

# HUMAN DIGESTIVE SYSTEM

# OVERVIEW

## **Major organs**

- Mouth
- Esophagus
- Stomach
- small intestine
- large intestine

## **Accessory organs:**

- Liver
- gall bladder
- Pancreas.

# HUMAN DIGESTIVE SYSTEM

The process of reducing food into smaller molecules that can be absorbed into the body

Digestive system consists of **2 major parts**

## ○ Major organs

- Mouth
- Esophagus
- Stomach
- small intestine
- large intestine.

## Acessory organs:

- Liver
- Gall bladder
- Pancreas.

# MAJOR ORGANS

## THE MOUTH

**pH: 7**

- The first part of the digestive system
- the entry point of food.

### Structures in the mouth that aids digestion

Teeth – cut, tear, crush and grind food.

Salivary glands – produce and secrete saliva into the oral cavity.

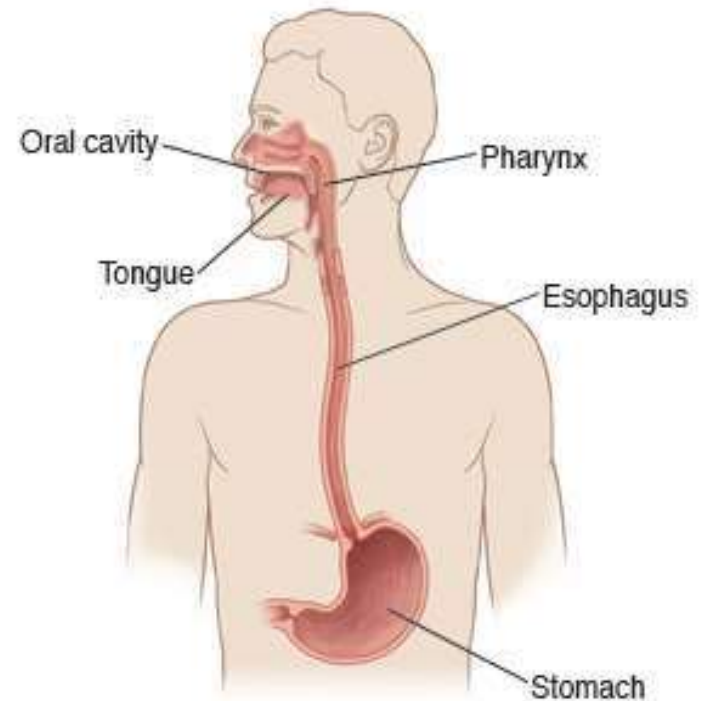
### saliva

moistens the food

contains enzymes (**ptyalin** or **salivary amylase**) begins digestion of starch into smaller polysaccharides.

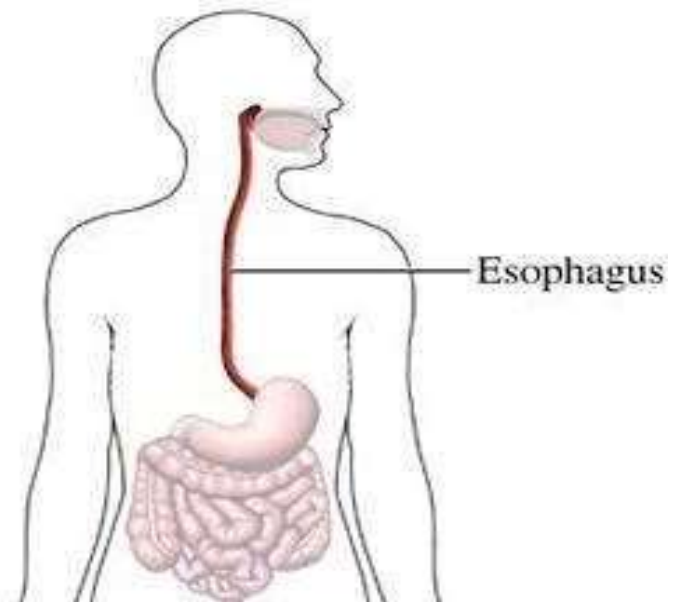
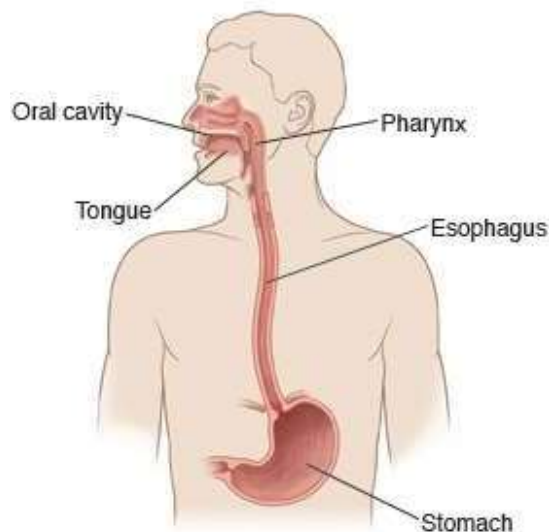
### Function:

- Mechanical digestion.
- increasing surface area for faster chemical digestion.



