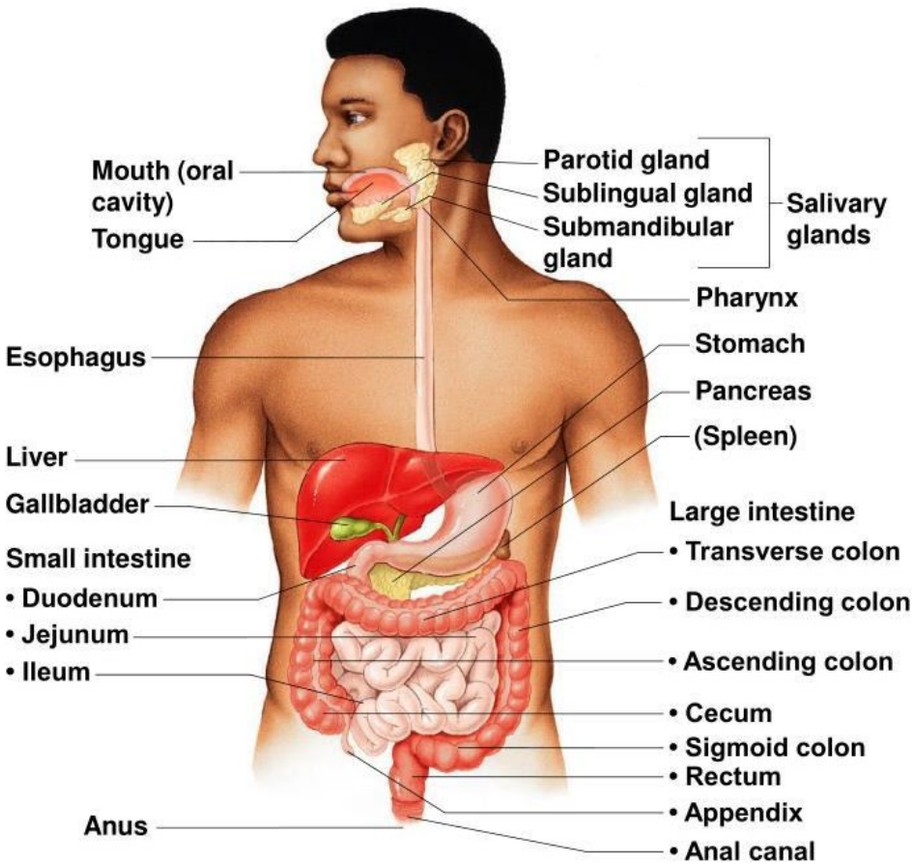
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Digestive System

Anatomy & Physiology

Alimentary canal, digestive glands, liver, pancreas and associated organs

For educational purposes only.



Digestive System - illustration 1

DIGESTIVE SYSTEM - APPLIED ANATOMY

1. Introduction

The digestive system is a group of organs responsible for the ingestion, digestion and absorption of food and the elimination of undigested waste materials.

It converts complex food substances into simpler nutrients that can be absorbed and utilized by the body.

Main Functions

1. Ingestion of food and fluids.
2. Mechanical and chemical digestion of food.
3. Absorption of nutrients, vitamins, minerals and water.
4. Transportation of food through the digestive tract.
5. Elimination of undigested waste.
6. Secretion of digestive enzymes and other substances.

7. Protection against harmful microorganisms through gut-associated immune tissues.

2. Parts of the Digestive System

The digestive system consists of two major components.

A. Alimentary Canal

The alimentary canal is a continuous muscular tube extending from the mouth to the anus.

It includes:

1. Mouth (Oral cavity).
2. Pharynx.
3. Oesophagus.
4. Stomach.
5. Small intestine.
6. Large intestine.
7. Rectum.
8. Anal canal and anus.

B. Accessory Digestive Organs

These organs help in digestion but food does not pass through them.

1. Teeth.
2. Tongue.
3. Salivary glands.
4. Liver.
5. Gallbladder.
6. Pancreas.

3. Mouth (Oral Cavity)

Definition

The mouth is the first part of the alimentary canal where food enters the digestive system.

Location

It is situated in the lower part of the face and opens externally through the lips.

Parts of the Oral Cavity

The oral cavity is divided into:

1. Vestibule

- Space between the lips and cheeks externally and the teeth and gums internally.

2. Oral Cavity Proper

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- Space enclosed by the teeth and gums.
- Contains the tongue.
- Extends posteriorly to the oropharynx.

Structures of the Mouth

- Lips: Help in food intake and speech.
- Cheeks: Maintain food between the teeth during chewing.
- Palate: Forms the roof of the mouth.
- Teeth: Perform mechanical breakdown of food.
- Tongue: Helps in taste, chewing and swallowing.

Functions

1. Receives food.
2. Begins mechanical digestion through chewing.
3. Mixes food with saliva.
4. Forms a bolus for swallowing.
5. Helps in taste and speech.

4. Teeth

Definition

Teeth are hard structures present in the jaws that help in biting, cutting, tearing and grinding food.

Types of Teeth

An adult human normally has 32 permanent teeth.

Type Number Function

Incisors 8 Cutting food

Canines 4 Tearing food

Premolars 8 Crushing food

Molars 12 Grinding food

Types According to Dentition

1. Deciduous Teeth
   - Also called milk teeth.
   - Total number: 20.
   - Usually begin erupting around 6 months of age.
2. Permanent Teeth
   - Total number: 32, including wisdom teeth.

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- Usually begin erupting around 6 years of age.

Structure of a Tooth

A tooth consists of three main parts:

1. Crown: Visible part above the gum.
2. Neck: Region between crown and root.
3. Root: Part embedded in the jawbone.

Tissues of a Tooth

- Enamel: Hardest substance in the human body; covers the crown.
- Dentine: Forms the major part of the tooth.
- Cementum: Covers the root.
- Pulp: Contains blood vessels, nerves and connective tissue.

Clinical Importance

- Dental caries: Tooth decay.
- Gingivitis: Inflammation of the gums.
- Periodontitis: Disease affecting supporting tissues of the teeth.

5. Tongue

Definition

The tongue is a muscular organ located in the oral cavity that helps in taste, chewing, swallowing and speech.

Parts

1. Apex: Tip of the tongue.
2. Body: Anterior two-thirds.
3. Root: Posterior one-third.

Papillae of the Tongue

1. Filiform papillae: Most numerous; mainly provide mechanical function and do not contain taste buds.
2. Fungiform papillae: Mushroom-shaped and contain taste buds.
3. Circumvallate papillae: Large papillae arranged in a V-shaped row near the posterior part.
4. Foliate papillae: Present along the posterolateral borders.

Functions

1. Helps in chewing.
2. Mixes food with saliva.
3. Helps in swallowing.
4. Provides taste sensation.

5. Assists in speech.

Nerve Supply

- Anterior two-thirds: General sensation through the lingual nerve (V3); taste mainly through the chorda tympani (VII).
- Posterior one-third: General sensation and taste mainly through the glossopharyngeal nerve (IX).
- Motor supply: Hypoglossal nerve (XII), except the palatoglossus muscle, supplied by the vagus nerve (X).

6. Salivary Glands

Definition

Salivary glands are exocrine glands that produce saliva and release it into the oral cavity.

Types of Salivary Glands

There are three pairs of major salivary glands.

