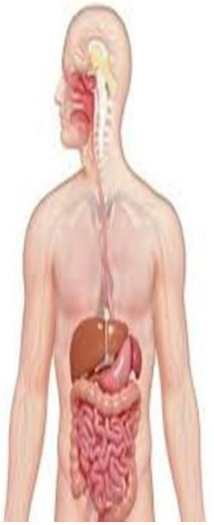


ANATOMY OF THE DIGESTIVE SYSTEM

HUMAN ANATOMY

College of Pharmacy

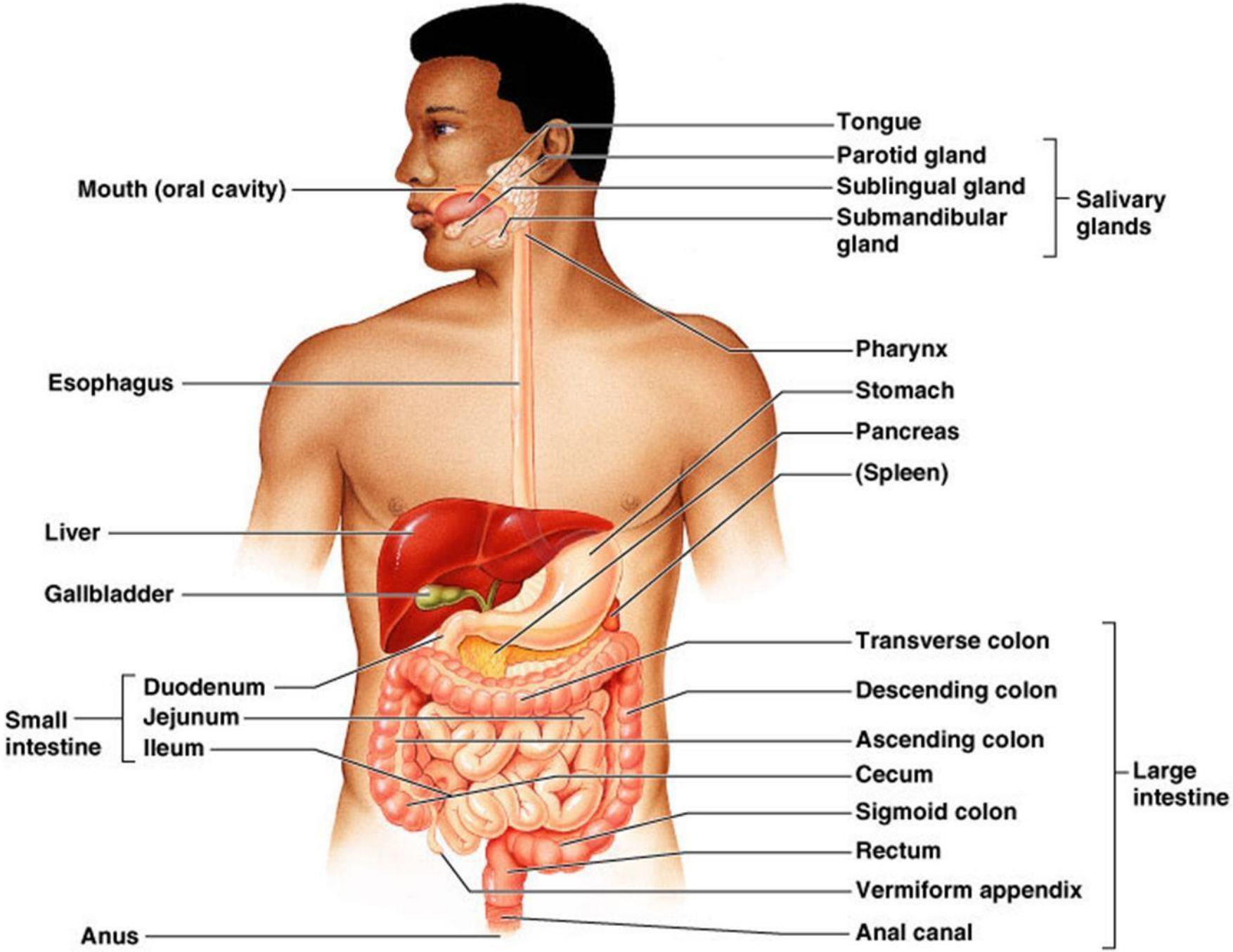
Dr. Abeer Abdullah

LEARNING OUTCOMES

- Name and identify the components of the digestive system
- List, identify, and describe the alimentary canal or gastrointestinal (GI) tract organs
- List, identify, and describe the accessory digestive organs

THE GENERAL REGIONS OF THE DIGESTIVE TRACT

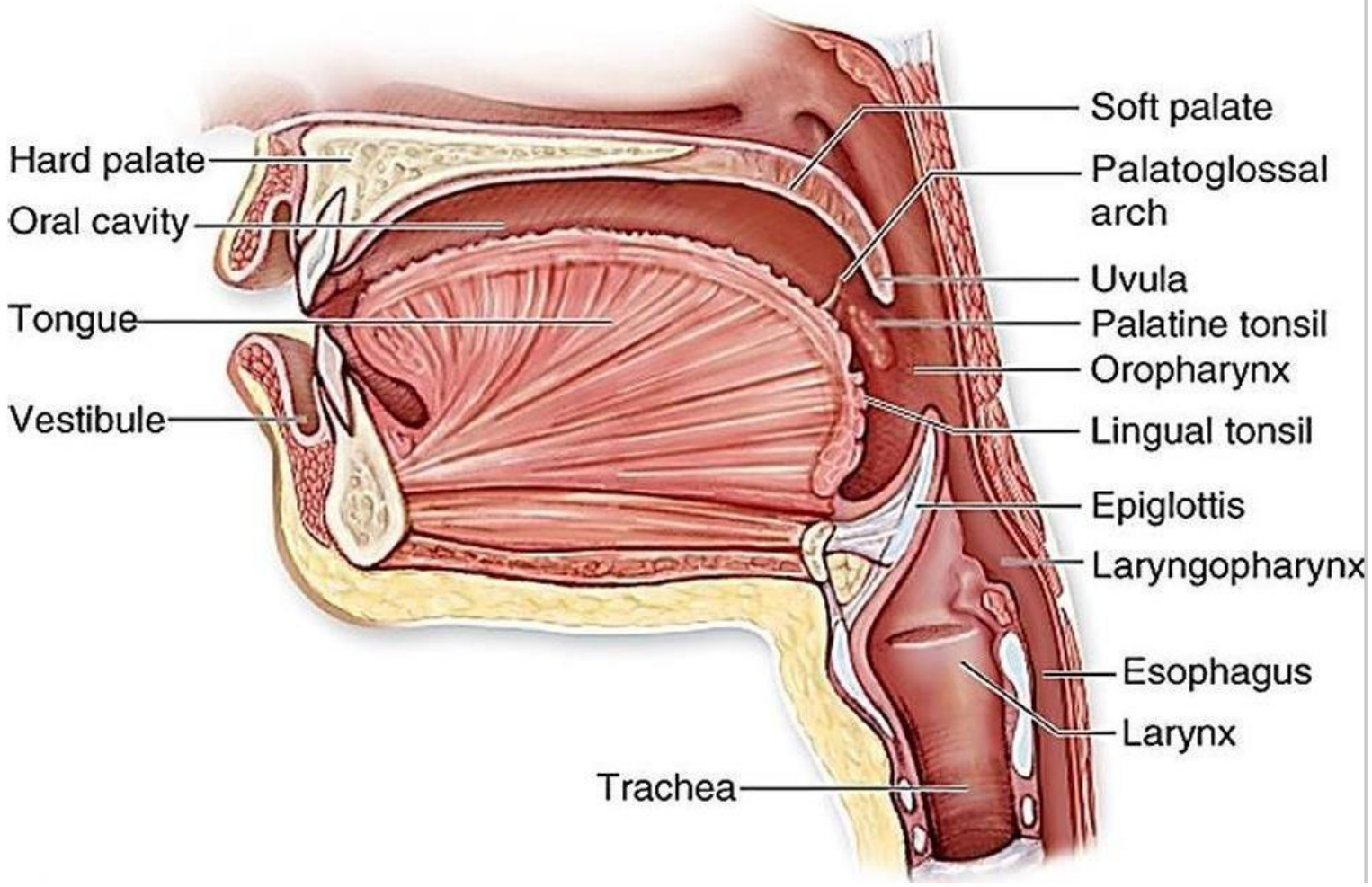
- Digestive system has two anatomical subdivisions:
- **The digestive tract (alimentary canal or gastrointestinal (GI) tract)**
  - Is a muscular and continuous tube
  - Extends from oral cavity to anus:
    - Passes through pharynx, oesophagus, stomach, and small and large intestines
    - Length of the GIT is variable about 5–7 meters
- **The accessory digestive organs**
  - Teeth, tongue, salivary glands, liver, gallbladder, and pancreas



THE MOUTH

Mouth = Oral or Buccal Cavity

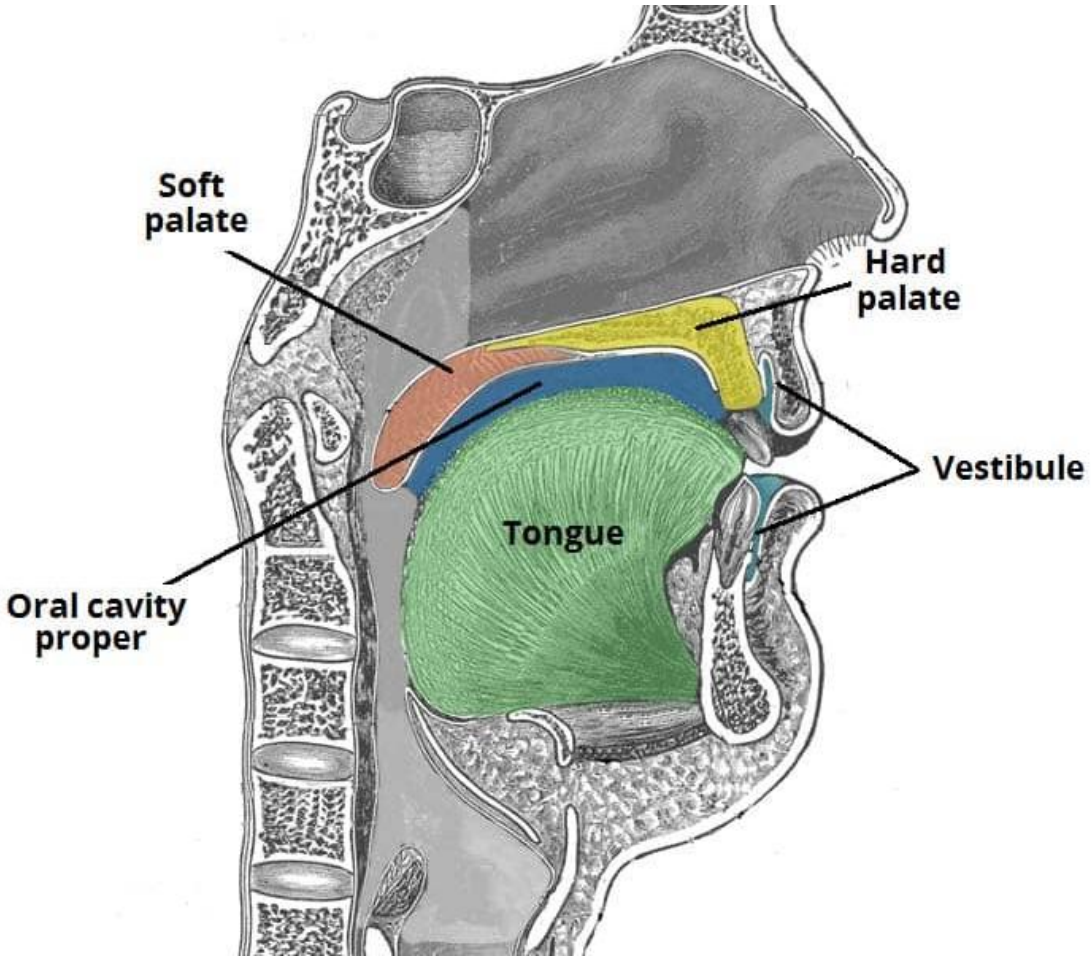
- Laterally: Cheeks (skin externally, mucous membrane internally)
- Superiorly: Hard and soft palates
- Inferiorly: Tongue
- Lips (Labia):Fleshy folds surrounding the mouth; Contain orbicularis oris muscle
- Teeth
- Salivary glands



