Introduction to human body, its anatomy and physiology
Elementary tissues of body and their classification along with brief description.

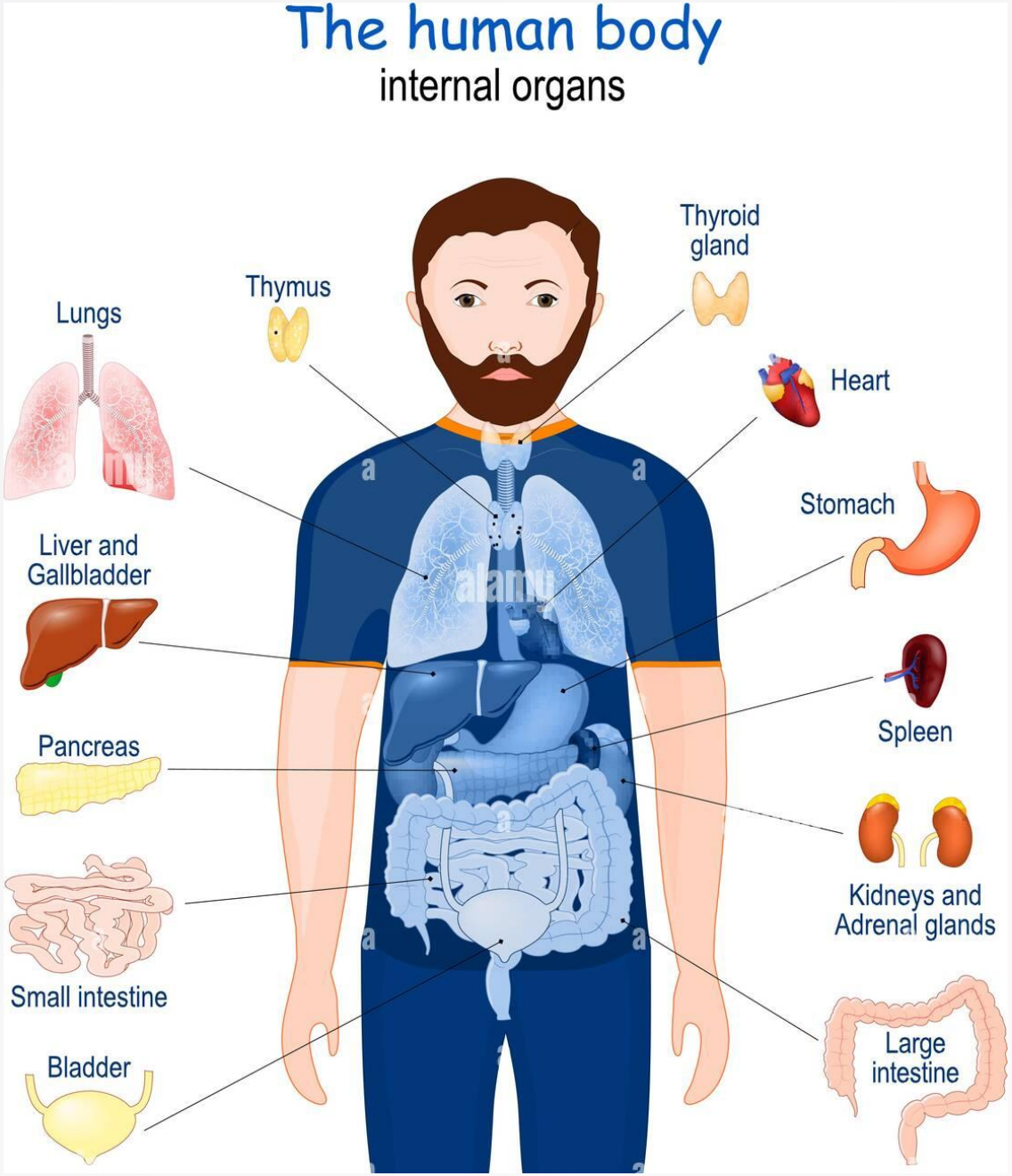
Digestive System Organs of digestion, histology of the digestive organs (stomach, small intestine, liver, pancreas)

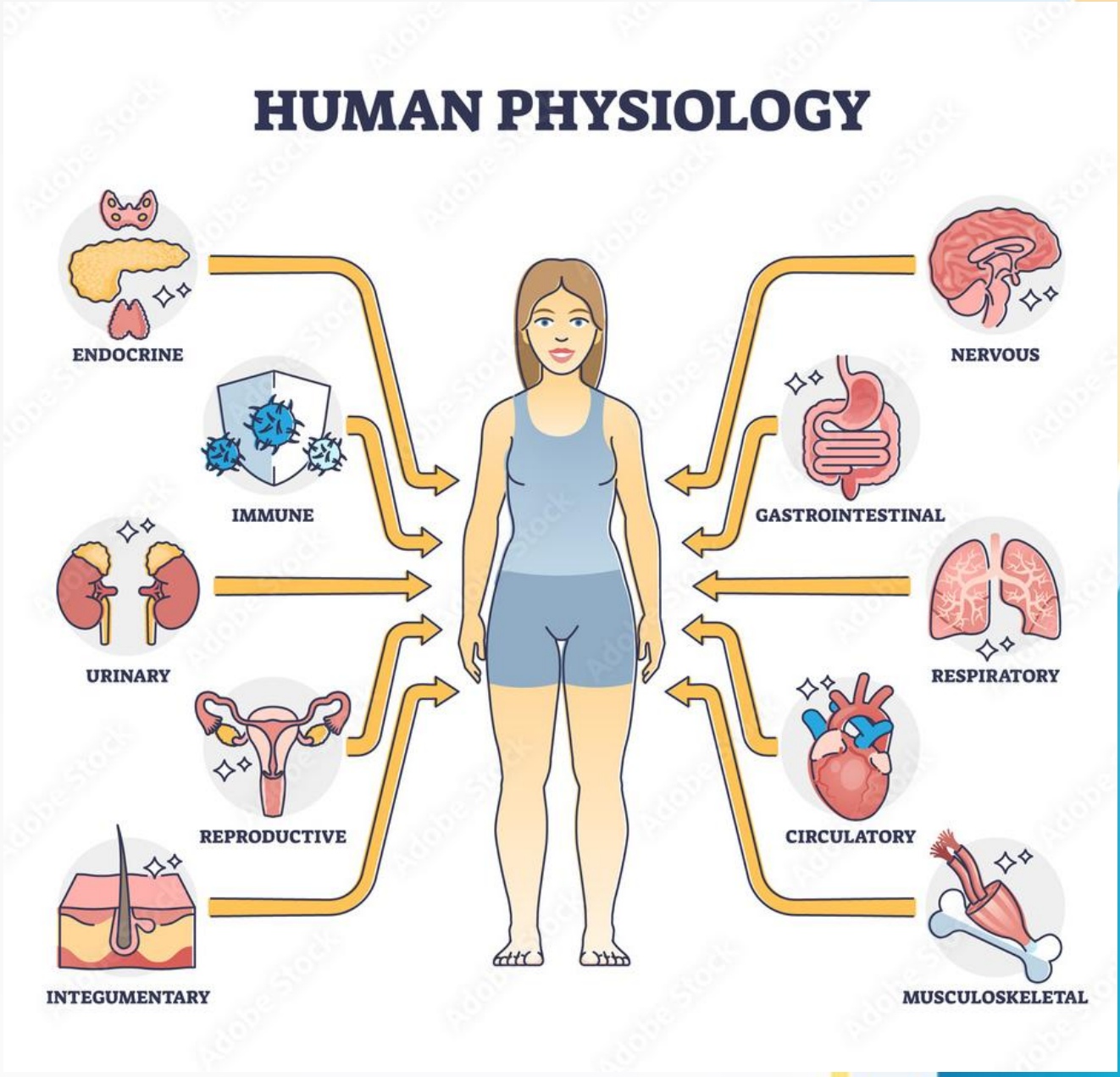
Process of digestion, Absorption and Elimination of food

- Human Anatomy:- (ana- = “up”, tome = “to cut”) is defined as the study of structures in the human body. Anatomy focuses on the description of form, or how body structures at different levels look. Gross anatomy studies macroscopic structures (for example, the body, organs, and organ systems), and histology studies microscopic structures (for example, tissues, cells, and organelles).

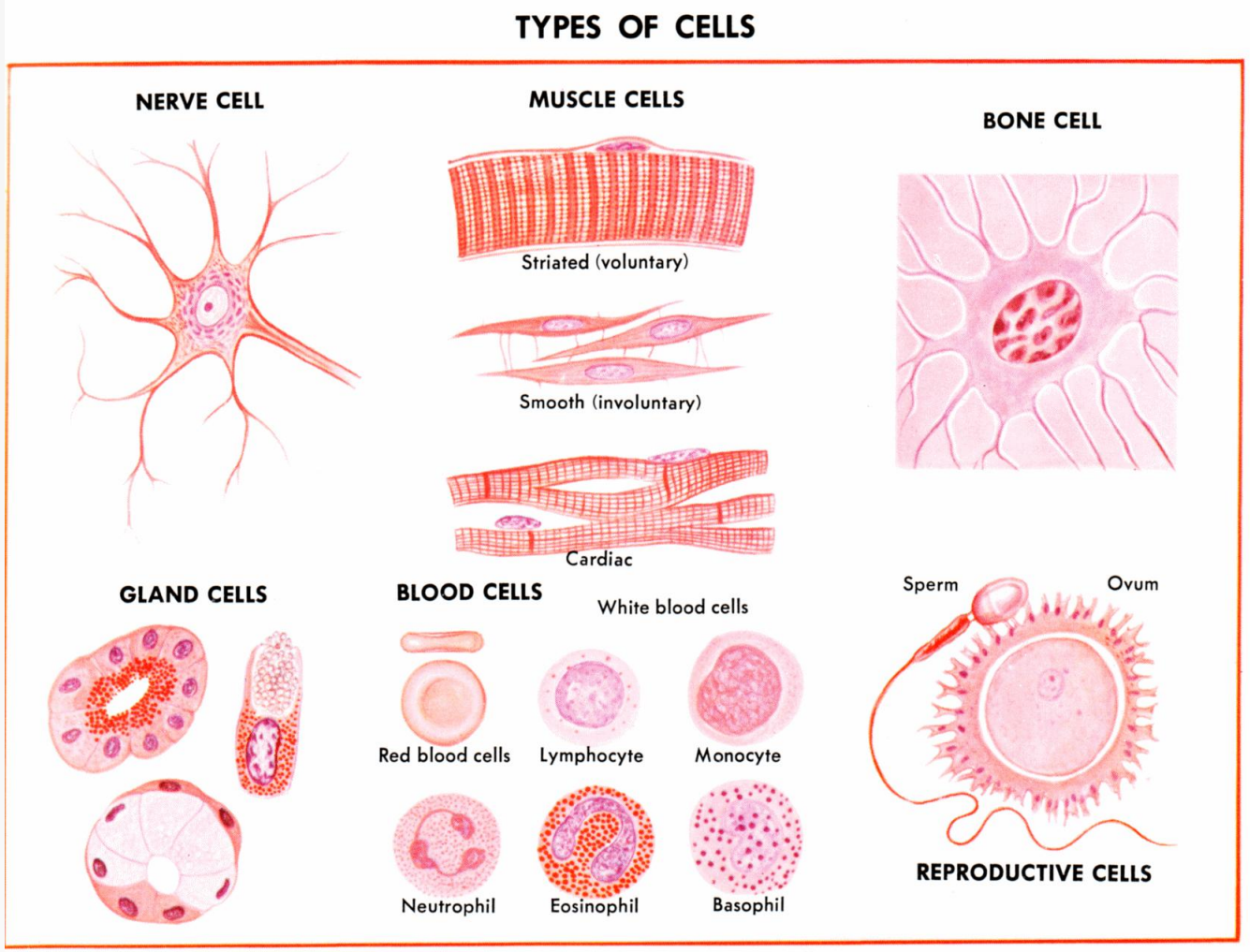
- Human Physiology :- (physio = “nature”; -logy = “study”) studies the “nature” of the human body, nature in the sense of how structures at different levels work. Physiology focuses on function, or how structures at different levels work. Human physiology is the study of how the human body's systems and functions work together to maintain a stable internal environment. It includes the study of the nervous, endocrine, cardiovascular, respiratory, digestive and urinary systems. Understanding human physiology is essential for diagnosing and treating health conditions and promoting overall wellbeing.