# The Esophagus

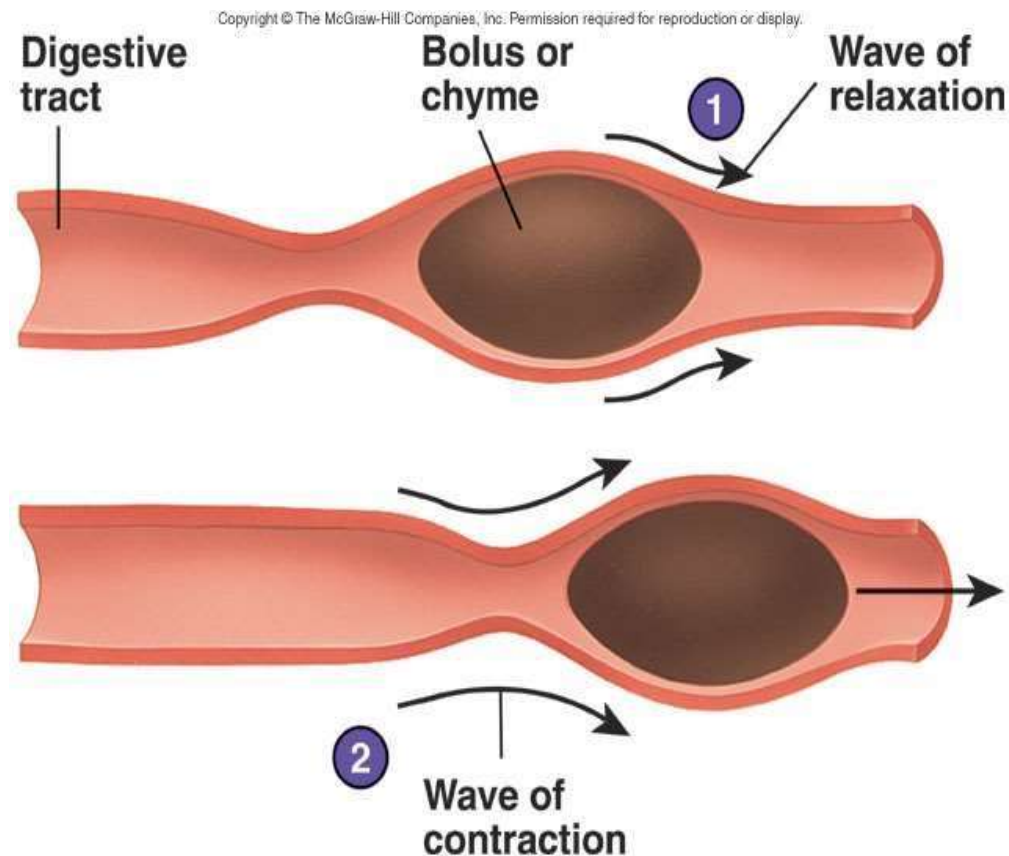
- a tube connecting the mouth to the stomach
- running through the Thoracic cavity.
- **Location:**
- lies behind windpipe (Trachea).
- The trachea has as an **epiglottis**
- preventing food from entering the windpipe,
- moving the food to the esophagus while swallowing.



- *Food travels down the esophagus, through a series of involuntary rhythmic contractions (wave-like) called **peristalsis**.*

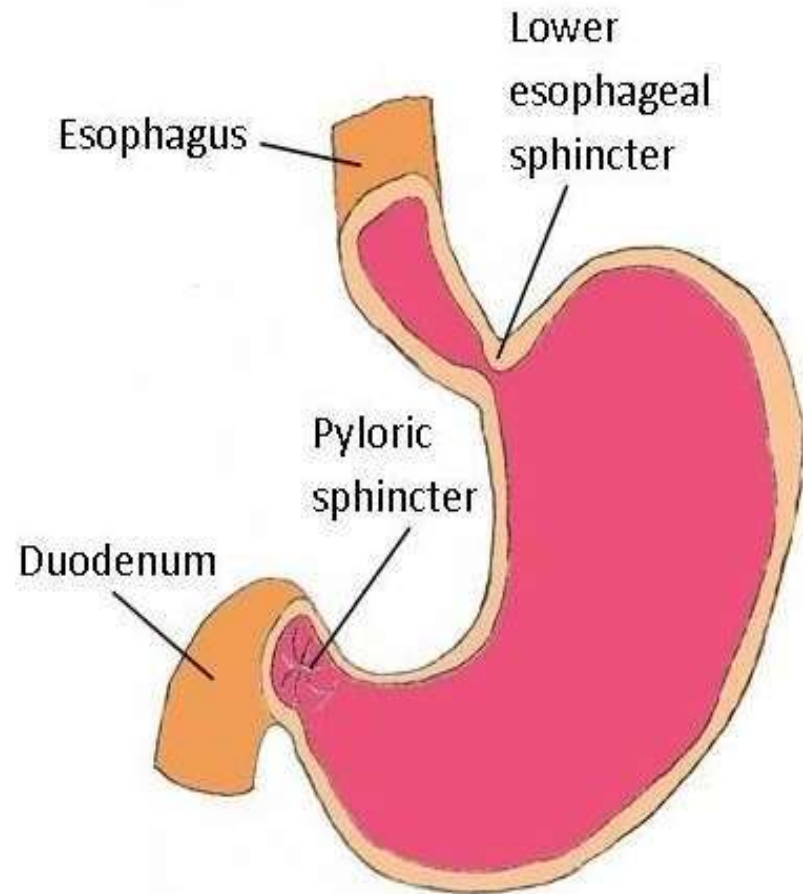
- **Function:**

- The lining of the esophagus secretes mucus
- Lubricating to support the movement of food.



## ESOPHAGEAL SPHINCTER:

- bolus reaches the stomach
- must pass through a muscular ringed valve called the esophageal sphincter (Cardiac Sphincter).
- **Function:**
- prevent stomach acids from back flowing into the esophagus.



# STOMACH

- J-shaped muscular sac
- Has inner folds (**rugae**)
- Increasing surface area of the stomach.

- **Function:**

- Stomach performs mechanical digestion

- **HOW**

By churning the bolus and mixing it with the gastric juices

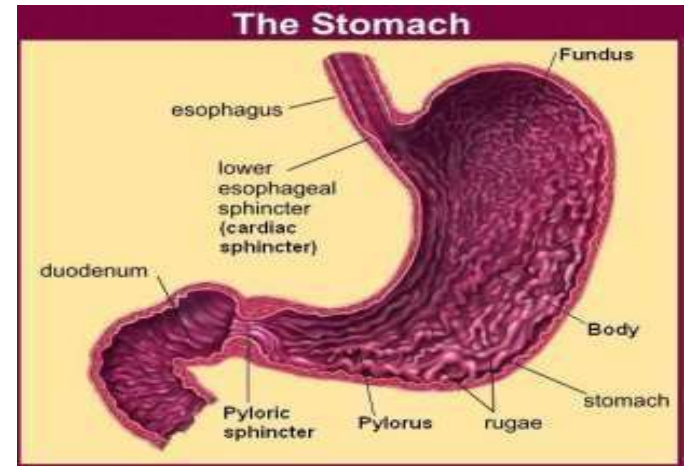
- secreted by the lining of the stomach.

- **GASTRIC JUICES**

HCl, salts, enzymes, water and mucus.

- HCL helps break down of food and kills bacteria that came along with the food.

