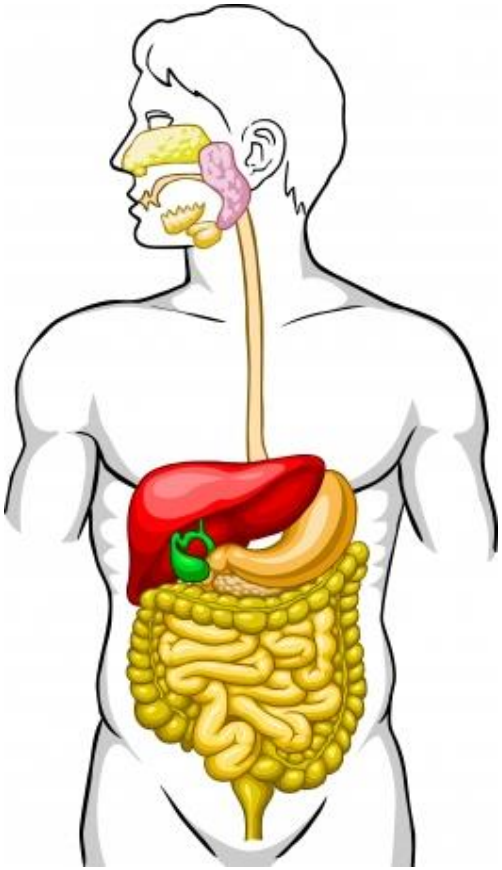
The Human Digestive System

SBI3UP

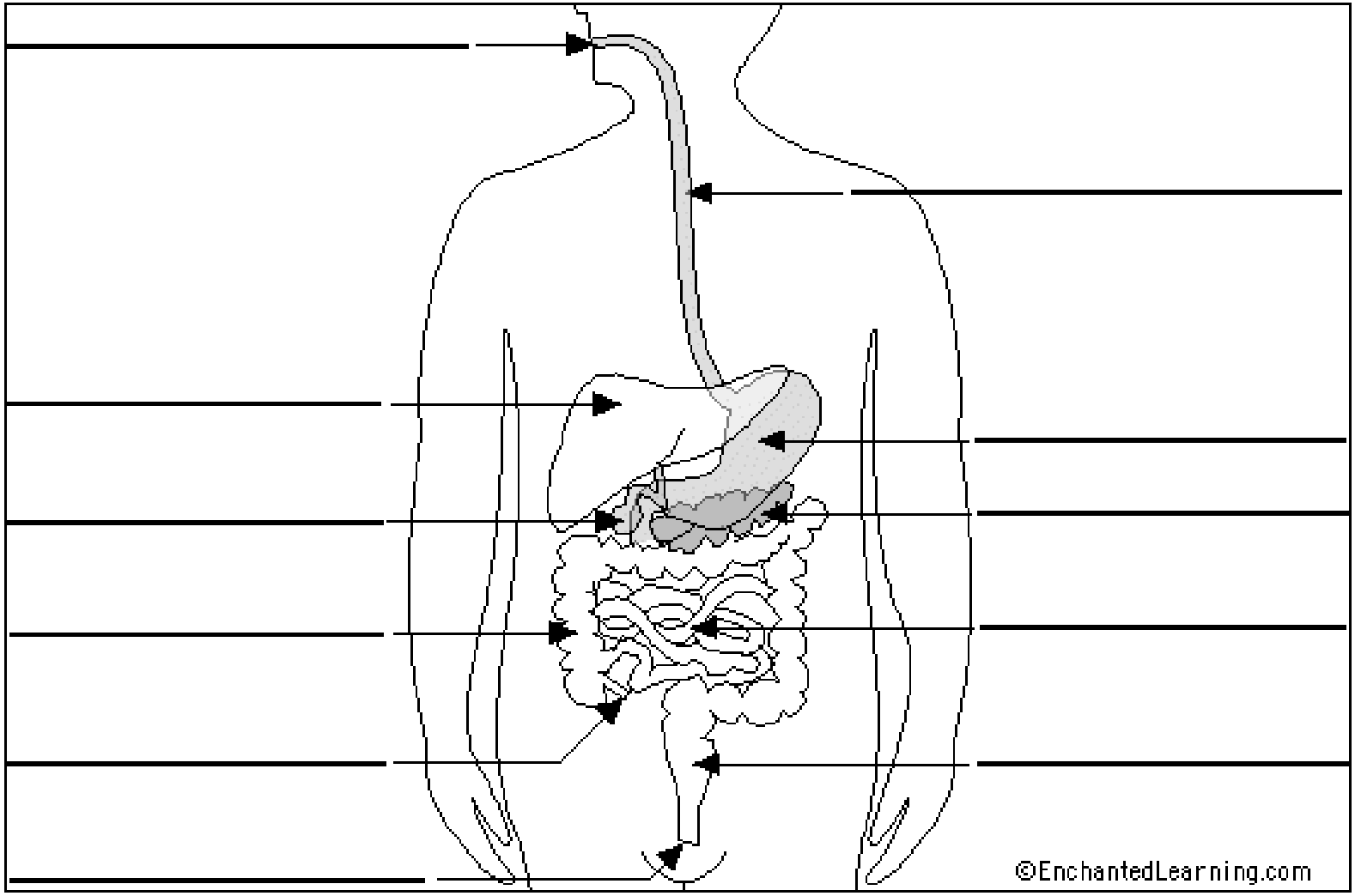
MRS. FRANKLIN

The Human Digestive System



The digestive tract has numerous organs with specific functions. Each organ helps to breakdown food.

DIAGRAM OF DIGESTIVE SYSTEM:



Four Stages of Digestion

Recall. . . **What are the four stages of digestion? What occurs in each of the stages?**

1) Ingestion -

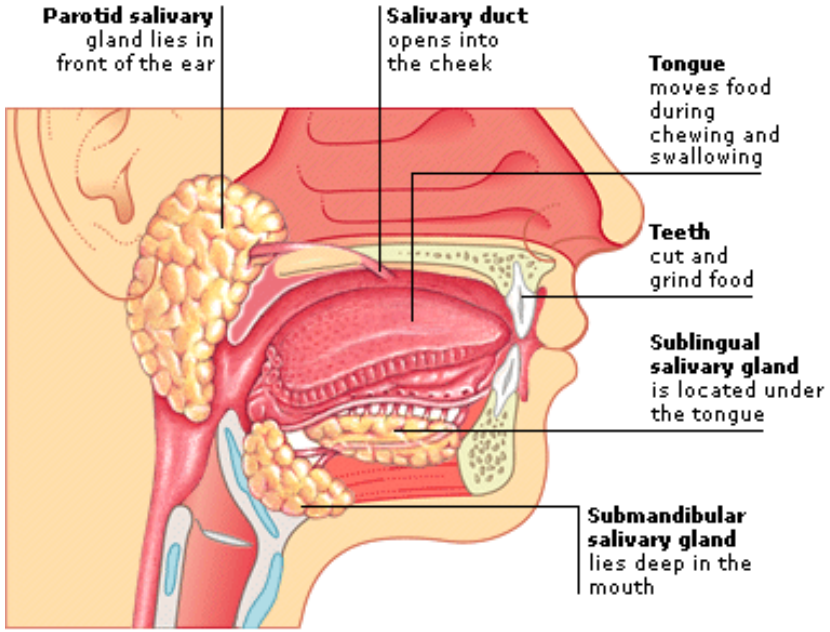
2) Digestion -

3) Absorption -

4) Excretion -

1. Ingestion

The process of ingestion occurs in the mouth. The teeth, tongue and salivary glands pay a vital role in the ingestion and breakdown of food.