- Anatomy and physiology are intimately related. A hand is able to grab things (function) because the length, shape, and mobility of the fingers (form) determine what things a hand can grab (function). A muscle contracts and brings bones together (function) due to the arrangement of muscles and bones, and the arrangement of organelles inside of muscle cells (form) determines how much and for how long a muscle can contract (function). Body structure functions depend on their form. The way structures work depend on the way they are organized. So understanding Physiology requires an understanding of Anatomy


The human body
internal organs
Lungs
Thymus
Thyroid gland
Heart
Stomach
Liver and Gallbladder
Spleen
Pancreas
Kidneys and Adrenal glands
Small intestine
Large intestine
Bladder

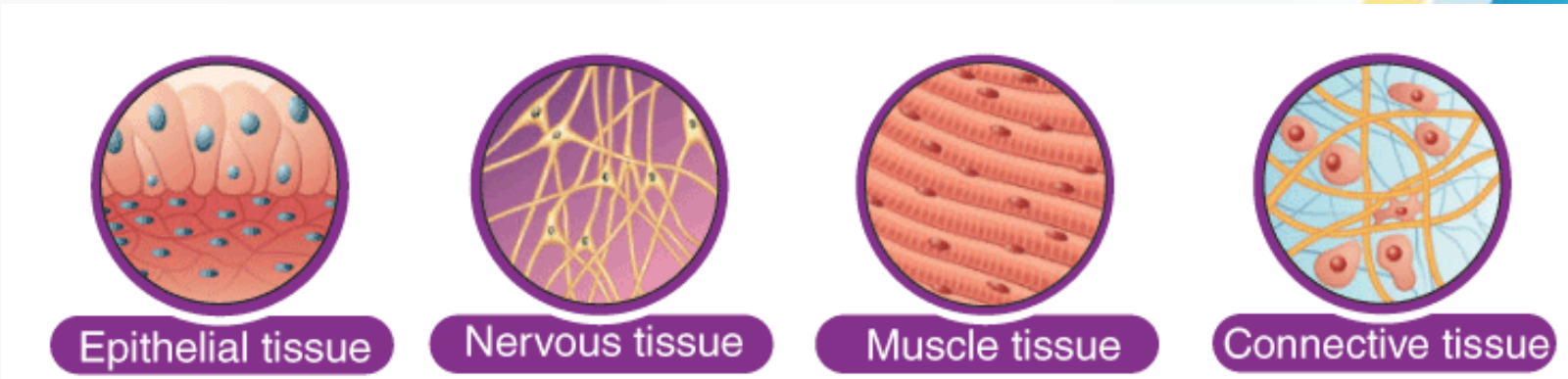

HUMAN PHYSIOLOGY
ENDOCRINE
NERVOUS
IMMUNE
GASTROINTESTINAL
URINARY
RESPIRATORY
REPRODUCTIVE
CIRCULATORY
INTEGUMENTARY
MUSCULOSKELETAL

- Cell Definition
- “A cell is defined as the smallest, basic unit of life that is responsible for all of life’s processes.”
- Cells are the structural, functional and biological units of all living beings. A cell can replicate itself independently. Hence, they are known as the building blocks of life.



- What are Tissues?
- In simple terms, tissue can be defined as a group of cells with similar shape and function are termed as tissues. They form a cellular organizational level, intermediate *(coming between two things in time, place, order, character)* between the cells and organ system. Organs are then created by combining the functional groups of tissues.

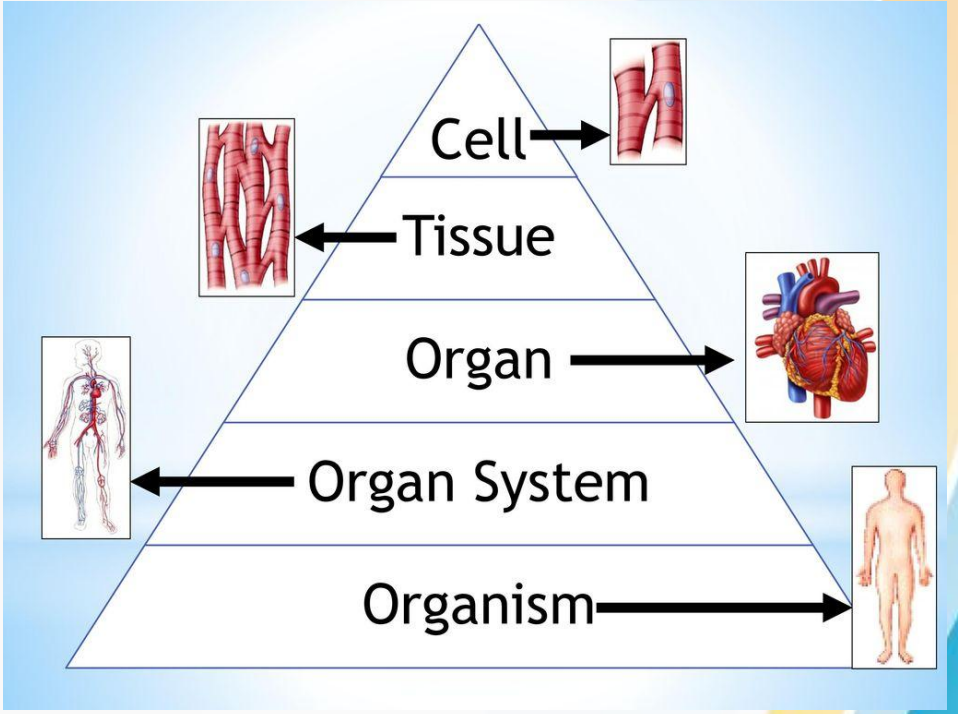
- Types of Animal Tissues:-
- Connective Tissue
- Muscle Tissue
- Nervous Tissue
- Epithelial Tissue
- The collection of tissues are joined in structural units to serve a standard function of organs. The primary purpose of these four types of tissue differs depending on the type of organism.



• ORGANIZATION OF THE HUMAN BODY

- The human body is organized into cells, tissues, organs, organ systems, and the total organism.
- Cells are the smallest living unit of body construction.
- A tissue is a grouping of cells working together. Examples are muscle tissue and nervous tissue. *(Neurons carry messages from the brain via the spinal cord. These messages are carried to muscles, which tell the muscle fibre to contract, which makes the muscles move)*
- An organ is a structure composed of several different tissues performing a particular function. Examples include the lungs and the heart. *(gether by the heart pumping oxygen-poor blood to the lungs where it picks up oxygen, then returns to the heart which pumps the now oxygen-rich blood throughout the body)*
- Organ systems are groups of organs which together perform an overall function. Examples are the respiratory system and the digestive system. *(The respiratory and digestive systems work together by providing the body with oxygen necessary to break down food and extract energy from nutrients, while the digestive system supplies the nutrients that the body needs to function)*
- The total organism is the individual human being. You are a total organism.

- Cell: The basic unit of life; a small, self-contained unit enclosed by a membrane, capable of performing life-sustaining functions.
- Tissue: A group of similar cells that work together to perform a specific function in an organism.
- Organ: A part of an organism, typically self-contained and with a specific vital function, composed of different types of tissues.
- Organ System: A group of organs that work together to perform complex bodily functions.
- Organism: An individual living entity that can reproduce, grow, respond to stimuli *(A stimulus is something that causes a change in behavior or physical activity. Examples of stimuli, Heat, light, and sound are physical stimuli,A medicine can be an external stimulus)*, and maintain homeostasis. *(Homeostasis refers to any automatic process that a living thing uses to keep its body steady on the inside while continuing to adjust to conditions outside of the body, or in its environment. The body makes these changes in order to work the right way and survive.)*



- Elementary Tissues of the Body:-
- Tissues are groups of similar cells that perform specific functions. The human body has four primary types of tissues:

- **1. Epithelial Tissue**
- Covers body surfaces, lines internal cavities, and forms glands.
- Functions: Protection, secretion, absorption, and excretion.

Types:

- Simple Epithelium: Single layer of cells (e.g., lining of the lungs and intestines).
- Stratified Epithelium: Multiple layers for protection (e.g., skin, esophagus lining).

- **2. Connective Tissue**
- Provides support, structure, and protection to the body.
- Components: Cells, fibers (collagen, elastic, reticular), and extracellular matrix.

Types:

- Loose Connective Tissue: Includes areolar tissue (fills spaces) and adipose tissue (fat storage).
- Dense Connective Tissue: Includes tendons (connect muscles to bones) and ligaments (connect bones to bones).
- Specialized Connective Tissue: Includes cartilage (flexible support), bone (rigid support), and blood (fluid tissue that transports nutrients).

- **3. Muscle Tissue**
- Responsible for movement and contraction of the body.

Types:

- Skeletal Muscle: Voluntary, striated muscle that moves bones.
- Cardiac Muscle: Involuntary, striated muscle found in the heart.
- Smooth Muscle: Involuntary, non-striated muscle found in the walls of internal organs.

- **4. Nervous Tissue**
- Specialized tissue for transmitting electrical impulses in the body.
- Components:
- Neurons: Functional units that conduct nerve signals.
- Neuroglia (Glial Cells): Supportive cells that nourish and protect neurons.

Introduction to the Human Body

The human body is a complex and well-organized system made up of trillions of cells that perform various functions necessary for life. These cells form tissues, which in turn form organs that work together in organ systems to maintain the body's overall function and homeostasis. *(Homeostasis refers to any automatic process that a living thing uses to keep its body steady on the inside while continuing to adjust to conditions outside of the body, or in its environment. The body makes these changes in order to work the right way and survive.)*

Anatomy and Physiology

Anatomy: The study of the structure and physical organization of the human body.

Types:

Gross Anatomy – Study of large structures (bones, muscles, organs).

Microscopic Anatomy – Study of cells and tissues under a microscope.