1. Parotid Glands
   - Largest salivary glands.
   - Located in front of and below each ear.
   - Secrete mainly serous saliva.
   - Their ducts are called Stensen's ducts.
2. Submandibular Glands
   - Located beneath the mandible.
   - Produce mixed serous and mucous saliva, predominantly serous.
   - Their ducts are called Wharton's ducts.
3. Sublingual Glands
   - Smallest major salivary glands.
   - Located beneath the tongue.
   - Produce mainly mucous saliva.
   - Drain through multiple small ducts.

Functions of Saliva

1. Moistens and lubricates food.
2. Helps in swallowing.
3. Begins carbohydrate digestion through salivary amylase.
4. Helps maintain oral hygiene.
5. Dissolves substances for taste.
6. Protects the oral mucosa and teeth.

Clinical Importance

- Mumps: Viral infection commonly affecting the parotid glands.
- Sialadenitis: Inflammation of a salivary gland.
- Xerostomia: Dry mouth due to reduced saliva production.

7. Pharynx

Definition

The pharynx is a muscular passage that connects the oral and nasal cavities with the oesophagus and larynx.

Location

It extends from the base of the skull to approximately the C6 vertebral level.

Parts

1. Nasopharynx.
2. Oropharynx.
3. Laryngopharynx.

Functions

1. Provides a passage for food and liquids.
2. Helps in swallowing.
3. Directs food towards the oesophagus.
4. Provides immune protection through tonsils.

8. Oesophagus (Food Pipe)

Definition

The oesophagus is a muscular tube that transports food from the pharynx to the stomach.

Location

It extends from the pharynx at C6 to the stomach, passing through the thoracic cavity and diaphragm.

Length

Approximately 25 cm in adults.

Parts

1. Cervical part.
2. Thoracic part.
3. Abdominal part.

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Structure

The oesophageal wall consists of four main layers:

1. Mucosa: Inner lining.
2. Submucosa: Contains connective tissue, blood vessels and glands.
3. Muscularis externa: Contains circular and longitudinal muscle layers.
4. Adventitia: Outer connective tissue covering, except for the short abdominal portion, which has serosa.

Muscular Composition

- Upper one-third: Skeletal muscle.
- Middle one-third: Mixed skeletal and smooth muscle.
- Lower one-third: Smooth muscle.

Functions

1. Transports food to the stomach.
2. Moves food through peristaltic contractions.
3. Prevents excessive reflux through the lower oesophageal sphincter mechanism.

Clinical Importance

- GERD: Gastro-oesophageal reflux disease.
- Oesophagitis: Inflammation of the oesophagus.
- Achalasia: Failure of normal relaxation of the lower oesophageal sphincter with impaired oesophageal movement.

9. Stomach

Definition

The stomach is a J-shaped, muscular, hollow organ that temporarily stores food and begins significant protein digestion.

Location

It is situated mainly in the left upper quadrant of the abdomen, below the diaphragm.

Capacity

Approximately 1-1.5 litres in an average adult, although it varies.

Parts of the Stomach

1. Cardia: Region where the oesophagus opens into the stomach.
2. Fundus: Dome-shaped upper portion.
3. Body: Largest central part.
4. Pyloric part: Lower region that leads to the duodenum.

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Curvatures

- Lesser curvature: Short, concave medial border.
- Greater curvature: Long, convex lateral border.

Sphincters

1. Lower oesophageal sphincter: Helps prevent reflux of stomach contents.
2. Pyloric sphincter: Regulates passage of gastric contents into the duodenum.

Layers of the Stomach Wall

1. Mucosa: Contains gastric glands.
2. Submucosa: Contains blood vessels, nerves and connective tissue.
3. Muscularis externa: Has three muscle layers:Inner oblique.Middle circular.Outer longitudinal.
4. Serosa: Outer protective covering.

Gastric Gland Cells

Cell Type

Secretion

Mucous cells

Mucus

Parietal cells

Hydrochloric acid and intrinsic factor

Chief cells

Pepsinogen

G cells

Gastrin

ECL cells

Histamine

Functions

1. Temporarily stores food.
2. Mixes food with gastric secretions.
3. Begins protein digestion.
4. Produces hydrochloric acid.
5. Helps destroy many ingested microorganisms.
6. Converts food into semi-liquid chyme.
7. Produces intrinsic factor required for vitamin B12 absorption.

Clinical Importance

- Gastritis: Inflammation of the stomach lining.
- Peptic ulcer: Ulceration in the stomach or duodenum.
- Gastric cancer: Malignant growth of the stomach.
- Pyloric stenosis: Narrowing of the pyloric outlet.

10. Small Intestine

Definition

The small intestine is a long, coiled tube extending from the pylorus of the stomach to the ileocaecal junction.

It is the main site of digestion and nutrient absorption.

Length

Approximately 6 metres in a living adult, with variation.

Parts of the Small Intestine

1. Duodenum
   - First and shortest part.
   - Approximately 25 cm long.
   - C-shaped structure surrounding the head of the pancreas.
   - Receives bile and pancreatic juice.
2. Jejunum
   - Middle part.
   - Approximately proximal two-fifths of the mobile small intestine.
   - Has prominent circular folds and a rich blood supply.
   - Important site for nutrient absorption.
3. Ileum
   - Final and longest part.
   - Approximately distal three-fifths of the mobile small intestine.
   - Contains Peyer's patches.
   - Absorbs vitamin B12 and bile salts, mainly in its terminal portion.

Structural Features

1. Circular Folds
   - Increase the surface area.
   - Slow the movement of intestinal contents.
2. Villi

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- Finger-like projections of the mucosa.
- Increase the surface area for absorption.

3. Microvilli
   - Tiny projections on the surface of intestinal epithelial cells.
   - Form the brush border.
4. Intestinal Crypts
   - Glandular structures between the villi.
   - Contain cells involved in secretion and renewal of intestinal epithelium.

Functions

1. Completes chemical digestion.
2. Absorbs carbohydrates, proteins and fats.
3. Absorbs vitamins and minerals.
4. Absorbs water and electrolytes.
5. Provides immune protection through lymphoid tissue.

Clinical Importance

- Enteritis: Inflammation of the small intestine.
- Celiac disease: Immune-mediated disorder triggered by gluten.
- Intestinal obstruction: Blockage of the intestinal passage.
- Crohn's disease: Chronic inflammatory bowel disease that can affect any part of the gastrointestinal tract.

11. Large Intestine

Definition

The large intestine is the final major part of the alimentary canal, responsible for absorbing water and electrolytes and forming faeces.

Length

Approximately 1.5 metres in adults.

Parts of the Large Intestine

1. Caecum.
2. Appendix.
3. Colon.
4. Rectum.
5. Anal canal.

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Colon

The colon is divided into four parts:

1. Ascending Colon
   - Located on the right side of the abdomen.
   - Extends from the caecum to the right colic flexure.
2. Transverse Colon
   - Passes across the abdomen from right to left.
   - Extends between the right and left colic flexures.
3. Descending Colon
   - Located on the left side of the abdomen.
   - Extends downwards from the left colic flexure.
4. Sigmoid Colon
   - S-shaped portion.
   - Connects the descending colon to the rectum.

Characteristic Features

1. Taeniae coli: Three longitudinal bands of smooth muscle.
2. Haustra: Pouch-like sacculations of the colon.
3. Appendices epiploicae: Small fat-filled peritoneal projections.