- **The bolus is now called Chyme.**

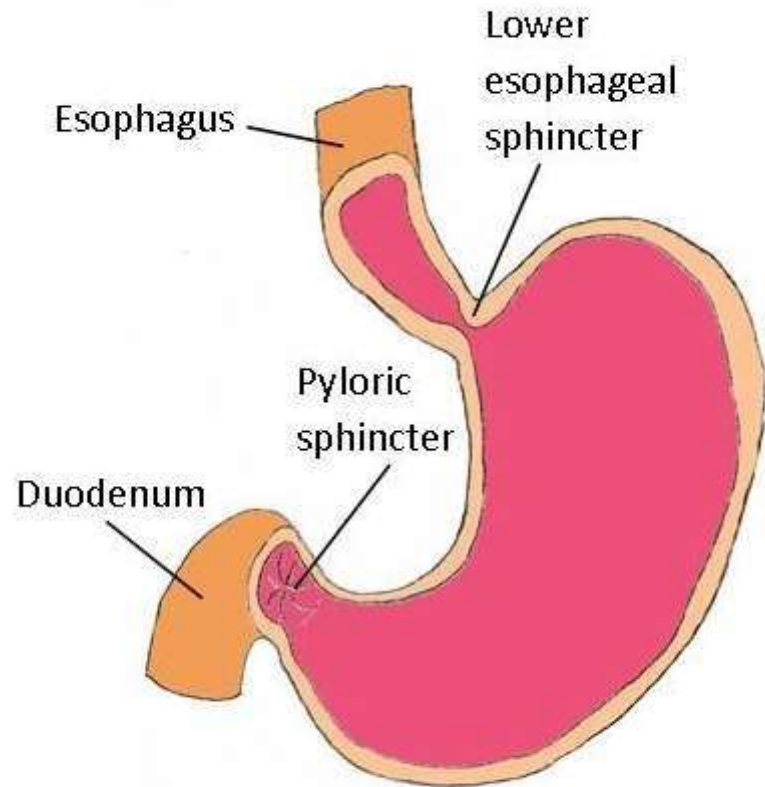




## ENZYMES IN STOMACH:

- Acidic environment
- **HCl secretion**
  - ✓ kill any microbes that are found in the bolus,
  - ✓ creating a pH of 2.
  - ✓ Mucus prevents the stomach from digesting itself.
- **Pepsin secretion**
  - responsible for initiating the breakdown of proteins (in )food.
  - hydrolyzes proteins to yield polypeptides.

- **Pyloric sphincter:**
- chyme moves from the stomach to the small intestine.
- It passes through a muscular ringed sphincter called the pyloric sphincter.



# STOMACH DOES NOT DIGEST ITSELF

## WHY?

- **Protective Mechanism:**

- 3 protective mechanisms.

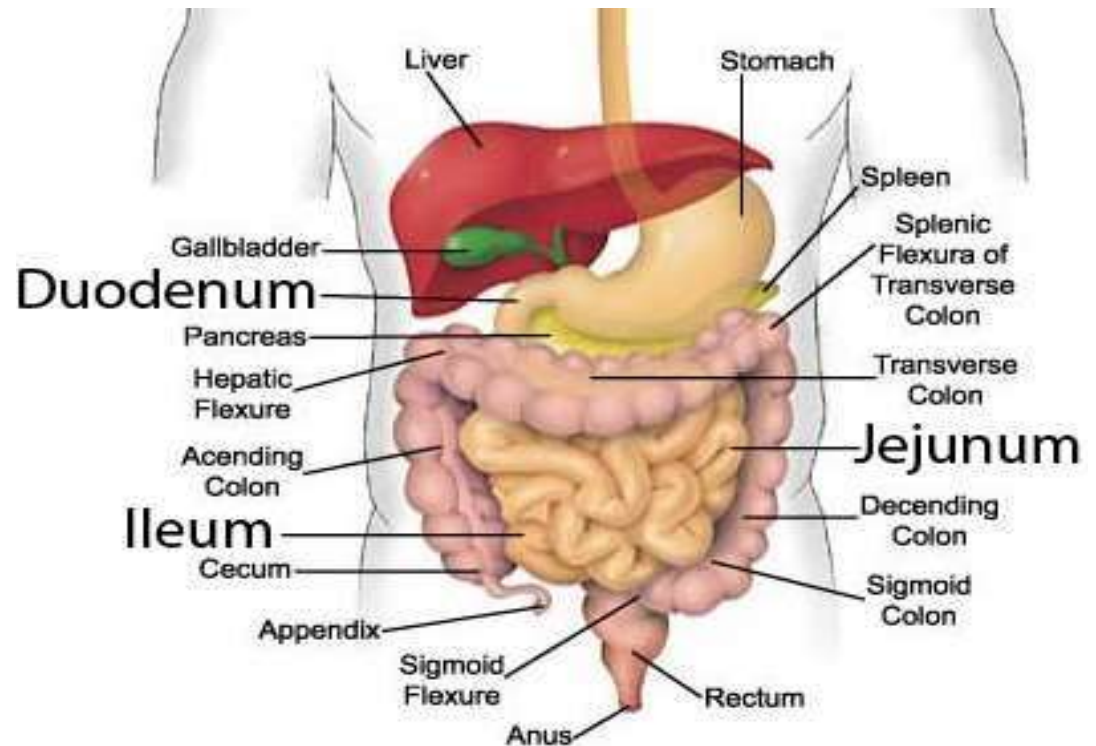
1. First the stomach only secretes small amounts of gastric juices until food is present.
2. Second the secretion of mucus coats the lining of the stomach protecting it from the gastric juices.
3. The third mechanism is the digestive enzyme pepsin is secreted in an inactive protein called pepsinogen. Pepsinogen is converted to pepsin in the increased presence of hydrochloric acid (pH 1).

