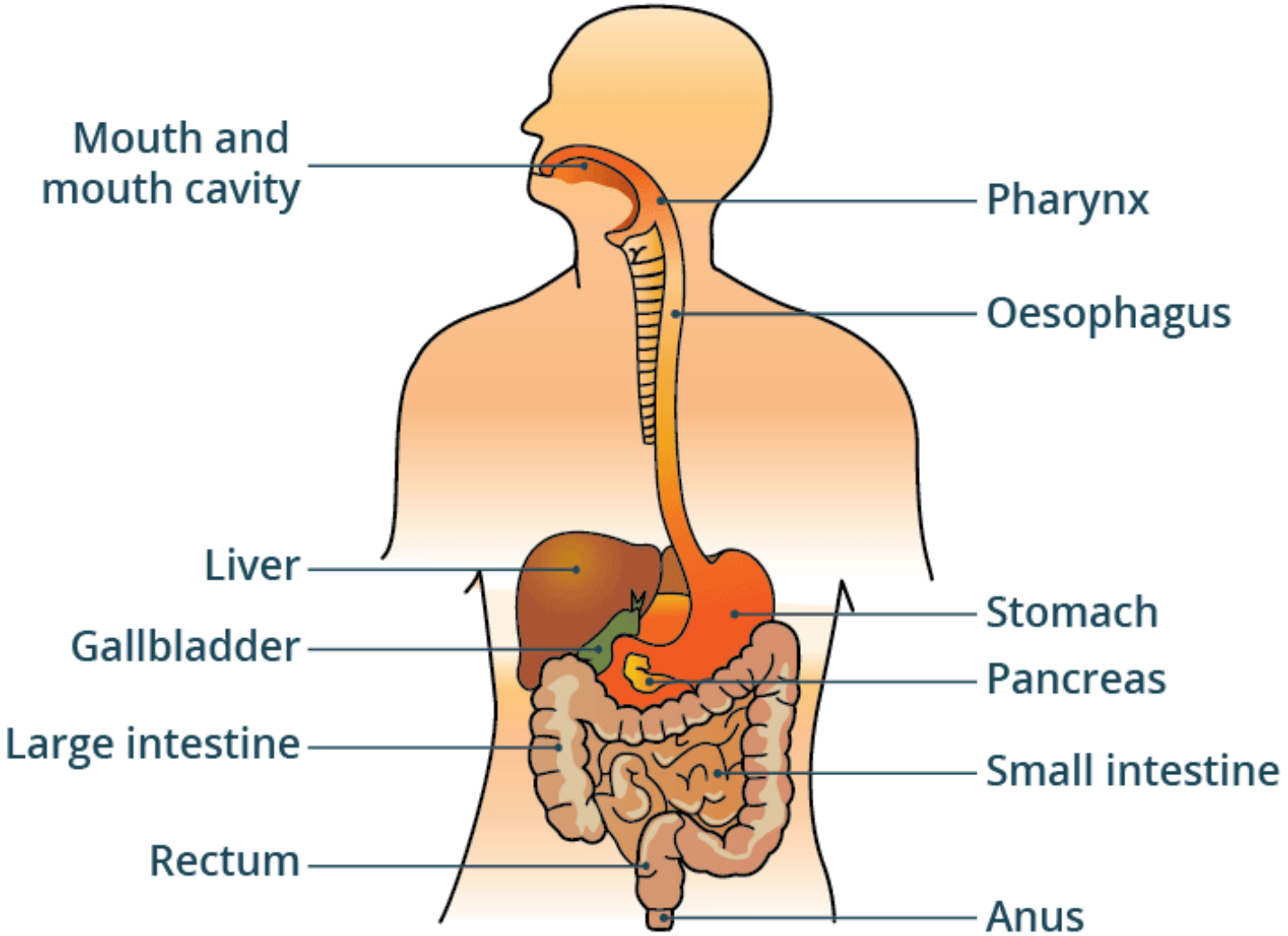
Human Digestive System

Dr. Shonal John



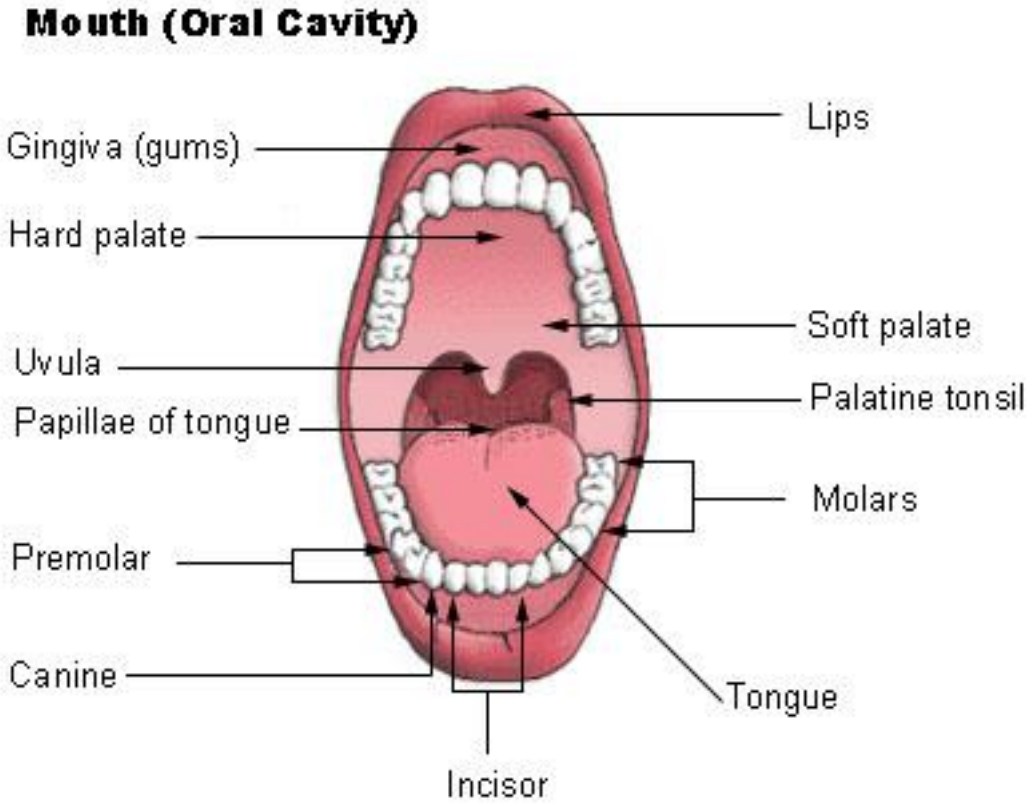
Structure of Digestive Organs & Digestion Process

- The digestive system consists of several organs that work together to break down food, absorb nutrients, and eliminate waste. The system is divided into two main categories: digestive tract (also called the gastrointestinal tract) and accessory organs (liver, pancreas, gall bladder).