Functions

1. Absorbs water and electrolytes.
2. Forms and stores faeces.
3. Houses intestinal microorganisms.
4. Supports vitamin production by gut bacteria, including vitamin K.
5. Helps eliminate waste through defecation.

Clinical Importance

- Colitis: Inflammation of the colon.
- Ulcerative colitis: Chronic inflammatory disease affecting the colon.
- Colorectal cancer: Malignant growth in the colon or rectum.
- Diverticulosis: Presence of diverticula in the colon.

12. Rectum and Anal Canal

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Rectum

The rectum is the terminal part of the large intestine that stores faeces before defecation.

Location

It lies in the pelvic cavity and continues from the sigmoid colon to the anal canal.

Length

Approximately 12-15 cm.

Functions

1. Temporarily stores faeces.
2. Initiates the defecation reflex when distended.
3. Helps regulate bowel emptying.

Anal Canal

The anal canal is the final part of the digestive tract and opens externally through the anus.

Anal Sphincters

1. Internal Anal Sphincter
   - Made of smooth muscle.
   - Under involuntary control.
2. External Anal Sphincter
   - Made of skeletal muscle.
   - Under voluntary control.

Clinical Importance

- Haemorrhoids: Swollen vascular cushions in the anal canal.
- Anal fissure: Tear in the anal canal lining.
- Rectal prolapse: Protrusion of rectal tissue through the anus.

13. Liver

Definition

The liver is the largest internal gland of the human body and performs important metabolic, digestive, storage and detoxification functions.

Location

It is situated mainly in the right upper quadrant of the abdomen, immediately below the diaphragm.

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Weight

Approximately 1.2-1.5 kg in an adult.

Surfaces of the Liver

1. Diaphragmatic surface: Smooth, convex surface facing the diaphragm.
2. Visceral surface: Irregular inferior surface related to abdominal organs.

Lobes of the Liver

The liver has four anatomical lobes:

1. Right lobe.
2. Left lobe.
3. Caudate lobe.
4. Quadrate lobe.

Porta Hepatis

The porta hepatis is a transverse fissure on the visceral surface of the liver through which important structures enter and leave.

It transmits:

- Portal vein.
- Hepatic artery proper.
- Hepatic ducts.
- Lymphatic vessels.
- Nerves.

Microscopic Structure

The structural unit commonly described in the liver is the hepatic lobule.

It contains:

- Hepatocytes.
- Central vein.
- Hepatic sinusoids.
- Kupffer cells.
- Portal triads.

Blood Supply

The liver has a dual blood supply:

1. Hepatic artery proper: Supplies oxygen-rich blood.
2. Hepatic portal vein: Carries nutrient-rich blood from the gastrointestinal tract and spleen.

Venous blood leaves the liver through the hepatic veins, which drain into the inferior vena cava.

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Functions of the Liver

1. Produces bile.
2. Metabolizes carbohydrates, proteins and fats.
3. Stores glycogen, vitamins and iron.
4. Detoxifies drugs and harmful substances.
5. Produces plasma proteins, including albumin.
6. Produces most blood clotting factors.
7. Converts ammonia into urea.
8. Breaks down old red blood cell components through its macrophage system.
9. Helps regulate blood glucose levels.

Clinical Importance

- Hepatitis: Inflammation of the liver.
- Cirrhosis: Chronic scarring and distortion of liver architecture.
- Fatty liver disease: Excess fat accumulation in liver cells.
- Hepatomegaly: Enlargement of the liver.
- Jaundice: Yellow discoloration due to increased bilirubin.

14. Gallbladder

Definition

The gallbladder is a small, pear-shaped sac that stores and concentrates bile produced by the liver.

Location

It is located on the inferior surface of the liver.

Parts

1. Fundus.
2. Body.
3. Neck.

Functions

1. Stores bile.
2. Concentrates bile by absorbing water and electrolytes.
3. Releases bile into the duodenum during digestion, especially after fatty meals.

Bile Duct System

Bile flows through the following pathway:

1. Right and left hepatic ducts.

2. Common hepatic duct.
3. Cystic duct.
4. Common bile duct.
5. Major duodenal papilla, through the hepatopancreatic ampulla when present.

The cystic duct connects the gallbladder to the common hepatic duct.

Clinical Importance

- Cholelithiasis: Formation of gallstones.
- Cholecystitis: Inflammation of the gallbladder.
- Biliary obstruction: Blockage of bile flow.

15. Pancreas

Definition

The pancreas is an elongated gland with both exocrine and endocrine functions.

Location

It is situated behind the stomach in the upper abdomen and is mostly retroperitoneal.

Parts of the Pancreas

1. Head: Lies within the C-shaped curve of the duodenum.
2. Neck: Short region connecting the head and body.
3. Body: Extends towards the left side of the abdomen.
4. Tail: Reaches towards the spleen.

Functions of the Pancreas

The pancreas has two major functions.

A. Exocrine Function

The exocrine pancreas produces pancreatic juice containing digestive enzymes and bicarbonate.

Important enzymes include:

- Pancreatic amylase: Digests carbohydrates.
- Pancreatic lipase: Digests fats.
- Trypsin and chymotrypsin: Digest proteins.
- Nucleases: Digest nucleic acids.

Bicarbonate helps neutralize acidic chyme entering the duodenum.

B. Endocrine Function

The endocrine pancreas consists of the islets of Langerhans.

Cell Type

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Hormone

Function

Alpha cells

Glucagon

Increases blood glucose

Beta cells

Insulin

Decreases blood glucose

Delta cells

Somatostatin

Inhibits secretion of several hormones

PP cells

Pancreatic polypeptide

Helps regulate pancreatic and gastrointestinal activity

Pancreatic Ducts

1. Main pancreatic duct (duct of Wirsung).
2. Accessory pancreatic duct (duct of Santorini), when present.

The main pancreatic duct usually joins the common bile duct before opening into the duodenum at the major duodenal papilla.

Clinical Importance

- Pancreatitis: Inflammation of the pancreas.
- Diabetes mellitus: Disorder involving impaired insulin secretion, insulin action or both.
- Pancreatic cancer: Malignant growth in pancreatic tissue.

16. Peritoneum and Mesentery

Peritoneum

The peritoneum is a serous membrane that lines the abdominopelvic cavity and covers many abdominal organs.

Layers

1. Parietal Peritoneum
   - Lines the inner surface of the abdominal and pelvic walls.
2. Visceral Peritoneum
   - Covers the external surfaces of many abdominal organs.

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Peritoneal Cavity

It is the potential space between the parietal and visceral peritoneum. It contains a small amount of lubricating serous fluid.

Mesentery

The mesentery is a double layer of peritoneum that attaches certain abdominal organs to the posterior abdominal wall.

Functions

1. Supports and stabilizes abdominal organs.
2. Provides pathways for blood vessels and nerves.
3. Provides pathways for lymphatic vessels.
4. Reduces friction between abdominal organs.

Clinical Importance

- Peritonitis: Inflammation of the peritoneum.
- Ascites: Abnormal accumulation of fluid in the peritoneal cavity.
- Adhesions: Fibrous bands that may develop between abdominal structures.

17. Blood Supply of the Digestive System

The major arteries supplying the gastrointestinal tract arise from the abdominal aorta.

Main Arteries

1. Coeliac Trunk
   - Supplies the foregut.
   - Gives rise to the left gastric, splenic and common hepatic arteries.
2. Superior Mesenteric Artery
   - Supplies most of the midgut.
   - Supplies the distal duodenum, jejunum, ileum, caecum, appendix, ascending colon and proximal two-thirds of the transverse colon.
3. Inferior Mesenteric Artery
   - Supplies the hindgut.
   - Supplies the distal one-third of the transverse colon, descending colon, sigmoid colon and upper rectum.