# SMALL INTESTINE

- Responsible for the complete digestion of all Macromolecules and the absorption of their component molecules

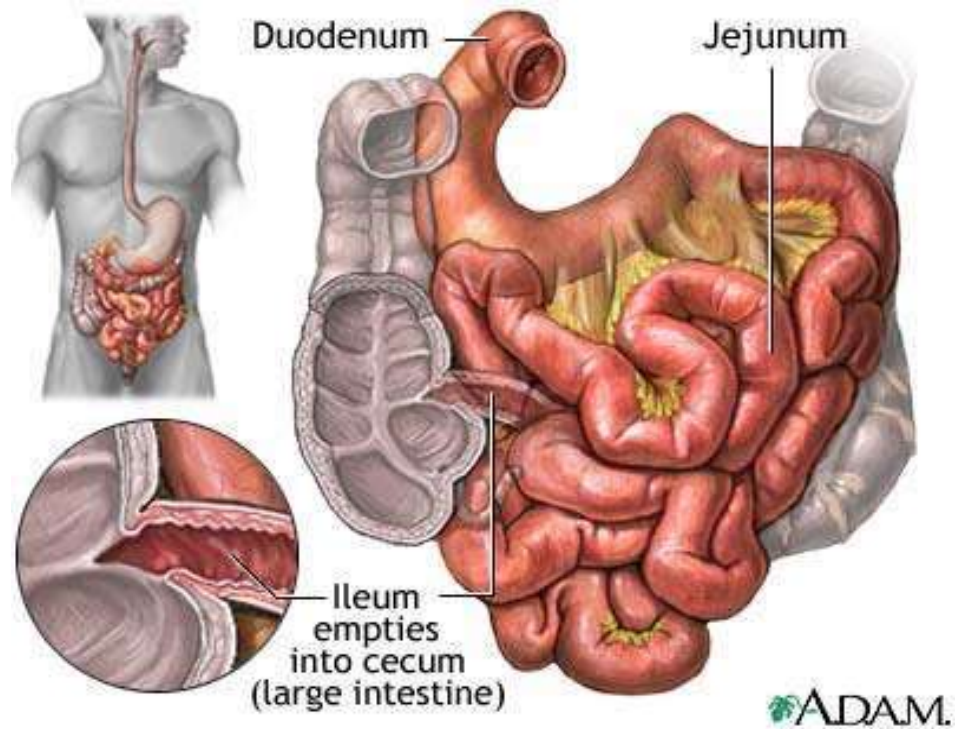
E.g

- Glucose
- Glycerol
- Fatty acids
- Amino acids
- Nucleotides



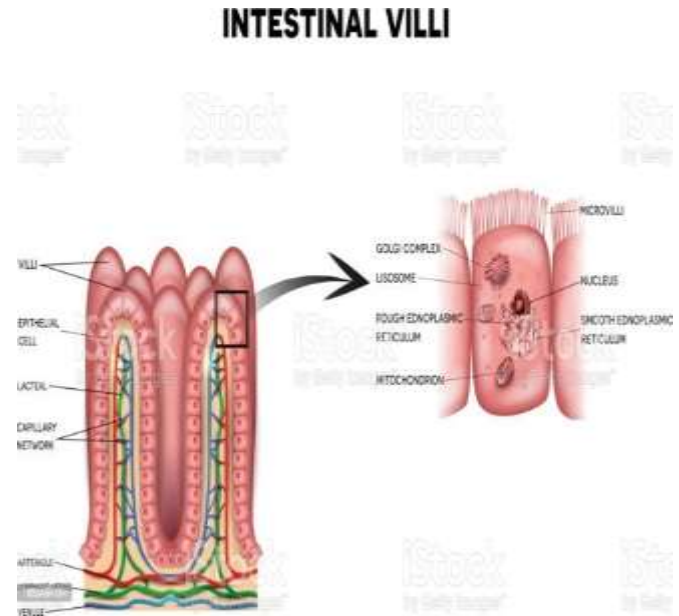
## PARTS OF SMALL INTESTINE

- The small intestine is made up of three parts
- **Duodenum**
- **Jejunum**
- **ileum**



# 1. DUODENUM

- The first part is the ***duodenum***, u-shaped organ.
- approximately 30 cm in length.
- This area completes most of the digestion processes.
- Enzymes are secreted into the duodenum from the pancreas and the gall bladder. The duodenum is lined by folds of tissue called ***villi***.
- The villi are covered by fine brush-like ***microvilli***.
- These folds increase the surface area of the small intestine increase the rate of absorption.