Digestive Organs and Their Structures

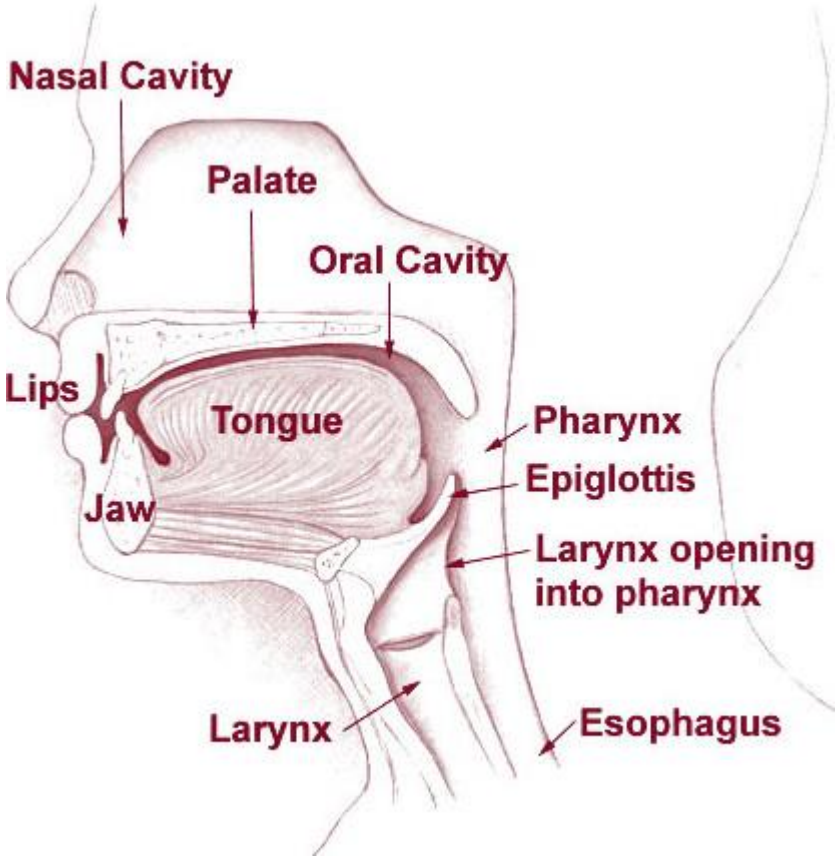
Mouth

- **Structure:** The mouth is the entry point for food. It consists of the oral cavity, teeth, salivary glands, and tongue.
- **Function:** Mechanical digestion starts with mastication (chewing), which breaks food into smaller pieces. Saliva, produced by salivary glands, contains salivary amylase, an enzyme that begins breaking down carbohydrates into simple sugars.



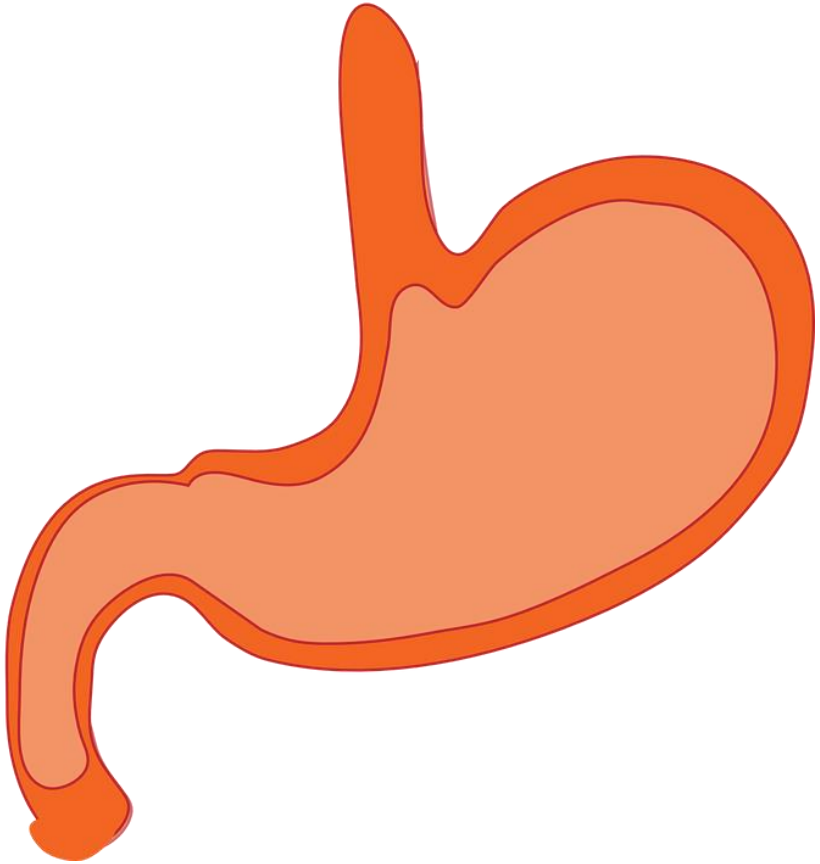
Esophagus:

- **Structure**: A muscular tube that connects the mouth to the stomach.
- **Function**: The food is moved from the mouth to the stomach through a process called peristalsis, which is a series of wave-like muscle contractions. The lower esophageal sphincter (LES) regulates the passage of food into the stomach and prevents reflux.



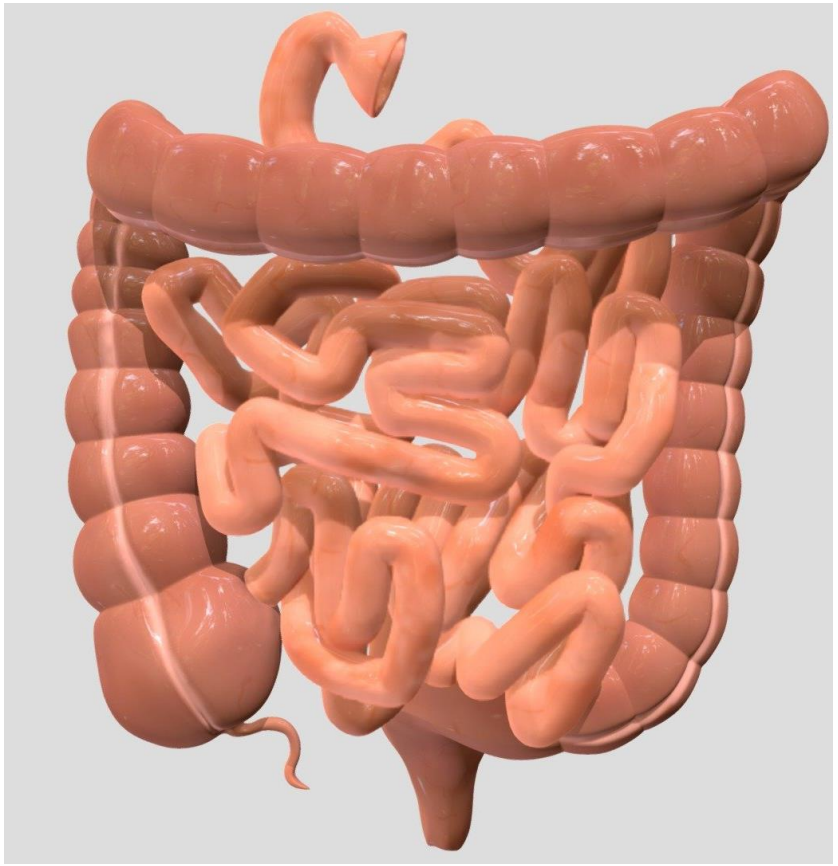
Stomach:

- **Structure**: A muscular, J-shaped organ that lies in the upper abdomen. The stomach consists of fundus, body, and pylorus.
- **Function**: The stomach performs mechanical digestion (churning food) and chemical digestion through gastric juices. Gastric juices contain hydrochloric acid (HCl), which activates the enzyme pepsinogen, converting it into pepsin to break down proteins. The stomach also produces mucus to protect its lining from the acidic environment.