Venous Drainage

Most venous blood from the digestive organs drains into the hepatic portal vein and passes through the liver before entering the systemic circulation.

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18. Nerve Supply of the Digestive System

The digestive system receives both parasympathetic and sympathetic nerve supply.

Parasympathetic Supply

- Vagus nerve (cranial nerve X): Supplies most of the digestive tract up to the proximal two-thirds of the transverse colon.
- Pelvic splanchnic nerves (S2-S4): Supply the distal colon and rectum.

Functions:

- Increases gastrointestinal motility.
- Promotes digestive secretions.
- Relaxes certain gastrointestinal sphincters.

Sympathetic Supply

- Arises mainly from thoracic and upper lumbar spinal segments.
- Reaches the digestive organs through autonomic plexuses.

Functions:

- Generally decreases gastrointestinal motility.
- Reduces digestive secretions.
- Causes vasoconstriction.
- Generally increases sphincter tone.

19. Applied and Clinical Anatomy

Condition

Description

GERD

Reflux of stomach contents into the oesophagus

Gastritis

Inflammation of the stomach lining

Peptic Ulcer

Ulcer in the stomach or duodenal lining

Appendicitis

Inflammation of the appendix

Hepatitis

Inflammation of the liver

Cirrhosis

Chronic scarring of the liver

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Cholelithiasis

Formation of gallstones

Cholecystitis

Inflammation of the gallbladder

Pancreatitis

Inflammation of the pancreas

Peritonitis

Inflammation of the peritoneum

Intestinal Obstruction

Blockage of the intestinal passage

Haemorrhoids

Swollen vascular cushions in the anal canal

20. Importance of Digestive Anatomy in Nursing

Knowledge of digestive anatomy helps nurses to:

1. Perform abdominal assessment and inspection.
2. Identify abdominal organs and their locations.
3. Assess bowel sounds.
4. Monitor bowel movements and elimination patterns.
5. Understand nasogastric tube insertion and feeding.
6. Provide care to patients with gastrointestinal disorders.
7. Monitor patients with liver and pancreatic diseases.
8. Understand nutritional absorption and digestion.
9. Identify signs of gastrointestinal bleeding.
10. Assist in digestive diagnostic procedures.

21. Important Examination Questions

Long Answer Questions

1. Describe the anatomy of the digestive system with a labelled diagram.
2. Explain the structure of the stomach and its functions.
3. Describe the small intestine and its three parts.
4. Explain the anatomy of the liver, including its blood supply and functions.
5. Describe the pancreas and explain its exocrine and endocrine functions.
6. Explain the anatomy of the large intestine.
7. Describe the salivary glands and their functions.

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Short Answer Questions

1. List the parts of the alimentary canal.
2. Explain the four types of teeth.
3. Describe the major salivary glands.
4. Write the parts of the stomach.
5. Differentiate between the small and large intestines.
6. Describe the lobes of the liver.
7. Write the functions of the gallbladder.
8. Explain the parts of the pancreas.
9. Describe the layers of the peritoneum.
10. Explain the blood supply of the gastrointestinal tract.

Very Short Answer Questions

1. What is the largest internal gland of the body?
2. What is the length of the oesophagus?
3. How many permanent teeth are present in adults?
4. Which organ produces bile?
5. Where is bile stored?
6. What is the functional unit commonly described in the liver?
7. Which part of the intestine absorbs vitamin B12?
8. Which cells produce insulin?
9. What is the first part of the small intestine?
10. Which enzyme digests fats?
11. What is the largest salivary gland?
12. Which nerve supplies most of the gastrointestinal tract parasympathetically?

22. Quick Revision Points

- Digestive system: Responsible for digestion, absorption and elimination.
- Alimentary canal: Mouth to anus.
- Accessory organs: Teeth, tongue, salivary glands, liver, gallbladder and pancreas.
- Adult permanent teeth: 32.
- Largest salivary gland: Parotid gland.
- Oesophagus: Approximately 25 cm long.
- Stomach: J-shaped muscular organ.
- Small intestine: Duodenum, jejunum and ileum.

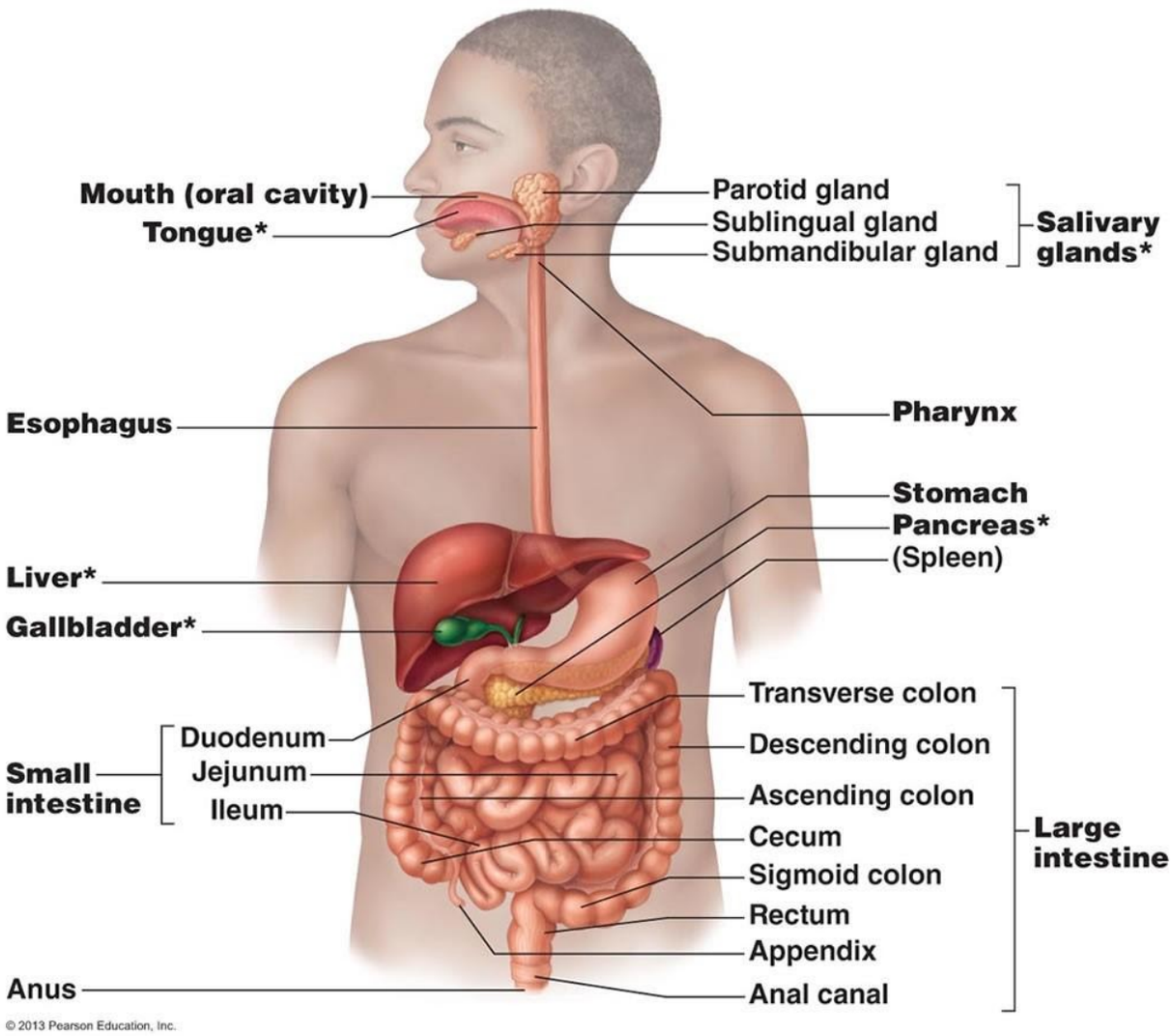
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- Main site of nutrient absorption: Small intestine.
- Large intestine: Approximately 1.5 metres long.
- Liver: Largest internal gland.
- Gallbladder: Stores and concentrates bile.
- Pancreas: Both exocrine and endocrine gland.
- Insulin: Produced by beta cells.
- Glucagon: Produced by alpha cells.
- Peritoneum: Serous membrane of the abdominopelvic cavity.
- Coeliac trunk: Supplies foregut structures.
- Superior mesenteric artery: Supplies most of the midgut.
- Inferior mesenteric artery: Supplies hindgut structures.
- Vagus nerve: Major parasympathetic nerve of the digestive tract.