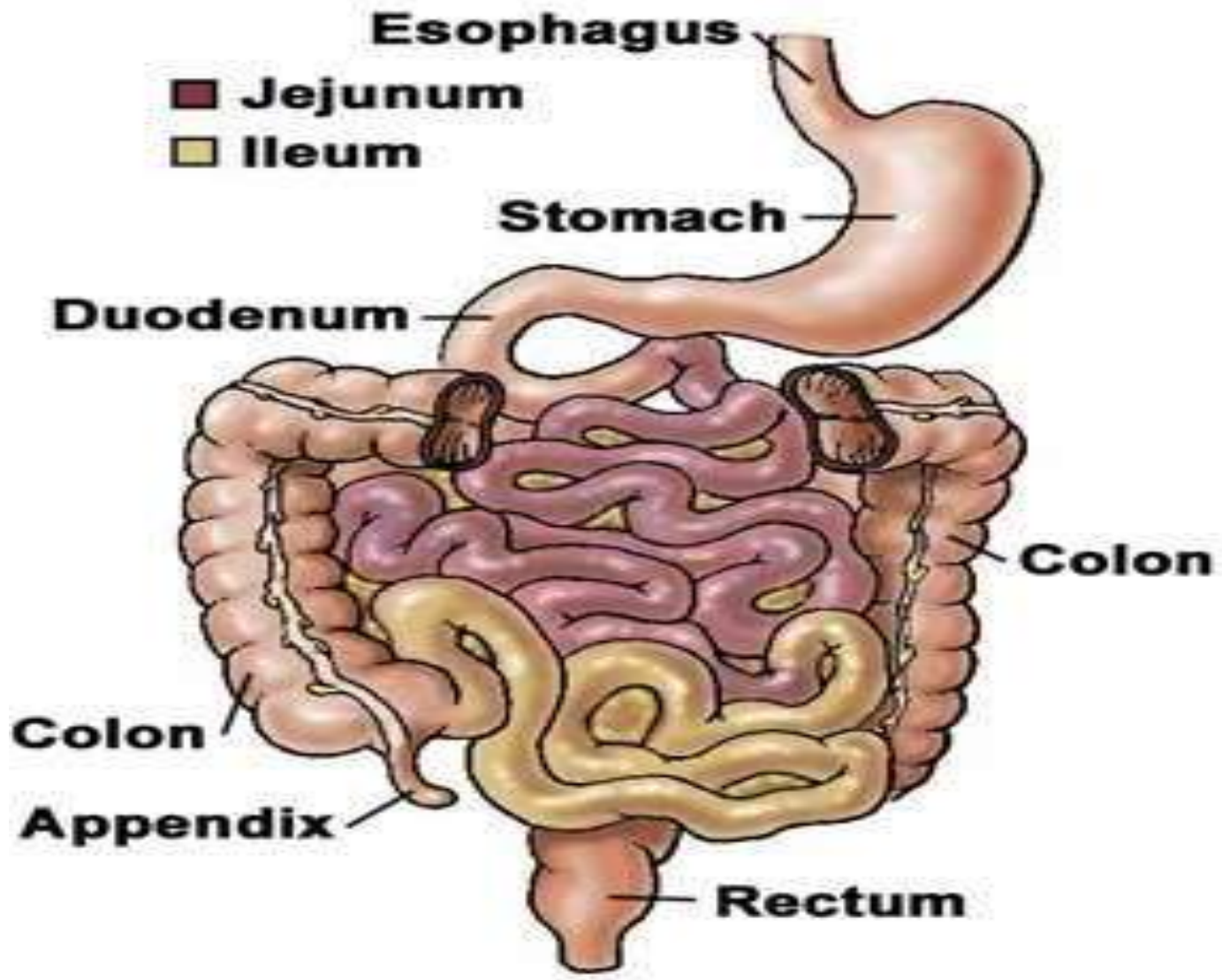


## 2. JEJUNUM

- The *jejunum* is approximately 2.5 m long.
- Although some digestion is completed here, it has more villi and microvilli; its role is absorption of nutrients.

## 3. Ileum

- The *ileum*, is approximately 3m long.
- has fewer villi and microvilli than the other two parts.
- Although absorption also occurs here, it is responsible for pushing the waste materials into the large intestine.





# FUNCTIONS OF THE SMALL INTESTINE

- 90% of the digestion and absorption of food occurs
- other 10% taking place in the stomach and large intestine.
- The main function of the small intestine is absorption of nutrients and minerals from food.

## **Digestion of proteins**

- Proteins, peptides and amino acids are acted upon by enzymes such as trypsin and chymotrypsin, secreted by the pancreas. This breaks them down to smaller peptides.

# DIGESTION OF LIPIDS

- Enzymes, like lipases secreted from the pancreas, act on fats and lipids in diet.
- lipase can break them into the smaller parts that can enter the intestinal villi for absorption.

## **Digestion of carbohydrates**

- Carbohydrates are broken down to simple sugars and monosaccharides like glucose.
- Pancreatic amylase breaks down some carbohydrates to oligosaccharides as well.
- Some carbohydrates and fibers pass undigested to the large intestine where they may, depending on their type, be broken-down by intestinal bacteria.

# ABSORPTION IN THE SMALL INTESTINES

- the nutrients are absorbed by the inner walls of the small intestine into the blood stream.
- The nutrients are absorbed by processes of simple/passive diffusion, facilitated diffusion, primary active transport, or secondary active transport.
- For transport, nutrients commonly rely upon
  - Lipids – undergo passive or simple diffusion
  - Short-chain fatty acids – diffusion
  - Amino acids – primary active transport
  - Glucose – secondary active transport
  - Fructose – facilitated diffusion

# ABSORPTION IN THE SMALL INTESTINES

- Other absorbed substances in the small intestines include:

## **1. Water**

- 80% is absorbed by the small intestine
- 10% by the large intestine
- remaining 10% excreted in the faeces.

## **2. Electrolytes**

## **3. Vitamins and minerals**

# LARGE INTESTINE

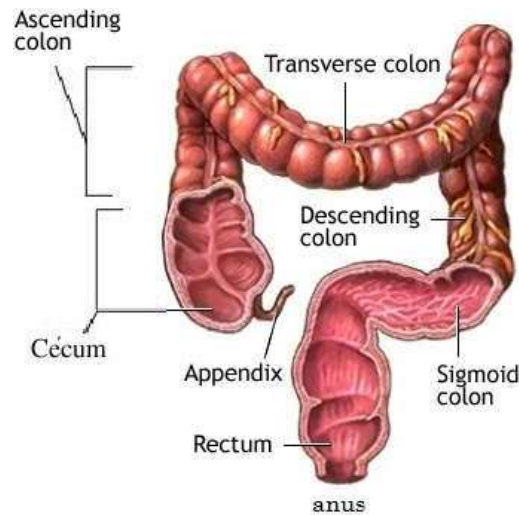
(parts & function )

Large Intestine

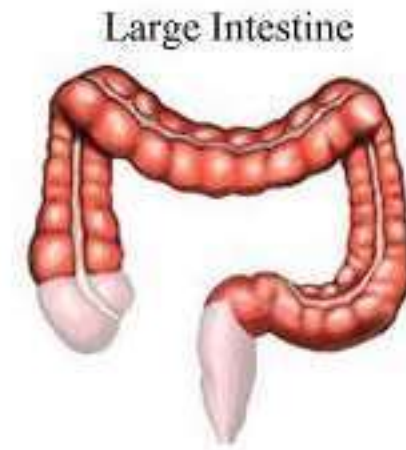


## COMPONENTS OF LARGE INTESTINE

- The large intestine is composed of several very distinctive parts:
- **Cecum:**
- **Colon:**. The colon consists of four parts:
  - Ascending colon
  - Transverse colon
  - Descending colon
  - Sigmoid colon
- **Rectum**