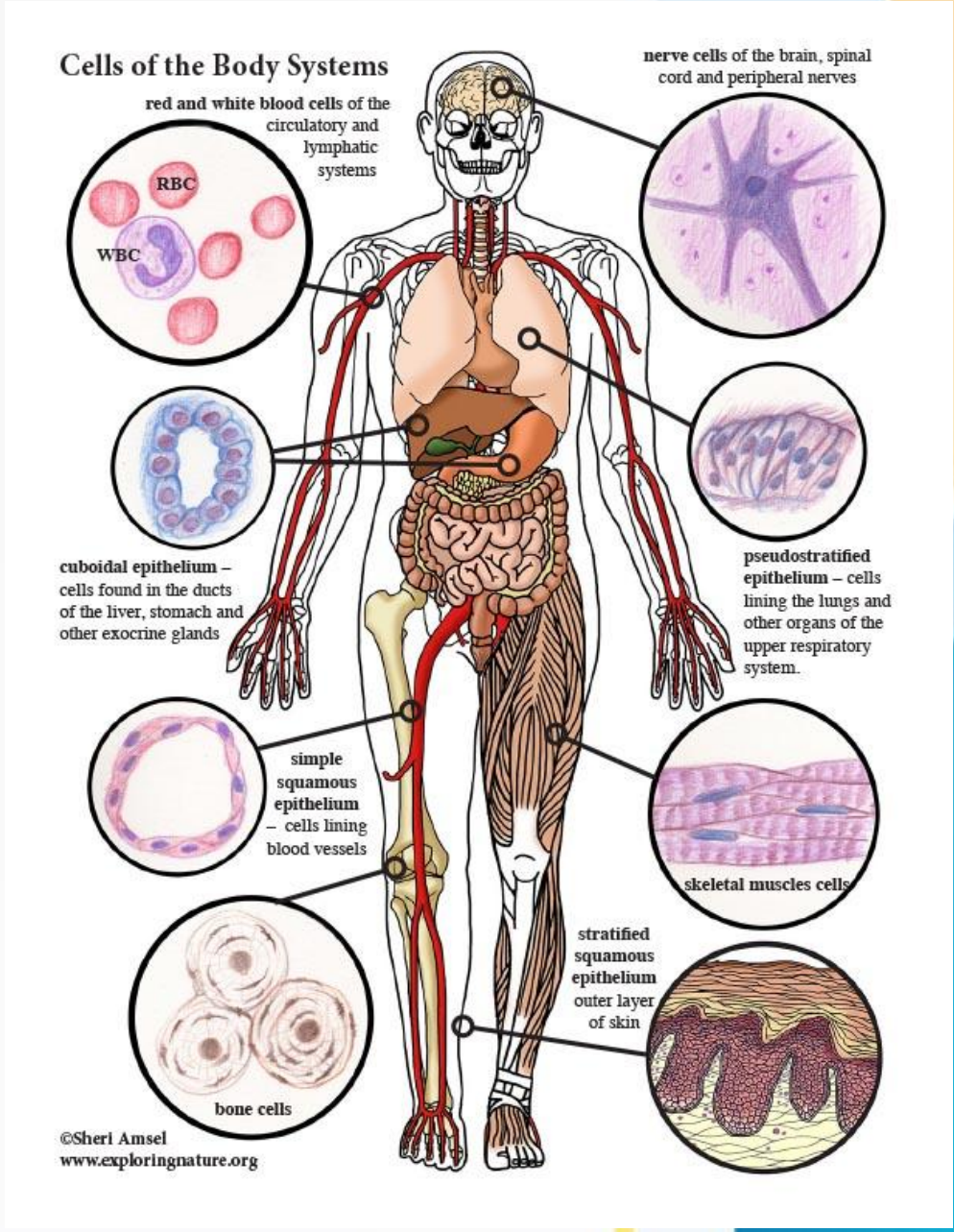
Physiology: The study of how the body functions and performs various processes.

Types:

Cell Physiology – Study of cellular processes.

Systemic Physiology – Study of how body systems work.

Pathophysiology – Study of diseases and their effects on body function.



INTRODUCTION

Digestion is defined as the process by which food is broken down into simple chemical substances that can be absorbed and used as nutrients by the body. Most of the substances in the diet cannot be utilized as such. These substances must be broken into smaller particles, so that they can be absorbed into blood and distributed to various parts of the body for utilization. Digestive system is responsible for these functions. Breakdown of food into simpler chemical compounds. A normal young healthy adult consumes about 1 kg of solid diet and about 1 to 2 liter of liquid diet every day. All these food materials are subjected to digestive process, before being absorbed into blood and distributed to the tissues of the body. Digestive system plays the major role in the digestion and absorption of food substances.

- Thus, the functions of digestive system include:
- 1. Ingestion or consumption of food substances
- 2. Breaking them into small particles
- 3. Transport of small particles to different areas of the digestive tract
- 4. Secretion of necessary enzymes and other substances for digestion
- 5. Digestion of the food particles
- 6. Absorption of the digestive products (nutrients)
- 7. Removal of unwanted substances from the body.

The digestive system consists of digestive tract and associated organs of digestion: teeth, tongue, salivary glands, liver, gallbladder and pancreas.

It provides water, electrolytes, vitamins and nutrients to the body with the help of the circulatory system. *(The circulatory system is made up of blood vessels that carry blood away from and towards the heart. Arteries carry blood away from the heart and veins carry blood back to the heart. The circulatory system carries oxygen, nutrients, and hormones to cells, and removes waste products, like carbon dioxide)*

The functions of digestive system are as follows:

- 1. Ingestion: taking in food through mouth.
- 2. Mastication: movements of the lower jaw during chewing to grinding food and mix it with the saliva. Mastication or chewing is the first mechanical process in the gastrointestinal (GI) tract, by which the food substances are torn or cut into small particles and crushed or ground into a soft bolus.
- 3. Deglutition: swallowing of food so that it passes from mouth to stomach.
- 4. Digestion: chemical breakdown of food material.
- 5. Absorption: nutrient molecules absorbed into circulatory system through mucous membrane of small intestine.
- 6. Peristalsis: rhythmic wave-like intestinal contractions that move food through digestive tract.
- 7. Defecation: elimination of solid/semisolid/liquid waste material of food (i.e. feces) through anus.

FUNCTIONAL ANATOMY OF DIGESTIVE SYSTEM

- Digestive system is made up of gastrointestinal tract (GI tract) or alimentary canal and accessory organs, which help in the process of digestion and absorption. GI tract is a tubular structure extending from the mouth up to anus, with a length of about 30 feet. It opens to the external environment on both ends.
- GI tract is formed by two types of organs:
- 1. Primary digestive organs.
- 2. Accessory digestive organs.

1. Primary Digestive Organs

Primary digestive organs are the organs where actual digestion takes place.

Primary digestive organs are:

i. Mouth

ii. Pharynx

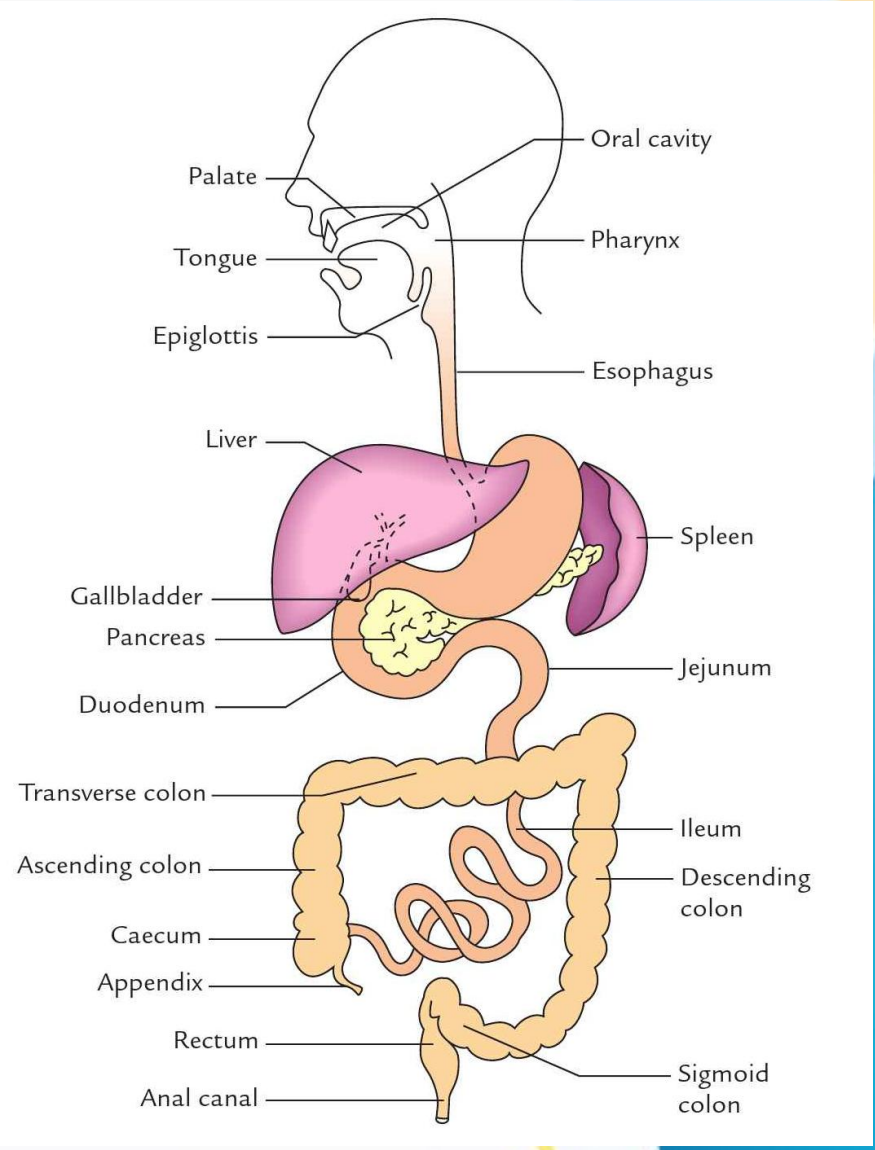
iii. Esophagus

iv. Stomach

v. Small intestine

vi. Large intestine.

- 2. Accessory Digestive Organs
- Accessory digestive organs are those which help primary digestive organs in the process of digestion.
- Accessory digestive organs are:
- i. Teeth
- ii. Tongue
- iii. Salivary glands
- iv. pancreas
- v. Liver
- vi. Gallbladder.



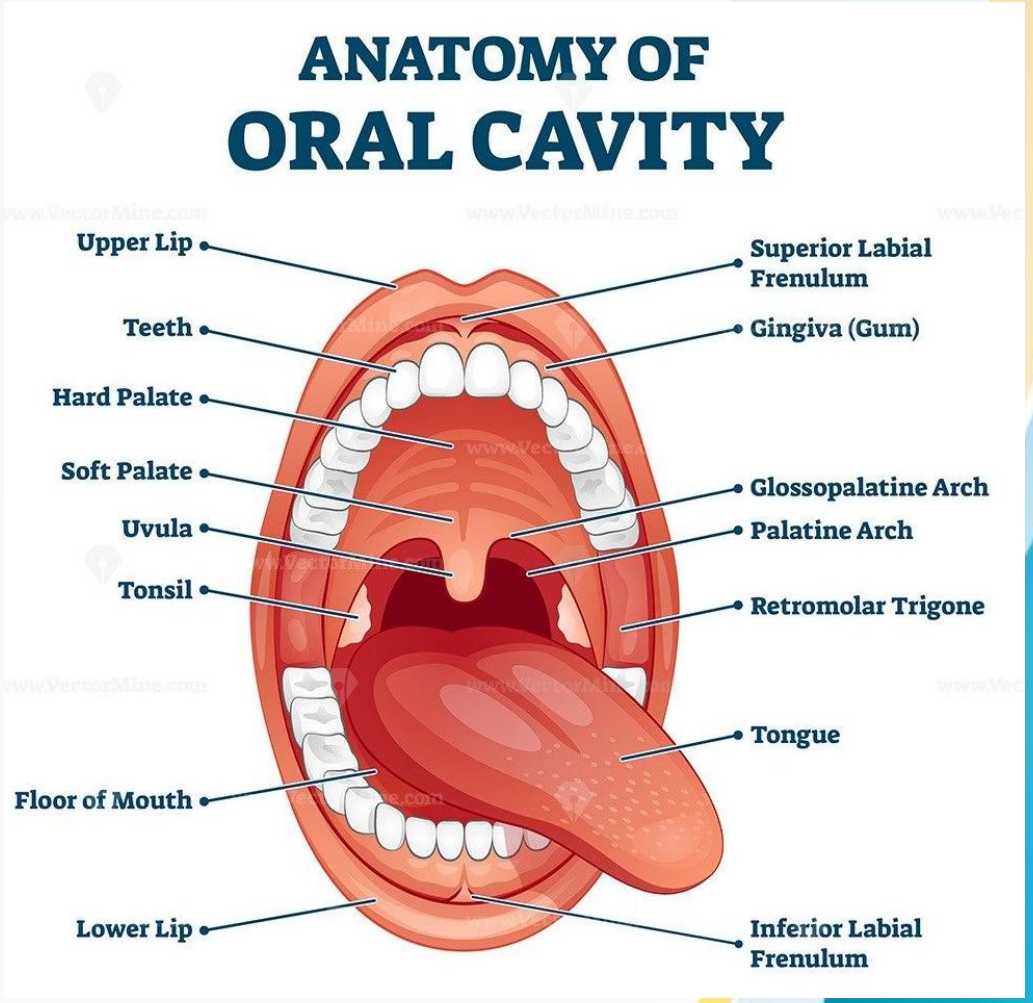
MOUTH (ORAL CAVITY)

The mouth or oral cavity is the first part of the digestive tract. It is bounded anteriorly by lips, laterally by cheeks, superiorly by palate and inferiorly by a muscular floor.

