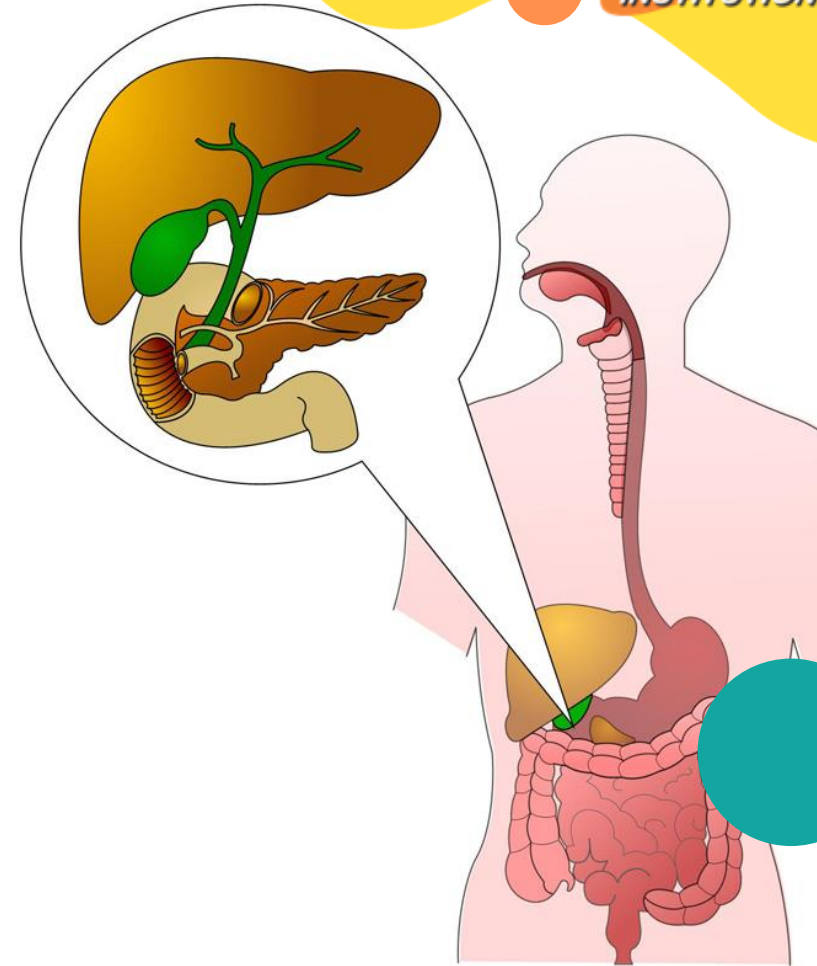
The liver is the largest organ in the body and weighs **roughly 1.4 kg.** It is protected by the lower ribs and is situated mainly in the upper right side of the abdomen.

- The liver carries out numerous functions including:
 - processing digested food from the intestines
 - regulating blood glucose levels
 - regulating fats/lipids
 - regulating amino acids
 - detoxifying alcohol, drugs and poisons absorbed by the blood
 - producing bile for fat emulsification
 - generating heat
 - forming and breaking down red blood cells
 - producing enzymes and proteins for chemical reactions in the body
 - fighting infections, particularly bacterial infection
 - storing vitamins and minerals, such as vitamin B12 and iron



Gall Bladder

- **Stores bile** from the liver, releases it into the **small intestine**.
- Fatty diets can cause **gallstones**
- The larger pancreatic duct joins with the bile duct from the liver which carries bile.
- Bile, which is secreted by the liver, is stored in the gall bladder. Release of bile is stimulated by the hormone cholecystikinin (CCK) from the duodenum.
 - Bile is composed of :
 - water
 - mineral and bile salts
 - mucus
 - bilirubin
 - cholesterol

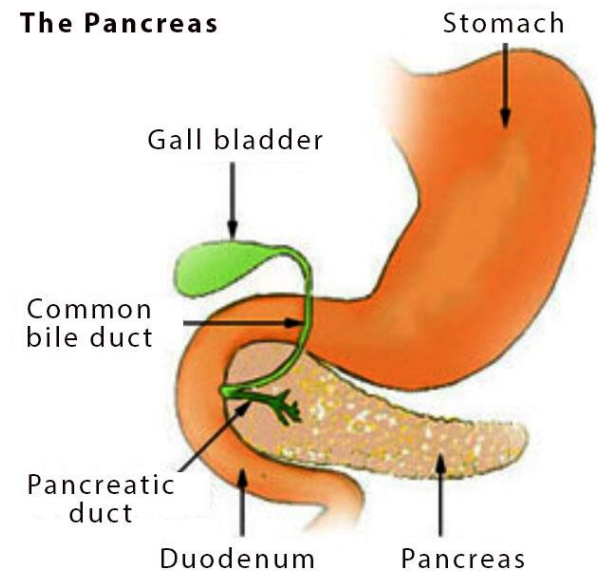




Pancreas

- pancreas is an oblong gland about 12 centimetres long by 2.5 centimetres thick lying in the fold between the Stomach and the duodenum
- produce 1.2 – 1.5 litres of pancreatic juice daily which travels to the duodenum via a pair of ducts.
- Produces digestive enzymes to digest **fats, carbohydrates** and **proteins**
- Regulates blood sugar by producing **insulin**