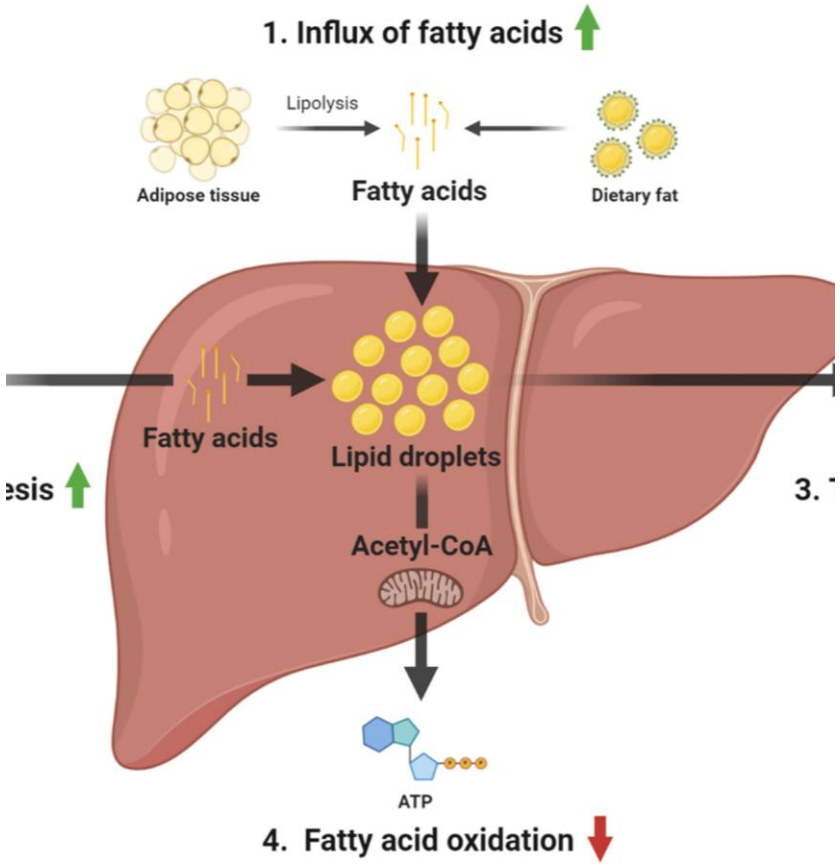
Small Intestine:

- **Structure:** The small intestine is divided into three sections: duodenum, jejunum, and ileum. It is a long, coiled tube that is lined with tiny finger-like projections called villi.
- **Function:** The primary function of the small intestine is nutrient absorption. The food is mixed with bile from the liver and pancreatic juice (containing enzymes like amylase, lipase, and protease) to break down carbohydrates, fats, and proteins into smaller molecules.



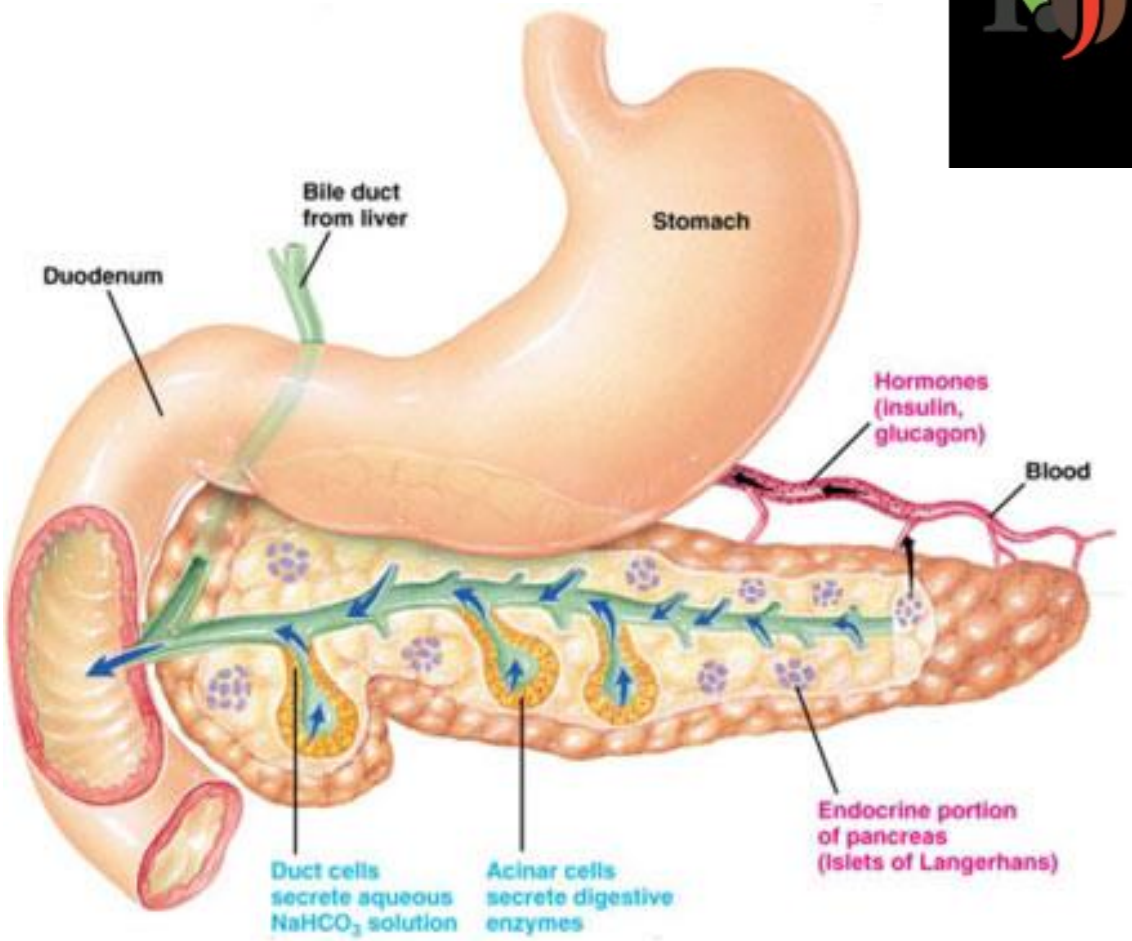
Liver

- **Structure**: The liver is a large, reddish-brown organ located on the right side of the abdomen.
- **Function**: The liver produces bile, which is stored in the gallbladder and released into the duodenum. Bile aids in the emulsification (breaking down) of fats into smaller droplets, which allows lipase to act more effectively. The liver also detoxifies harmful substances and stores glycogen.



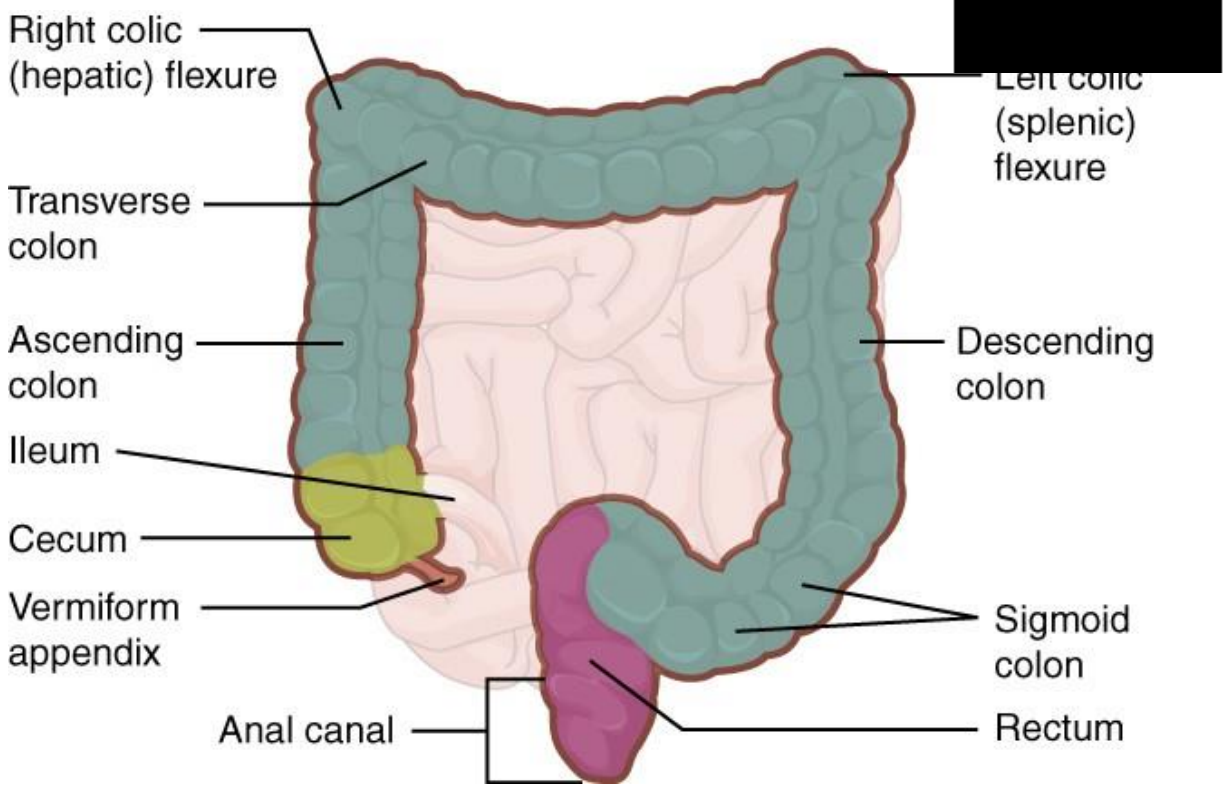
Pancreas:

- **Structure**: A gland located behind the stomach.
- **Function**: The pancreas secretes pancreatic enzymes (such as **amylase**, **lipase**, and **proteases**) into the small intestine to help digest food. The pancreas also produces **insulin** and **glucagon**, which regulate blood sugar levels.



Large Intestine:

- **Structure**: The large intestine is wider than the small intestine and is made up of the cecum, colon, rectum, and anus.
- **Function**: The large intestine absorbs water and electrolytes from the undigested food, forming feces. It also houses bacteria that help digest remaining food particles.



The Digestion Process

Ingestion: The process begins when food is taken into the mouth, where it is mechanically broken down by chewing and chemically broken down by salivary amylase.

Swallowing and Peristalsis: The bolus of food (chewed food) is swallowed and moves through the esophagus by peristalsis (wave-like muscle contractions). The food passes through the lower esophageal sphincter into the stomach.

Stomach Digestion: Once in the stomach, food is mixed with gastric juices, including hydrochloric acid and the enzyme pepsin. This breaks down proteins into smaller peptides. The food is churned into a semi-liquid substance called chyme.

Small Intestine Digestion: In the duodenum, the chyme is mixed with bile from the liver and pancreatic juices containing digestive enzymes. The enzymes break down carbohydrates (amylase), proteins (proteases), and fats (lipase). The absorption of nutrients (such as glucose, amino acids, and fatty acids) occurs in the villi and microvilli of the small intestine.

Absorption: The nutrients are absorbed into the blood (glucose, amino acids) or lymphatic system (fatty acids and glycerol). Water and some vitamins are absorbed, and the remaining waste moves to the large intestine.

Excretion: Indigestible food particles and waste products move into the large intestine, where water and salts are reabsorbed. The remaining solid waste is stored in the rectum and expelled through the anus.

Enzymatic Action in Digestion

Salivary Amylase: Produced in the salivary glands, it begins the breakdown of carbohydrates (polysaccharides) into disaccharides in the mouth.

Pepsin: Secreted as **pepsinogen** by the gastric glands, it becomes activated in the acidic stomach and breaks down proteins into smaller peptides.

Pancreatic Amylase: Continues the breakdown of carbohydrates into simple sugars in the small intestine.

Lipase: Produced in the pancreas and released into the small intestine, lipase breaks down fats into fatty acids and glycerol.

Proteases (Trypsin and Chymotrypsin): Secreted by the pancreas, these enzymes continue the breakdown of proteins into amino acids.

Intestinal Enzymes: **Disaccharidases** break down disaccharides into monosaccharides, and peptidases break down peptides into amino acids.

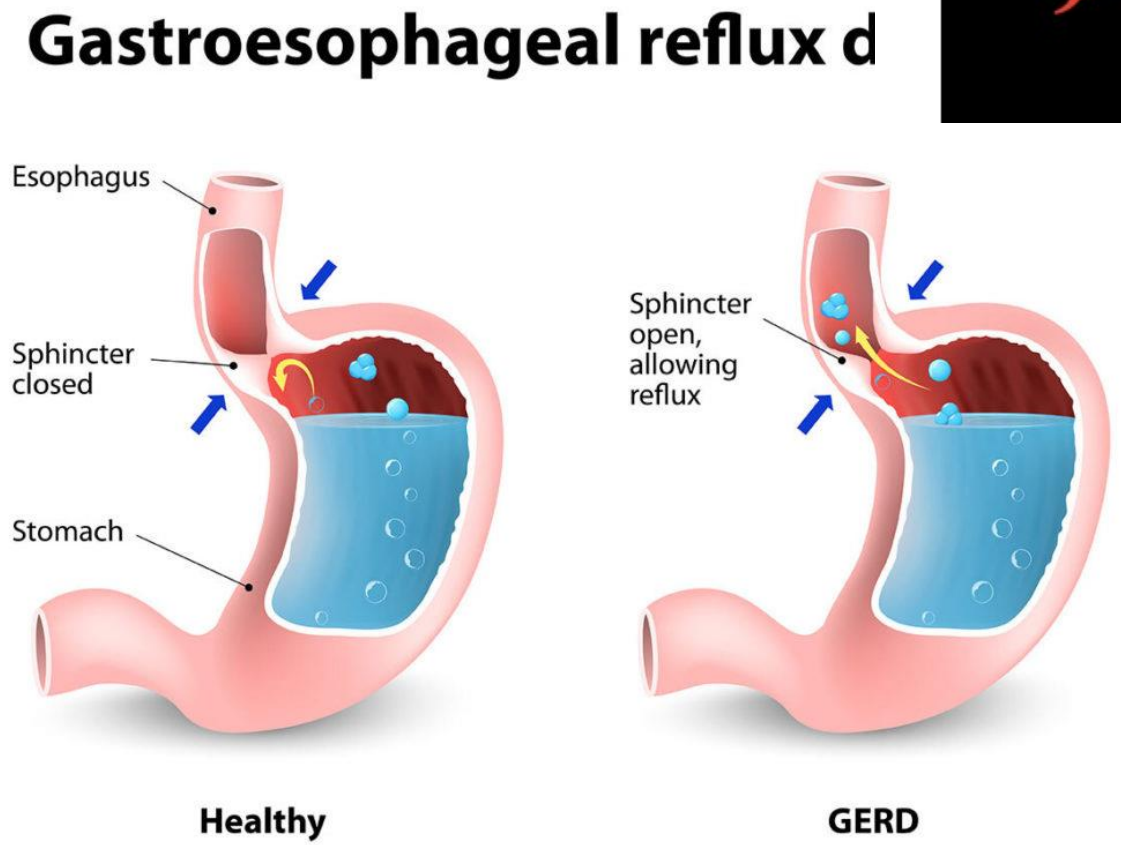
Absorption in the Small Intestine

- The small intestine is designed for nutrient absorption, primarily in the duodenum and jejunum. The absorption occurs through tiny hair-like structures called villi, which increase the surface area for absorption. Each villus contains capillaries that absorb nutrients into the bloodstream and lacteals that absorb fatty acids and glycerol into the lymphatic system.
- Carbohydrates are absorbed as monosaccharides (e.g., glucose).
- Proteins are absorbed as amino acids.
- Fats are absorbed as fatty acids and glycerol into the lymphatic system via lacteals.
- Water and electrolytes are also absorbed, and the remaining waste moves to the large intestine.