Conclusion

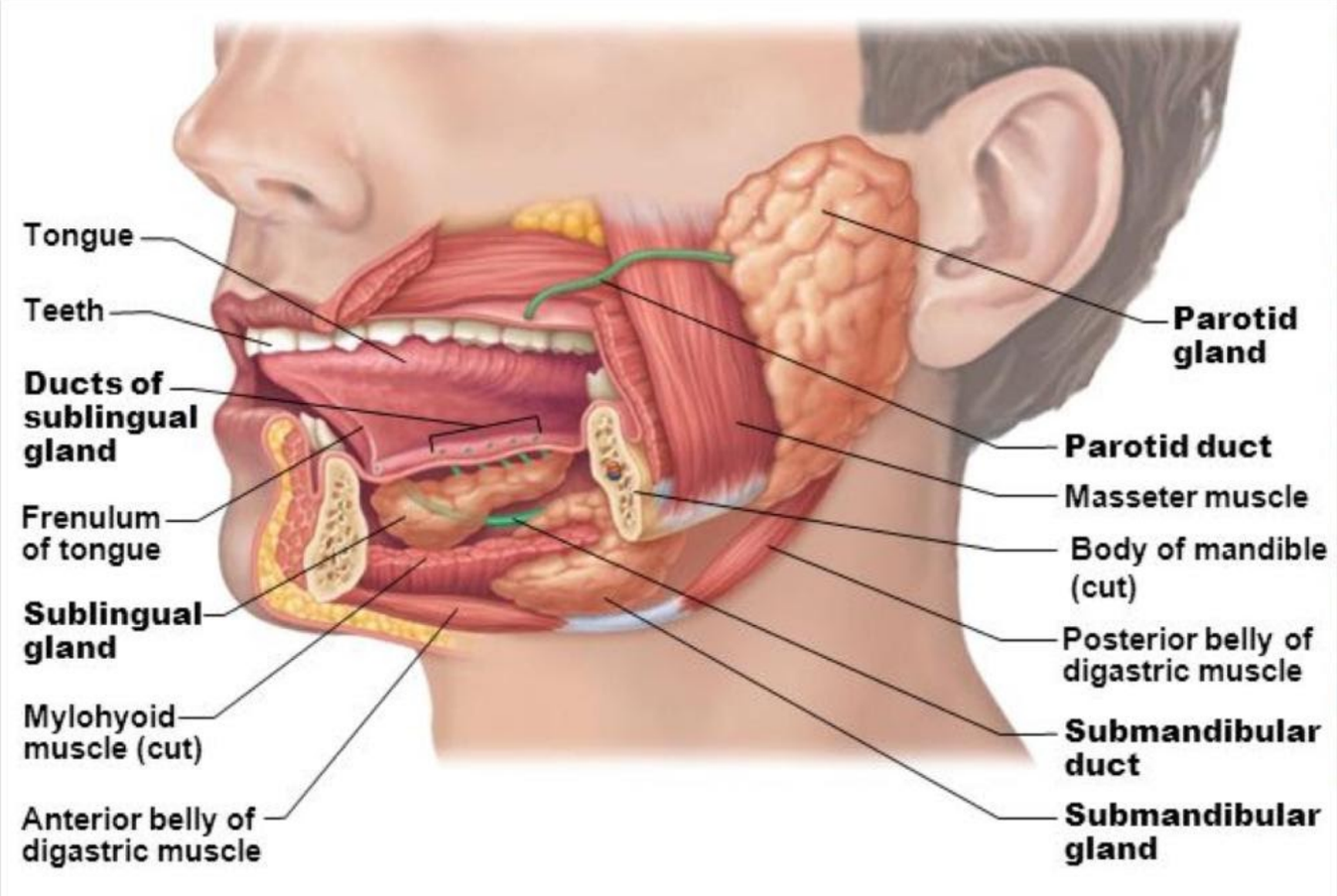
The digestive system is essential for the breakdown of food, absorption of nutrients and elimination of waste. Knowledge of the alimentary canal, digestive glands, liver, pancreas, gallbladder and associated organs is important for understanding nutrition, gastrointestinal disorders and nursing care.