Lips and Cheeks

The lips are muscular folds guarding the oral orifice *(opening)* and cheeks form lateral walls of the oral cavity. The lips and cheeks are lined internally by mucosa and externally by skin. The lips and cheeks play an important role in the process of mastication. They help manipulate the food within the oral cavity and hold the food in place for proper crushing and cutting by the teeth.

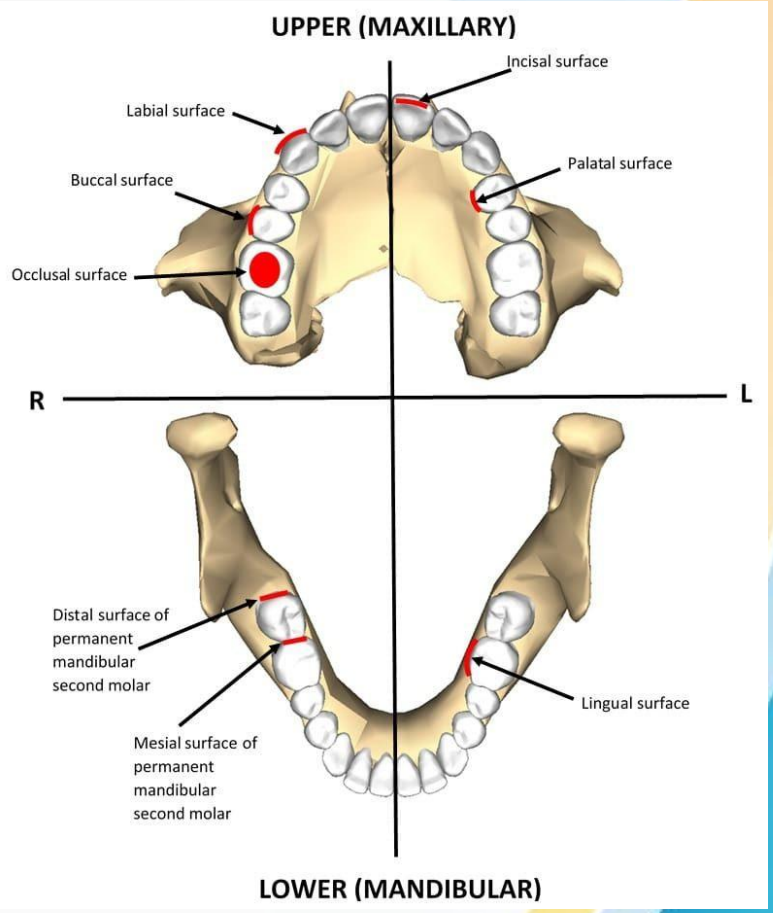
FUNCTIONAL ANATOMY OF MOUTH:-
Mouth is otherwise known as oral cavity or buccal cavity. It is formed by cheeks, lips and palate. It encloses the teeth, tongue and salivary glands.
Digestive juice present in the mouth is saliva, which is secreted by the salivary glands.



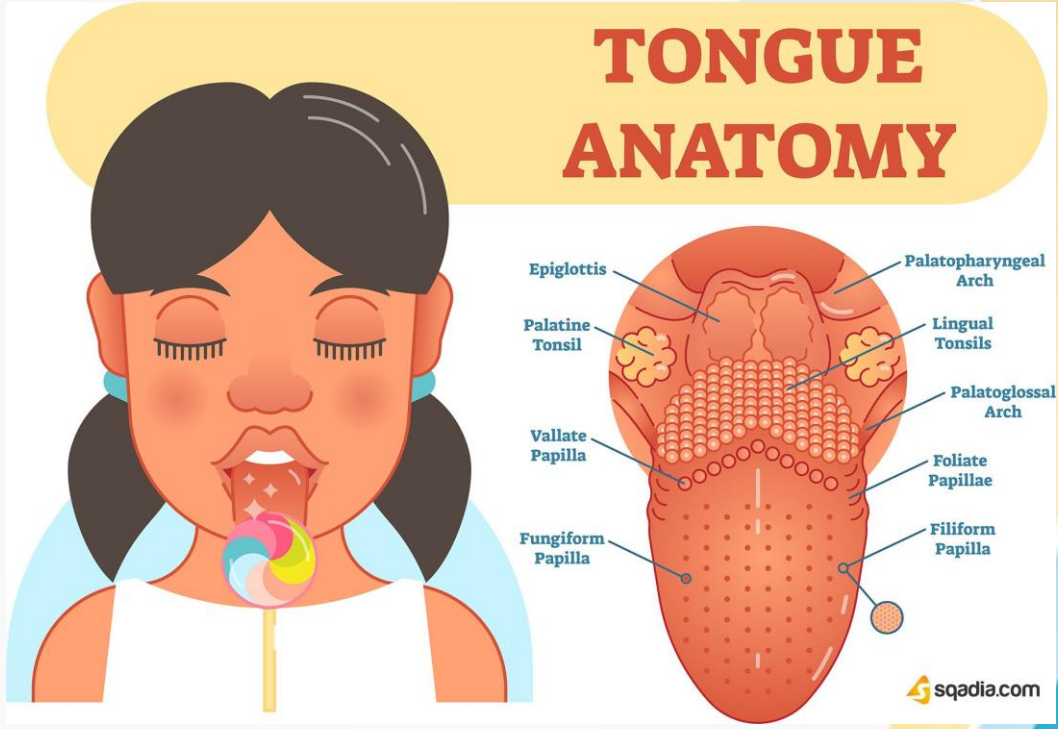
- FUNCTIONS OF MOUTH
- Primary function of mouth is eating and it has few other important functions also.
- Functions of mouth include:
- 1. Ingestion of food materials
- 2. Chewing the food and mixing it with saliva
- 3. Appreciation of taste of the food
- 4. Transfer of food (bolus) to the esophagus by swallowing
- 5. Role in speech
- 6. Social functions such as smiling and other expressions.

- Teeth
- Tooth (plural teeth) is a hard, calcified structure found in the jaws (or mouths) of many vertebrates and used to break down food. In an adult individual, there are 32 teeth, 16 in each jaw.

- ➢ they are located on the jaws and in or around the mouth.



- Tongue
- The tongue is a large muscular organ that occupies the most of the oral cavity.The tongue is the major sensory organ for taste. The taste buds containing these receptors are located on the dorsal sur-face of the tongue.The oral cavity along with lips and cheeks holds the food in place during mastication. The tongue also plays a major role in swallowing the food and water, etc.



- PHARYNX
- pharynx, commonly called the throat, is muscular, funnel-shaped passageway inside the body. that connects the mouth and nasal cavity to the esophagus and larynx. It plays a key role in swallowing, breathing, and speaking. The pharynx is in the middle of the neck. it is about 4.5 inches long
- ▪ function:-

1. Passage for Food & Air:

Directs food and liquids from the mouth to the esophagus (digestive system).

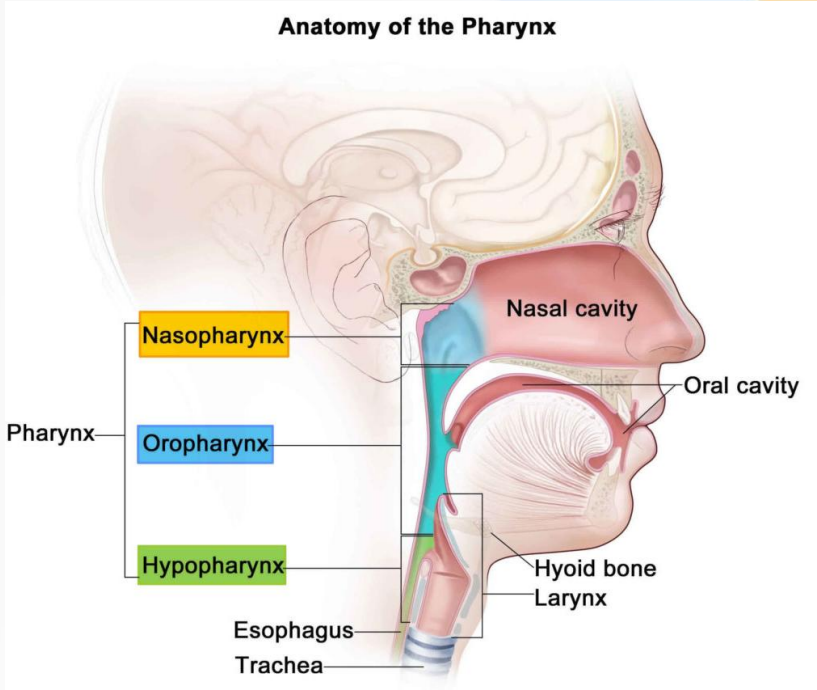
Directs air from the nose/mouth to the larynx & trachea (respiratory system).

2. Prevents Choking: The epiglottis (a flap in the pharynx) closes over the trachea during swallowing to prevent food from entering the lungs.

3 . When we swallow, the pharynx helps direct food from the mouth to the esophagus. Pushes food into the esophagus so it’s not breathed in.

- Parts of pharynx
- 1. Nasopharynx : Behind the nose; allows air passage.
- 2. Oropharynx : Behind the mouth; allows food and air passage.
- 3. Laryngopharynx : Connects to both the esophagus (food) and larynx (air)

according to location of part behind nasal cavity, oral cavity and laryngeal cavity, respectively. The nasopharynx is the part of respiratory system whereas oropharynx and laryngo-pharynx are passages common to both the respiratory and the digestive systems.