Digestive Disorders

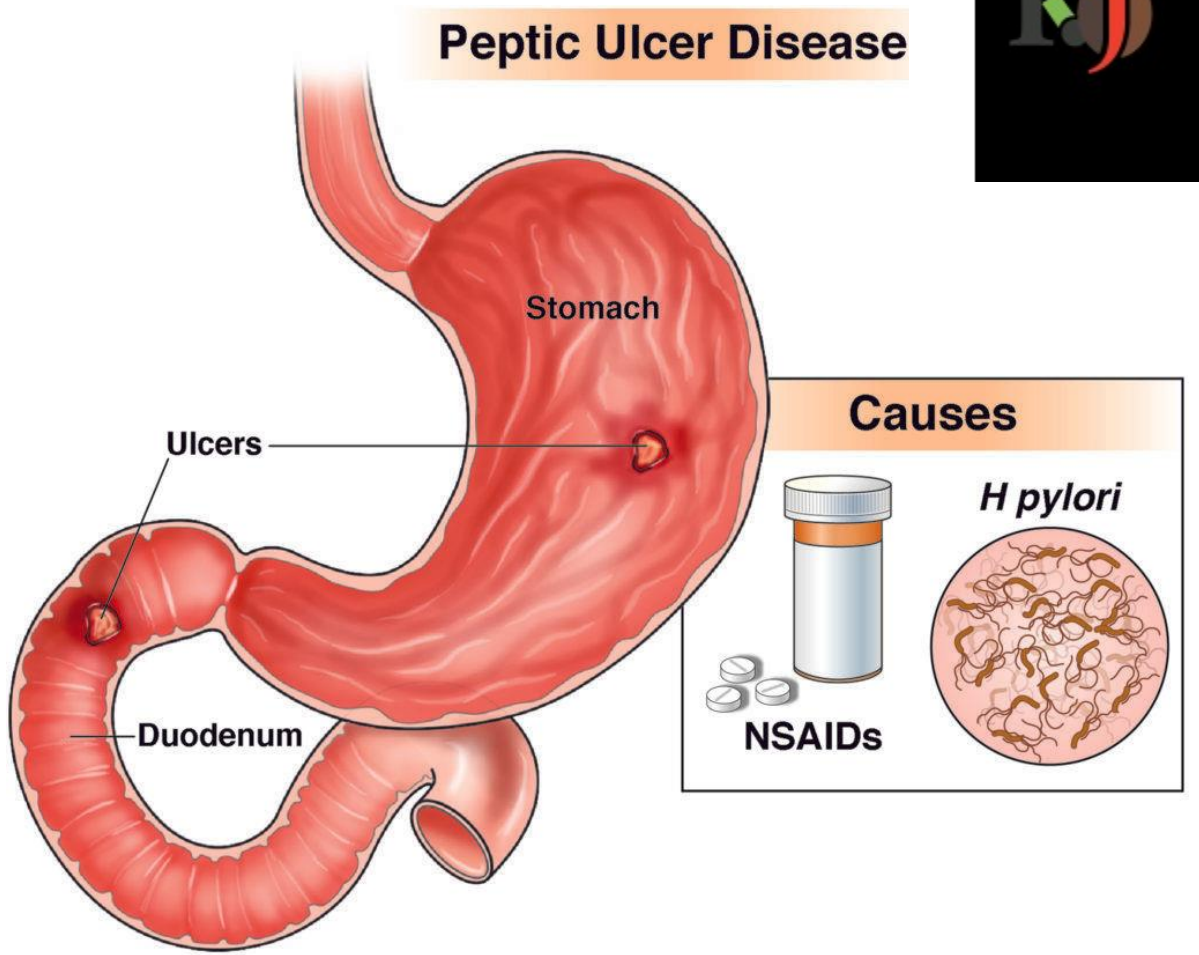
Acid Reflux (GERD):

- **Cause**: When the lower esophageal sphincter (LES) weakens, stomach acid moves back into the esophagus.
- **Symptoms**: Heartburn, regurgitation, chest pain, difficulty swallowing.
- **Treatment**: Antacids, proton pump inhibitors (PPIs), lifestyle changes.



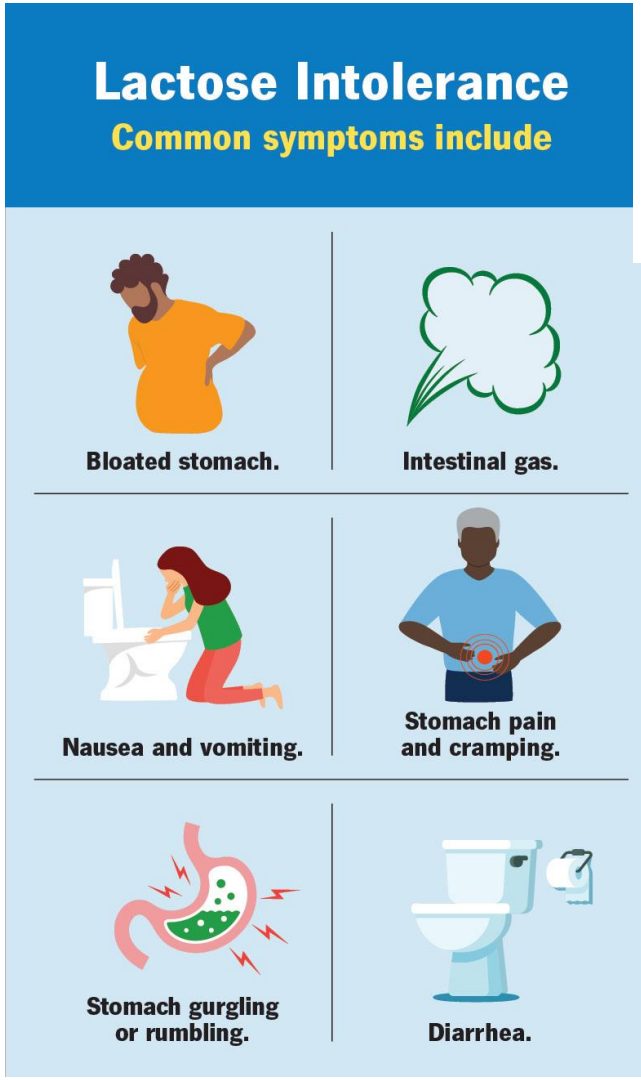
Peptic Ulcers:

- **Cause**: Caused by the breakdown of the protective mucus lining in the stomach or duodenum due to **H. pylori** bacteria or excessive use of nonsteroidal anti-inflammatory drugs (NSAIDs).
- **Symptoms**: Burning stomach pain, nausea, vomiting, bloating.
- **Treatment**: Antibiotics, antacids, and dietary changes.



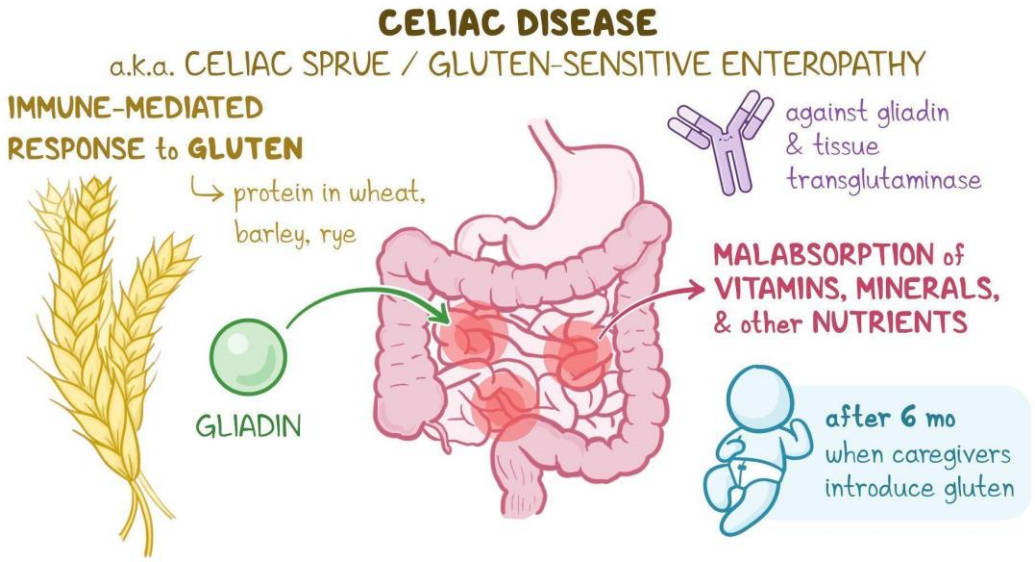
Lactose Intolerance:

- **Cause**: Lack of the enzyme **lactase**, which is responsible for breaking down lactose (milk sugar).
- **Symptoms**: Bloating, diarrhea, stomach cramps after consuming dairy products.
- **Treatment**: Avoid dairy or take lactase supplements.