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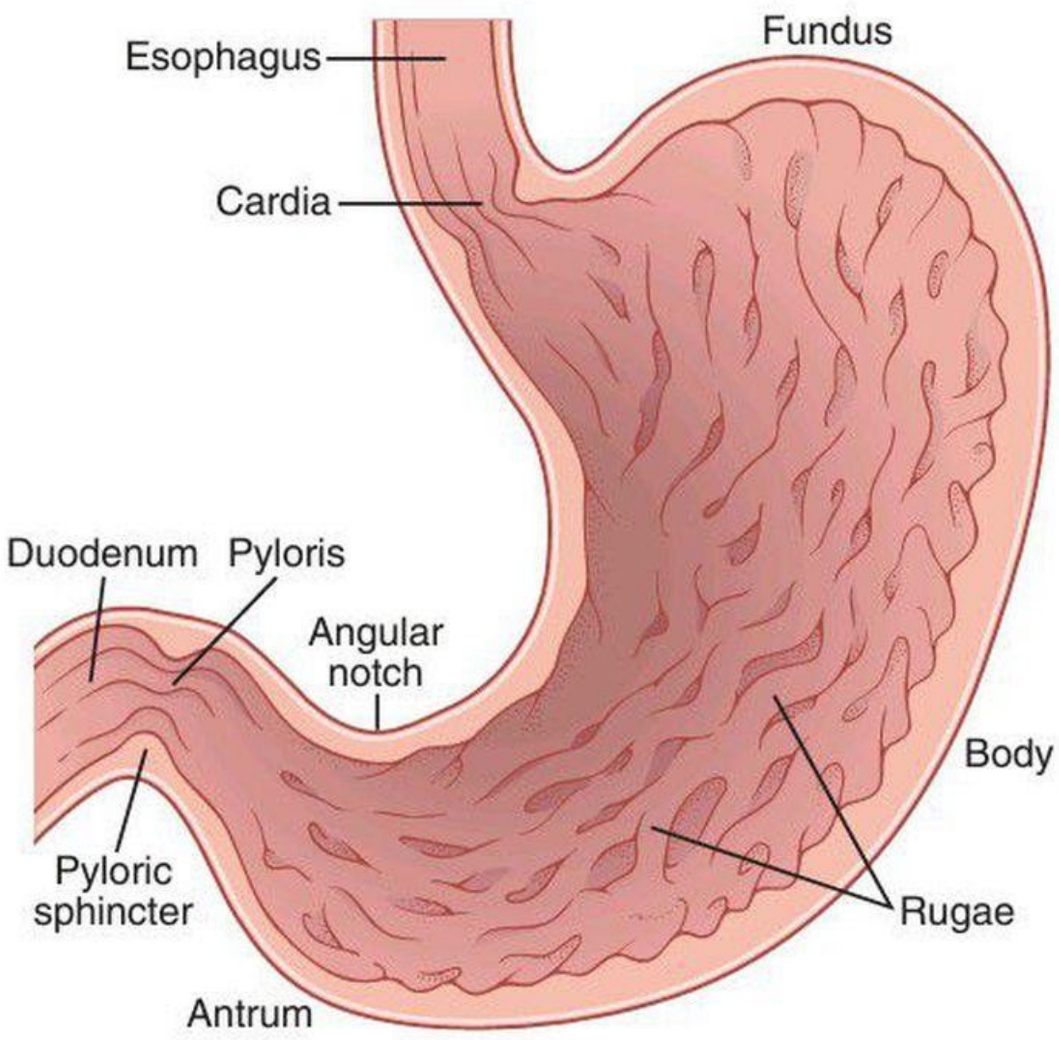
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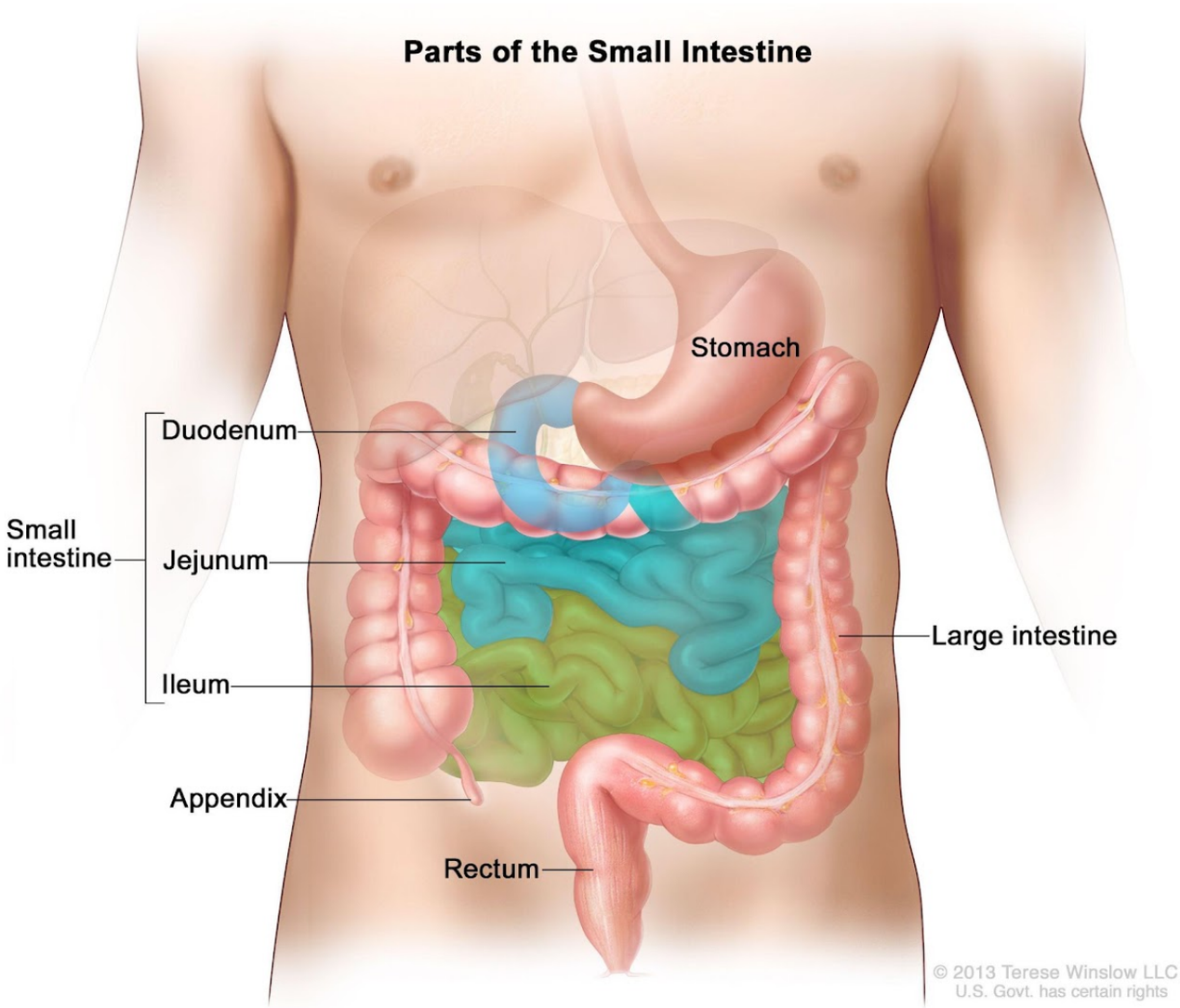
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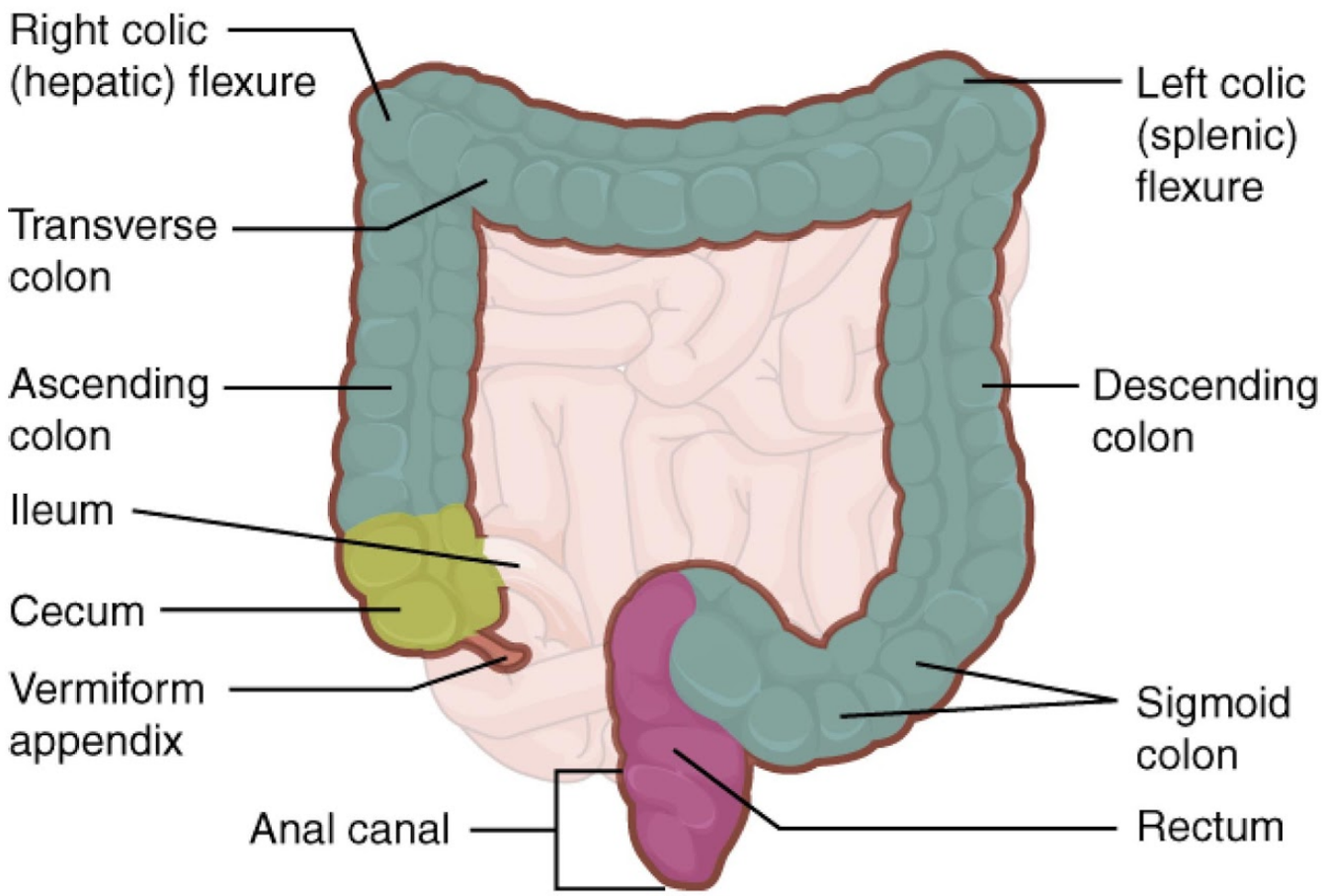
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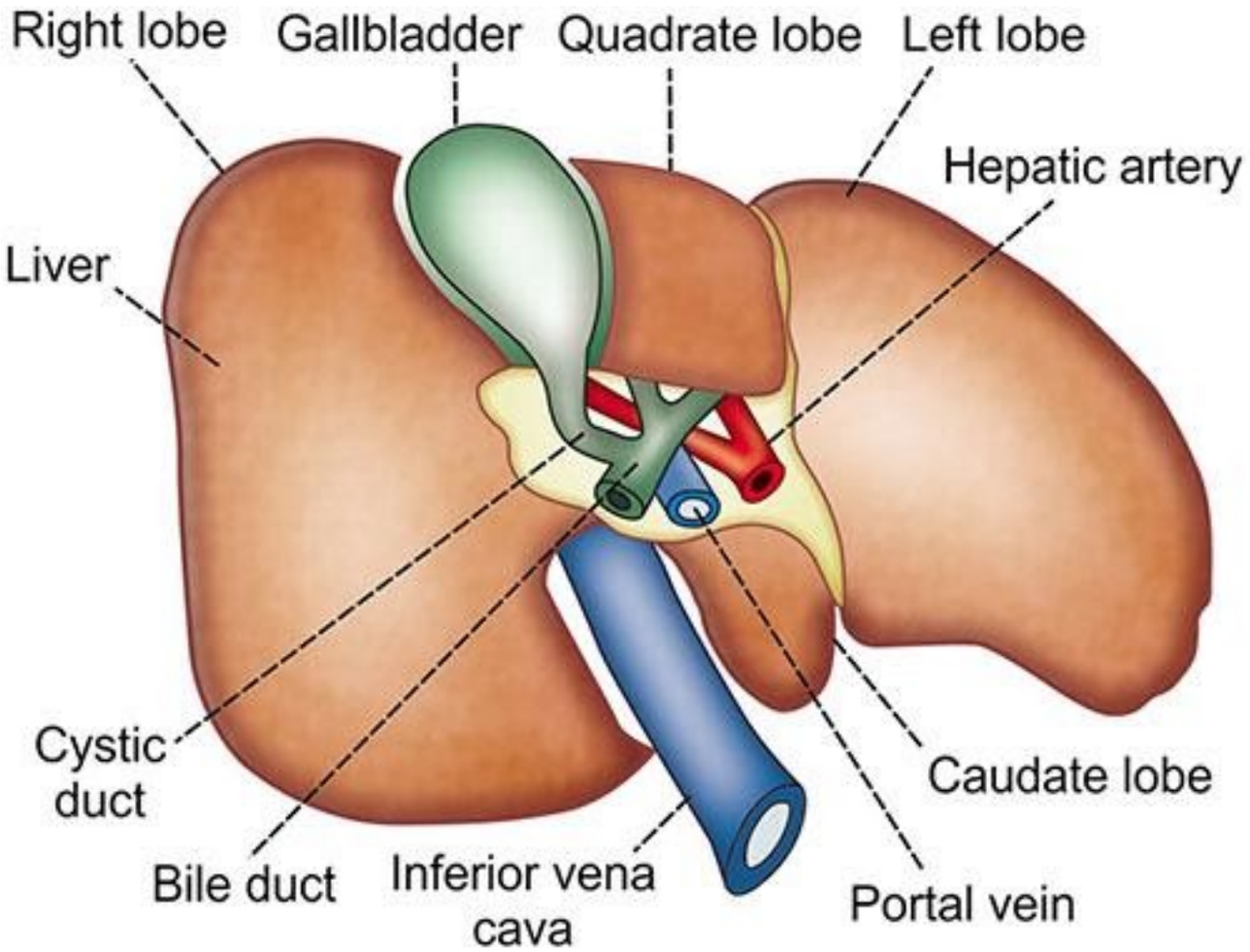
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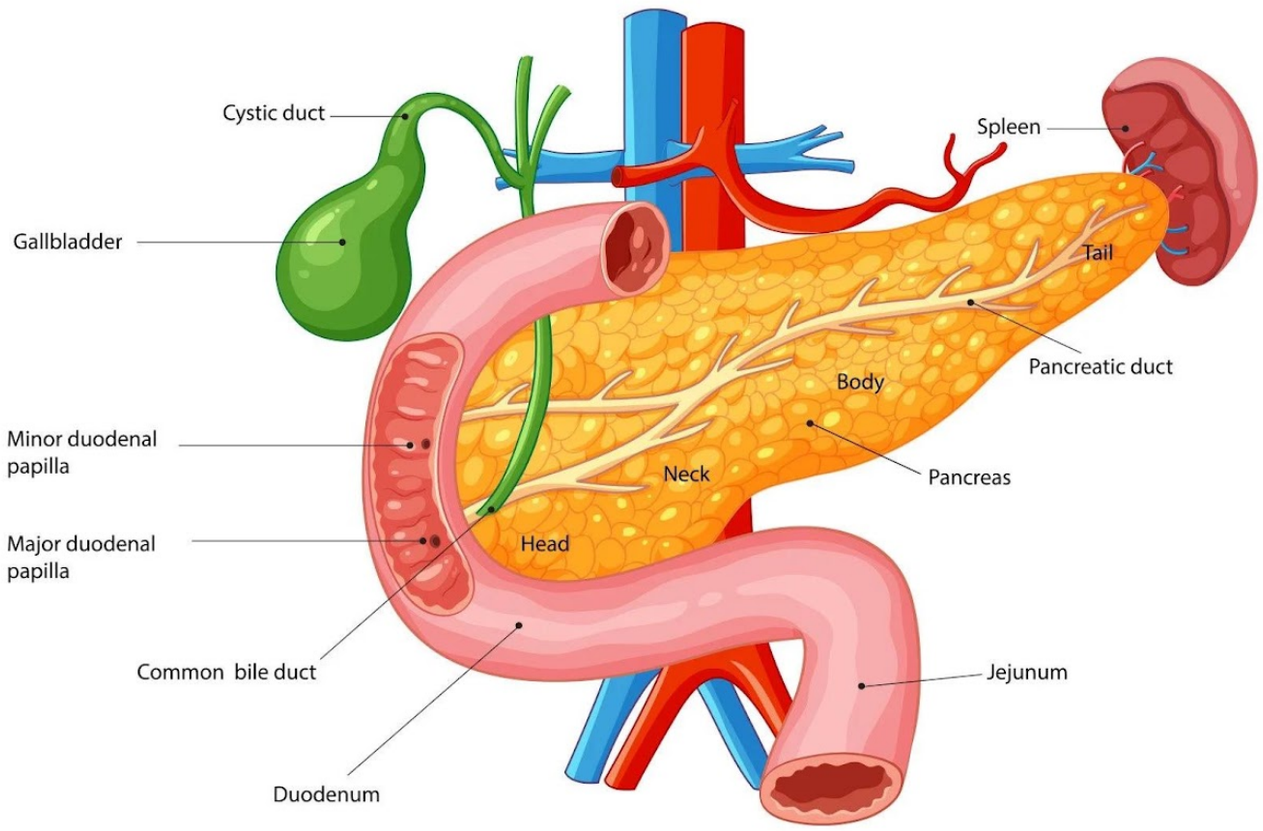
Digestive System - illustration 6