Mechanical digestion: Teeth breakdown the food into small pieces

Chemical digestion: **Amylase (enzyme)** breaks down the bonds in carbohydrates

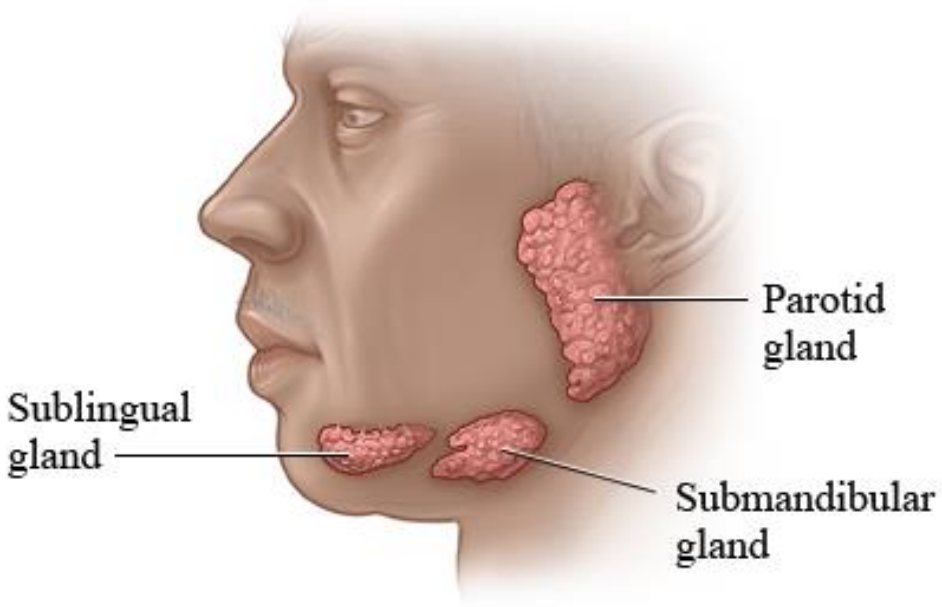
1. Ingestion - Mouth

The process of ingestion within the mouth involves the following:

- An enzyme (amylase) breaks down starches (carbohydrates) into simpler sugars
- Dissolves water soluble food particles
- Stimulates taste buds
- Lubricates the food so it can be swallowed

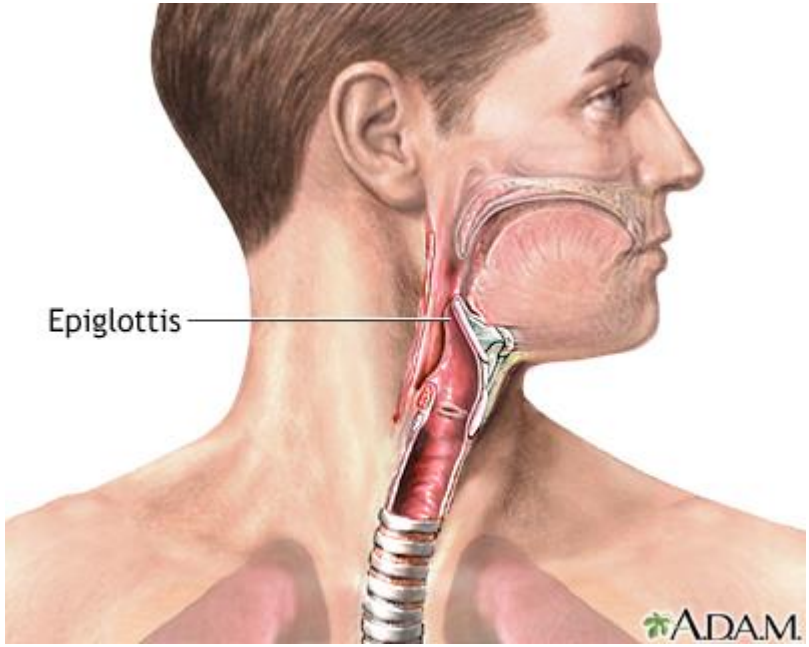
1. Ingestion - Mouth

The **saliva** is secreted from 3 salivary glands. The secretion of saliva is triggered before you have food in your mouth.



1. Ingestion - Esophagus

The mouth creates a bolus of food which the tongue pushes back to the back of the throat.



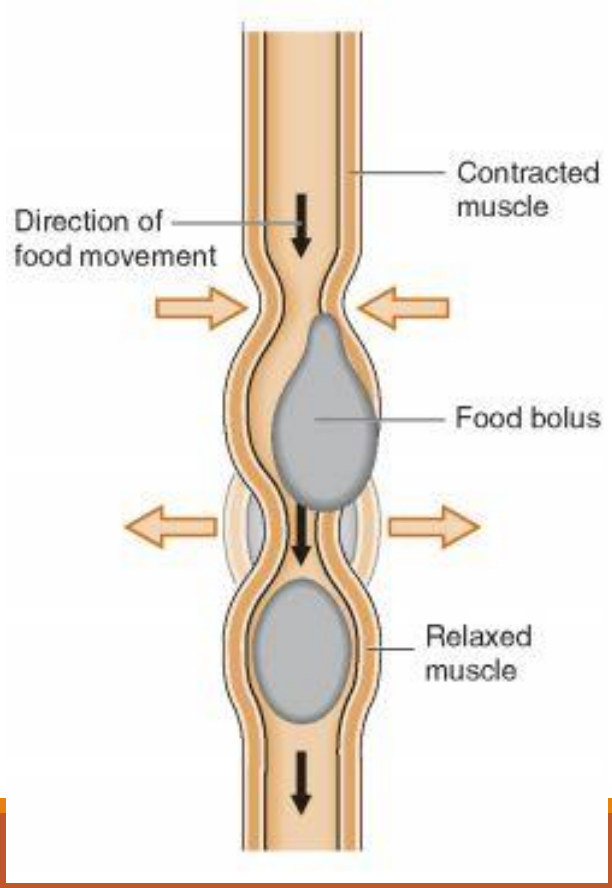
Epiglottis *– flap covers trachea so food doesn't get in. It causes the food to only enter the esophagus.*