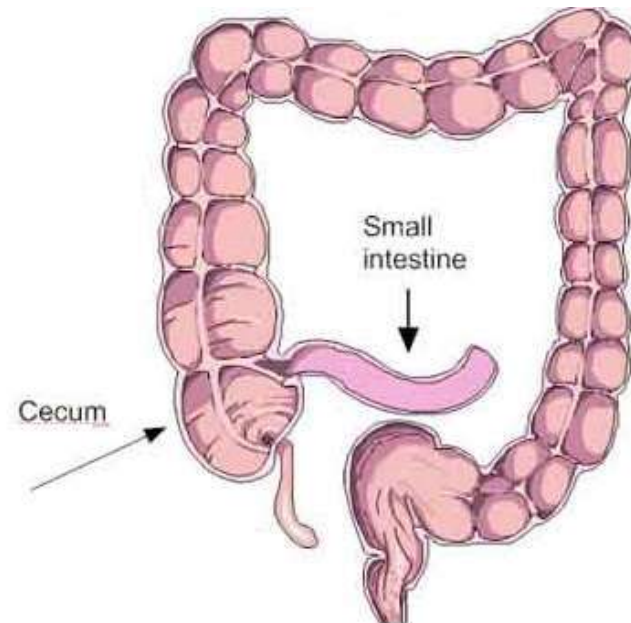
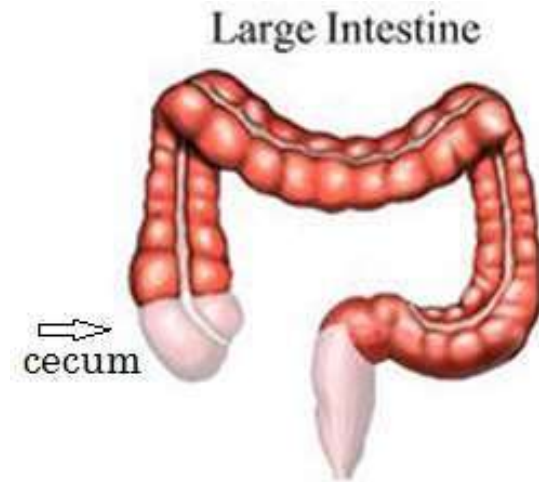


Components of Large Intestine



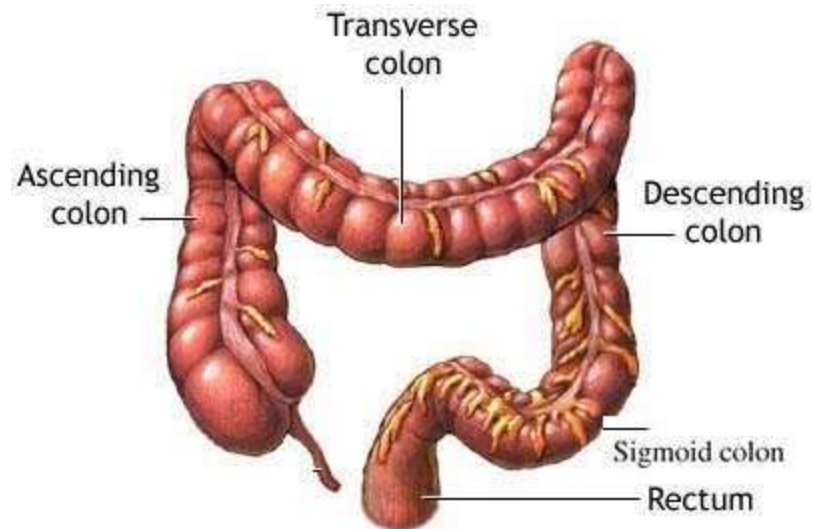
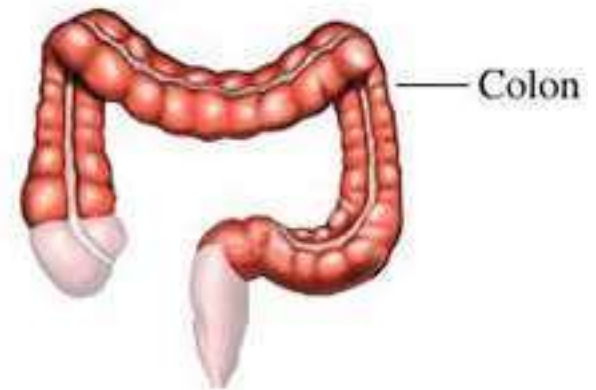
# CECUM

- first section of your large intestine
- looks like a pouch,
- two inches long.
- **ROLE**
- taking in digested liquid from the ileum (small intestine) &
- passes it on to the colon.



## COLON :

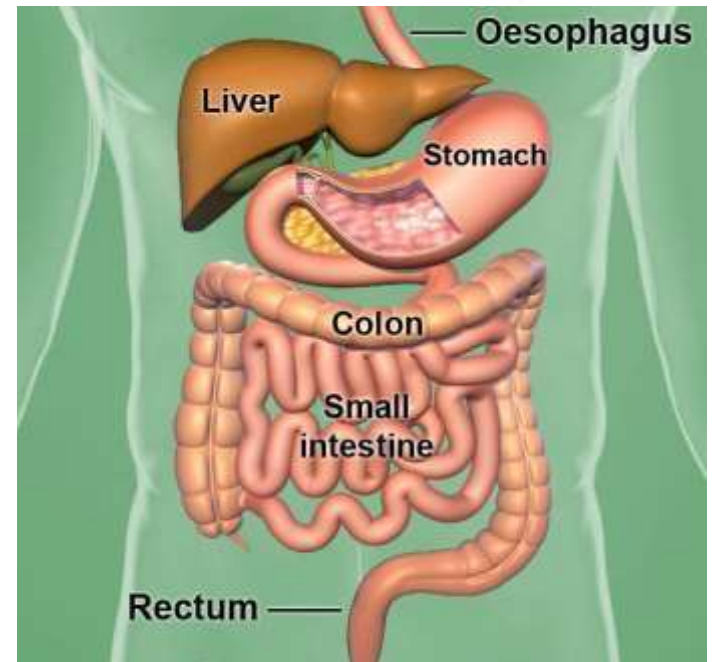
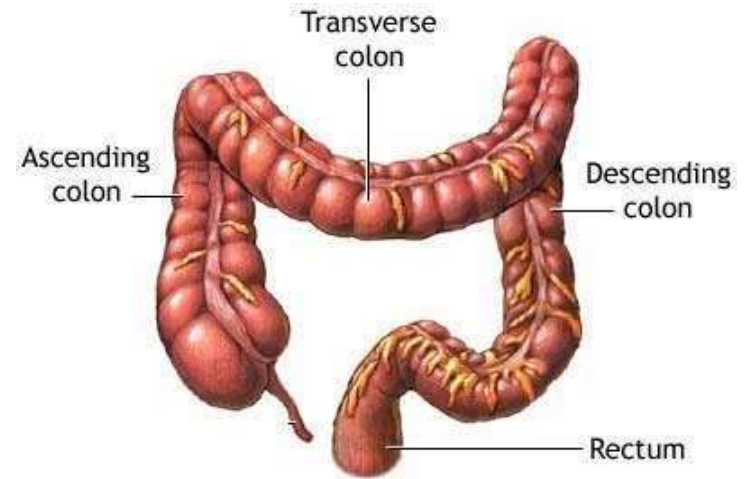
- major section of the large intestine
- **Function:**
- the principal place for water reabsorption,
- absorbs salts when needed.
- **Components :**
- The colon consists of 4 parts:
  - ❖ Ascending colon
  - ❖ Transverse colon
  - ❖ Descending colon
  - ❖ Sigmoid colon