Celiac Disease:

- **Cause**: An autoimmune disorder where the ingestion of **gluten** triggers an immune response that damages the lining of the small intestine.
- **Symptoms**: Diarrhea, weight loss, fatigue, nutrient deficiencies.
- **Treatment**: Strict gluten-free diet.

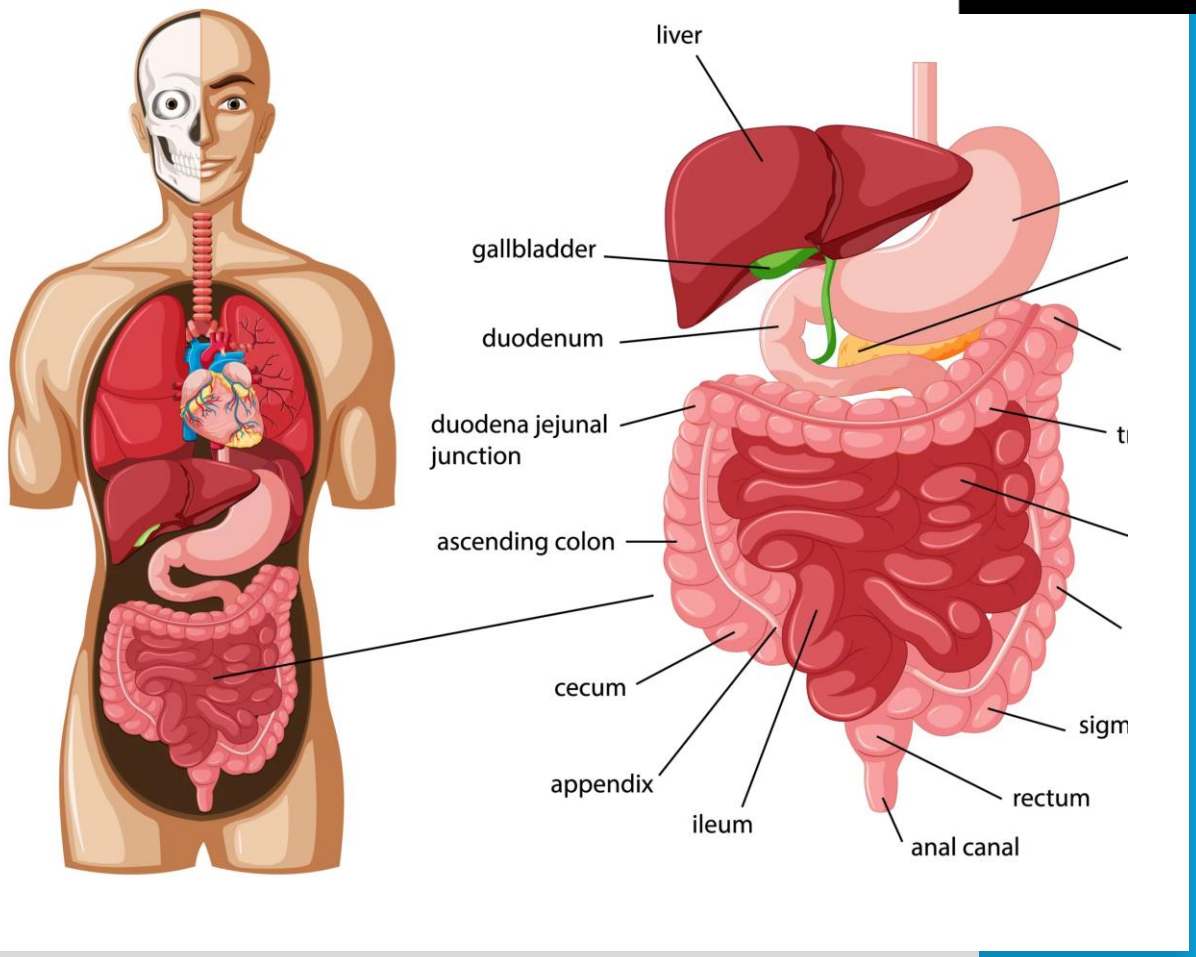


Irritable Bowel Syndrome (IBS):

- **Cause**: A disorder of the large intestine, often triggered by stress or diet.
- **Symptoms**: Abdominal pain, bloating, diarrhea, constipation.
- **Treatment**: Diet modification, stress management, and medication.

Conclusion

- The digestive system is crucial for breaking down food, absorbing nutrients, and eliminating waste. Understanding the structure and function of each digestive organ, the role of enzymes, and how absorption occurs is fundamental to understanding human physiology. Additionally, recognizing common digestive disorders helps in the management and prevention of digestive health issues.



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The largest part of the digestive system is the:

- A) Small intestine
- B) Large intestine
- C) Stomach
- D) Liver

Which of the following is the main function of the stomach?

- A) Absorption of nutrients
- B) Mechanical digestion
- C) Production of bile
- D) Production of insulin

Where is bile stored in the human body?

- A) Liver
- B) Gallbladder
- C) Pancreas
- D) Small intestine

Which organ is primarily responsible for the absorption of nutrients?

- A) Stomach
- B) Large intestine
- C) Small intestine
- D) Esophagus

The villi of the small intestine are important for:

- A) Absorbing water
- B) Increasing surface area for absorption
- C) Digestion of proteins
- D) Producing digestive enzymes

Which enzyme is secreted by the salivary glands and begins carbohydrate digestion in the mouth?

- A) Amylase
- B) Pepsin
- C) Lipase
- D) Trypsin

The process of moving food through the digestive tract by wave-like muscle contractions is called:

- A) Peristalsis
- B) Ingestion
- C) Diffusion
- D) Emulsification

Which of the following occurs in the stomach during digestion?

- A) Protein breakdown by pepsin
- B) Absorption of glucose
- C) Breakdown of fats by bile
- D) Digestion of starch by amylase

The enzyme pepsin is activated by:

- A) Bile
- B) Hydrochloric acid
- C) Salivary amylase
- D) Pancreatic lipase

Where does most of the chemical digestion and absorption take place?

- A) Stomach
- B) Small intestine
- C) Large intestine
- D) Mouth

The primary role of bile in digestion is to:

- A) Neutralize stomach acid
- B) Emulsify fats
- C) Digest carbohydrates
- D) Break down proteins

Which enzyme is responsible for the breakdown of proteins in the stomach?

- A) Amylase
- B) Pepsin
- C) Lipase
- D) Trypsin

Lipase, secreted by the pancreas, is responsible for:

- A) Breaking down proteins
- B) Breaking down fats
- C) Breaking down carbohydrates
- D) Breaking down nucleic acids

Which enzyme is responsible for the breakdown of carbohydrates into simple sugars?