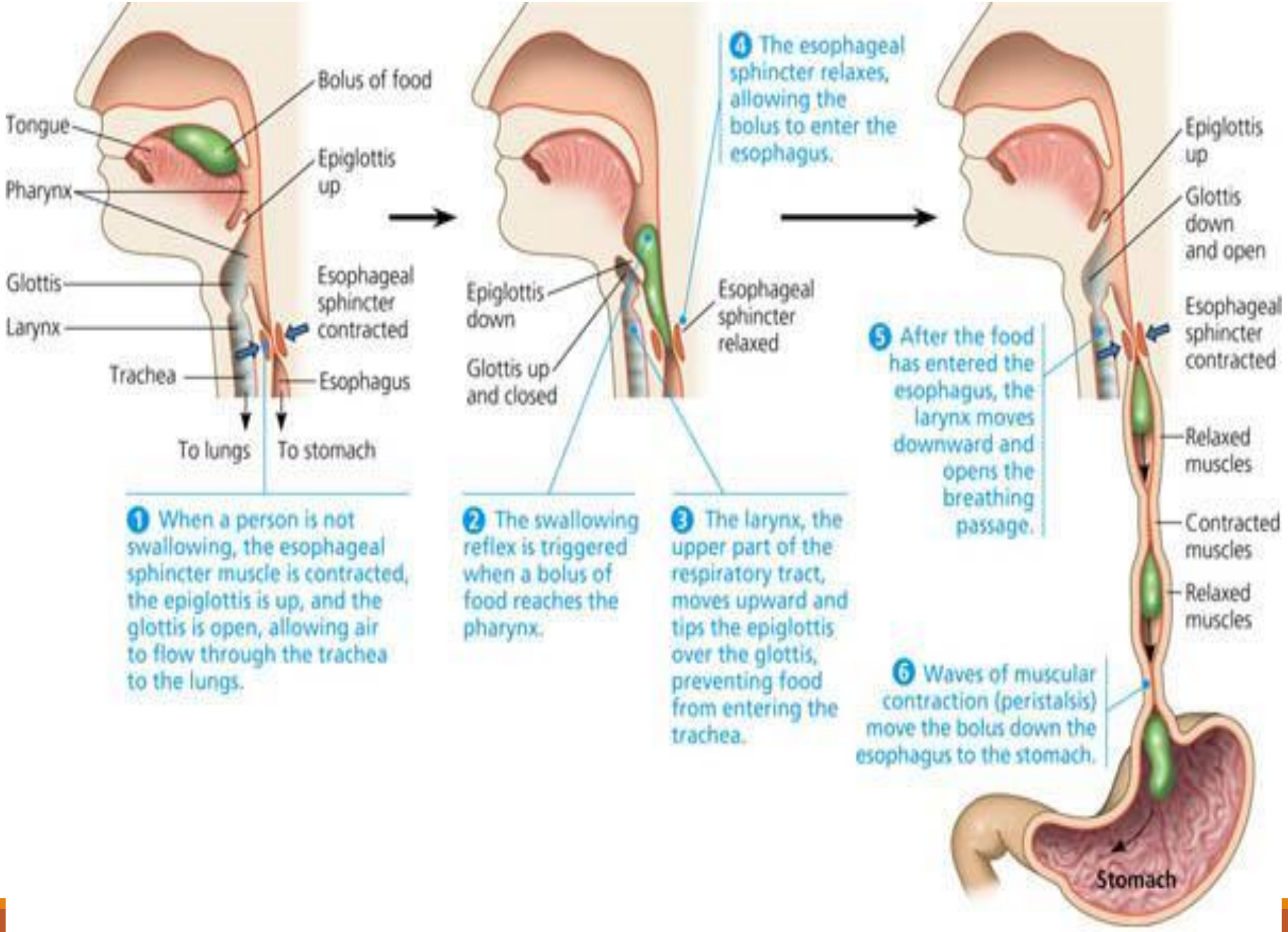
1. Ingestion - Esophagus

The walls of the esophagus walls are stretched by food and a series of rhythmic contractions occur **(peristalsis)** to help move food down into the stomach.

Glands in the lining **produce mucus**

- keeps the tube moist
- facilitates movement of food




Bolus of food
Tongue
Epiglottis up
Pharynx
Glottis
Esophageal sphincter contracted
Larynx
Trachea
Esophagus
To lungs
To stomach
1 When a person is not swallowing, the esophageal sphincter muscle is contracted, the epiglottis is up, and the glottis is open, allowing air to flow through the trachea to the lungs.
Epiglottis down
Glottis up and closed
2 The swallowing reflex is triggered when a bolus of food reaches the pharynx.
4 The esophageal sphincter relaxes, allowing the bolus to enter the esophagus.
Esophageal sphincter relaxed
3 The larynx, the upper part of the respiratory tract, moves upward and tips the epiglottis over the glottis, preventing food from entering the trachea.
Epiglottis up
Glottis down and open
Esophageal sphincter contracted
5 After the food has entered the esophagus, the larynx moves downward and opens the breathing passage.
Relaxed muscles
Contracted muscles
Relaxed muscles
6 Waves of muscular contraction (peristalsis) move the bolus down the esophagus to the stomach.
Stomach