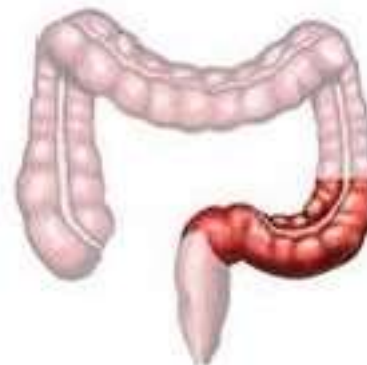
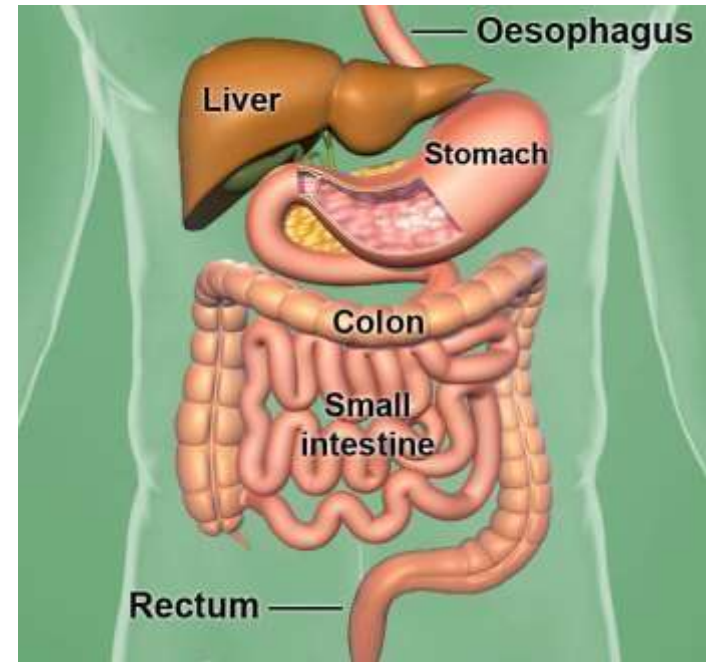
## COMPONENTS OF COLON

- **Ascending colon:**
- 1st portion of the colon
- pushes any undigested debris up from the cecum
- just under the right lower end of the liver.
- **Transverse colon:**
- 2nd portion of the colon
- Food traveling from left to right just under your stomach.



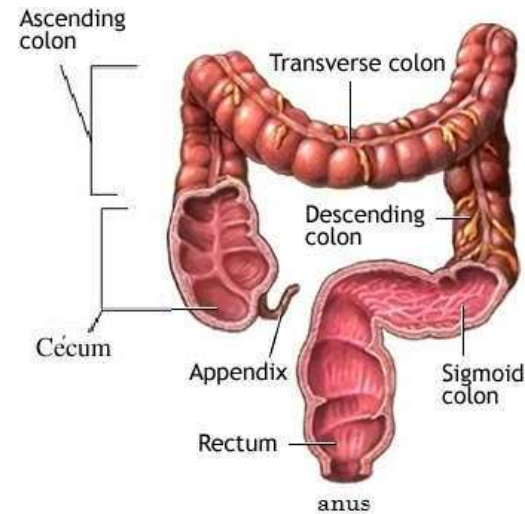
## COMPONENTS OF COLON

- **Descending colon:**
  - 3rd portion of colon
  - pushes its contents from down to the lower left side of your abdomen
- 
- **Sigmoid colon:**
  - final
  - S-shaped length of the colon,
  - empties into the rectum.



# RECTUM

- The final section
- measures from 1 to 1.6 inches (or 2.5 to 4 cm).
- Leftover waste collects there
- expanding the rectum
- emptied through anus



Components of Large Intestine

# FUNCTION OF LARGE INTESTINE

- **1. Absorb Water**
- One of the primary functions is to absorb water
- prepare the waste as a solid stool that will be expelled from the body.
- **2. Absorb Vitamin**
- beneficial bacteria
- role in breaking down undigested sugars and fibers into fatty acids.
- produce many vitamins, of which are Vitamin K and Biotin that are absorbed back into the body.

## FUNCTION OF LARGE INTESTINE(LI)

- **3. Reduce Acidity**

The fatty acids cause acidic environment.

The LI produces alkaline solutions

reduce the acidity and balance the pH in the LI

- **4. Protect from Infections**

The mucous lining of the large intestine acts as a protective layer

prevents harmful bacteria from being reabsorbed into the body.

## FUNCTION OF LARGE INTESTINE(LI)

- **5. Produce Antibodies**

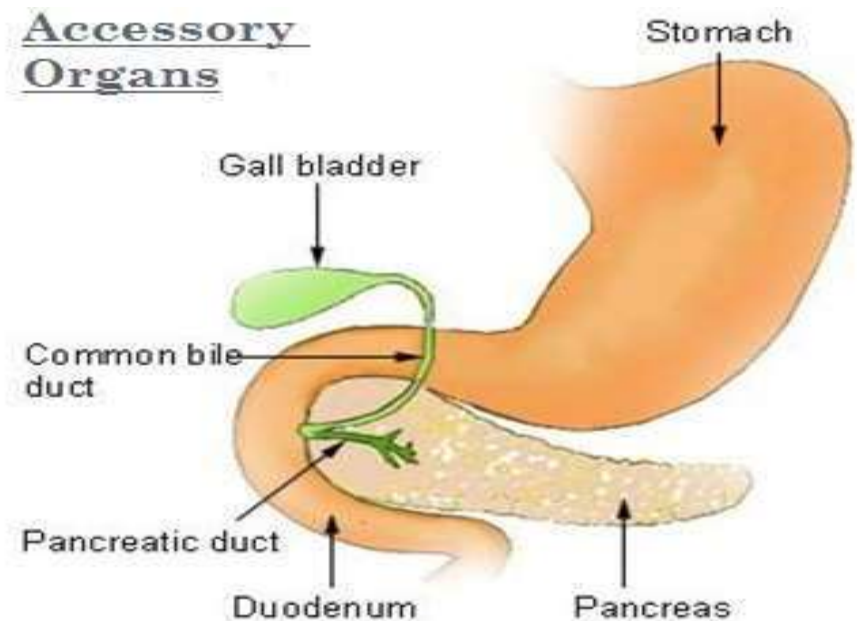
also produces antibodies

help to boost immunity.