- A) Pepsin
- B) Amylase
- C) Trypsin
- D) Lipase

What is the main function of proteases like trypsin and chymotrypsin?

- A) Breakdown of carbohydrates
- B) Breakdown of proteins
- C) Breakdown of fats
- D) Breakdown of nucleic acids

Which of the following enzymes is responsible for breaking down starches into maltose?

- A) Amylase
- B) Pepsin
- C) Maltase
- D) Trypsin

The small intestine is primarily responsible for the absorption of:

- A) Water
- B) Vitamins
- C) Nutrients like glucose, amino acids, and fatty acids
- D) Electrolytes

In the large intestine, the main function is to:

- A) Absorb water and electrolytes
- B) Digest carbohydrates
- C) Digest proteins
- D) Absorb nutrients

The products of fat digestion are absorbed into the lymphatic system via:

- A) Blood capillaries
- B) Lacteals
- C) Lymph vessels
- D) Venous sinuses

Which of the following is absorbed directly into the bloodstream in the small intestine?

- A) Fatty acids and glycerol
- B) Amino acids
- C) Chylomicrons
- D) Micelles

The process by which glucose is absorbed in the small intestine is known as:

- A) Diffusion
- B) Osmosis
- C) Active transport
- D) Endocytosis

Which of the following is a common symptom of lactose intolerance?

- A) Diarrhea
- B) Nausea
- C) Stomach cramps
- D) All of the above

Celiac disease is caused by an autoimmune reaction to:

- A) Lactose
- B) Gluten
- C) Fructose
- D) Casein

Which of the following conditions is characterized by acid reflux from the stomach into the esophagus?

- A) GERD (Gastroesophageal reflux disease)
- B) Peptic ulcers
- C) Appendicitis
- D) Irritable bowel syndrome

Which of the following is the main cause of peptic ulcers?

- A) Stress
- B) Infection with *Helicobacter pylori*
- C) Excessive salt intake
- D) Excessive alcohol consumption

Irritable Bowel Syndrome (IBS) primarily affects the:

- A) Stomach
- B) Small intestine
- C) Large intestine
- D) Liver

Which structure prevents food from entering the trachea during swallowing?

- A) Epiglottis
- B) Esophagus
- C) Pharynx
- D) Glottis

Which of the following is NOT a digestive enzyme?

- A) Amylase
- B) Pepsin
- C) Insulin
- D) Lipase

The primary function of the liver in digestion is to:

- A) Digest food
- B) Produce bile
- C) Absorb nutrients
- D) Store glucose

What structure connects the mouth to the stomach?

- A) Pharynx
- B) Esophagus
- C) Large intestine
- D) Duodenum

Which of the following is a major function of the small intestine?

- A) Absorption of water
- B) Digestion of proteins
- C) Absorption of nutrients
- D) Production of bile

The term "chyme" refers to:

- A) Undigested food
- B) Food mixed with gastric juices
- C) A type of enzyme
- D) The hormone produced by the pancreas

Which vitamin is primarily absorbed in the small intestine?

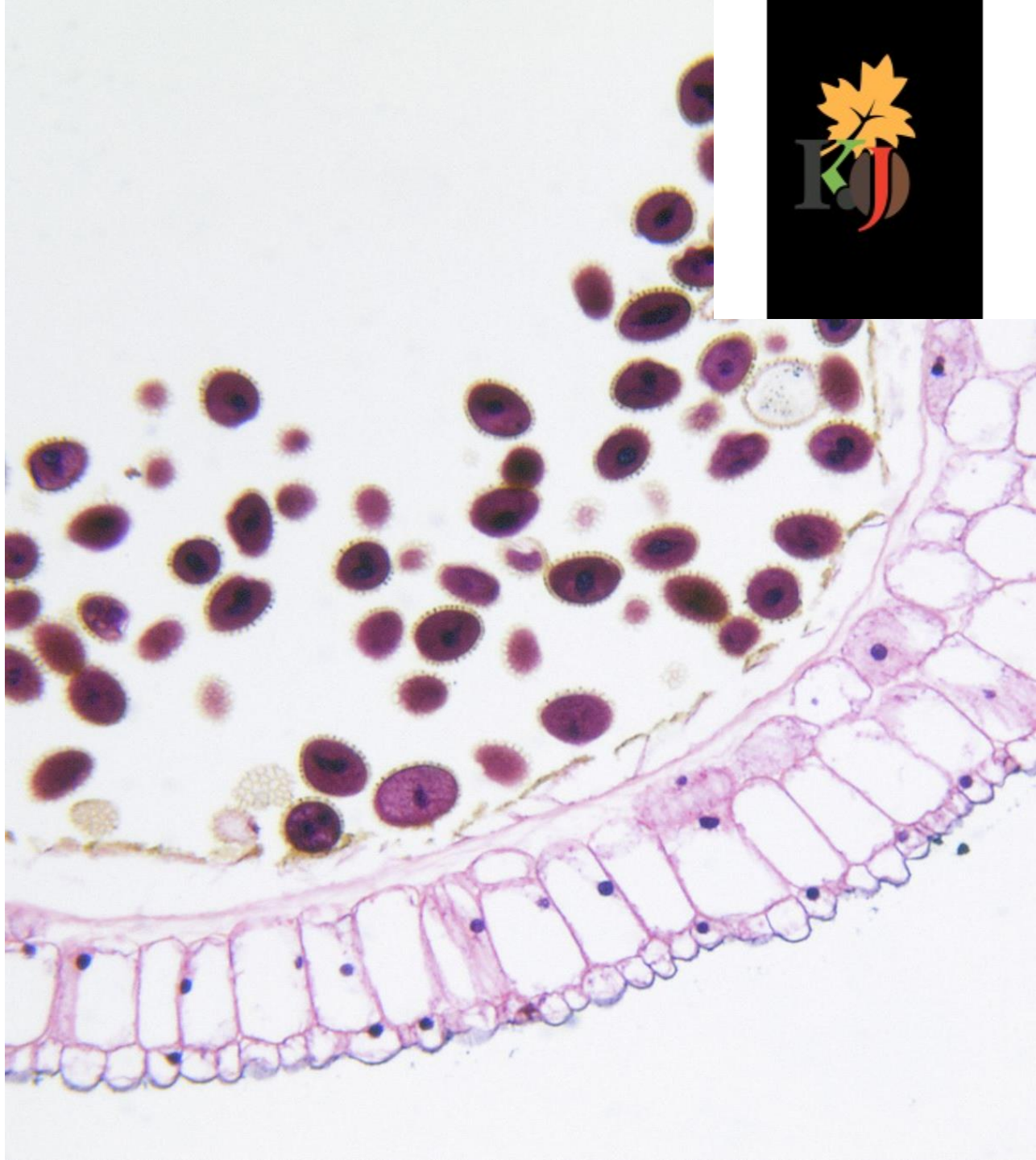
- A) Vitamin C
- B) Vitamin A
- C) Vitamin D
- D) Vitamin B12

Which of the following hormones stimulates the production of gastric juices?

- A) Insulin
- B) Gastrin
- C) Secretin
- D) Glucagon

Which part of the digestive system is involved in the final stages of digestion and absorption?