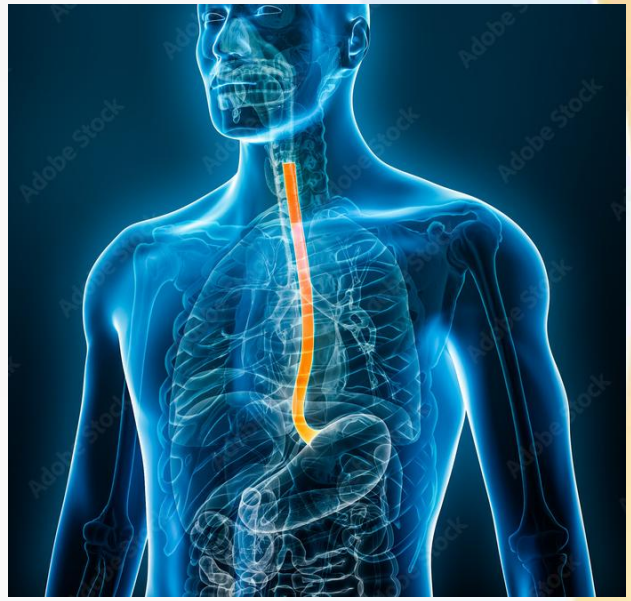


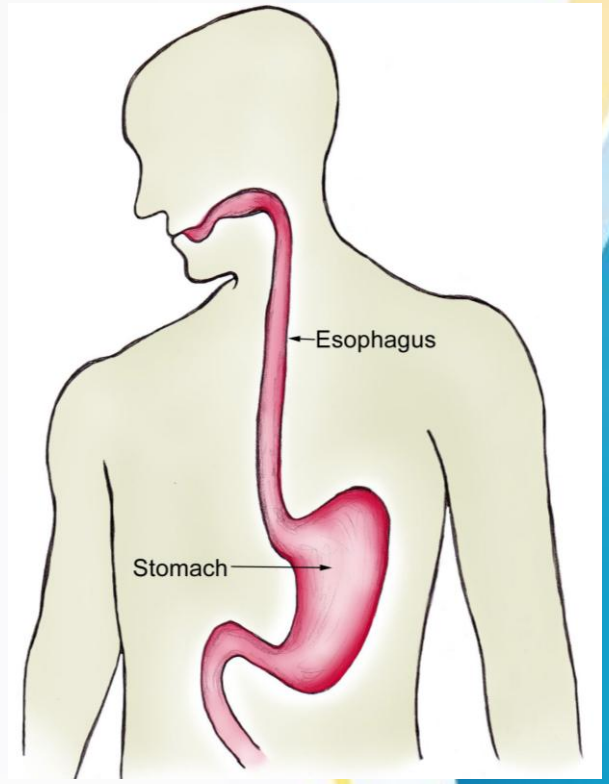
- The laryngopharynx is the lower part of the pharynx (throat), located behind the larynx (voice box) and above the esophagus. It is the last section of the pharynx before food and air separate into different pathways:

- Air goes into the larynx → trachea → lungs.
- Food & liquids go into the esophagus → stomach.
- Located: Behind the larynx, connecting the oropharynx to the esophagus and trachea.

- Function:
- Acts as a passageway for both food and air.
- Directs food toward the esophagus and air toward the larynx.
- Works with the epiglottis to prevent choking by closing the airway when swallowing.

- ESOPHAGUS
- The esophagus is a muscular tube-shaped organ of around 25 centimeters in length & It has a diameter of 2 cm. that connects the pharynx to the stomach . Esophagus transports bolus of food from pharynx to stomach by peristaltic movements.Its primary function is to transport food and liquids from the mouth to the stomach. The swallowed food takes about 5-9 seconds to travel to the stomach.
- *(Peristaltic movement is the wave-like muscular contractions that push food, liquids, and other substances through hollow organs like the esophagus, stomach, intestines, and ureters.)*
- *(How Peristalsis Works?*
- *1Muscles behind the food contract, pushing it forward.*
- *2Muscles in front of the food relax, allowing it to move easily.*
- *3This rhythmic contraction and relaxation continue, moving food smoothly through the digestive tract.)*





- Functions of the Esophagus:-

1. Food & Liquid Transport

- The esophagus moves food and liquids from the mouth to the stomach using peristalsis (wave-like muscle contractions).

2. Prevention of Backflow (Reflux Control)

- The lower esophageal sphincter (LES), a muscular valve at the end of the esophagus, prevents stomach acid and food from coming back up (acid reflux).

3. Assists in Swallowing

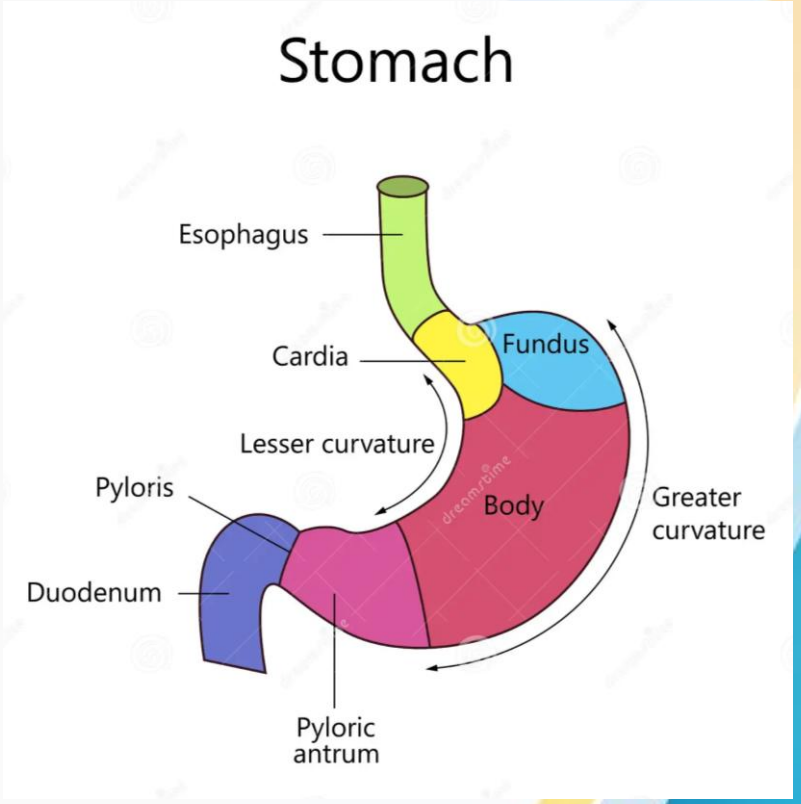
- The esophagus works with the epiglottis (a flap in the throat) to direct food into the esophagus and keep it out of the airway (trachea).

How Does the Esophagus Work?

- Swallowing Begins – The tongue pushes food to the back of the throat.
- Peristalsis Starts – Muscles in the esophagus contract rhythmically, moving food downward.
- Lower Esophageal Sphincter Opens – Food enters the stomach.
- Sphincter Closes – Prevents acid reflux or backflow of stomach contents.

STOMACH:-

Stomach is a muscular, J-shaped organ in the upper part of the abdomen in between esophagus and the duodenum (the first part of the small intestine).



FUNCTIONAL ANATOMY OF STOMACH:-

Stomach is a hollow organ situated just below the diaphragm on the left side in the abdominal cavity. The stomach can accommodate volumes from 0.5 to 5 L. Under normal conditions, it can expand to accommodate 1 L to 1.5 L of solids and liquids. However, it is capable of expanding still further up to 4 L.

- Main Functions of the Stomach:-

1- Temporary Food Storage

The stomach holds food after swallowing before passing it into the small intestine.

2- Mechanical Digestion :

The stomach's muscular walls contract to mix food with digestive juices, breaking it down into a semi-liquid mixture called chyme.

3- Chemical Digestion

- The stomach releases gastric juices that contain:
- Hydrochloric acid (HCl) – Kills harmful bacteria & activates enzymes.
- Pepsin – An enzyme that digests proteins into smaller molecules

4- Regulation of Food Release into the Small Intestine

- The pyloric sphincter controls the gradual release of chyme into the small intestine for further digestion and absorption.

5- Absorption of Some Substances

- The stomach absorbs small amounts of alcohol, water, and certain medications (e.g., aspirin).
  (Alcohol and some medications are small, lipid-soluble molecules that can easily diffuse across the stomach wall.The stomach has a rich blood supply, which helps in the rapid absorption of substances like alcohol and aspirin.Once absorbed, these substances enter the bloodstream quickly without needing digestion.Unlike proteins, fats, and carbohydrates that require enzymatic digestion, alcohol and certain drugs (e.g., aspirin) do not need breakdown before absorption.This is why alcohol can enter the bloodstream within minutes of consumption.)

6- Defense Against Infections

- The acidic environment of the stomach kills bacteria and pathogens present in food.

- PARTS OF STOMACH
- In humans, stomach has four parts:
- 1. Cardiac region
- 2. Fundus
- 3. Body or corpus
- 4. Pyloric region.

- 1. Cardiac Region (Cardia)
- Location: The upper part of the stomach, where the esophagus connects to the stomach.

Function:

- Contains the lower esophageal sphincter (LES), which prevents acid reflux (backflow of stomach contents into the esophagus).
- Receives swallowed food and begins mixing with gastric juices.

- 2. Fundus
- Location: The rounded, dome-shaped upper portion of the stomach, above the cardiac region.

Function:

- Acts as a temporary storage area for food and gases released during digestion.
- Produces gastric juices, mucus, and digestive enzymes.
- Helps in slow mixing of food before it moves downward.

- 3. Body (Corpus)
- Location: The largest and central part of the stomach.
- Function:
- Main site for mechanical digestion (mixing food) and chemical digestion (breaking down proteins with enzymes and acid).
- Secretes hydrochloric acid (HCl) to kill bacteria and activate pepsin (a protein-digesting enzyme).
- Breaks food into a semi-liquid mixture called chyme before passing it to the pyloric region.

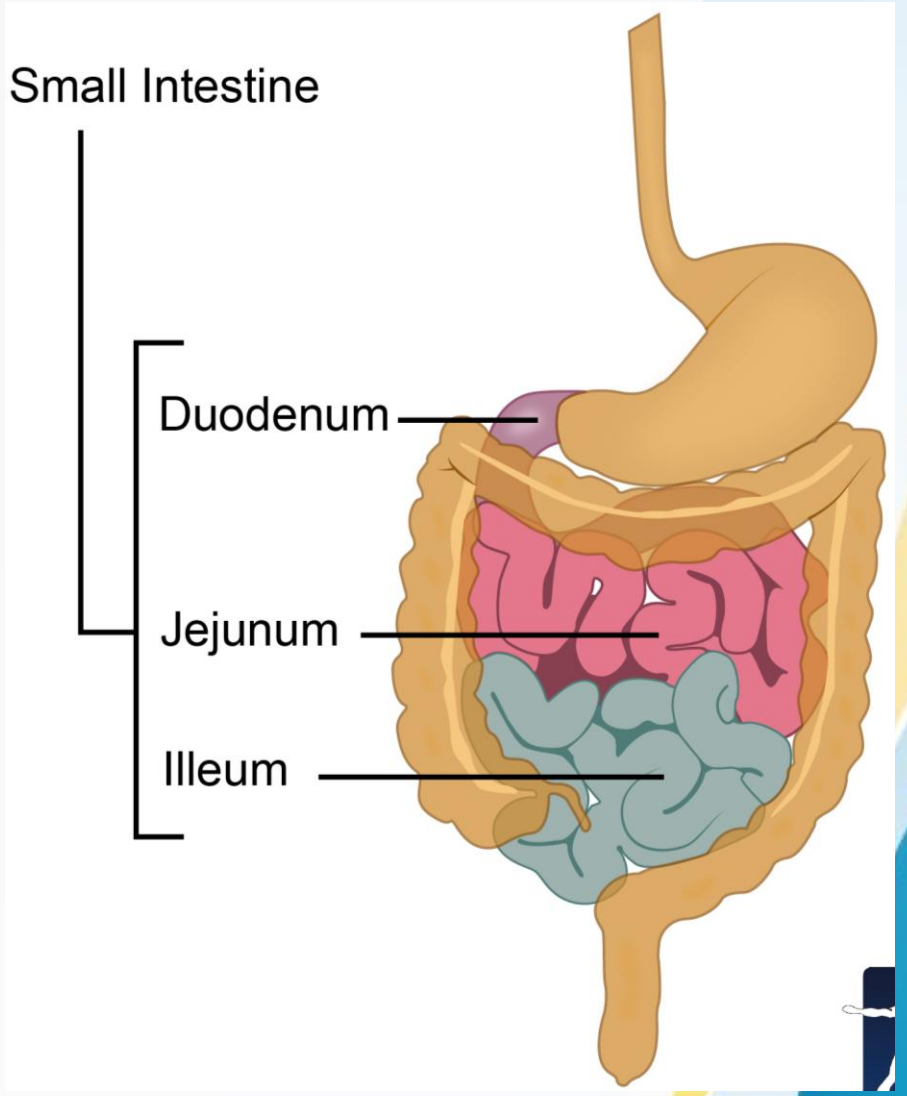
- 4. Pyloric Region (Antrum & Pylorus)
- Location: The lower part of the stomach, leading to the small intestine.
- Function:
- Grinds & regulates the movement of chyme (partially digested food) into the small intestine.
- The pyloric sphincter controls the release of food into the duodenum (first part of the small intestine) in small amounts.
- Prevents backflow of intestinal contents into the stomach.