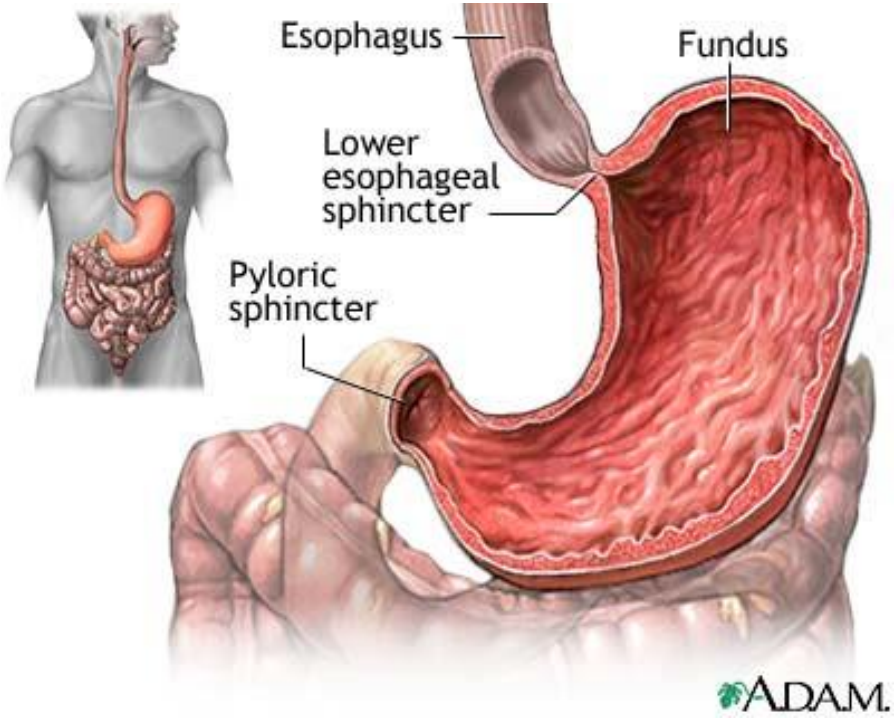
2. Digestion - Stomach

The stomach is a muscular, J-shaped organ that is present on the left side of the abdominal cavity.

*Performs both **chemical** and **mechanical** digestion*

2. Digestion - Sphincter

The lower esophageal sphincter is a muscle that opens in the presence of the bolus of food and allows it to enter the stomach.



Video

2. Digestion - Stomach

The stomach walls are **folded** and can **expand** after a meal.

Glands on the stomach wall release **gastric juice**

- HCl, salts, enzymes, water and mucus

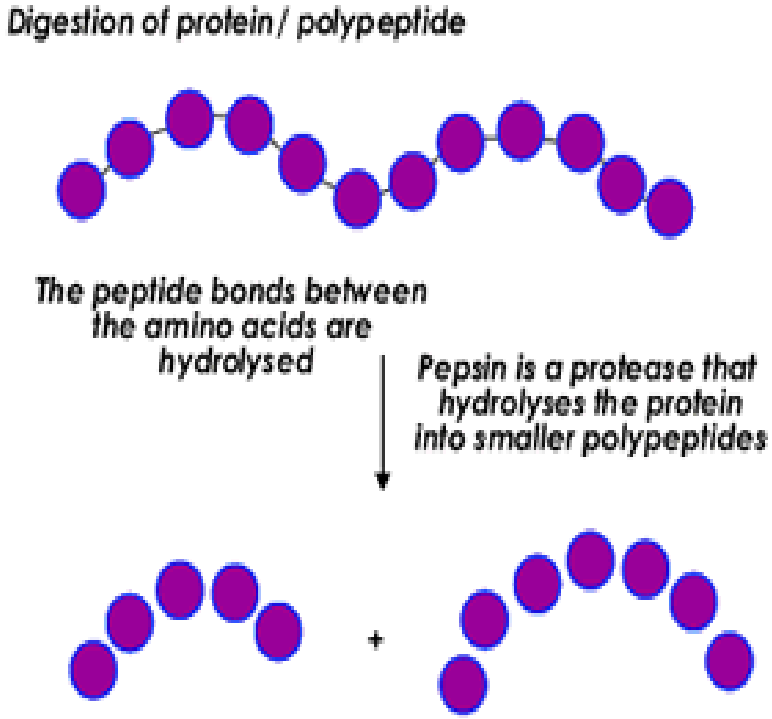
The wall is also covered in a **mucus coat**

- Protects from the **acid** released from the gastric juices

2. Digestion - Stomach

The enzyme **pepsinogen** is released but remains **inactive** until HCl is secreted from the glands.

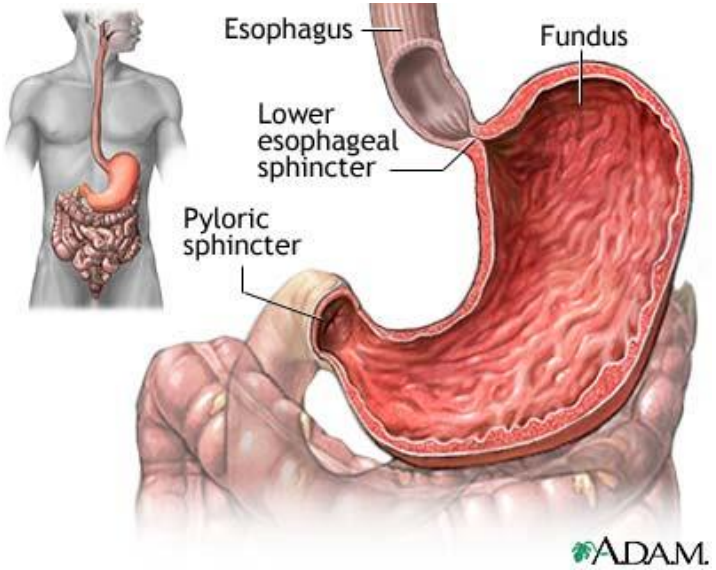
The HCl activates the pepsinogen and converts it into **pepsin**, so that it can breakdown proteins.



2. Digestion - Stomach

The HCl breaks down food and destroys foreign bacteria. The stomach also **contracts** and **relaxes** to churn the food.

Churning - *Breaks up food and mixes with gastric juices. It creates chyme which is delivered into the small intestine.*



*Pyloric Sphincter **opens** to move food into the **small intestine***

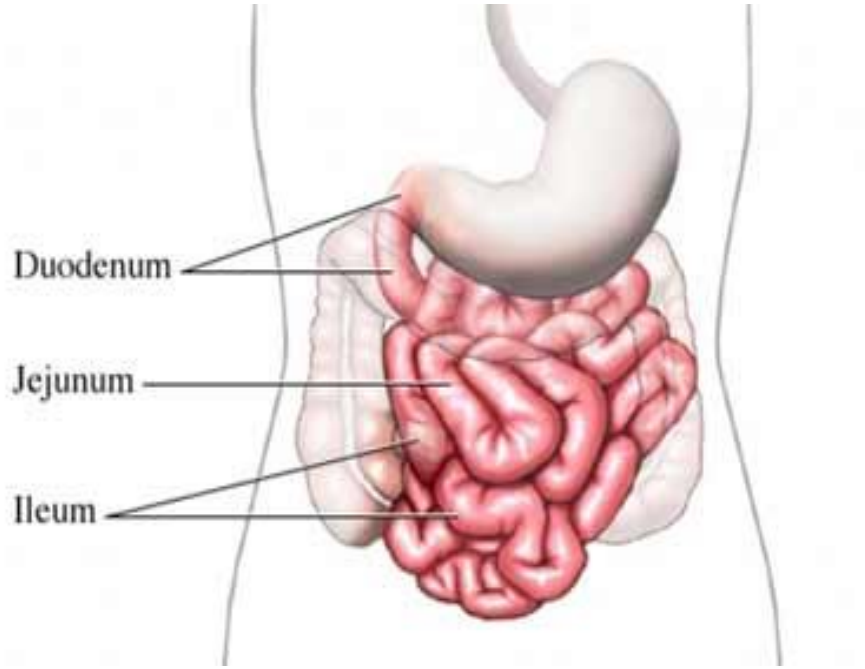
2. Digestion – Small Intestine

The small intestine is made up of three main parts:

1) Duodenum

2) Jejunum

3) Ileum



2. Digestion – Small Intestine

1) Duodenum:

- Receives secretions from the gallbladder and pancreas
- Further breaks down proteins, fats and carbohydrates by releasing enzymes (trypsin and chymotrypsin)
- The folds (villi) increase the surface area = increase absorption

2. Digestion – Small Intestine

2) Jejunum:

- 2.5 m long
- Contains more folds (villi) than the duodenum, which enables more absorption to occur.
- Breaks down remaining proteins and carbohydrates to be absorbed

2. Digestion – Small Intestine

3) Ileum:

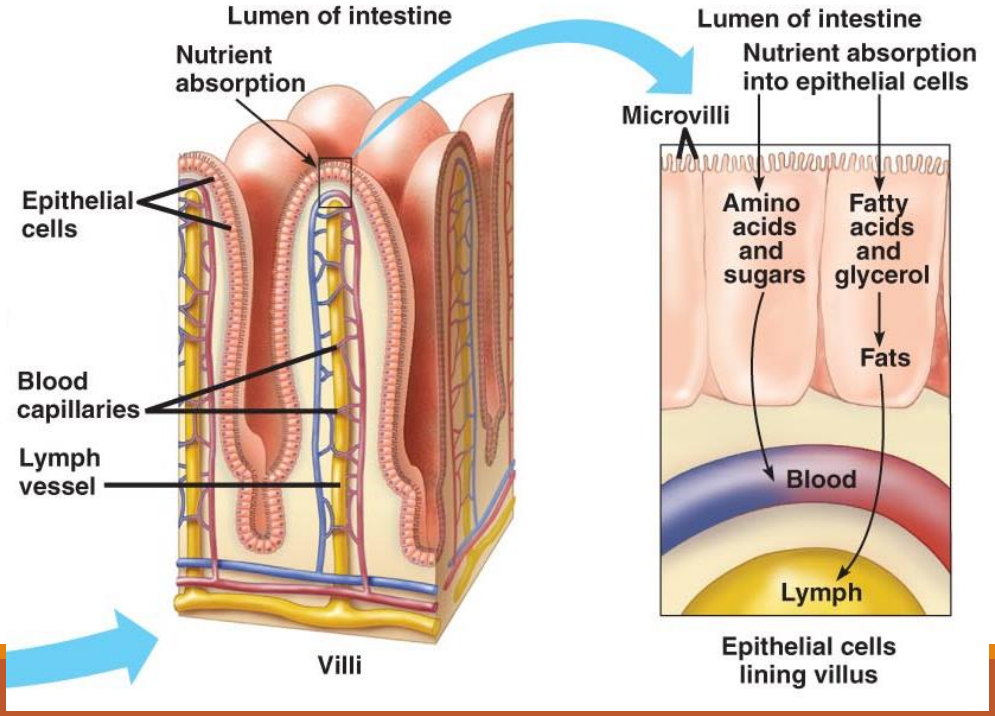
- 3 m long
- Has fewer villi (folds) than the dueodenum and jejunum
- Absorbs nutrients and pushes undigested material into the large intestine

3. Absorption – Small Intestine

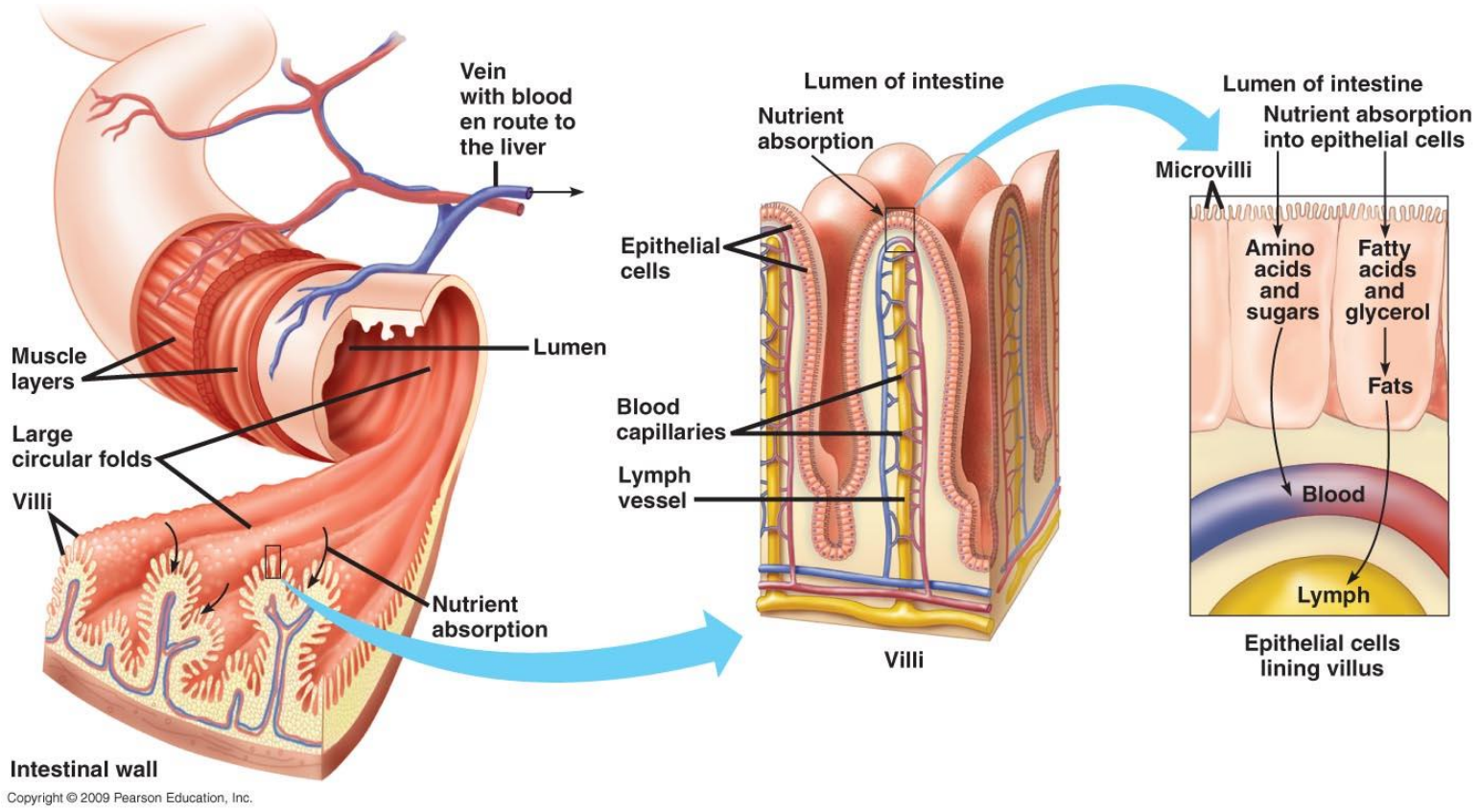
Villi: tiny finger-like projections covering the folds

- Increases the surface area for absorption of **nutrients** into bloodstream.
- composed of cells with **microvilli** on the surface

There is a **capillary network** within the villi. The nutrients diffuse from small intestine into villi and into capillary network.