- pancreatic juice consists of these enzymes:
 - pancreatic amylase for starch digestion
 - pancreatic lipase for fat digestion
 - pancreatic protease for protein digestion





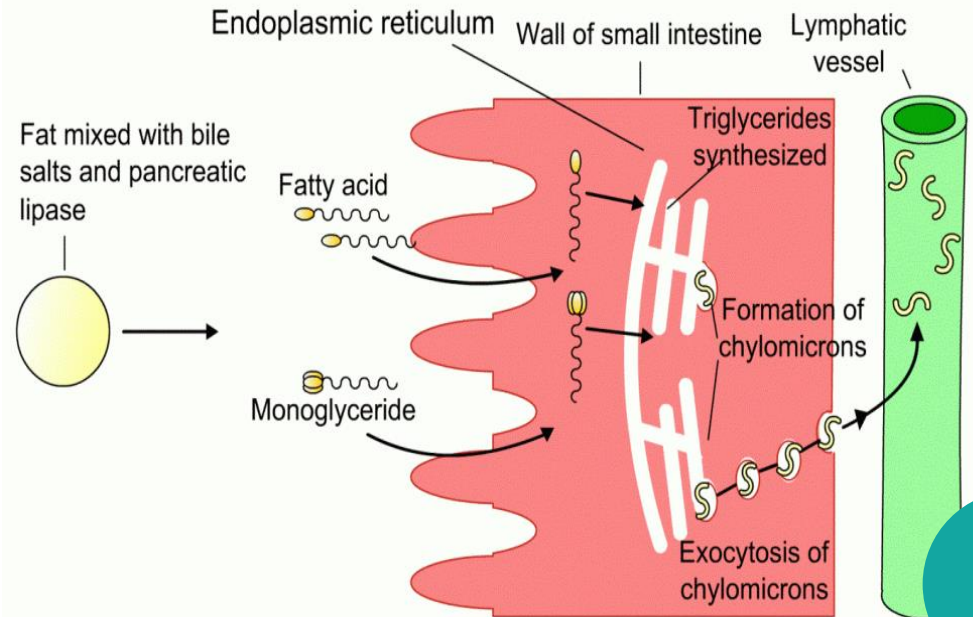
Absorption of carbohydrates and proteins

- Absorption involves the passage of **digested nutrients** from the gastrointestinal tract into the **blood and lymphatic systems**.
- Most **nutrients are absorbed via the small intestine** although some are absorbed through the stomach or large intestine.
- Monosaccharides, amino acids and a few short-chain fatty acids pass into the epithelial cells of the small intestine, through capillary walls into the bloodstream.
- Capillaries join up to form the hepatic portal vein which carries the products of digestion to the liver.



Absorption of fats

- Long-chain fatty acids and monoglycerides are surrounded by bile salts to form small droplets called **micelles**.
- These pass into lacteal vessels in the epithelial lining, first re-forming into triglycerides, then attaching to protein molecules to form **chylomicrons** in the lymph fluid.
- The digested fats in the lymph fluid eventually drain into the cardiovascular system at the left subclavian vein, travelling on to the liver via the hepatic artery.



Now it's...

QUIZ TIME!

Proteins... Which one of the options below is correct?

- a) Proteins, Polypeptides, Peptides, Amino Acids, Bloodstream
- b) Proteins, Triglycerides, Bloodstream
- c) Proteins, Polypeptides, Peptides, Amino Acids, Lymphatic System
- d) Proteins, Peptides, Amino Acids, Bloodstream

Fats... Which one of the options below is correct?

- a) Fats, Triglycerides, Lymphatic System
- b) Fats, Glycerol and Fatty Acids, Lymphatic System
- c) Fats, Triglycerides, Glycerol and Fatty Acids, Lymphatic System
- d) Fats, Triglycerides, Glycerol and Fatty Acids, Blood Stream

Carbohydrates... Which one of the options below is correct?

- a) Carbohydrates, Disaccharides, Polysaccharides, Monosaccharides, Blood Stream
- b) Carbohydrates, Monosaccharides, Disaccharides, Polysaccharides, Blood Stream
- c) Carbohydrates, Disaccharides, Monosaccharides, Blood Stream
- d) Carbohydrates, Polysaccharides, Disaccharides, Monosaccharides, Blood Stream

Proteins... Which one of the options below is correct?