FYI: Clinical Relevance for Pharmacy

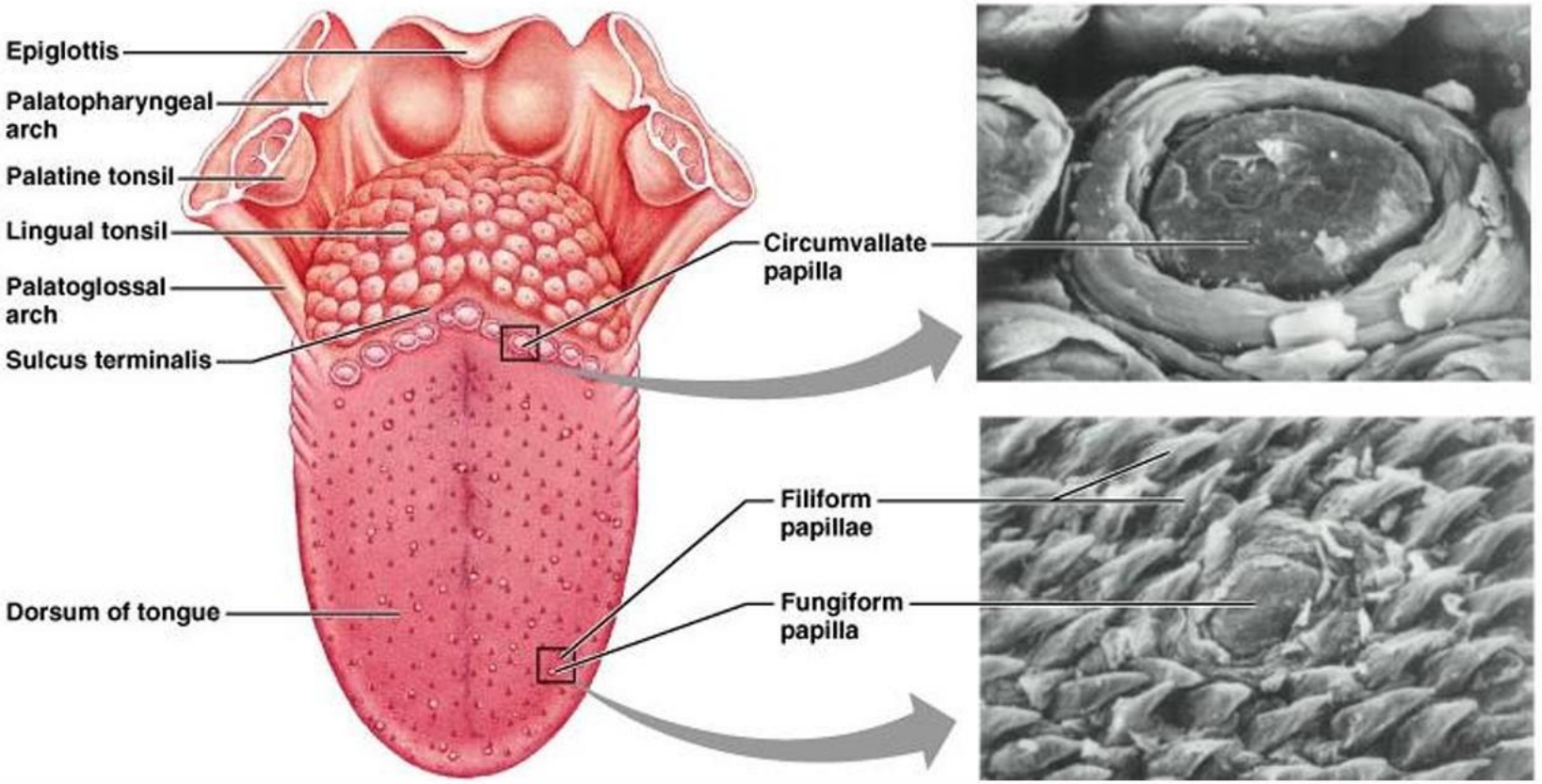
Divisions of the Oral Cavity

- **Oral Vestibule:**
  - **Location:** Between cheeks/lips and gums/teeth
  - **Use:** Placement of buccal tablets (e.g., analgesics)
- **Oral Cavity Proper:**
  - **Location:** Behind teeth to **oropharyngeal isthmus** (opening to pharynx)
  - **Use:** Rapid absorption for nitroglycerin; region under the tongue (high vascularization)



TONGUE

- **Accessory** digestive organ composed of skeletal **muscle** covered by mucous membrane
- Location: Forms the **floor of the oral cavity**
- Dorsum (upper surface): Covered with papillae
- Lateral Surfaces: Contain papillae and taste buds
- Types of **Papillae**: Fungiform, Vallate, Foliate, and Filiform*

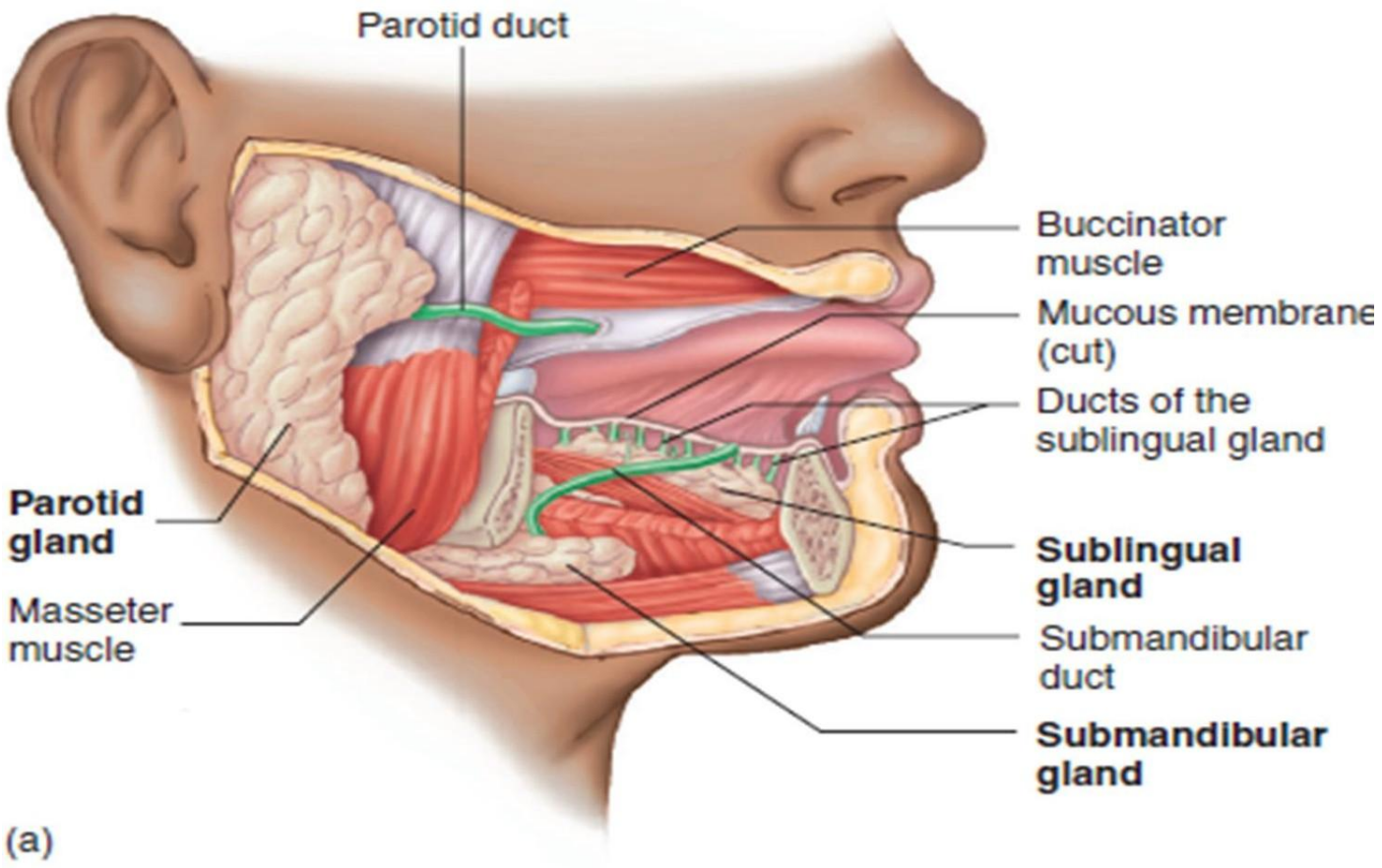


SALIVARY GLANDS

- Exocrine glands **secreting saliva** into the oral cavity
- Moistens oral mucosa and pharynx; Cleanses mouth/teeth
- Three pairs (**salivary glands**):

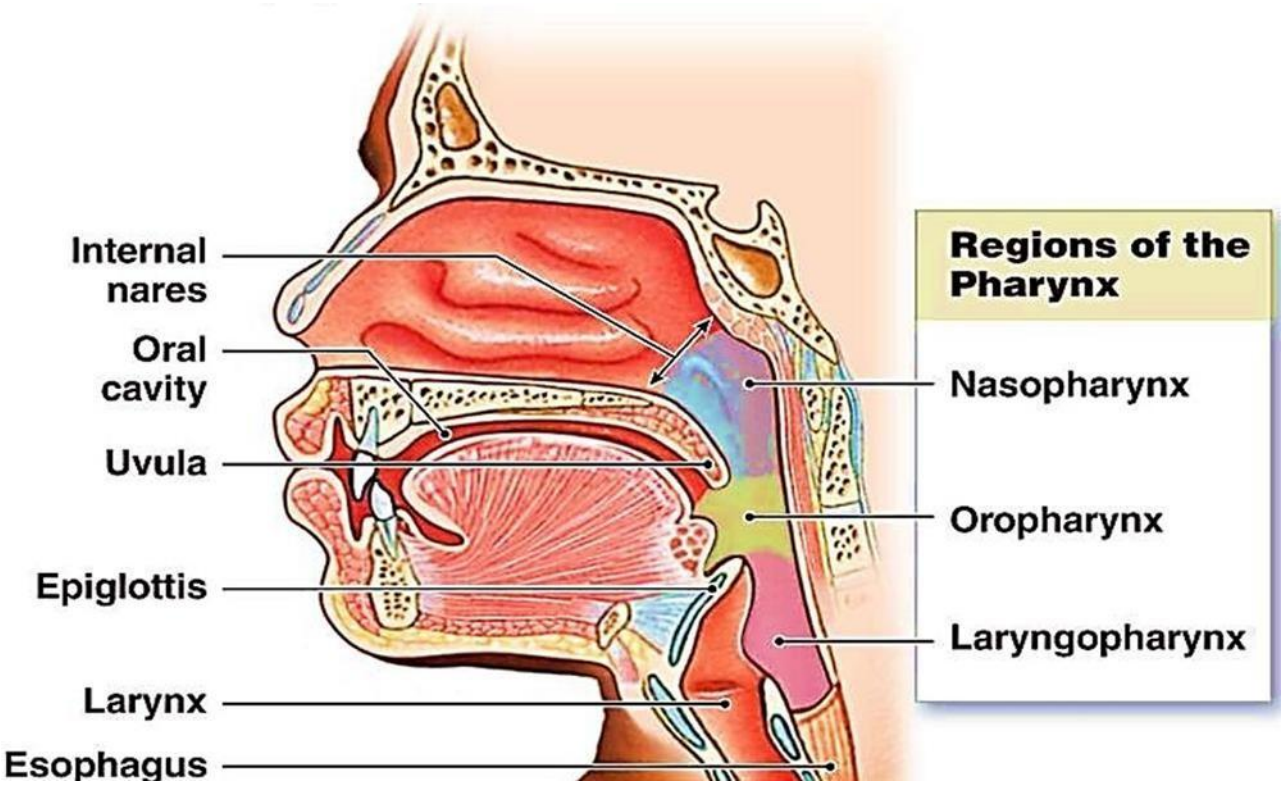
1. **Parotid:** Inferior/anterior to ears**;** largest salivary gland
2. **Submandibular**: Medial surface mandible; Floor of mouth
3. **Sublingual:** Under tongue; floor of mouth; Superior to submandibular glands

- **Ducts** carry secretions of glands to the oral cavity



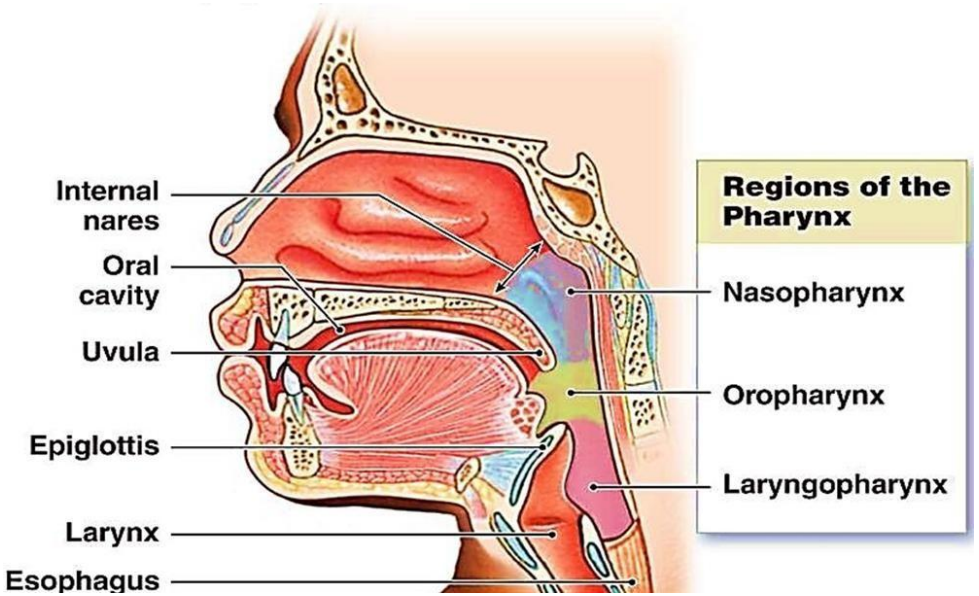
PHARYNX (THROAT)

- A Funnel-shaped muscular tube connecting nasal/oral cavities to esophagus posteriorly/larynx anteriorly
- **Subdivisions:** Nasopharynx, Oropharynx and Laryngopharynx
- Nasopharynx functions only in respiration
- Oropharynx and laryngopharynx have both digestive and respiratory functions
- Swallowing: Presence of bolus in the pharynx stimulates wave of peristalsis



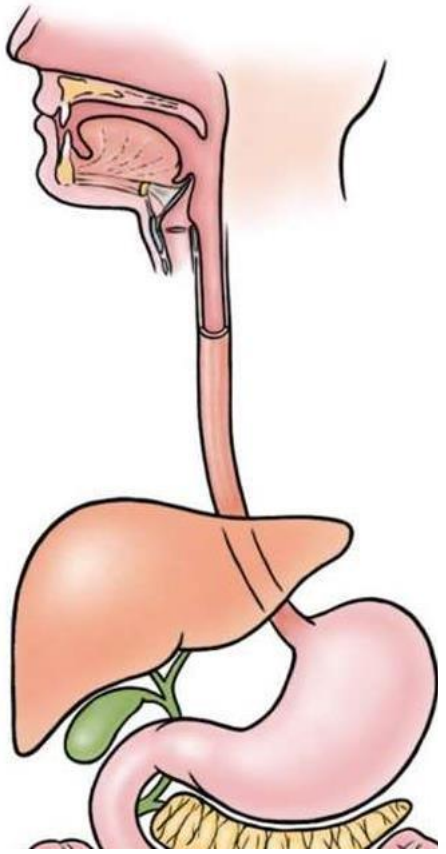
PHARYNX (THROAT)