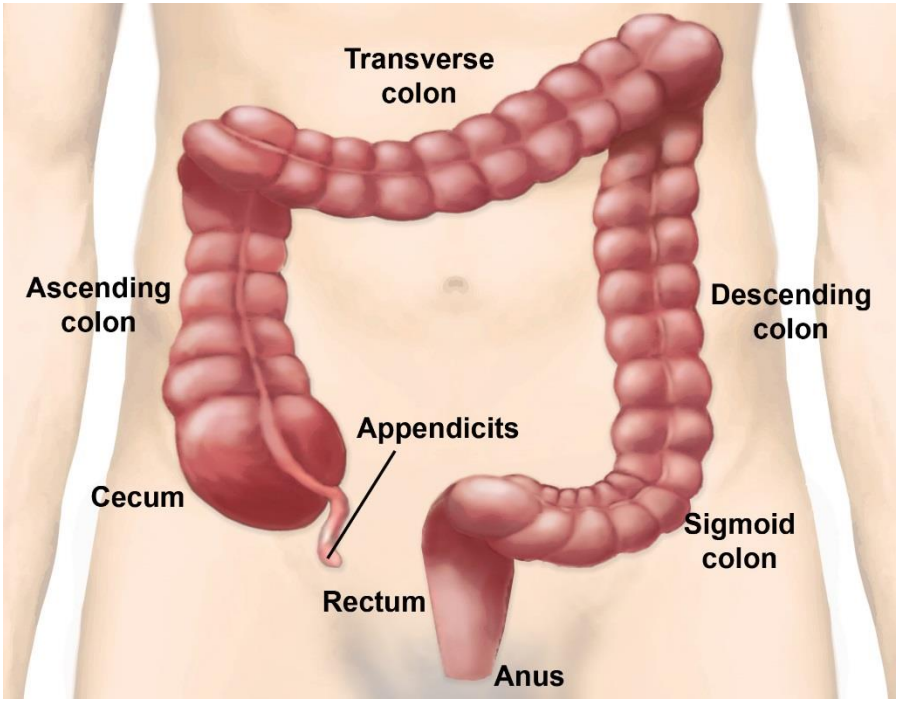


3. Absorption – Small Intestine



3. Absorption – Large Intestine

The large intestine (a.k.a colon) reabsorbs fluids and electrolytes. It absorbs 90% of water back into the blood



The appendix is thought not play a major role in the process of absorption and digestion.

3. Absorption – Large Intestine

Bacteria live within the large intestine and they produce vitamin K/B and break down undigested matter.

The **feces** is known as any undigested material that remains. It is stored in the large intestine for elimination through the rectum.

4. Elimination– Rectum

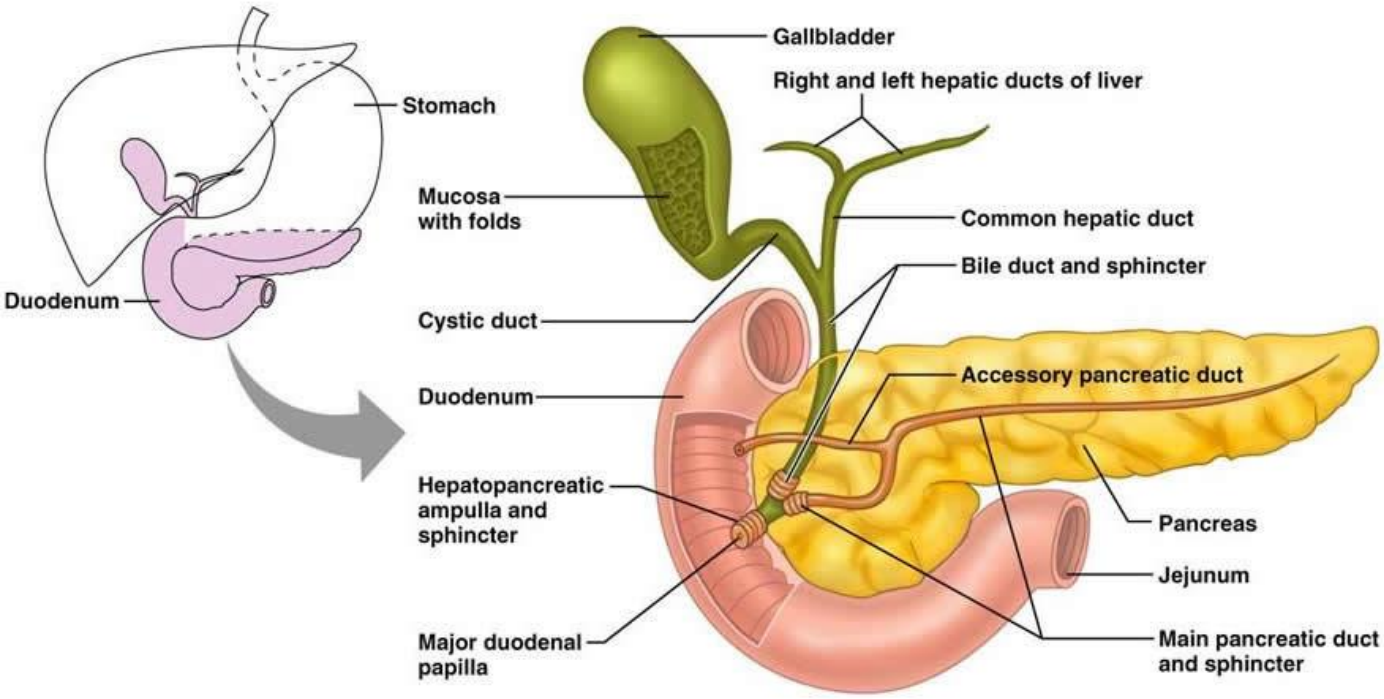
Main component of feces:

- **Cellulose:** makes up plant cell walls, cannot be digested by humans
- Living and dead bacteria
- Water
- Toxic wastes are removed

People who don't eat enough cellulose (plant material and fibre) have fewer bowel movements and are at risk of colon cancer

Accessory Organs

There are 3 major accessory organs (pancreas, gallbladder and liver) that are connected to the duodenum of the small intestine. All three help in the process of digestion.