Summary of Stomach Parts & Functions	
Part of Stomach	Function
Cardiac Region	Prevents acid reflux, receives food.
Fundus	Stores food & gases, secretes gastric juices.
Body (Corpus)	Main digestion site: churns food, releases acid & enzymes.
Pyloric Region	Regulates chyme movement into the small intestine.

- SMALL INTESTINE:-

- The small intestine is the longest part of the digestive system (about 6 meters in length) that connects stomach with the large intestine.It is located in the center of abdominal cavity surrounded by the large intestine.and plays a crucial role in digestion and nutrient absorption. It is divided into three parts:

duodenum, jejunum, and ileum, each with specific functions.



Digestion of Food

- The small intestine receives chyme (partially digested food) from the stomach and continues breaking it down.
- It produces digestive enzymes and also receives enzymes from the pancreas (amylase, lipase, protease) and bile from the liver/gallbladder to digest:
- Carbohydrates → Simple sugars (glucose)
- Proteins → Amino acids
- Fats → Fatty acids & glycerol

- Nutrient Absorption
- The small intestine absorbs 90% of nutrients into the bloodstream.

Important nutrients absorbed:

Duodenum – Absorbs iron & minerals

Jejunum – Absorbs carbohydrates, proteins, vitamins

Ileum – Absorbs fats, bile salts, vitamin B12

- 3. Movement of Food (Peristalsis)
- The small intestine moves food forward using peristaltic movements (wave-like muscle contractions).
- It ensures proper mixing of enzymes and gradual absorption of nutrients.

- 4. Immunity & Defense Against Pathogens
- The small intestine contains gut-associated lymphoid tissue (GALT), which helps in immune defense.
- It prevents harmful bacteria from entering the bloodstream.

- 5. Water & Electrolyte Absorption
- The small intestine absorbs water along with essential minerals like sodium, potassium, and chloride, preventing dehydration.

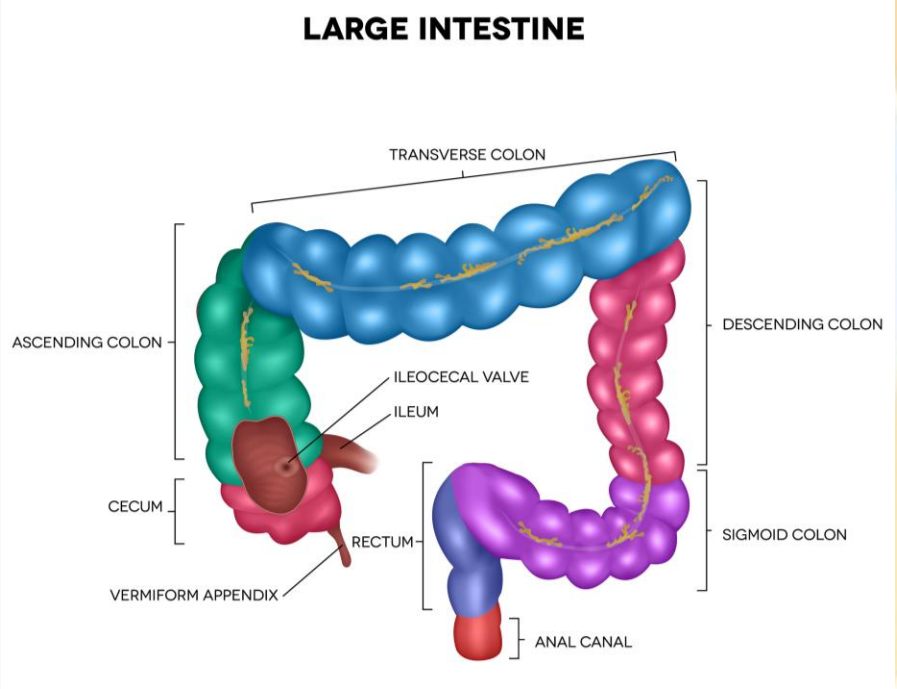
Summary of Small Intestine Functions

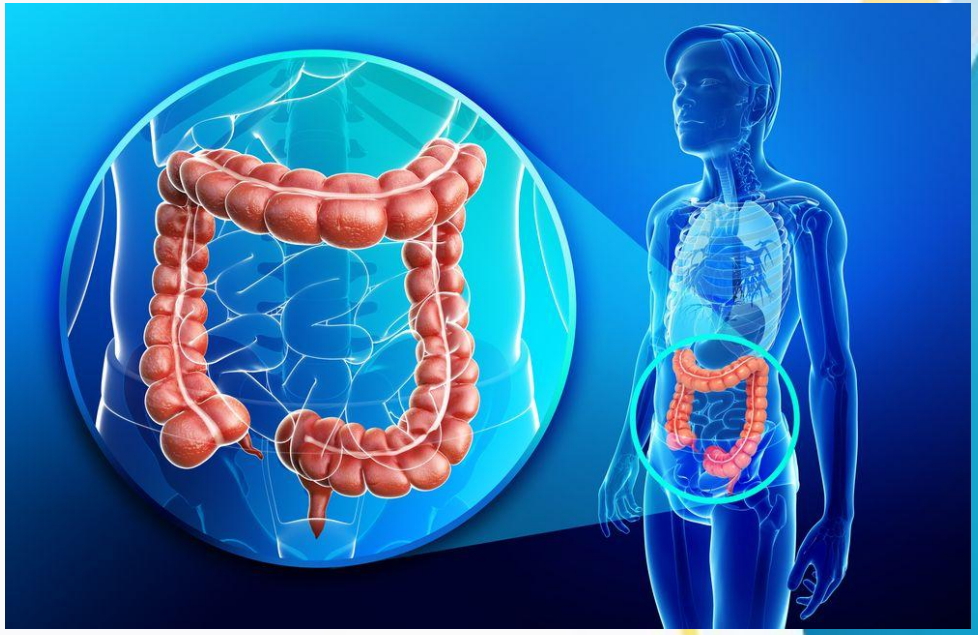
Function	Description	
Digestion	Breaks down food into nutrients using enzymes & bile.	
Absorption	Transfers nutrients into the bloodstream.	
Peristalsis	Moves food through the intestine.	
Immunity	Protects against harmful bacteria & infections.	
Water Absorption	Absorbs fluids and maintains body hydration.	

- LARGE INTESTINE:-

- The large intestine (also called the colon) is the final part of the digestive system. It is about 1.5 meters long and plays a vital role in absorbing water, forming stool, and eliminating waste. It extends from ileo-cecal junction to the anal orifice, & it is the last part of the gastrointestinal tract and of the digestive system. It is called the large intestine not only it is longer than small intestine but also its diameter is larger than that of small intestine

- ➢ Location: The large intestine wraps around the border of the abdominal body cavity from the right side of the body, across the top of the abdomen, and finally down the left side.





1. Absorption of Water & Electrolytes

- The large intestine absorbs water from undigested food, preventing dehydration.
- It also absorbs electrolytes like sodium, potassium, and chloride, which help maintain the body's fluid balance.

2. Formation & Storage of Feces

- The remaining undigested material is converted into solid waste (feces).
- The rectum stores feces until it is eliminated through the anus during defecation.

3. Fermentation of Undigested Food by Gut Bacteria

- The large intestine contains beneficial bacteria (gut microbiota) that help:
- Break down undigested carbohydrates (fiber) into short-chain fatty acids.
- Produce vitamins like Vitamin K & Vitamin B12.
- Prevent harmful bacteria from growing.

4. Production of Mucus

- The lining of the large intestine secretes mucus, which:
- Helps in the smooth passage of stool.
- Protects the intestine from irritation.

5. Gas Production

- During bacterial fermentation, gases like carbon dioxide, methane, and hydrogen are produced, which may cause flatulence (gas formation).

6. Immunity & Protection Against Infections

- The gut microbiome in the large intestine helps boost immunity by preventing harmful bacteria from entering the bloodstream.

7. Absorption of Vitamins & Minerals

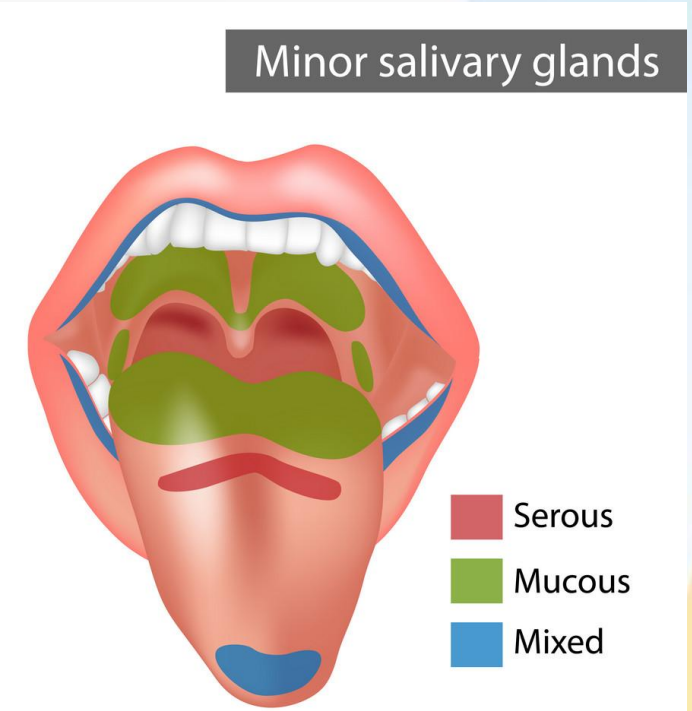
- Some vitamins (like Vitamin K and Biotin) and minerals are absorbed in the large intestine, which helps in blood clotting and energy production.