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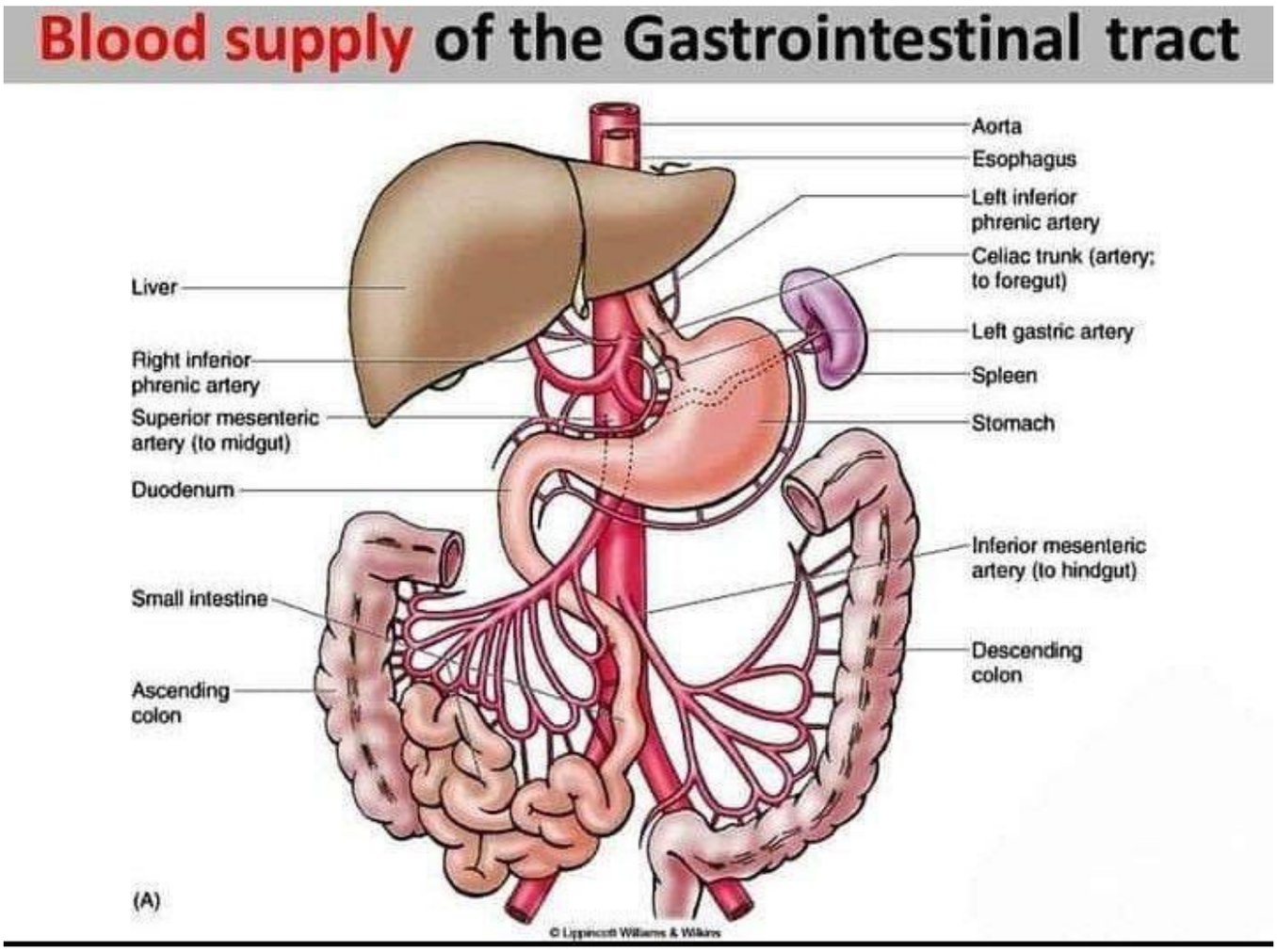
Digestive System - illustration 7