- a) Proteins, Polypeptides, Peptides, Amino Acids, Bloodstream
- b) Proteins, Triglycerides, Bloodstream
- c) Proteins, Polypeptides, Peptides, Amino Acids, Lymphatic System
- d) Proteins, Peptides, Amino Acids, Bloodstream

Fats... Which one of the options below is correct?

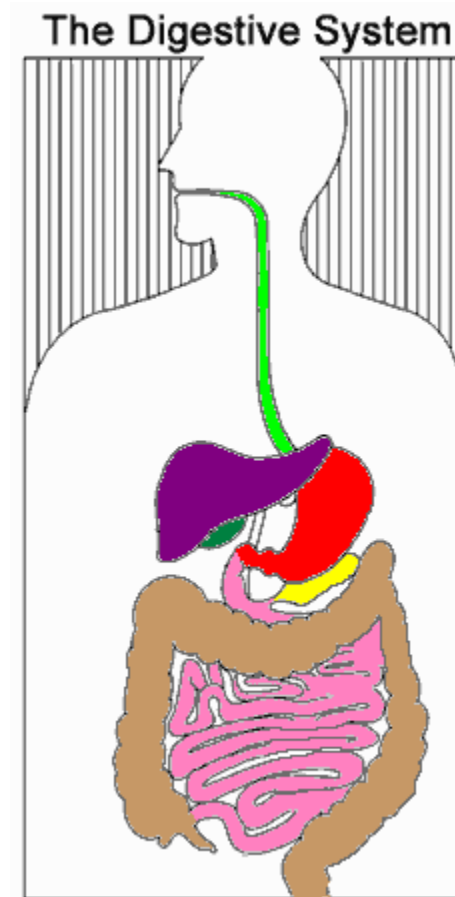
- a) Fats, Triglycerides, Lymphatic System
- b) Fats, Glycerol and Fatty Acids, Lymphatic System
- c) Fats, Triglycerides, Glycerol and Fatty Acids, Lymphatic System
- d) Fats, Triglycerides, Glycerol and Fatty Acids, Blood Stream

Carbohydrates... Which one of the options below is correct?

- a) Carbohydrates, Disaccharides, Polysaccharides, Monosaccharides, Blood Stream
- b) Carbohydrates, Monosaccharides, Disaccharides, Polysaccharides, Blood Stream
- c) Carbohydrates, Disaccharides, Monosaccharides, Blood Stream
- d) Carbohydrates, Polysaccharides, Disaccharides, Monosaccharides, Blood Stream

On a sheet of paper, write the name of each colored organ:

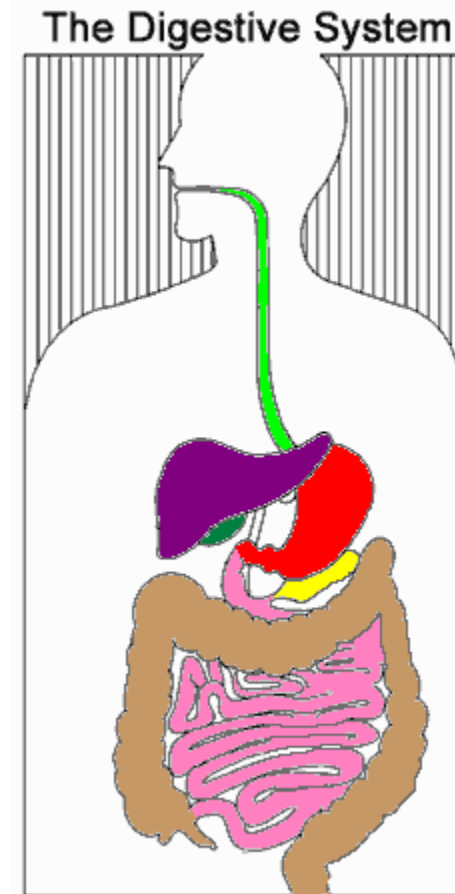
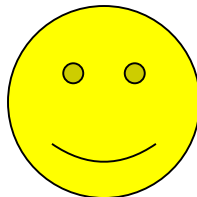
- Green:
- Red:
- Pink:
- Brown:
- Purple:
- Green:
- Yellow:



How'd you do?

- Green: Esophagus
- Red: Stomach
- Pink: Small Intestine
- Brown: Large Intestine
- Purple: Liver
- Green: Gall Bladder
- Yellow: Pancreas

Great Job!



- <https://www.youtube.com/watch?v=VY9CRilrVKQ>
- https://www.youtube.com/watch?v=1_qJOwgpQKE
- https://www.youtube.com/watch?v=zr4onA2k_LY

References and Links

- [Your Digestive System and How It Works](#)
 - Digestive system diagram comes from this site
- [The Real Deal on the Digestive System](#)
- [Pancreas: Introduction and Index](#)
- [Your Gross and Cool Body - Digestive System](#)
- [Laurentian Regional High School Data Base](#)
 - **you must know the Username and Password**