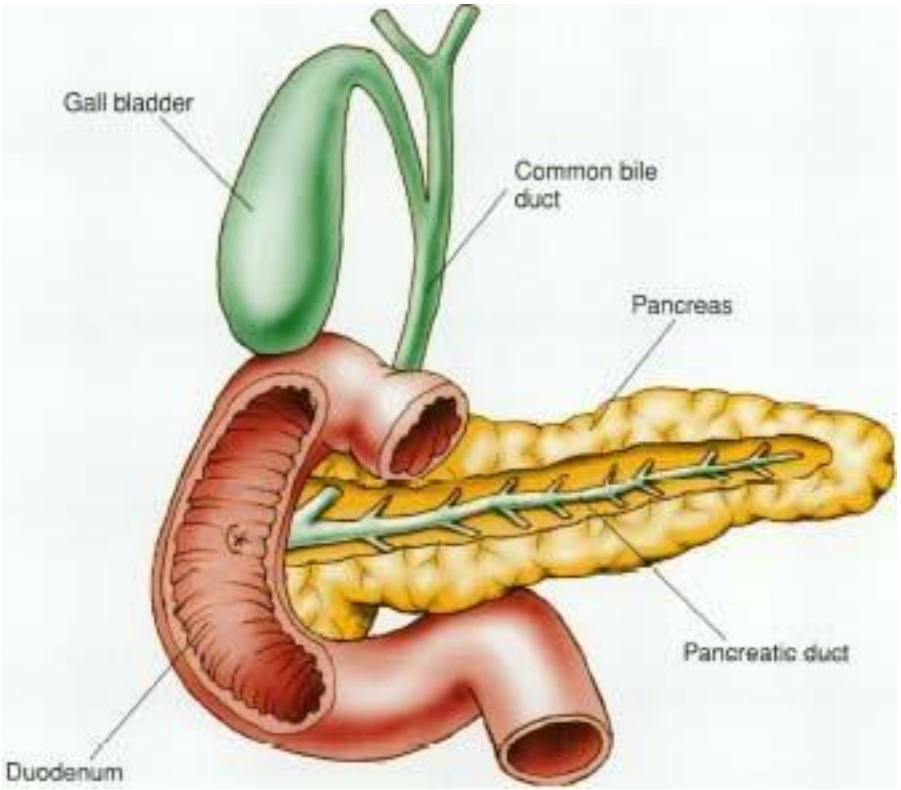


Pancreas

The pancreas secretes approximately 1 L of pancreatic fluid into the duoedenum each day.

Pancreatic Fluid contains:

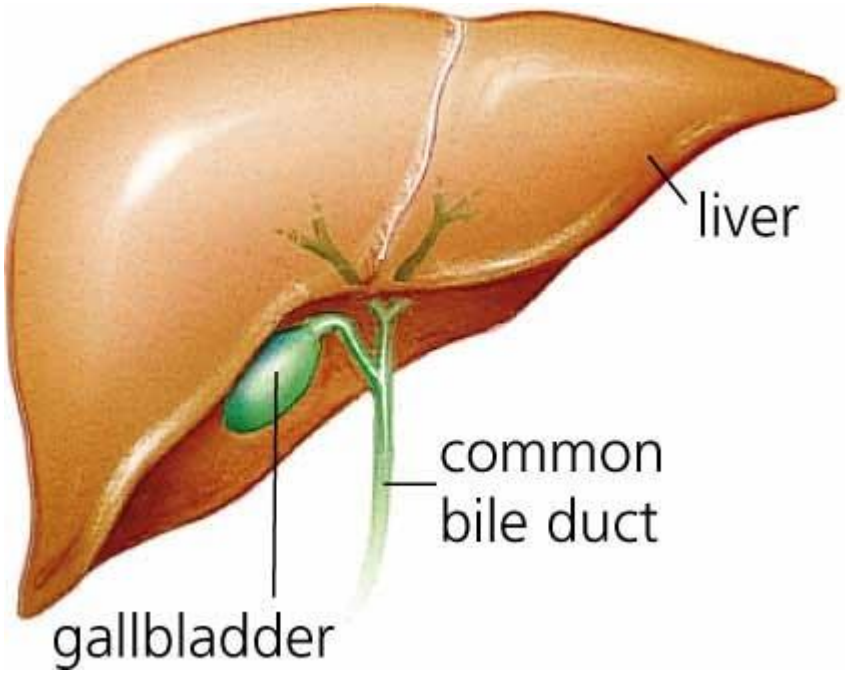
- **Pancreatic Enzymes** - chemically digest nutrients
- **Bicarbonates** – alters pH of chyme so that enzymes can be activated. (pH 1 to pH 8)



Liver & Gallbladder

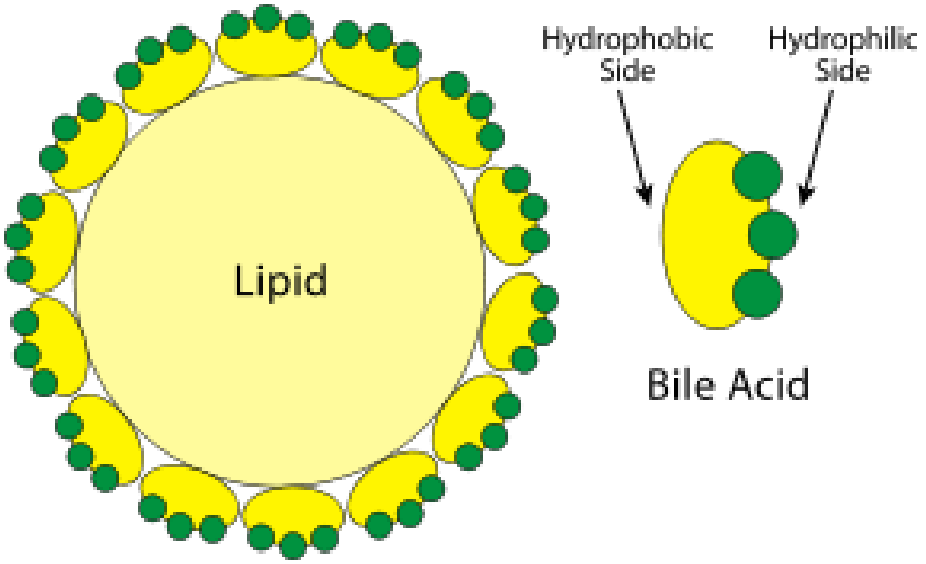
The liver is the largest **internal organ** in the human body. It releases **bile** (greenish-yellow fluid made up of bile pigments and salts) which helps in the breakdown of fats.