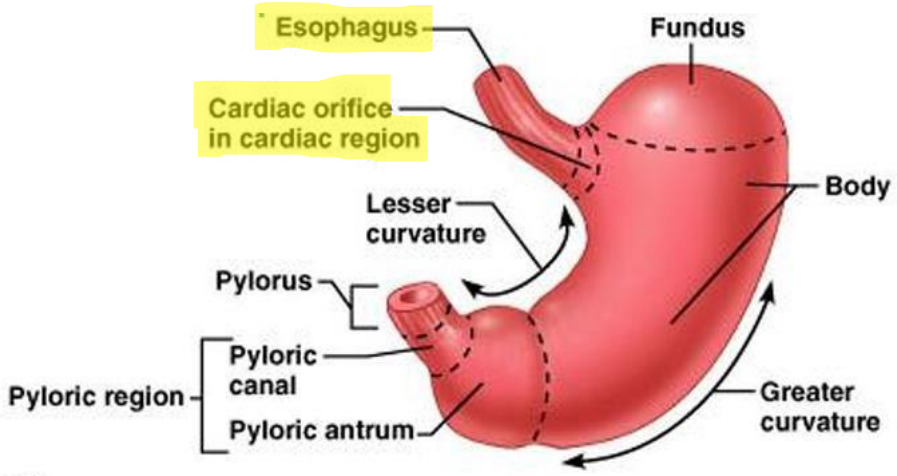
Region	Location	Function
Nasopharynx	Behind nasal cavity	Air passage; Eustachian tube link
Oropharynx	Behind oral cavity	Food/air passage
Laryngopharynx	Connects to esophagus/larynx	Directs food/air



ESOPHAGUS

- 25 cm Hollow muscular tube (skeletal/smooth muscle); collapsed when lumen empty
- Extends form the pharynx to stomach
- On anterior surface of vertebral column; Posterior to trachea
- Path: Laryngopharynx → Mediastinum → Esophageal hiatus (diaphragm) → Stomach
- Joins stomach at **cardiac orifice**
- The upper and lower ends of the esophagus are closed by sphincters

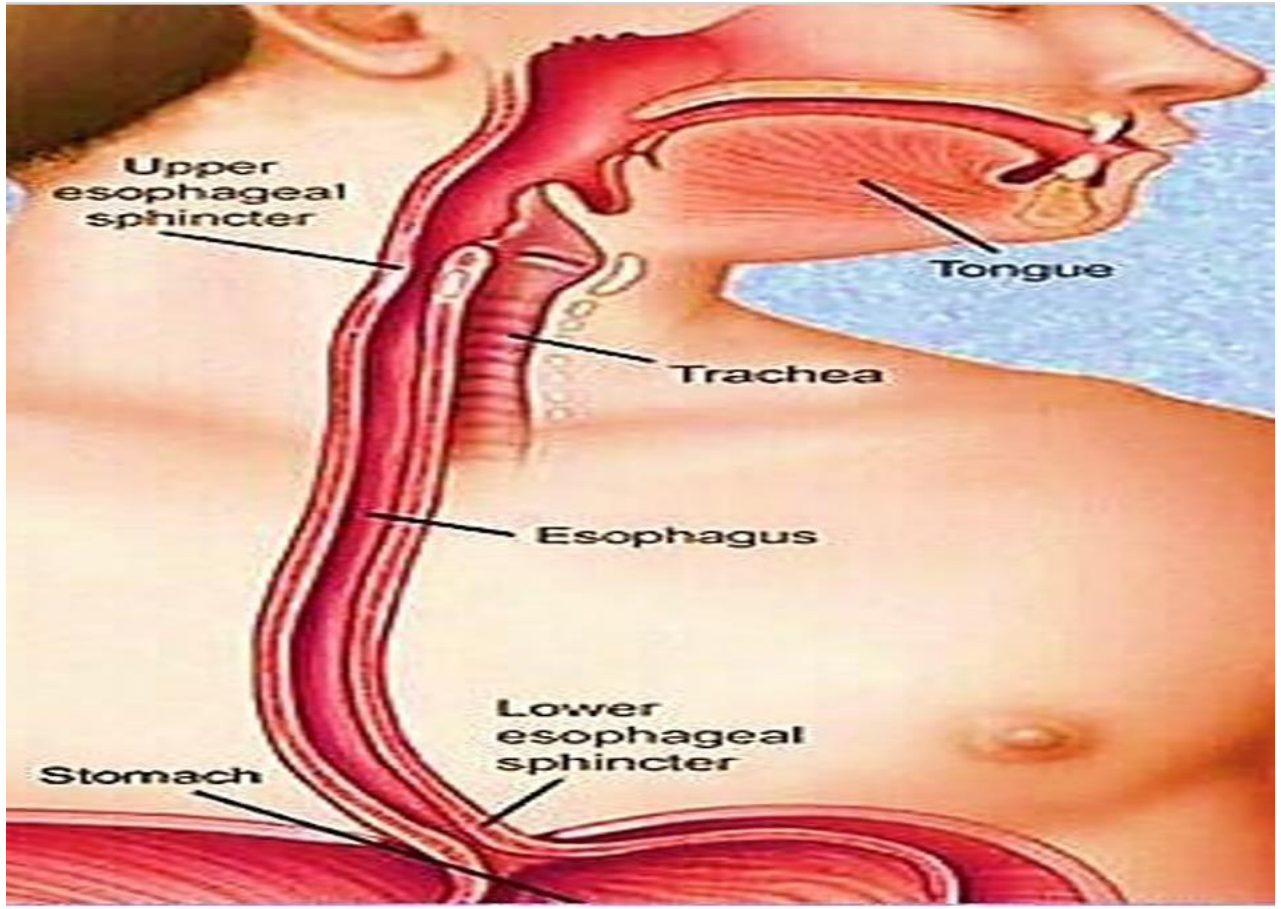




(a)

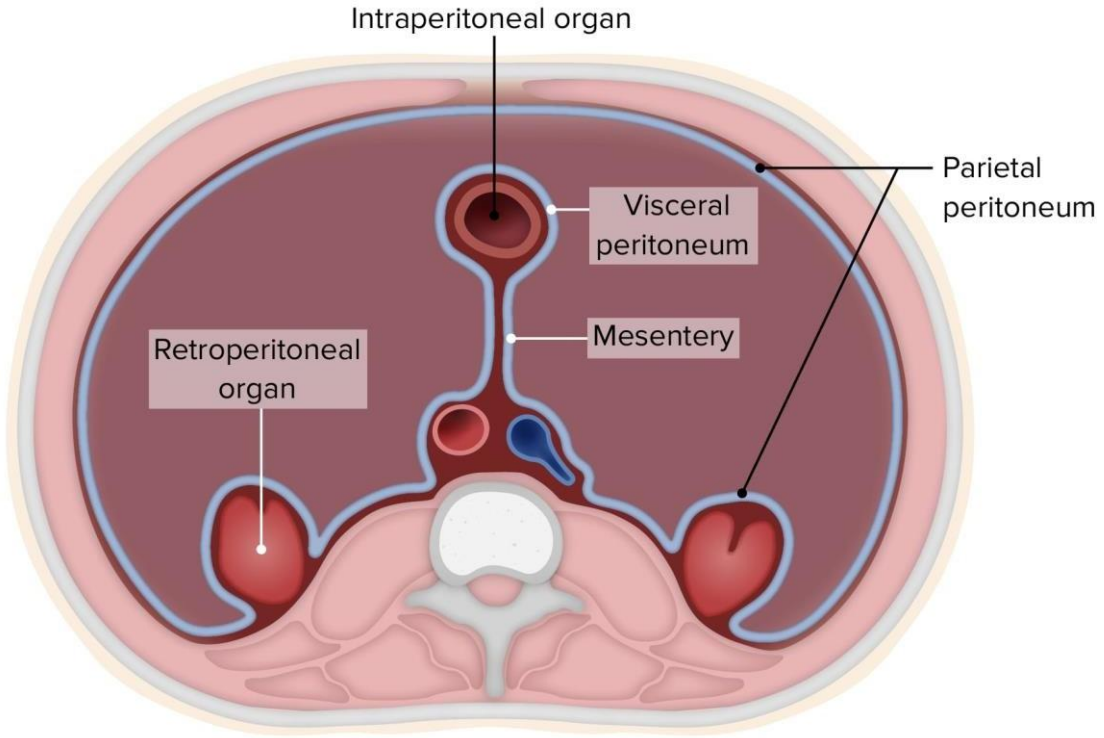
ESOPHAGEAL SPHINCTERS

- **Upper esophageal sphincter:** Prevents air passing into GIT during respiration and aspiration of its contents
- **Lower esophageal sphincter:** Prevents reflux of acid gastric contents



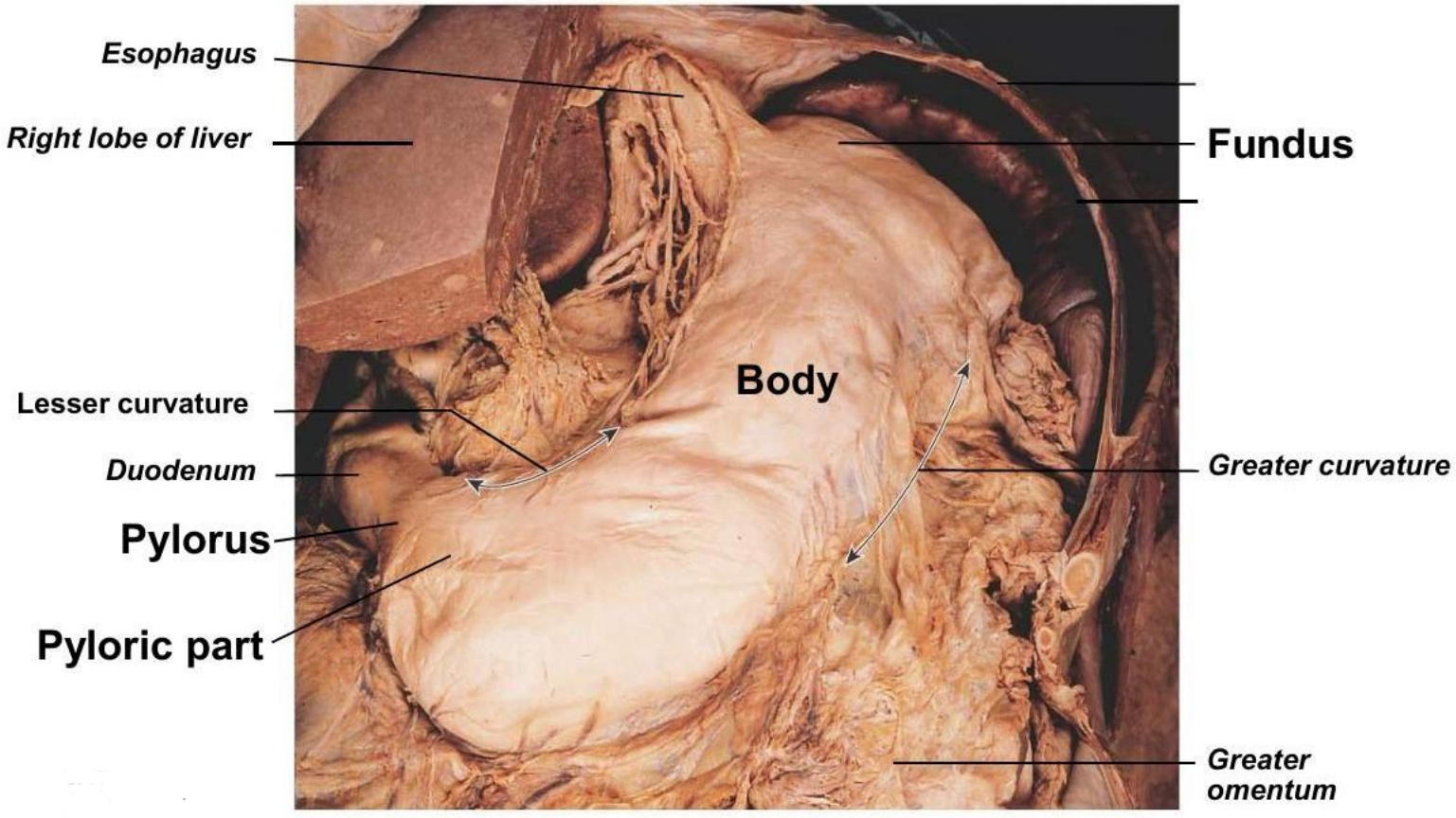
PERITONEUM

- Thin, serous membrane
  - **Parietal peritoneum**
    - Lines the walls of the abdominal and pelvic cavities
  - **Visceral peritoneum**
    - Covers the organs within peritoneal cavity
- Peritoneal cavity: serous fluid



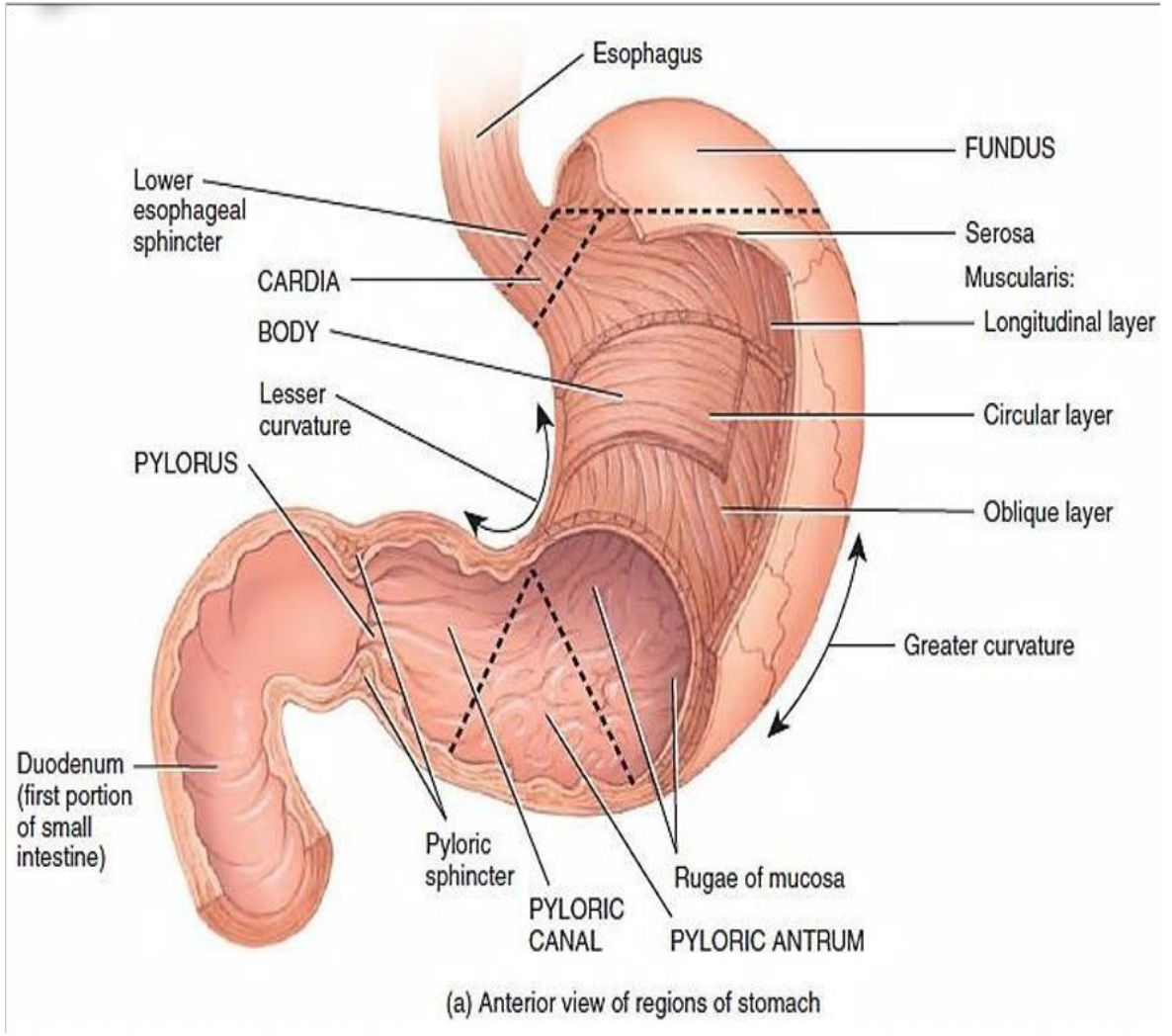
STOMACH

- J-shaped organ in the epigastric/umbilical regions, inferior to the diaphragm
- Lies mostly in LUQ
- Anterior to (in front of) spleen and pancreas
- Tucked under left lower margin of liver