It is believed that the appendix may have been a major producer of antibodies at some point in the evolutionary process

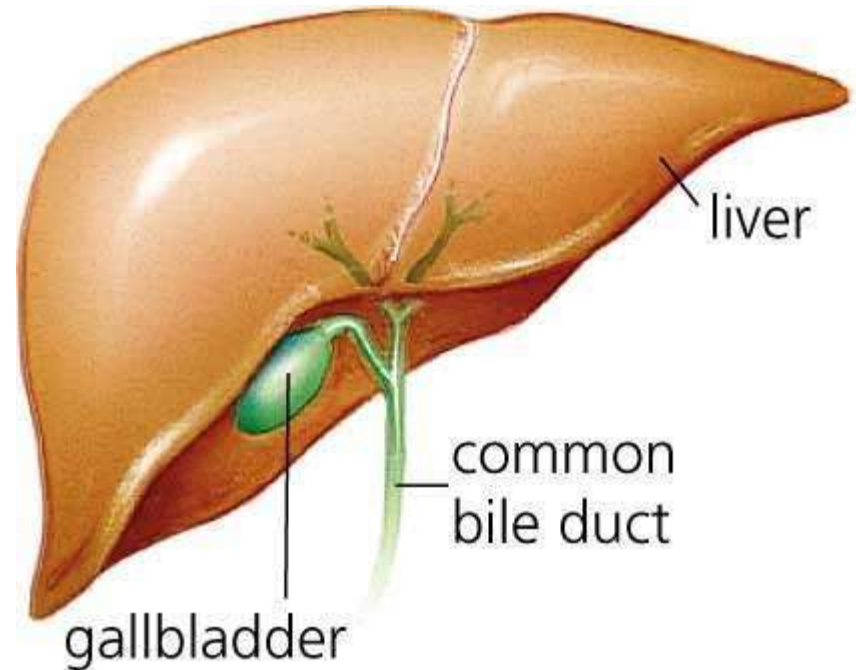
## THE ACCESSORY ORGANS:

- support the digestive system BUT are not part of the digestive tract
- These organs secrete fluids into the digestive tract, and are connect by ducts.
- The accessory organs include
- liver
- gall bladder
- pancreas.



# 1. LIVER

- largest of these organs
- mass of about 1.5 kg.
- liver produces bile
- **bile**  
greenish yellow pigment  
made up bile pigments and  
bile salts
- it breaksdown old red blood  
cells.

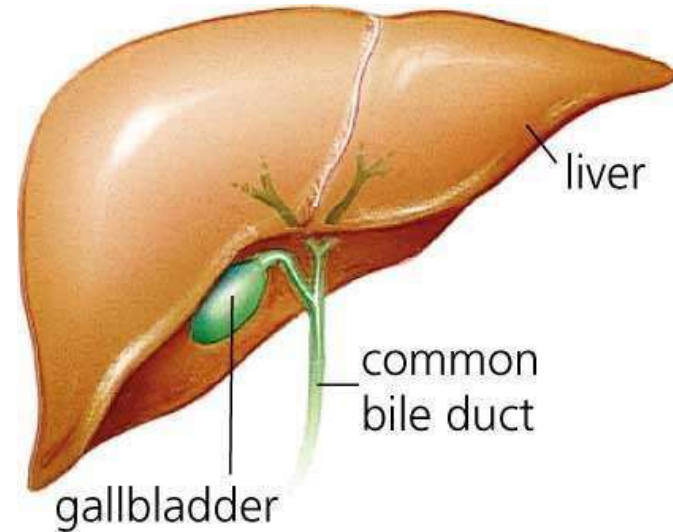


Carlyn Iverson

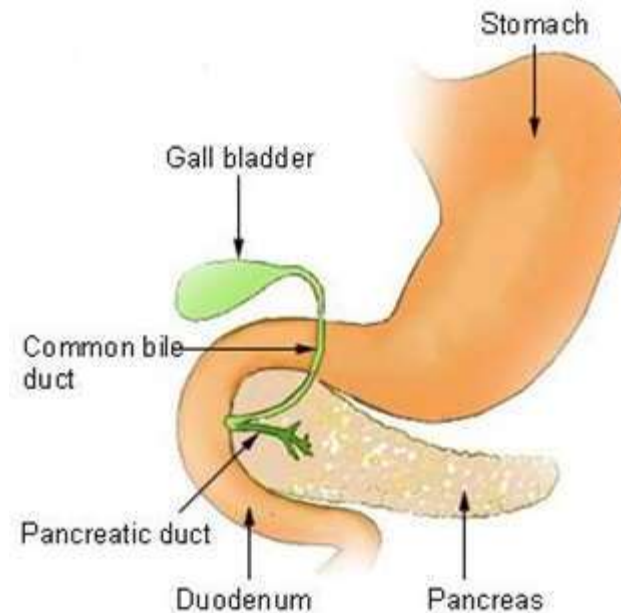


## 2. GALL BLADDER

- a storage sac.
- The bile is secreted into it
- The bile is stored here.
- HOW IT WORKS
  - food containing fat enters the digestive tract
  - salts are secreted into the small intestine to digest fats.
  - The bile emulsifies fats in partly digested food thereby assisting their absorption



Carlyn Iverson



### 3. PANCREAS

- The pancreas secretes a number of different enzymes into the small intestine.
- Role is to digest carbohydrates lipids & proteins completely.
- It also secretes ***bicarbonate ions***
- **Role :**  
Neutralize the HCl from the stomach  
change the pH of the small intestine to a pH of 8.
- The pancreas will secrete about 1.0 L. of pancreatic fluids per day.