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Digestive System - illustration 8

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Digestive System - illustration 9

Quick Revision

- Alimentary canal: Mouth -> pharynx -> oesophagus -> stomach -> small intestine -> large intestine -> rectum -> anal canal. Accessory structures include teeth, tongue, salivary glands, liver, gallbladder and pancreas.

- Wall & major regions:

- Liver, gallbladder & pancreas: The common hepatic duct joins the cystic duct to form the common bile duct. The pancreatic duct commonly joins it near entry into the duodenum.

- Glands & peritoneum: Major salivary glands are parotid, submandibular and sublingual. The peritoneum has parietal and visceral layers; mesenteries support organs and carry vessels, lymphatics and nerves. The hepatic portal vein brings nutrient-rich blood from much of the digestive tract to the liver.

Examination questions

1. Name four layers of the alimentary canal wall.

2. Compare small and large intestinal structure.

3. Trace bile from liver to duodenum.

Practice questions

Choose one best answer. The answer key and explanations follow the questions.

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1. Which layer is closest to the intestinal lumen?

A. Serosa
B. Muscularis externa
C. Mucosa
D. Submucosa

2. The pancreatic head lies in the curve of the:

A. Duodenum
B. Sigmoid colon
C. Ileum
D. Oesophagus

3. Which structure stores and concentrates bile?

A. Liver
B. Gallbladder
C. Spleen
D. Pancreas

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Answer key and explanations

1. C - Mucosa

The mucosa is the innermost wall layer.

2. A - Duodenum

The C-shaped duodenum surrounds the pancreatic head.

3. B - Gallbladder

The liver produces bile; the gallbladder stores and concentrates it.

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