PARTS OF THE STOMACH

- **Curvatures** of stomach:
  - **Greater:** Convex lateral surface of the stomach
  - **Lesser:** Concave medial surface
- Four main **regions** of stomach: **Cardia, Fundus, Body (corpus),and Pylorus**
- Function:
  - Mixing/holding reservoir for food
  - Secretes acid/enzymes (e.g., pepsin, HCl)

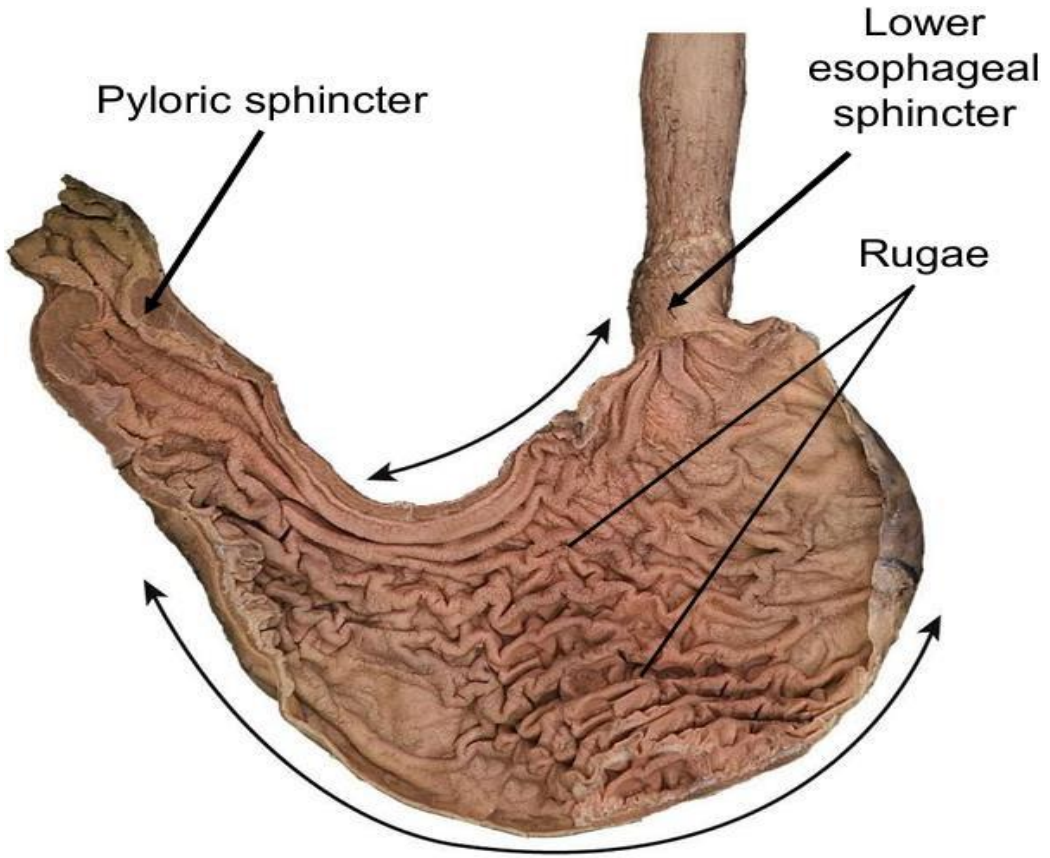


Anatomical Regions of the Stomach

Region	Location	Clinical Relevance
Cardia	Surrounds esophageal opening	Risk site - acid reflux
Fundus	Dome-shaped superior portion	Gas accumulation (e.g., antacids)
Body	Central main region	Primary site for drug absorption
Pylorus	Connects to duodenum	Pyloric sphincter regulates gastric emptying (affects drug kinetics)

INTERNAL FEATURES OF THE STOMACH

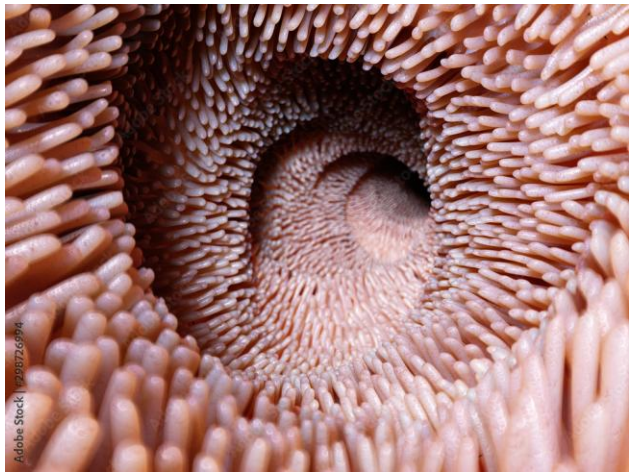
- Lower esophageal (“cardiac”) sphincter: Prevents reflux of gastric content
- **Pyloric sphincter:** Junction between stomach and the duodenum, relaxed and open when the stomach is inactive
- **Rugae:** Folds of mucosa

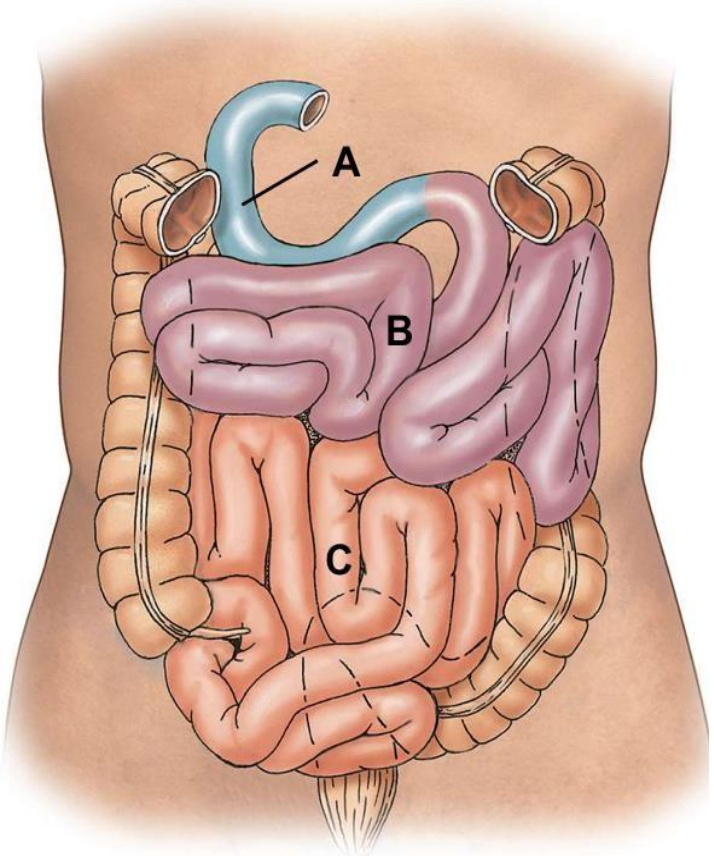


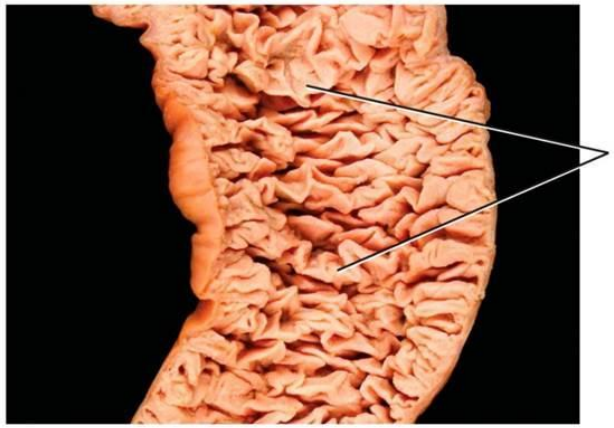
SMALL INTESTINE

- Digestion & absorption of nutrients/drugs
- Length: ~3m (living); ~6.5m (cadaver) loss of smooth muscle tone after death
- Adaptations for Absorption: **Plicae circulares** (folds), **villi, microvilli** (more surface area)
- **Regions/Subdivisions**:

A. **Duodenum** (25 cm; C-shaped)
B. **Jejunum** (1 m; LUQ)
C. **Ileum** (2 m; RLQ)





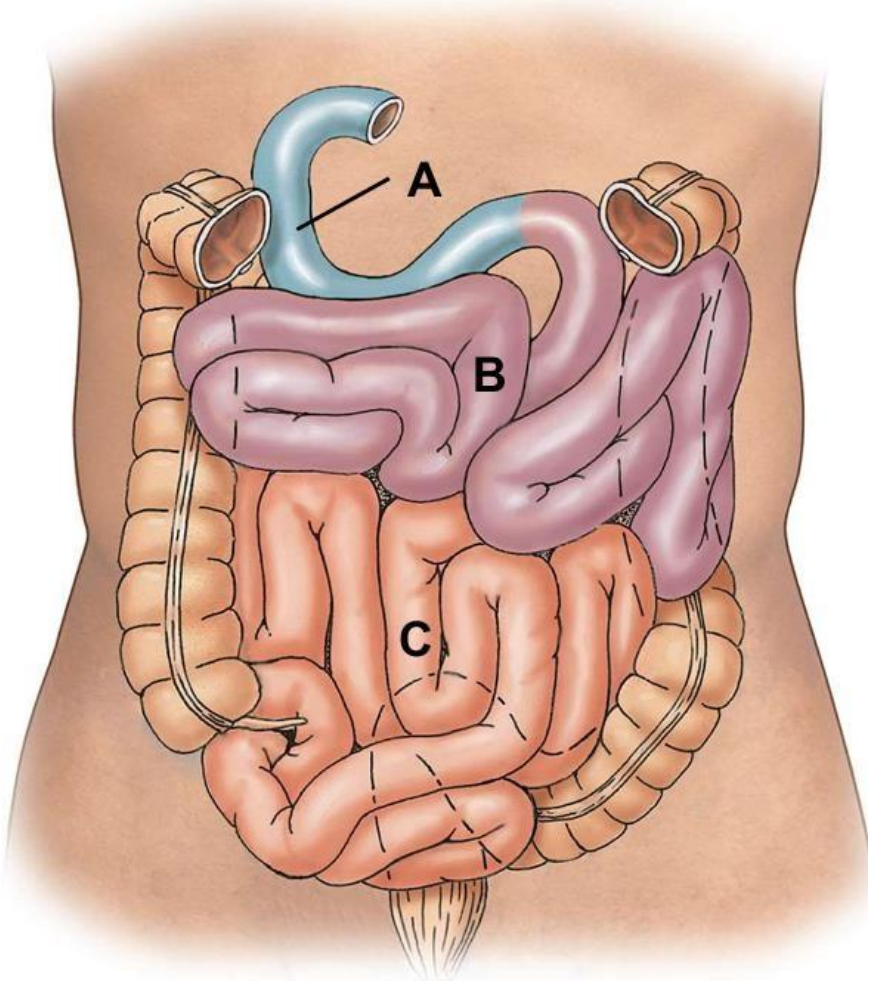


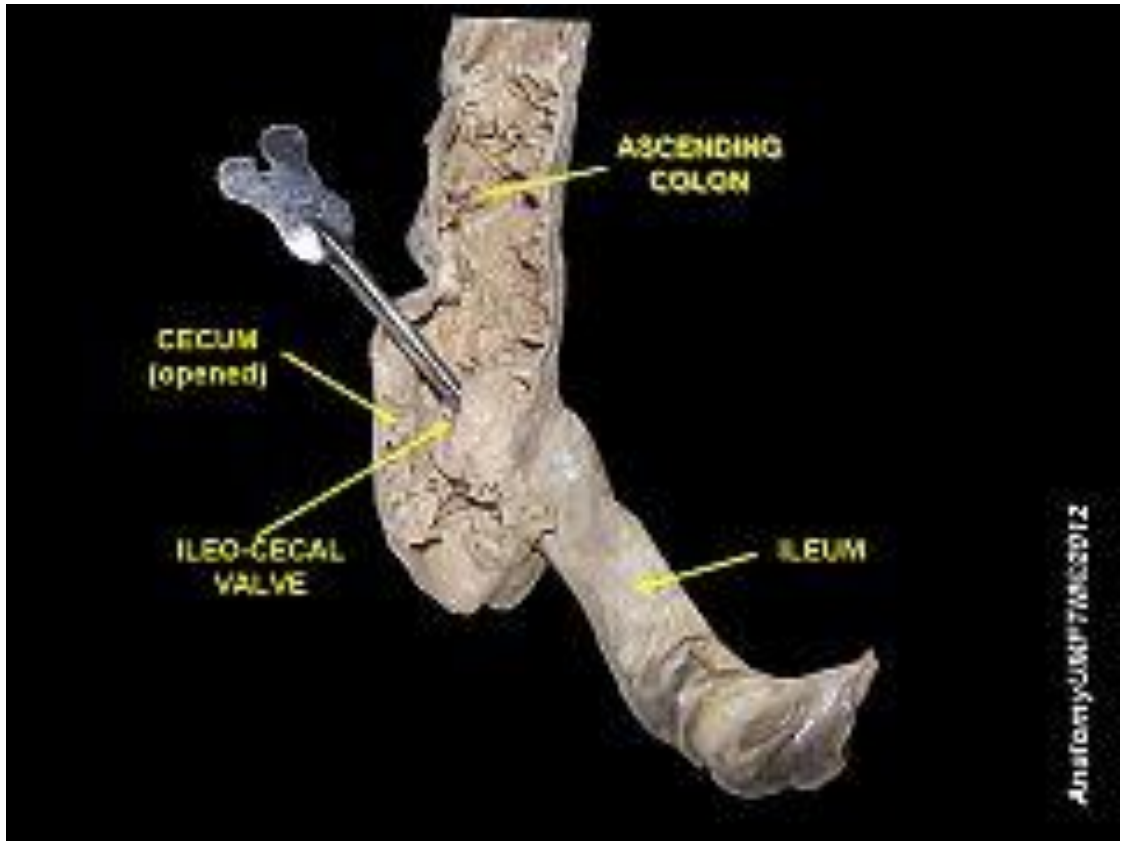
Internal anatomy of jejunum

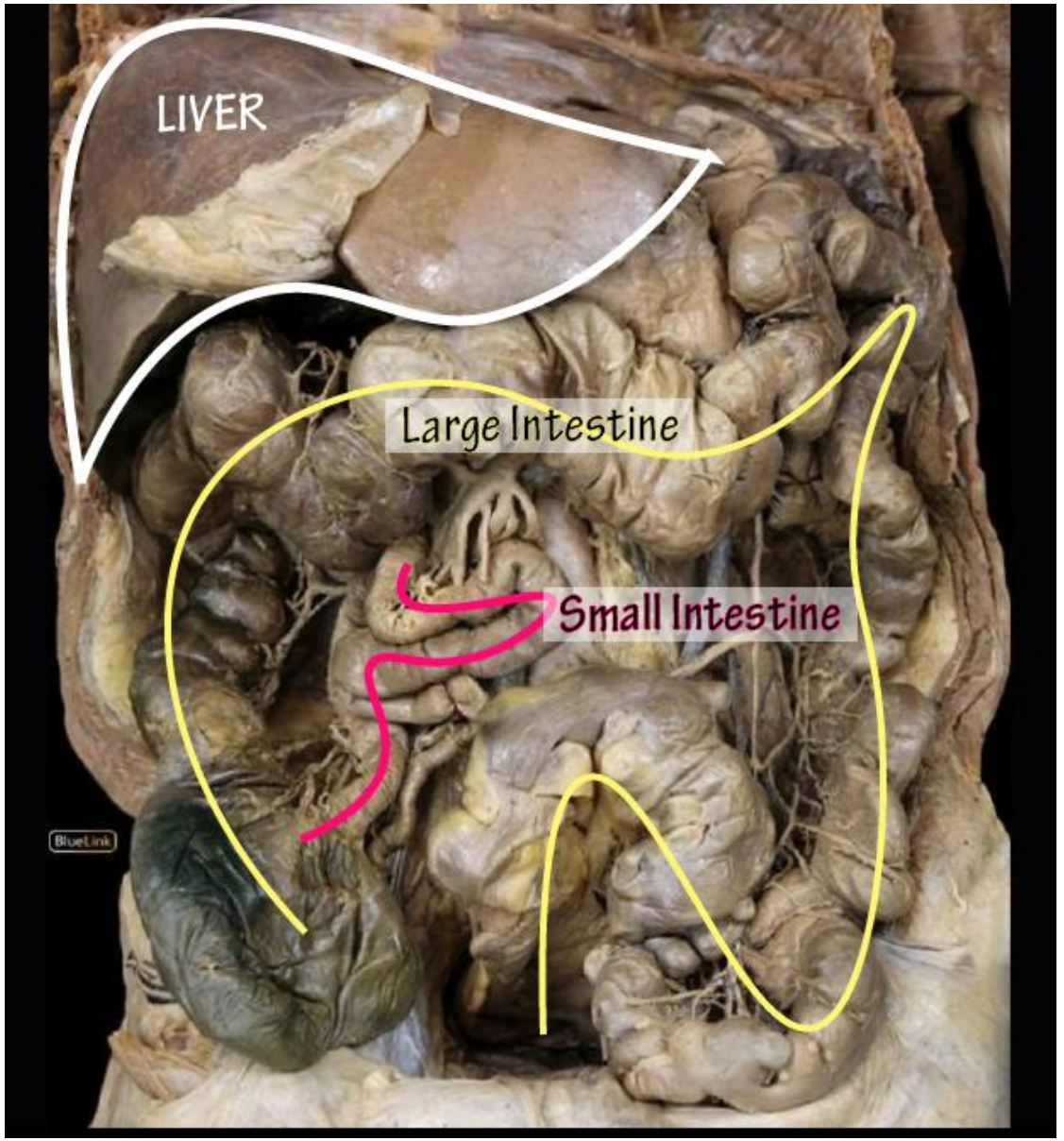
SMALL INTESTINE

Three subdivisions:

- **A. Duodenum** mixes chyme from stomach with exocrine secretions of pancreas & liver
- **B. Jejunum** (LUQ) most chemical digestion & nutrient absorption occurs here
- **C. Ileum** (RLQ) ends at the ileocecal valve, which controls the movement of intestinal contents into the cecum of the large intestine

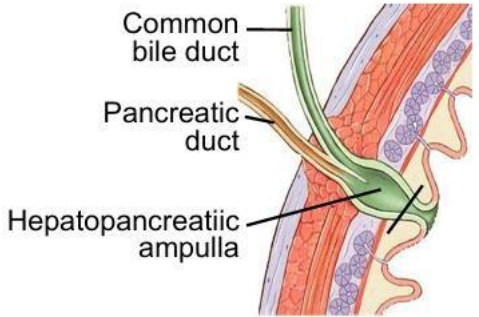


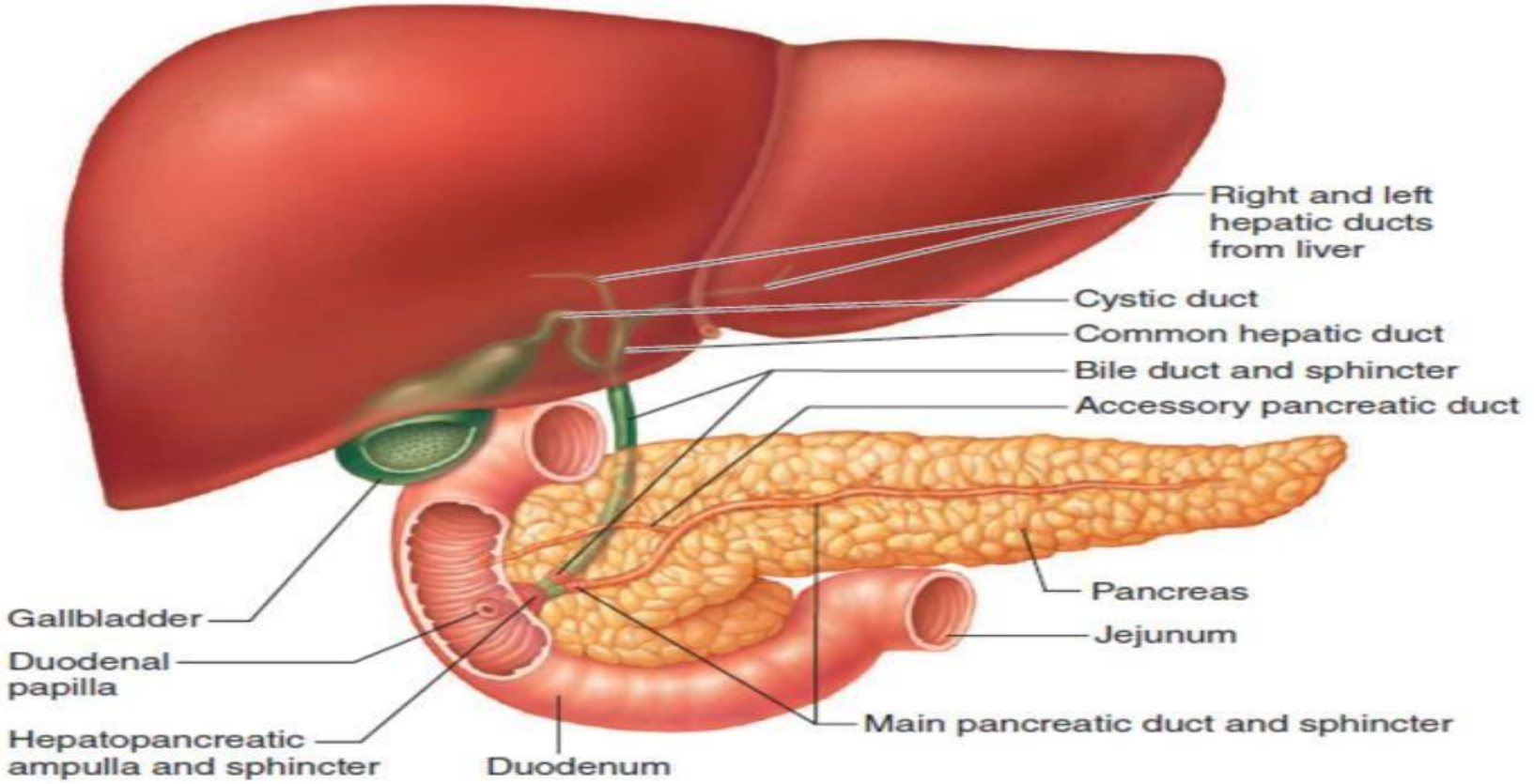

ASCENDING COLON
CECUM (opened)
ILEO-CECAL VALVE
ILEUM


LIVER
Large Intestine
Small Intestine
BlueLink

DUODENUM AND RELATED ORGANS

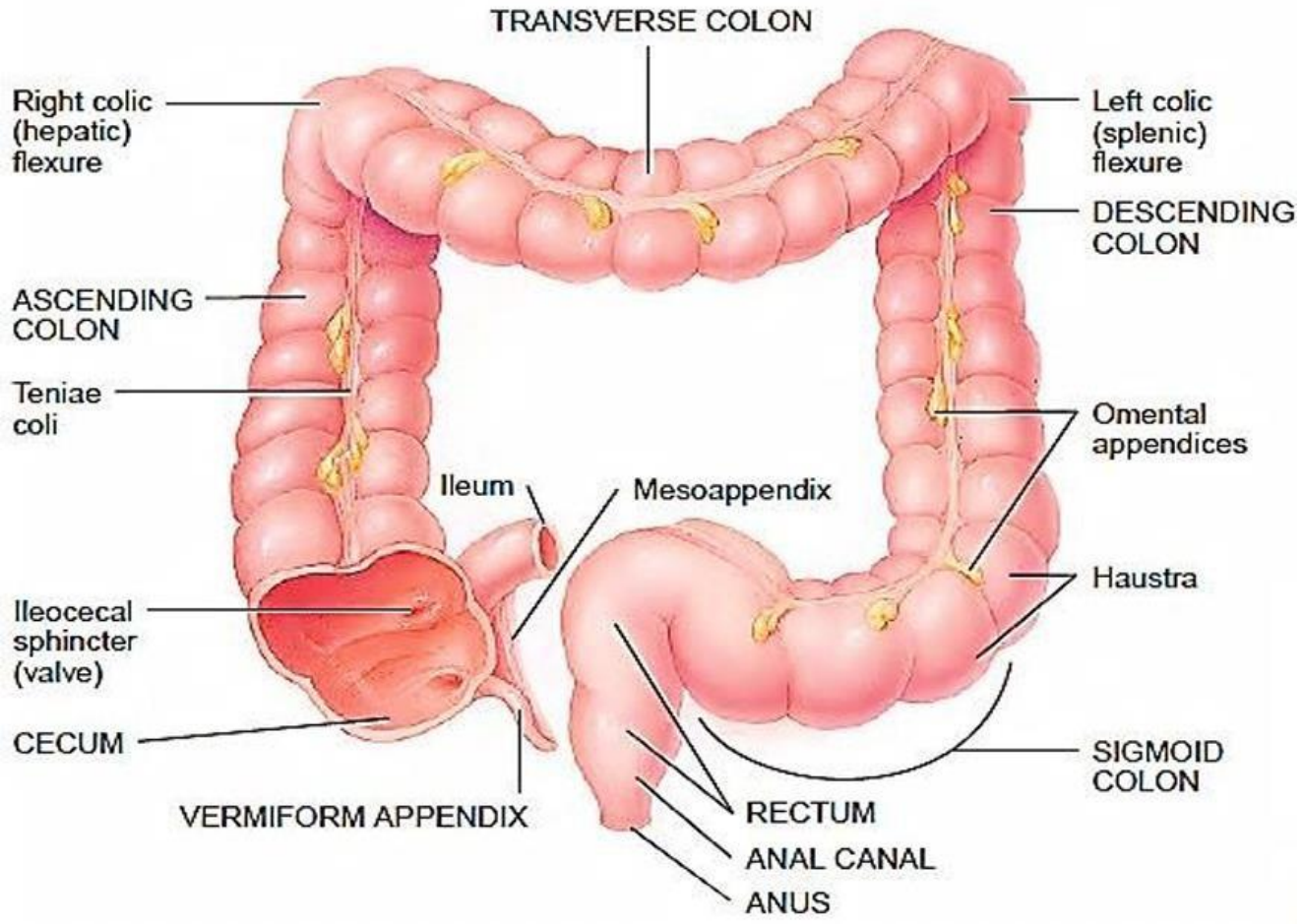
- Common bile duct and pancreatic duct form hepatopancreatic ampulla
- Ampulla opens into lumen of duodenum
- Opening is guarded by hepatopancreatic sphincter
- Secretion from the pancreas drained by pancreatic duct to the duodenal ampulla