- A) Large intestine
- B) Stomach
- C) Duodenum
- D) Jejunum

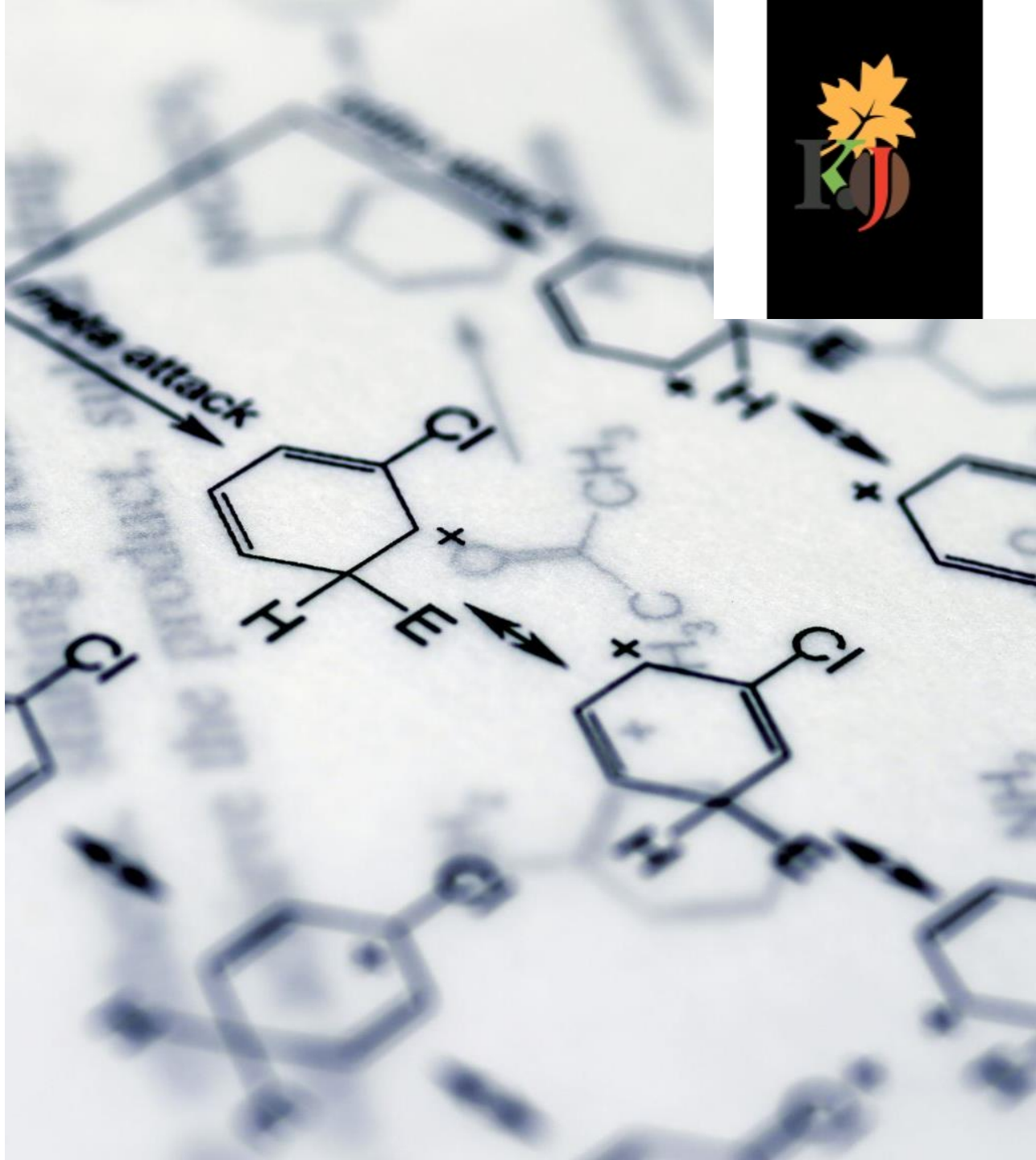


Which of the following is the first section of the small intestine?

- A) Jejunum
- B) Duodenum
- C) Ileum
- D) Cecum

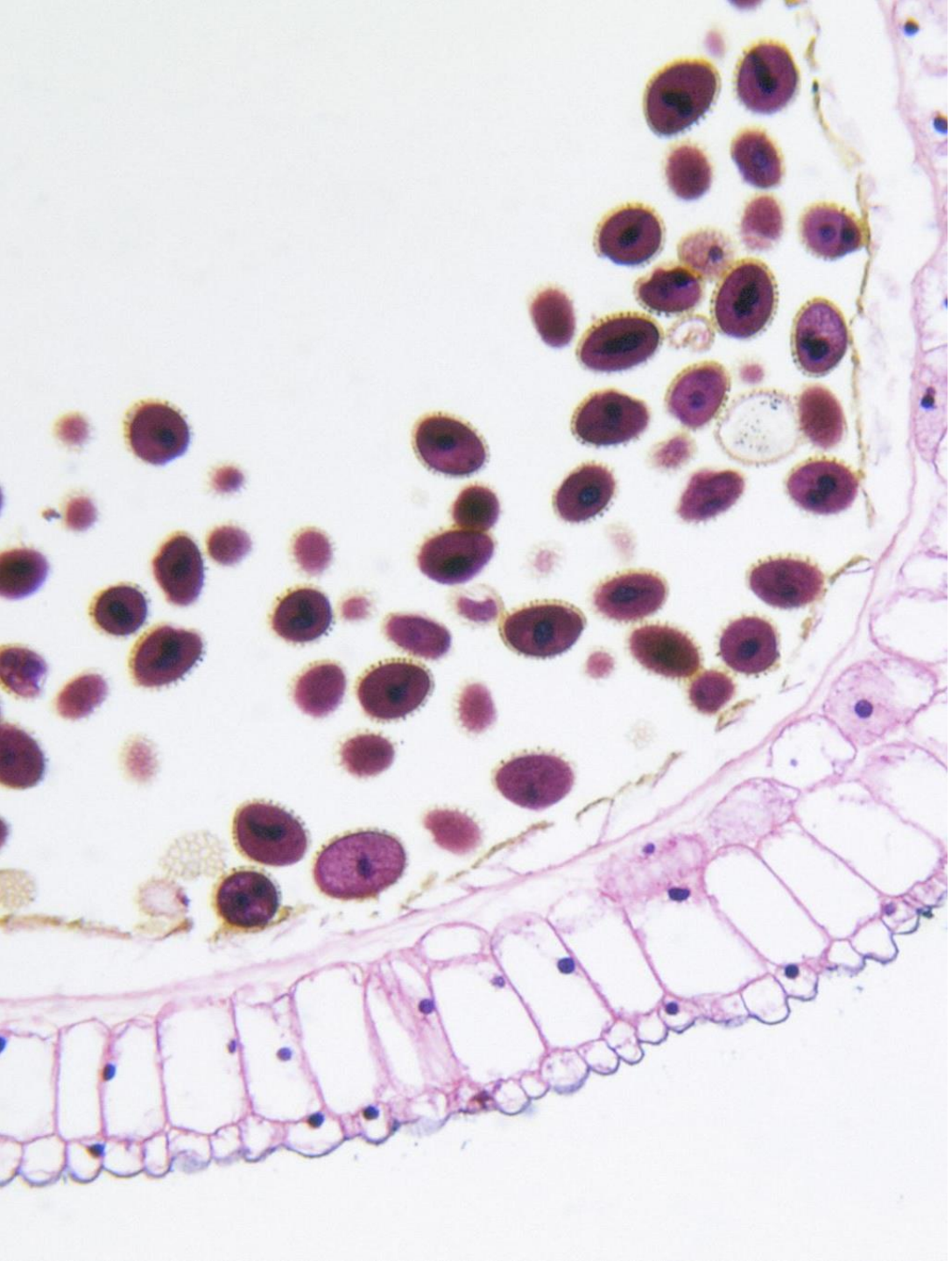
Which of the following processes is responsible for the breakdown of large fat molecules into smaller droplets?

- A) Emulsification
- B) Digestion
- C) Absorption
- D) Fermentation



Which of the following is NOT a part of the large intestine?

- A) Cecum
- B) Colon
- C) Rectum
- D) Duodenum



Which of the following is involved in the regulation of food intake?

- A) Pancreas
- B) Stomach
- C) Hypothalamus
- D) Liver