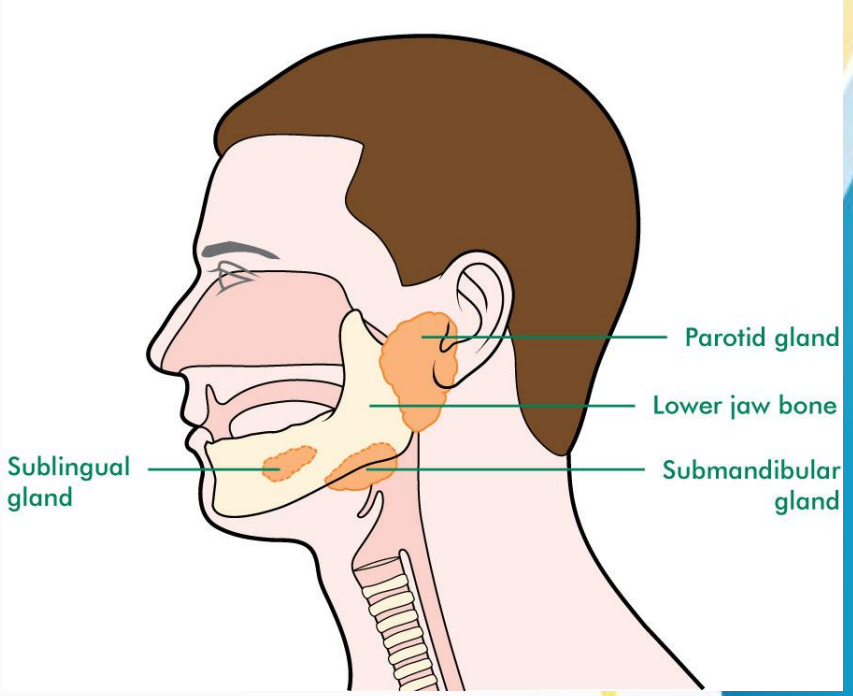
Summary of Large Intestine Functions

Function	Description
Water Absorption	Prevents dehydration by absorbing water.
Electrolyte Absorption	Balances sodium, potassium, and chloride.
Feces Formation	Converts undigested food into stool.
Bacterial Fermentation	Gut bacteria help break down fiber & produce vitamins.
Mucus Secretion	Aids in smooth stool movement & protects the lining.
Gas Production	Fermentation creates gases like CO2 & methane.
Immunity Support	Gut bacteria prevent infections & boost immune function.

- SALIVARY GLANDS
- The salivary glands are responsible for producing saliva, which plays a crucial role in digestion, lubrication, and oral health. Humans have three major pairs of salivary glands:

- 1Parotid Glands (largest, located near the ears)
- 2Submandibular Glands (below the jaw)
- 3Sublingual Glands (under the tongue)
- These are accessory glands of digestion that produce saliva. The saliva acts as a solvent in cleaning the teeth and dissolving the food chemicals so that they can be tasted.





1. Parotid Glands

- Parotid glands are the largest of all salivary glands, situated at the side of the face just below and in front of the ear. Each gland weighs about 20 to 30 g in adults

2. Submaxillary Glands

- Submaxillary glands or submandibular glands are located in submaxillary triangle, medial to mandible. Each gland weighs about 8 to 10 g.

3. Sublingual Glands

- Sublingual glands are the smallest salivary glands situated in the mucosa at the floor of the mouth. Each gland weighs about 2 to 3 g.

- Main Functions of Salivary Glands

1. Production of Saliva

- Secretes 1–1.5 liters of saliva per day, which is essential for digestion and oral hygiene.

2. Digestion Begins in the Mouth

- Saliva contains amylase (ptyalin enzyme), which starts breaking down carbohydrates (starch → maltose).

3. Lubrication & Swallowing

- Saliva moistens food, making it easier to chew and swallow (bolus formation).

4. Protection Against Bacteria & Infections

- Contains antimicrobial enzymes (lysozyme & lactoferrin) that kill bacteria.
- Helps maintain oral hygiene by washing away food particles.

5. Aids in Speech & Taste

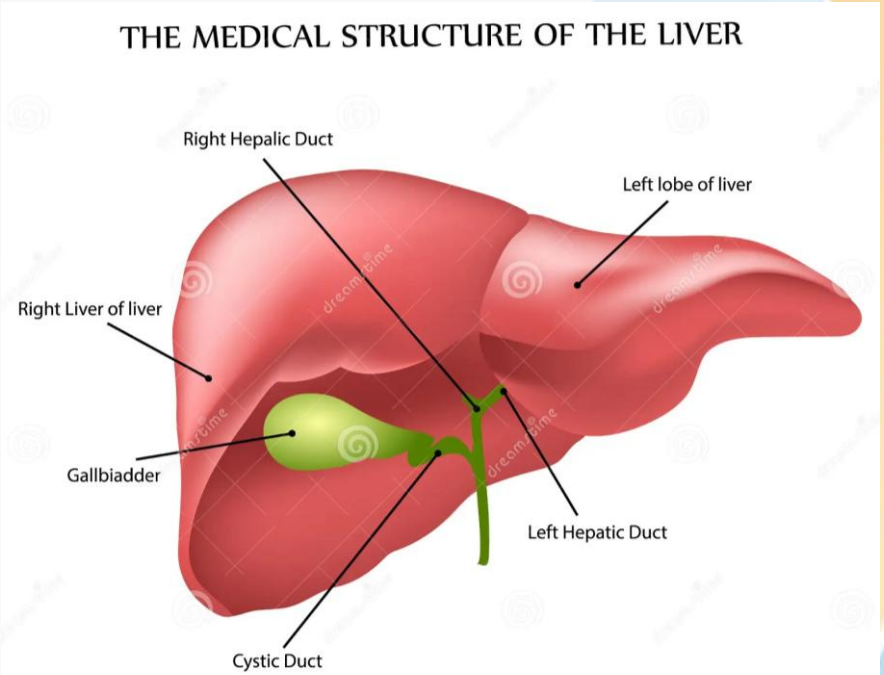
- Keeps the mouth and throat moist, allowing clear speech.
- Dissolves food molecules, making it possible to sense taste.

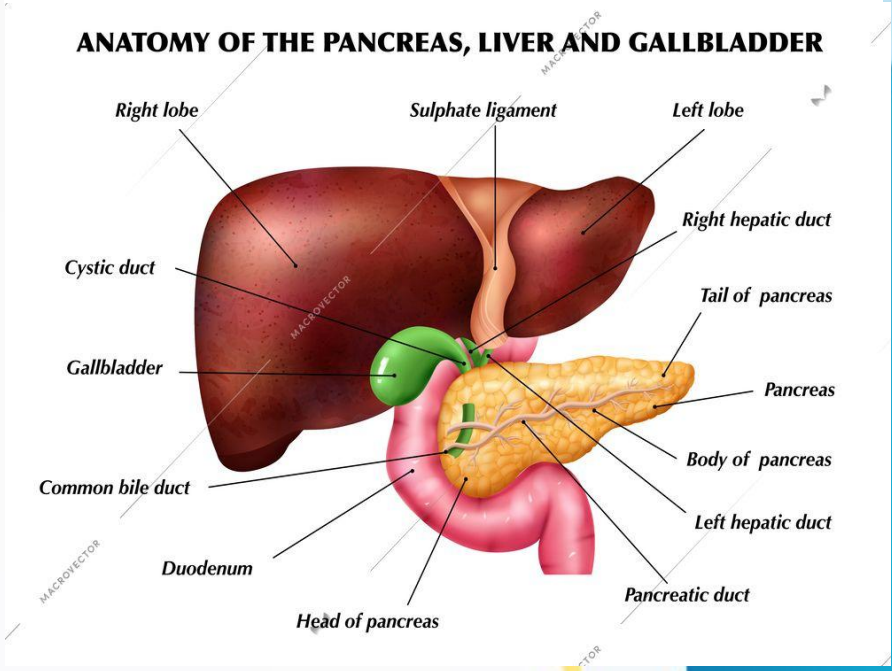
6. pH Balance & Tooth Protection

- Neutralizes acids and prevents tooth decay (dental caries).
- Contains minerals like calcium and phosphate, which help in tooth enamel protection.

Summary	Table
Function	Description
Saliva Production	Produces ~1–1.5L of saliva daily.
Digestion	Contains amylase to break down starch.
Lubrication	Moistens food for easier swallowing.
Antibacterial Action	Enzymes prevent infections.
Speech & Taste	Keeps mouth moist & enhances taste perception.
Tooth Protection	Maintains pH balance & prevents cavities.

- LIVER:-
- The human liver is an organ and gland in the human body. It’s spongy, wedge shaped *(The liver is roughly triangular (wedge-shaped)*, reddish-brown The liver is the largest internal organ of the body weighing about 1500 g (1.5 kg) in an adult. The liver is located in the upper right-hand portion of the abdominal cavity, beneath the diaphragm .it Makes bile, a fluid that helps the body digest (break down) food. Stores glycogen (an energy source) and vitamins to be used by the body later.





• Functions of the liver:-

1. **Bile Production & Fat Digestion**
- The liver produces bile, a digestive juice that helps in breaking down fats.
- Bile is stored in the gallbladder and released into the small intestine for digestion.

2. **Detoxification & Removal of Toxins**
- The liver filters toxins from blood, including drugs, alcohol, and harmful substances.
- It breaks down toxic ammonia into urea, which is excreted through urine.

3. **Metabolism of Nutrients**
- The liver processes and regulates nutrients:
- Carbohydrates → Glucose (for energy).
- Proteins → Amino acids (for muscle repair & enzymes).
- Fats → Fatty acids & cholesterol (for energy & cell function)

4. **Storage of Nutrients & Vitamins**
- The liver stores:
- Glucose (as glycogen) for energy.
- Vitamins A, D, E, K, B12 for various body functions.
- Iron & Copper for red blood cell production.

5. **Blood Filtration & Production**
- The liver filters blood coming from the digestive tract.
- It removes old or damaged red blood cells and helps produce new blood proteins.
- During fetal development, the liver produces red blood cells.

6**. Regulation of Blood Sugar Levels**

- When blood sugar is high, the liver stores glucose as glycogen.
- When blood sugar is low, it releases glucose into the bloodstream.

7. **Protein Synthesis & Blood Clotting**

- The liver produces important proteins, such as:
- Albumin – Maintains fluid balance in blood.
- Clotting factors – Helps in blood clot formation to stop bleeding.

8. **Breakdown of Hormones & Medications**

- The liver breaks down excess hormones, like insulin and estrogen.
- It metabolizes medications to make them easier for the body to excrete.

9. **Immunity & Defense Against Infections**

- The liver contains special immune cells (Kupffer cells) that destroy bacteria and viruses, preventing infections.

10. **Conversion of Ammonia to Urea**

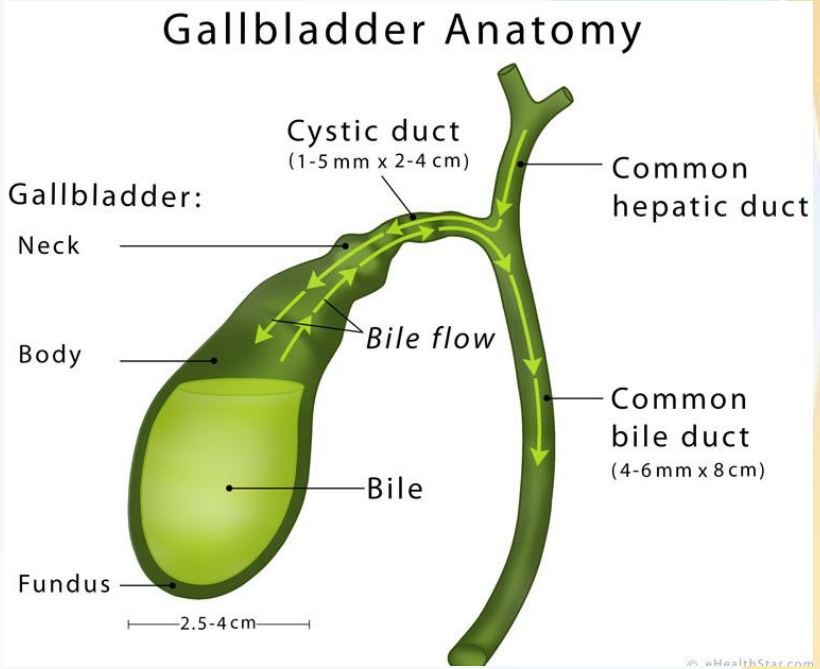
- The liver converts toxic ammonia (a byproduct of protein digestion) into urea, which is excreted through the kidneys in urine