LARGE INTESTINE

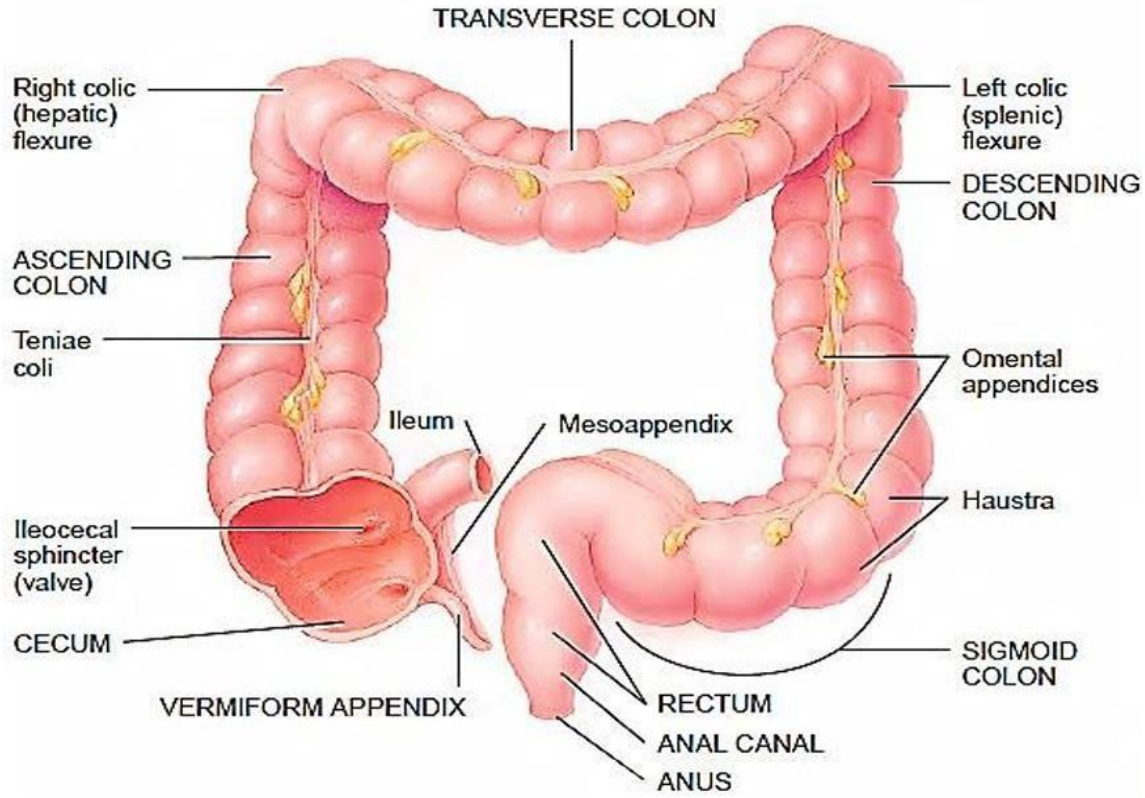
- The terminal portion of the GI tract
- Processes chyme through bacterial action
- Absorbs water, ions, and vitamins
- Forms and eliminates feces
- Length: 1.5 m; Diameter: 6.5 cm (consistent in living/cadavers)
- Extends from ileum to anus
- Four principal regions: Cecum → Colon → Rectum → Anal canal



LARGE INTESTINE

Regions/Subdivisions:

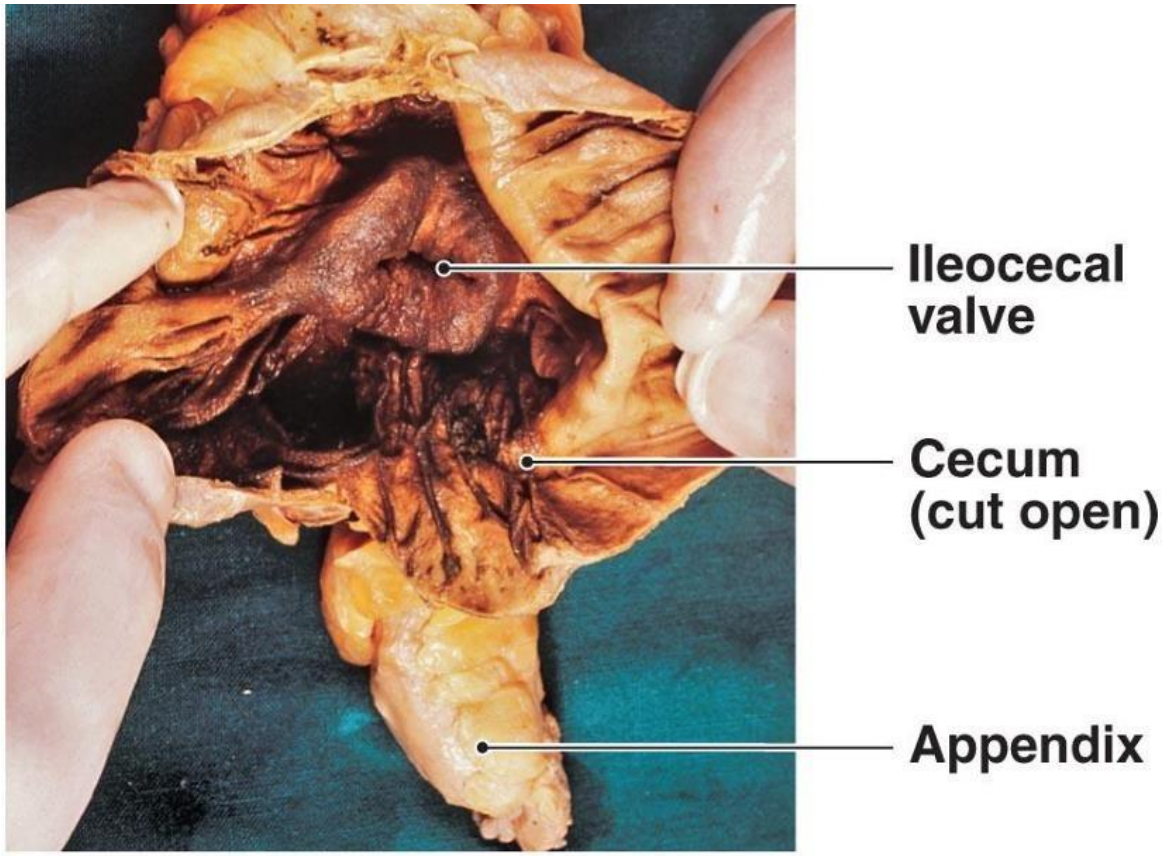
- **Cecum, appendix**
- **Colon:**
  1. Ascending colon
  2. Transverse colon
  3. Descending colon
  4. Sigmoid colon
- **Rectum**
  - Rectum: Anterior to the sacrum and coccyx
  - **Anal canal:** The terminal of the large intestine
  - Anus: The opening of the anal canal to the exterior



LARGE INTESTINE

Region	Description
Cecum	Small pouch (~6 cm long); Contains appendix
Ascending colon	Right abdominal side; Ends at hepatic flexure (liver inferior surface)
Transverse colon	Crosses abdomen leftward; Ends at splenic flexure (spleen inferior end)
Descending colon	Left side to iliac crest
Sigmoid colon	From iliac crest to midline; Terminates at rectum (S3 level)
Rectum	~15 cm long; Anterior to sacrum/coccyx
Anal canal	▪ Terminal 2-3 cm ▪ Longitudinal anal columns (mucosal folds) ▪ Contains arteries/veins ▪ Normally closed except during defecation ▪ Sphincters: 1. Internal (smooth muscle, involuntary) 2. External (skeletal muscle, voluntary)

APPENDIX



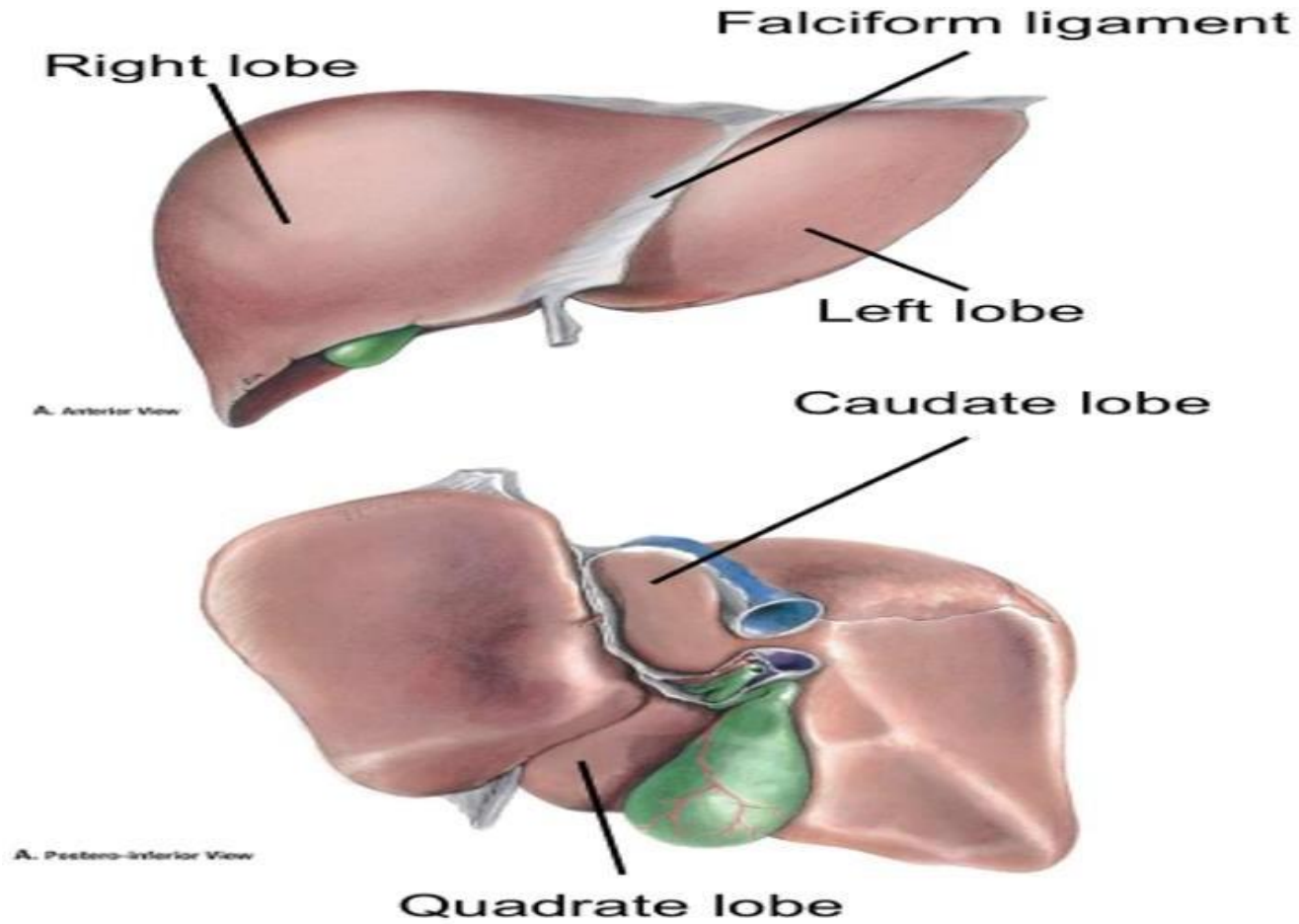
(b) Cecum and appendix

Clinical Relevance

- **Drug Delivery Routes:**
  - **Oral:** Jejunum = optimal absorption site
  - **Rectal:** Bypasses first-pass metabolism (e.g., suppositories for nausea)
- **Microbiome Interactions:**
  - Gut bacteria metabolize drugs (e.g., **sulfasalazine** activated in colon)
  - Antibiotics disrupt flora → diarrhea (probiotic counseling)
- **Motility Disorders:**
  - **Laxatives (osmotic/stimulant):** Target colon water absorption
  - **Antidiarrheals (loperamide):** Slow peristalsis

LIVER

- Largest internal** organ (~1.4 kg); Heaviest gland in the body
- Location: Primarily in RUQ and epigastric region; Inferior to the diaphragm
- Has four **lobes**

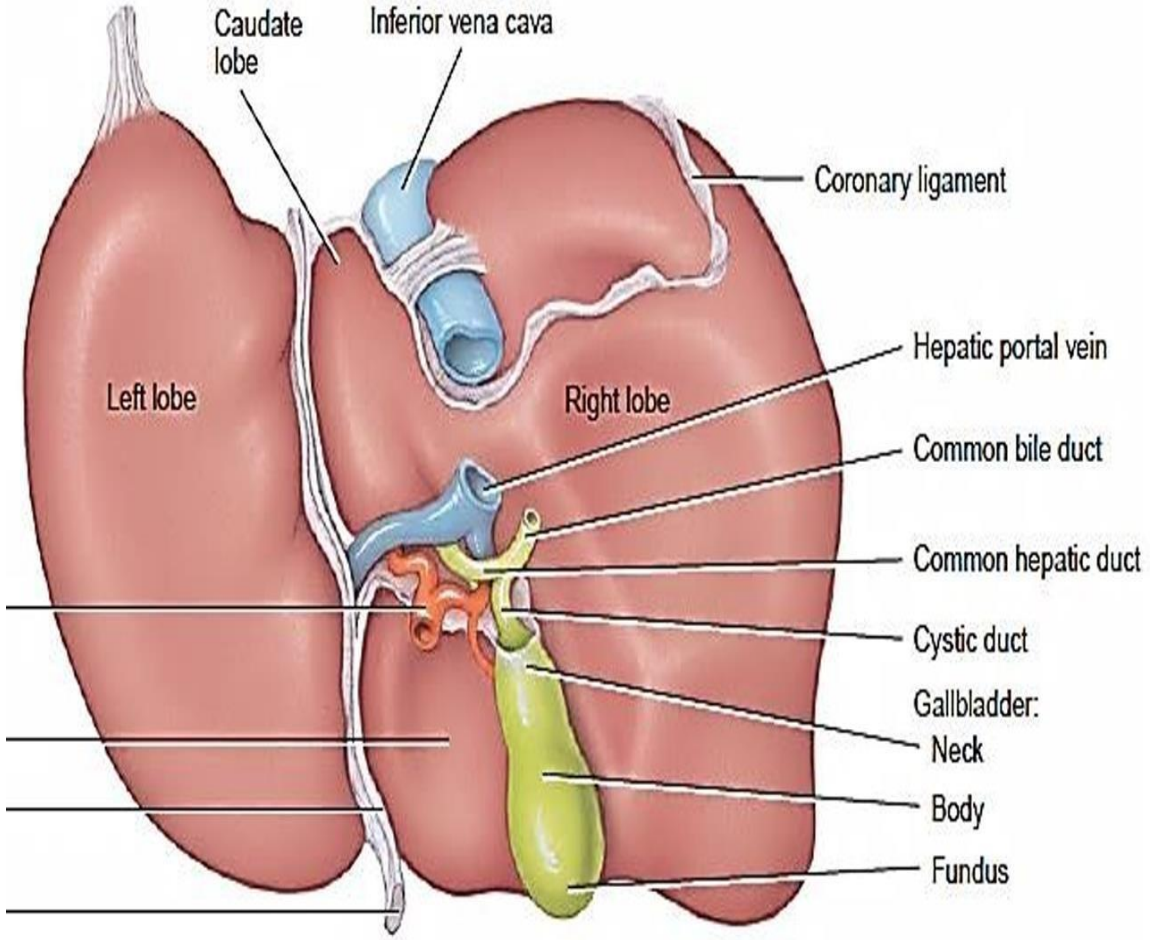


GALLBLADDER

- Pear-shaped sac (7–10 cm) on liver's inferior surface
- Parts:

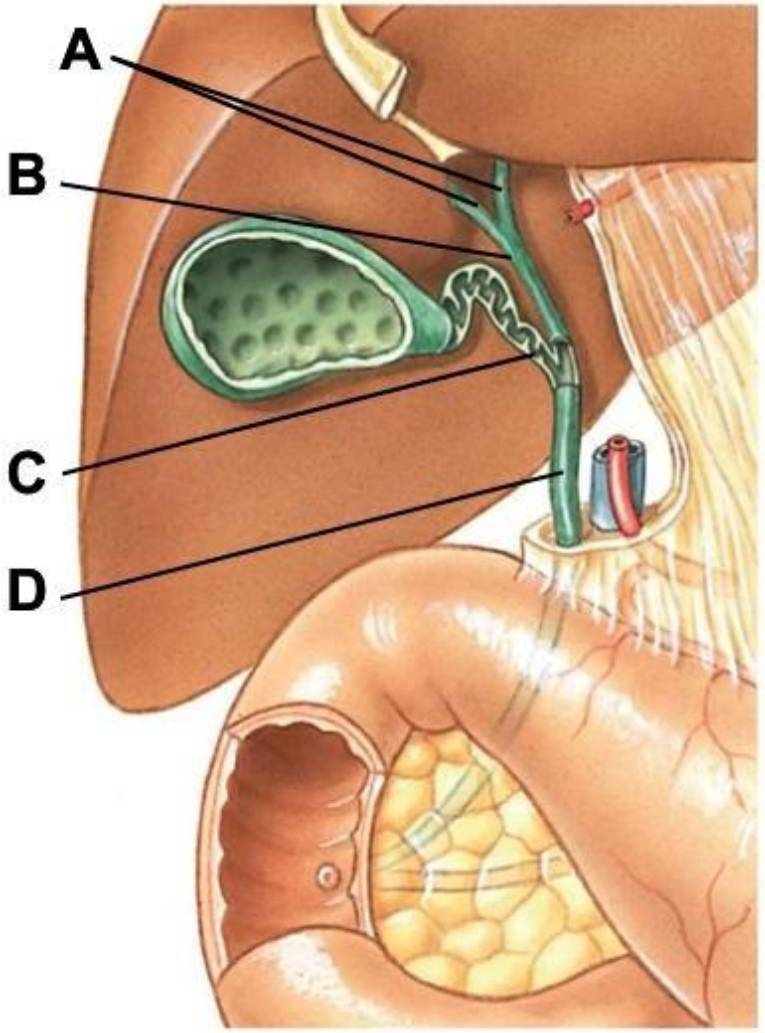
1. Fundus (projects below liver)
2. Body (central portion)
3. Neck (connects to cystic duct)

- Function: Stores/concentrates bile
- **Ducts:**
  - Common hepatic duct
  - Common bile duct (note: duodenum)
  - Cystic duct



GALLBLADDER

- Bile ducts within the liver coalesce to form R, L hepatic ducts (A)
- These join, forming the common hepatic duct (B)
- It unites with the cystic duct (C), the duct of the gallbladder to form the common bile duct (D)

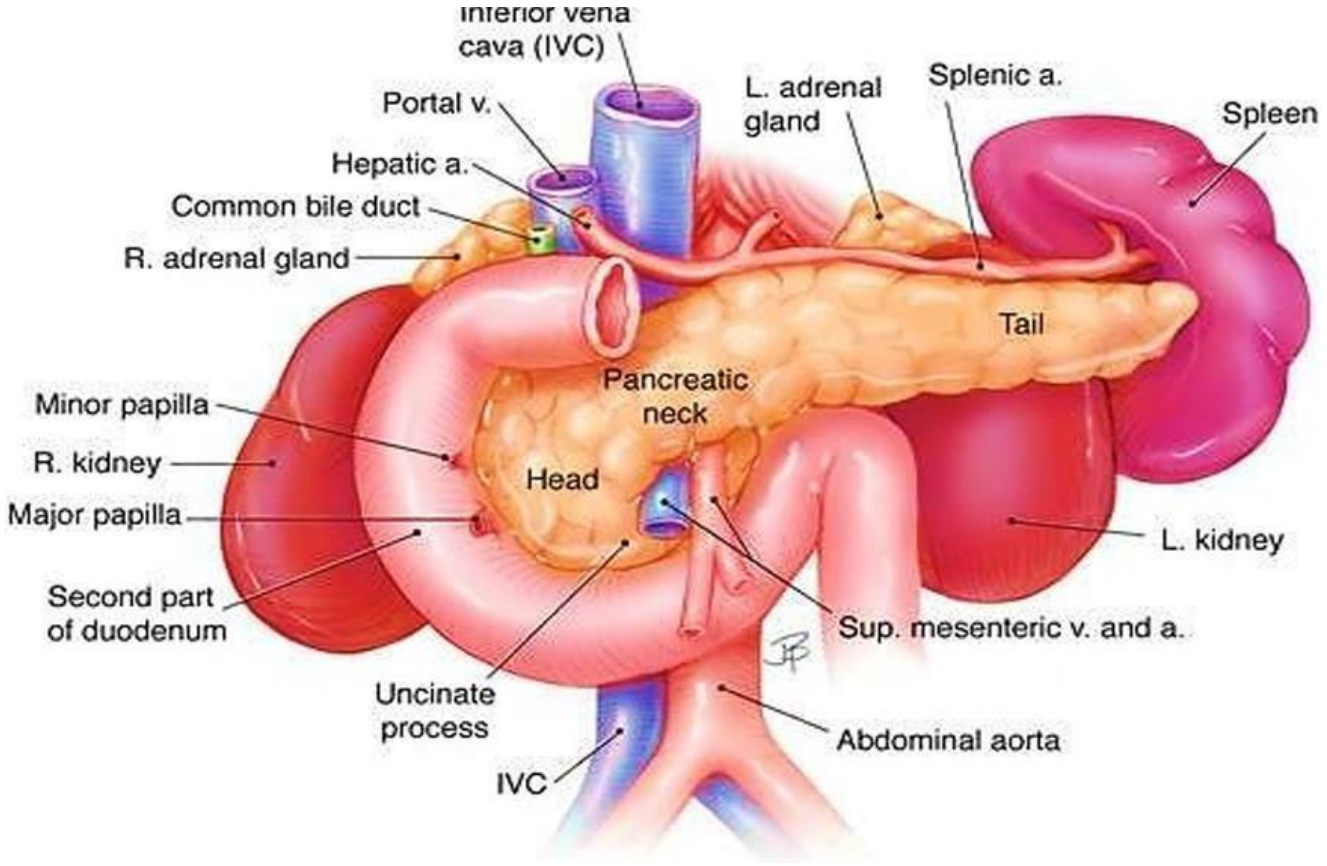


PANCREAS

- Location & Size:
  - Retroperitoneal gland
  - 12-15 cm long, 2.5 cm thick
  - Lies posterior to stomach's greater curvature
- Function:

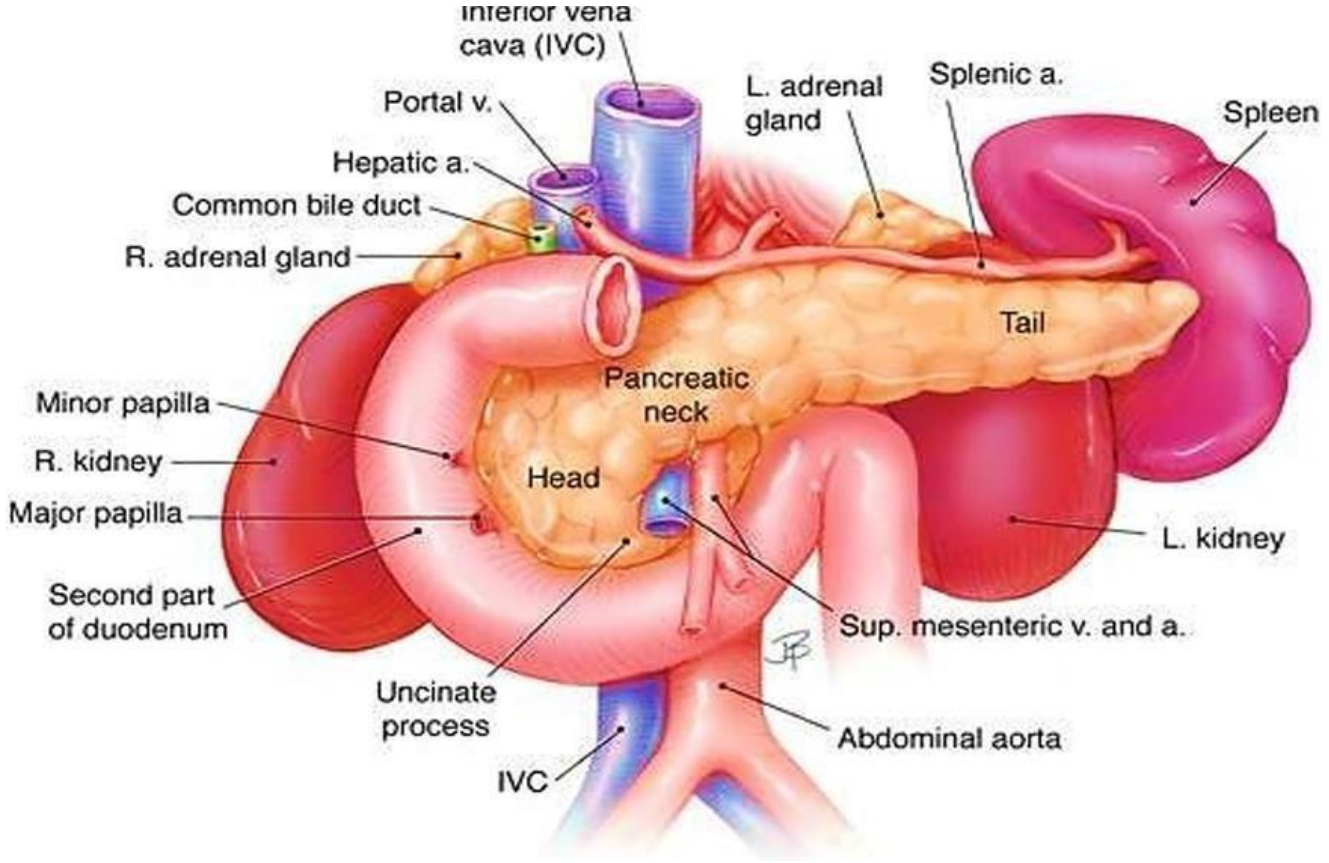
1. Exocrine: Digestive enzymes (e.g., lipase)
2. Endocrine: Insulin/glucagon (islets of Langerhans)

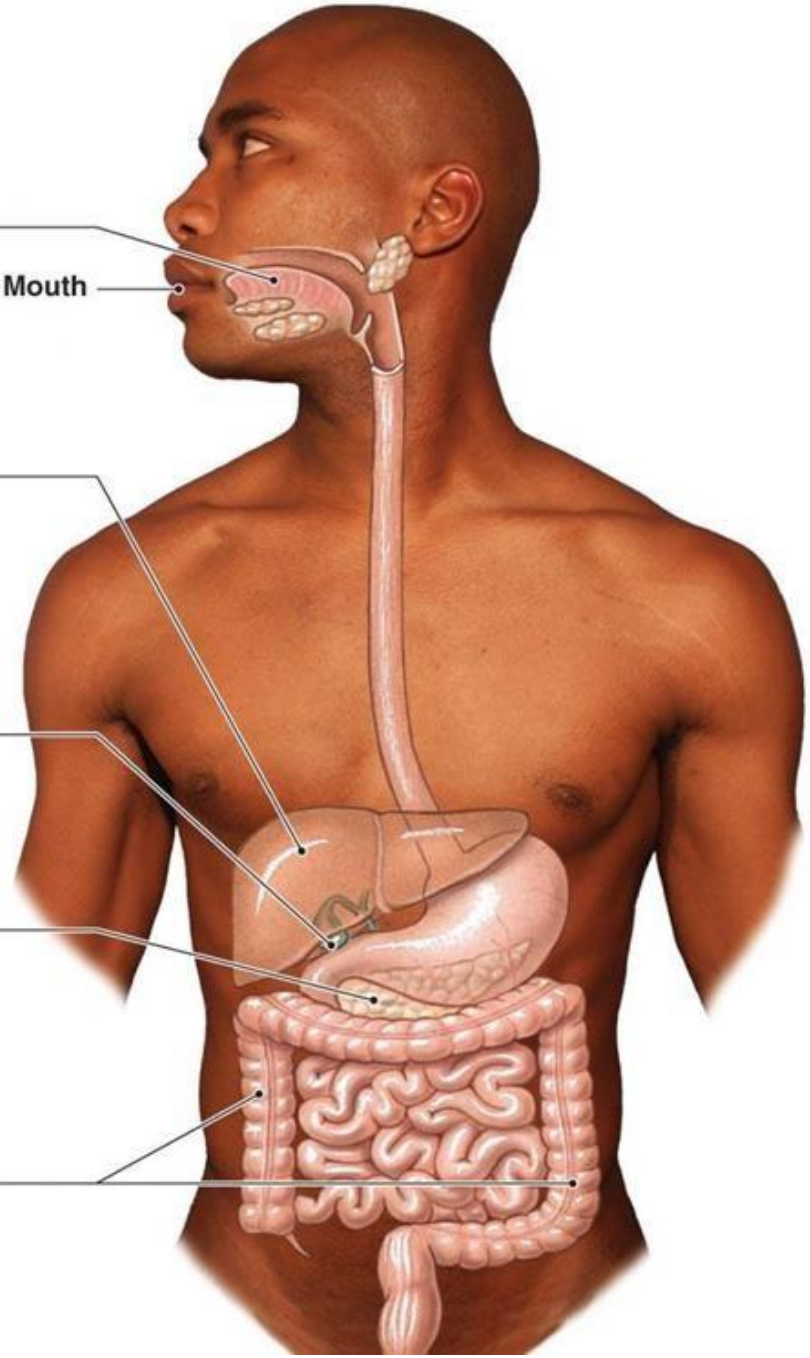
- **Components:**
  1. **Head**
  2. **Body**
  3. **Tail**