*Bile is sent to the **gallbladder** where it is temporarily stored*



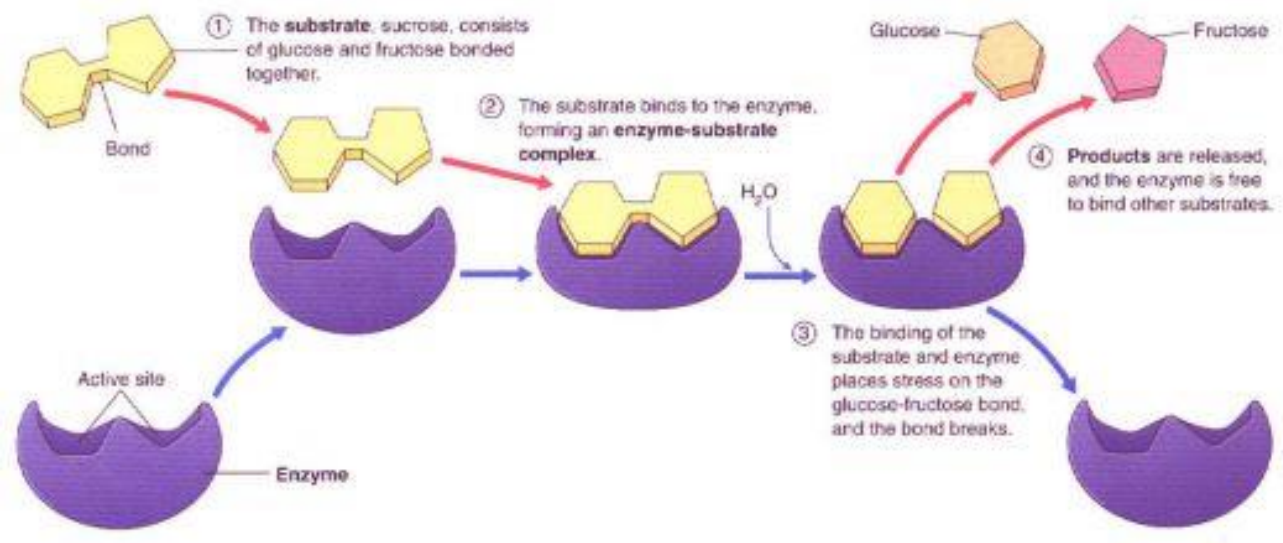
Bile

Bile salts *contain a hydrophobic and hydrophilic area which enables it to bind to the fats and increase their surface area so that they can be further digested by the enzymes.*



Digestive Enzymes

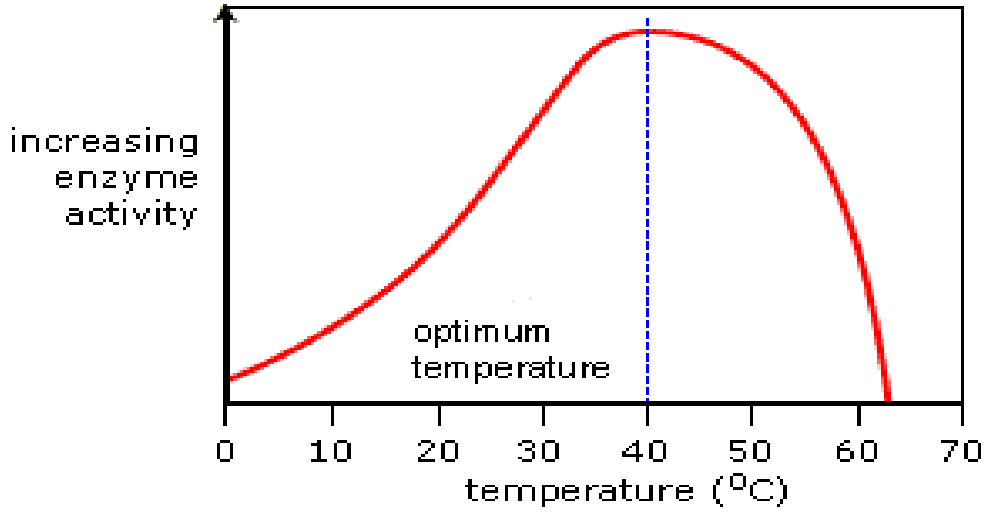
Enzymes are proteins that help speed up chemical reactions.



Induced Fit Model: The substrate and enzyme have complementary shapes. Thus making them fit perfectly into one another.

Factors affecting enzymes

1) **Temperature:**
   - Most human enzymes have an optimal activity at 37˚
   - If temperature is too high the chemical bond in the enzyme breaks thus denaturing the enzyme

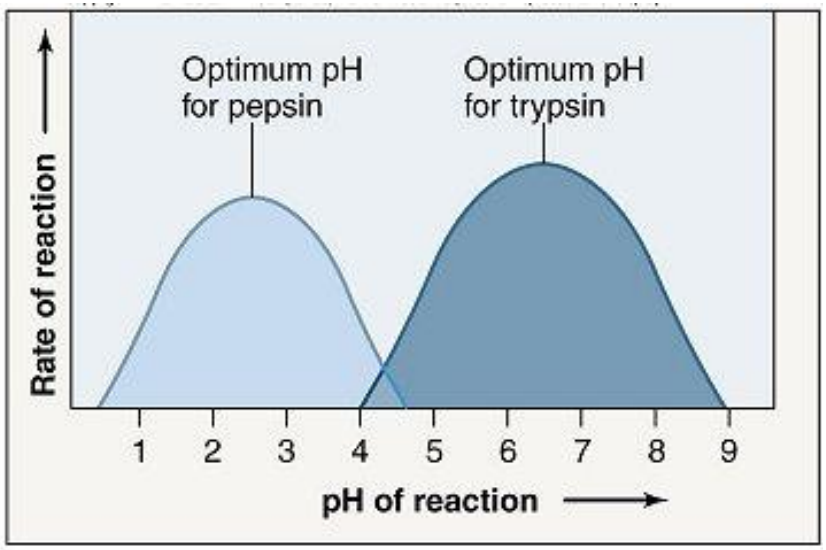


Every enzyme has an optimal temperature in which they function best.

Factors affecting enzymes

2) pH:

- Optimal pH at which enzymes work best
- Pepsin, is only active when it is immersed in a low pH
- Trypsin works best at a pH of 6 to 8.



Homework

Textbook: pg. 419 #1, 4-13 and worksheet