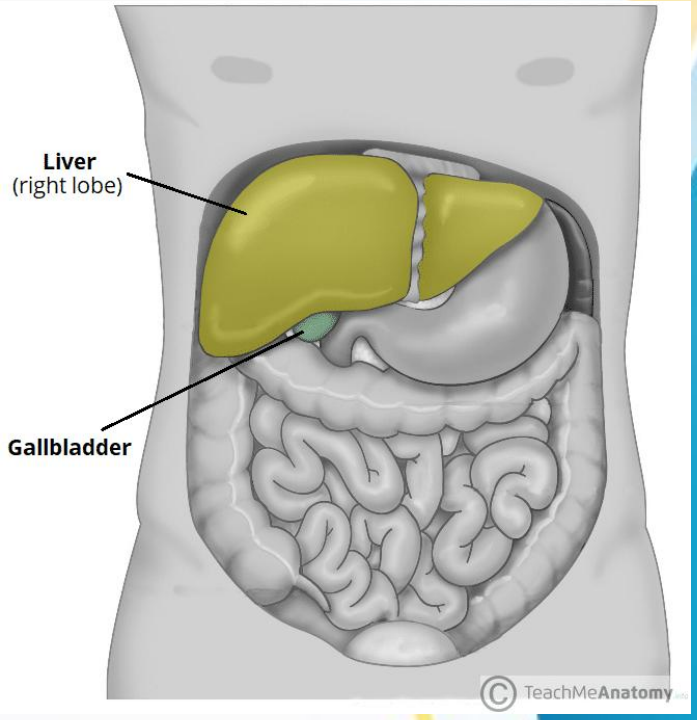
Summary of Liver Functions	
Function	Description
Bile Production	Helps digest fats.
Detoxification	Removes toxins & drugs.
Nutrient Metabolism	Processes carbohydrates, proteins & fats.
Storage of Nutrients	Stores glucose, vitamins, and minerals.
Blood Filtration	Removes waste & produces blood proteins.
Blood Sugar Regulation	Maintains glucose levels.
Protein Synthesis	Produces albumin & clotting factors.

- GALLBLADDER

- The gallbladder is a pear-shaped sac attached to the inferior surface of the right lobe of the liver. The gallbladder stores and concentrates bile which it receives from liver through hepatic ducts and cystic ducts.
- Function :The gallbladder holds a digestive fluid called bile that's released into your small intestine. And stores bile produced by the liver.

- The bile is a yellowish-green fluid containing bile salts and bile pigments. When the fatty chyme enters into duodenum from stomach, the intestinal glands in the duodenal mucosa release hormone called cholecystokinin which induces contraction of gallbladder musculature and bile is poured into the duodenum





1. Storage of Bile

- The gallbladder stores bile, a digestive fluid produced by the liver.
- Bile contains bile salts, cholesterol, and waste products (bilirubin).

2. Concentration of Bile

- The gallbladder removes water from bile, making it more concentrated and effective in digestion.

3. Release of Bile into the Small Intestine

- When we eat fatty foods, the gallbladder contracts and releases bile into the small intestine through the bile duct.
- Bile helps break down fats into smaller droplets, making it easier for enzymes (lipase) to digest them.

4. Aids in Fat Absorption & Digestion

- Bile emulsifies fats, allowing them to mix with water for better digestion.
- It helps in the absorption of fat-soluble vitamins (A, D, E, K).

5. Helps in Waste Excretion

- Bile helps remove cholesterol, toxins, and bilirubin (a waste product from old red blood cells).
- If bile is not properly released, it can lead to gallstones and digestive issues.

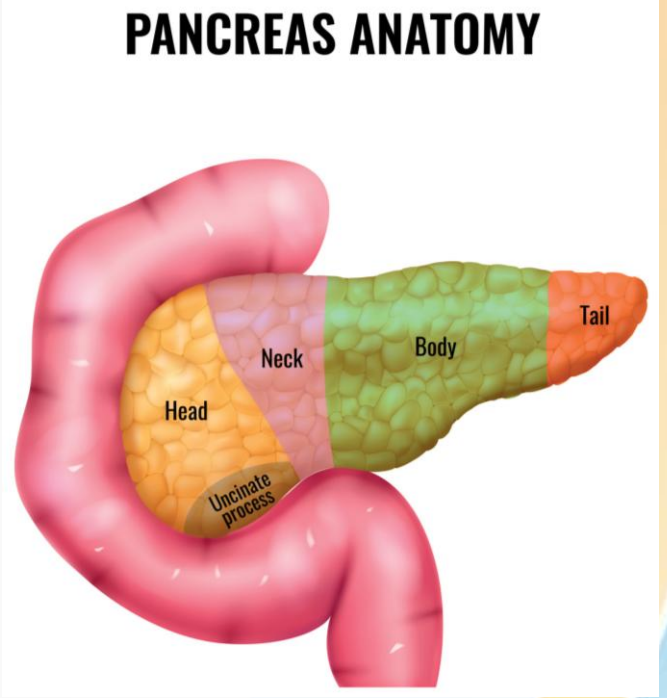
Summary of Gallbladder Functions

Function	Description
Bile Storage	Stores bile from the liver.
Bile Concentration	Removes water to make bile stronger.
Bile Release	Sends bile into the small intestine for fat digestion.
Fat Digestion & Absorption	Helps break down fats & absorb fat-soluble vitamins.
Waste Excretion	Removes cholesterol & toxins from the body.

- PANCREAS

- The pancreas is a long, soft and lobulated gland that extends across the posterior abdominal wall behind the stomach. It has expanded head near duodenum, a centrally located body, and a tapering tail near the spleen. It acts as both exocrine and endocrine glands. The pancreatic acinį secrete pancreatic juice (exocrine secretion) that passes to the duodenum through pancreatic duct. The pancreatic duct joins the common bile duct (CBD) to form the ampulla of Vater, which opens into the second part of the duodenum. The pancreatic juice is highly alka-line (pH = 8) due to the presence of carbonates. This helps to neutralize the acidic chyme as it enters the duodenum. The enzymes in the pancreatic juice are: trypsin, amylase and lipase. The trypsin helps in the digestion of carbohydrates, amylase in the digestion of starch and lipase in the digestion of fat.

- Pancreatic islets of Langerhans secrete hormones, namely insulin and glucagon (endocrine secretion). Insulin plays a major role in carbohydrate metabolism.



1. Digestive Function (Exocrine Role)

a. Produces Digestive Enzymes:

- Amylase – Breaks down carbohydrates into simple sugars.
- Lipase – Helps digest fats.
- Proteases (Trypsin & Chymotrypsin) – Break down proteins into amino acids.

b. Releases Enzymes into the Small Intestine:

- Through the pancreatic duct, these enzymes enter the duodenum to aid digestion.

2. Blood Sugar Regulation (Endocrine Role)

a. Produces Hormones in the Islets of Langerhans:

- Insulin – Lowers blood sugar by helping cells absorb glucose.
- Glucagon – Raises blood sugar by converting stored glycogen into glucose.
- Somatostatin – Regulates insulin & glucagon balance.

b. Prevents Diabetes:

- A lack of insulin leads to diabetes mellitus (high blood sugar levels).

3. Fat, Protein & Carbohydrate Metabolism

- The pancreas breaks down food for absorption in the small intestine.
- Helps in the digestion of fats, proteins, and carbohydrates.

4. pH Balance & Acid Neutralization

- The pancreas releases bicarbonate, which neutralizes acidic chyme from the stomach.

Process of digestion, Absorption and Elimination of food

The digestive system is responsible for breaking down food, absorbing nutrients, and eliminating waste. This process involves three main stages: Digestion, Absorption, and Elimination.

1. Ingestion

Ingestion is the process by which food is taken into the alimentary canal.
It includes the processes that take place while the food is in the mouth (mouth = 'buccal cavity'), such as chewing and grinding using the teeth, the lubrication and chemical effects of saliva released from the salivary glands, and swallowing of the food - which sends it onwards down the digestive tract.

2. Digestion

Digestion is the process by which ingested (food) material is broken down in the earlier stages of the alimentary canal into a form that can then be absorbed and assimilated into the tissues of the body.

Digestion includes two types of processes -

Mechanical (e.g. chewing, grinding, churning, mixing), and
Chemical (e.g. action of digestive enzymes, bile, acids, etc.).
The mechanical processes include the chewing and grinding of food by the teeth and also the churning and mixing of the contents of the stomach.
Chemical processes that contribute to digestion also begin in the mouth with action of saliva on food. However, most of the chemical digestive processes occur in the stomach and small intestine - where the partly-digested materials are subjected to gastric juices, pancreatic juice, succus entericus and so on.

- Steps of Digestion

1. Mouth (Oral Cavity)

- Mechanical digestion – Teeth chew food into smaller pieces (mastication).
- Chemical digestion – Saliva (contains amylase) starts breaking down carbohydrates.
- The tongue pushes food into the pharynx (throat), and swallowing occurs.

2. Esophagus

- Moves food to the stomach through peristaltic movements (wave-like contractions).

3. Stomach

- Mechanical digestion – Stomach muscles churn food into a liquid called chyme.
- Chemical digestion – Gastric juices (HCl and pepsin) break down proteins.

4. Small Intestine (Major site of digestion)

- Bile (from liver & gallbladder) breaks down fats.
- Pancreatic enzymes digest carbohydrates, proteins, and fats.
- Food is now in a simple form for absorption.

3. Absorption / Assimilation

Absorption is the uptake of fluids or other substances by the tissues of the body.

Digested 'food' (which is referred to by other terms depending on its stage of passage through the digestive system - see transit through the alimentary canal) is absorbed into the bodily fluids blood and lymph from the alimentary canal. Most of the absorption part of the digestive process occurs in the jejunum and the ileum of the small intestine, though alcohol is readily absorbed through the stomach. The small intestine is lined with minute finger-like processes (called 'villi', a single example being a 'villus'), that greatly increase its surface area, and hence the rate at which absorption can take place.

Assimilation is the process by which components / chemicals from food (incl. liquid refreshments such as milk drinks, fruit juices etc.) are taken into the cells of the body - after the food/beverage has been digested and absorbed.

4. Elimination

Elimination is the final stage of this 4-stage summary of digestion.

In physiology more generally the word 'elimination' can also apply to the entire process of excretion of metabolic waste products, incl. from the blood via the kidneys and urinary tract (as described in the section about the Renal System).

2. Absorption – Nutrient Uptake

- Absorption is the process where nutrients enter the bloodstream or lymph for use by the body.

a. Small Intestine (Main Absorption Site)

- Villi & microvilli (tiny finger-like projections) increase the surface area for absorption.

b. Absorbed nutrients:

- Carbohydrates → Glucose (bloodstream)
- Proteins → Amino acids (bloodstream)
- Fats → Fatty acids & glycerol (lymphatic system)
- Vitamins & minerals are also absorbed.

c. Large Intestine (Water Absorption)

- Absorbs water, electrolytes (sodium, potassium), and vitamins (B & K).
- The remaining undigested food is converted into solid waste (feces).

3. Elimination – Removal of Waste

- Elimination is the process of removing undigested food and waste products from the body.

a. Large Intestine (Colon)

- Forms solid waste (feces) from undigested material.
- Beneficial bacteria help ferment fiber and produce vitamins.

b. Rectum & Anus

- Rectum stores feces until elimination.
- Defecation (bowel movement) occurs when waste is expelled through the anus.

	Summary of the Process	
Stage	Function	Main Organs Involved
Digestion	Breaks down food into simple nutrients.	Mouth, Esophagus, Stomach, Small Intestine, Pancreas, Liver, Gallbladder
Absorption	Transfers nutrients into the blood & lymph.	Small Intestine, Large Intestine
Elimination	Removes undigested waste from the body.	Large Intestine, Rectum, Anus

The End

Thank you for attention!