PANCREAS

1. **Head:**
   - Disc-shaped expanded portion
   - Enclosed by duodenal curve
   - Features:
     - **Uncinate process** (hook-like projection)
       - Arches behind superior mesenteric artery/vein
       - Encircles vessels with pancreatic tissue
2. **Body:** Central portion; Located superior and left of head
3. **Tail:** Tapering end; Extends leftward from body





ORAL CAVITY, TEETH, TONGUE

Mechanical processing, moistening, mixing with salivary secretions

LIVER

Secretion of bile (important for lipid digestion), storage of nutrients, many other vital functions

GALLBLADDER

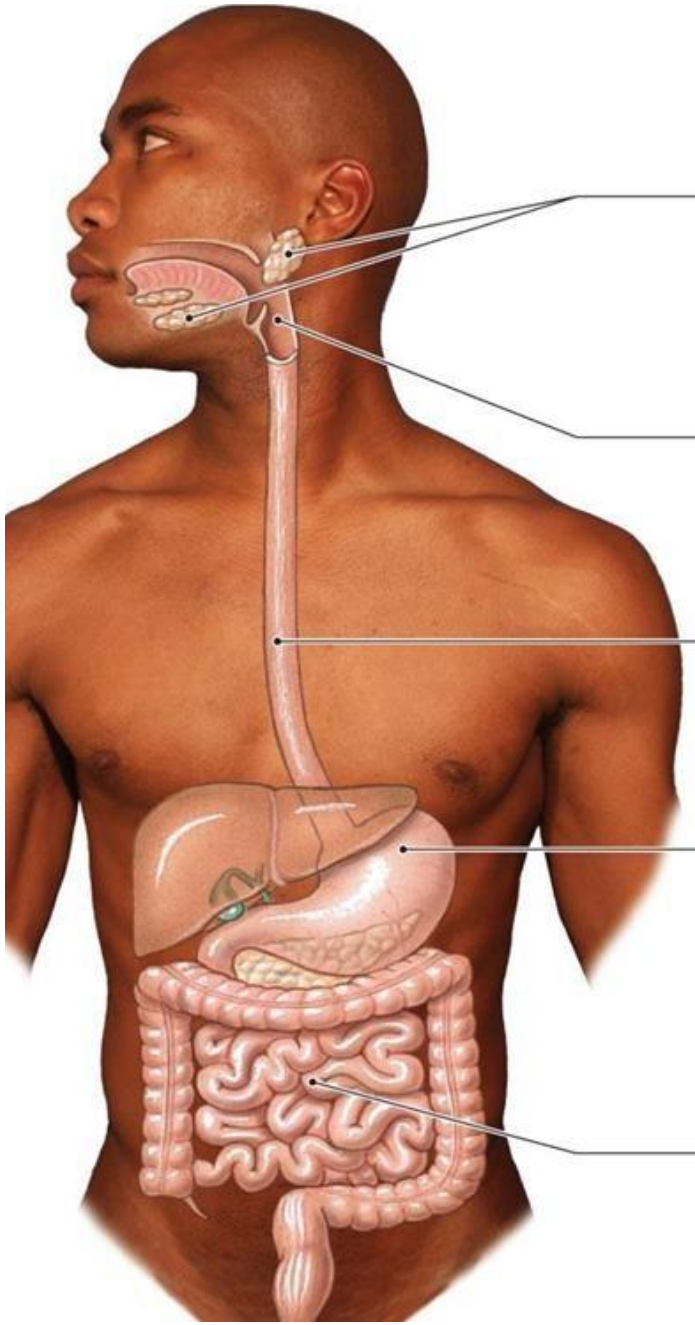
Storage and concentration of bile

PANCREAS

Exocrine cells secrete buffers and digestive enzymes; endocrine cells secrete hormones

LARGE INTESTINE

Dehydration and compaction of indigestible materials in preparation for elimination



SALIVARY GLANDS

Secretion of lubricating fluid containing enzymes that break down carbohydrates

PHARYNX

Muscular propulsion of materials into the esophagus

ESOPHAGUS

Transport of materials to the stomach

STOMACH

Chemical breakdown of materials via acid and enzymes; mechanical processing through muscular contractions

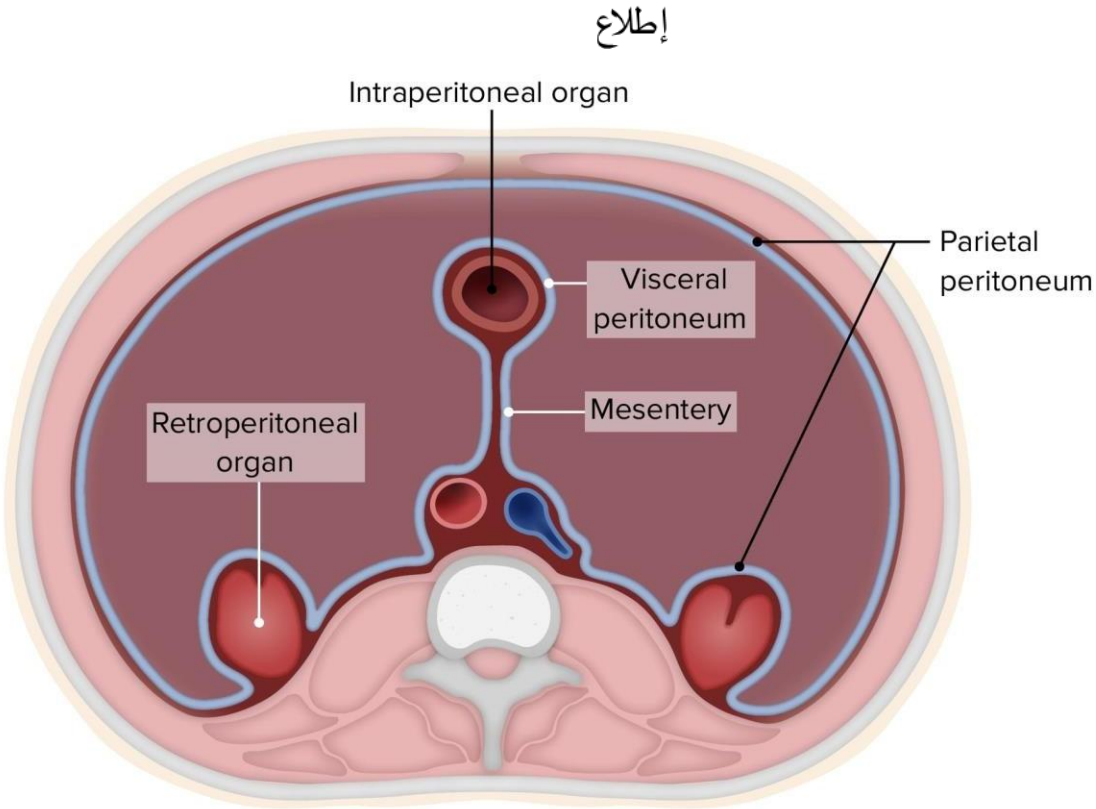
SMALL INTESTINE

Enzymatic digestion and absorption of water, organic substrates, vitamins, and ions

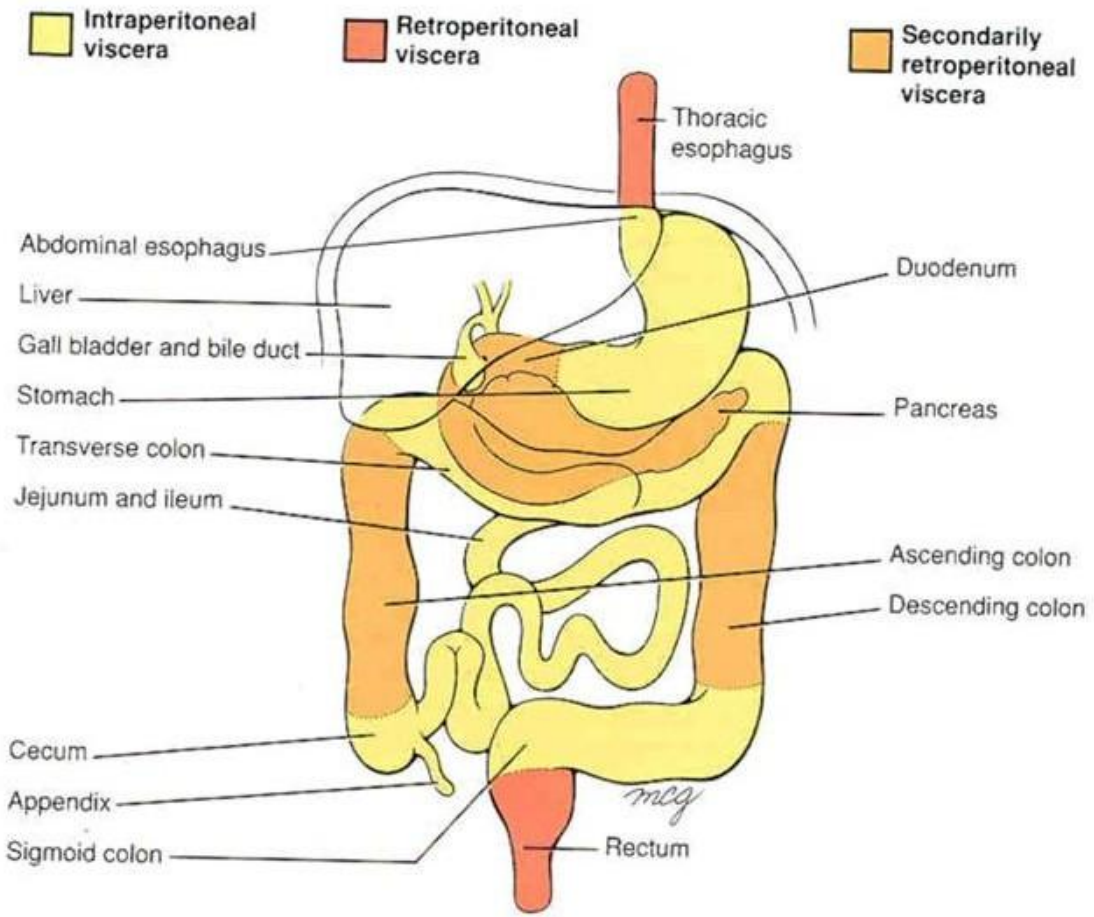
THANK YOU

SOME BASIC TERMS

- Mesentery is a double fold of the peritoneum
- Retroperitoneal Organ:
  - Incompletely surrounded by peritoneum
  - Does not have a mesentery
  - Fixed to the posterior abdominal wall
- Intraperitoneal Organ:
  - Surrounded by the visceral peritoneum
  - Attached to the wall by a mesentery
  - Mobile



SUMMARY: POSITION OF ABDOMINAL ORGANS



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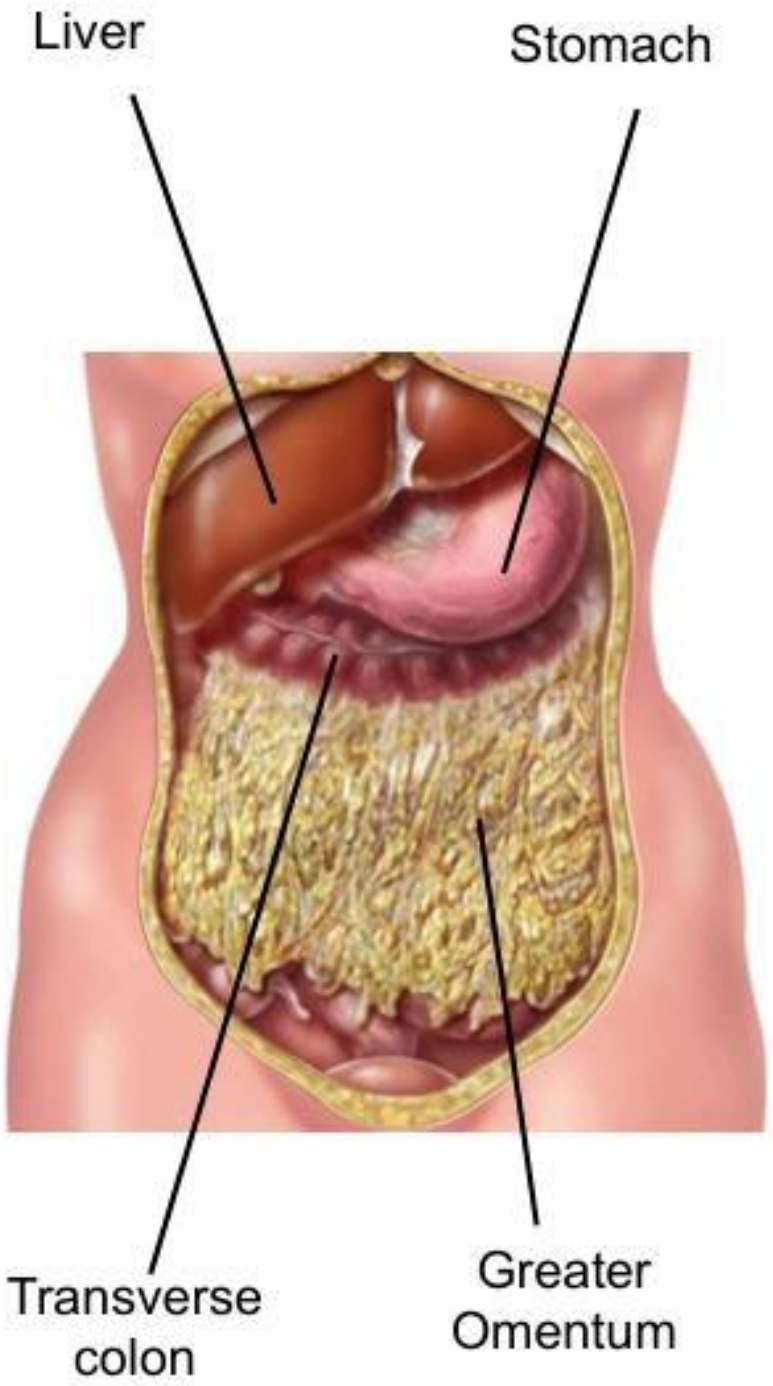

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