The State Medical and Pharmaceutical

University "Nicolae Testemiţanu"

General Splanhnology-Viscera

Functional Anatomy of the Digestive System

Department of Human Anatomy

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Plan

- Viscera
- Digestive System

- Locomotor apparatus – movement
- Internal organs - supply the locomotor apparatus

CLASSIFICATION OF THE INTERNAL ORGANS

According to functional point of view the viscera are divided into systems of organs and apparatuses.

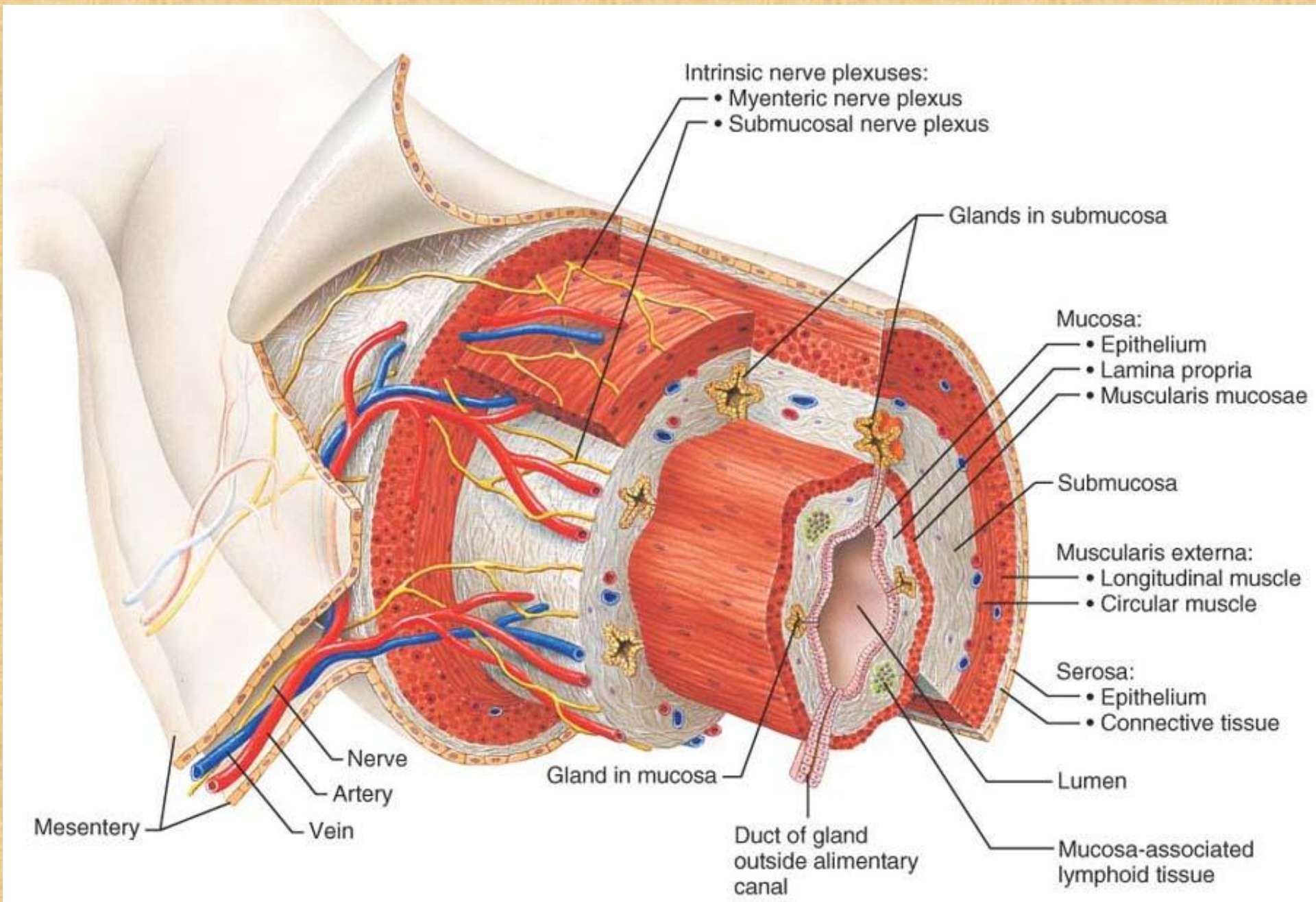
- **Digestive system (**energy, nutrients for growing up **)** /the mouth, esophagus, gastrointestinal tract, liver and pancreas and salivary glands/;
- **Respiratory system** (exchange of gases O2 to support burning)/(the nose, airways, larynx and lungs);
- **Urogenital system** (excretion also skin)(the urinary and genital or reproductive organs) – (multiplication);
- **Controlling system Endocrine and Nervous systems** (the ductless glands and cells which produce hormones);
- **Circulatory system** (the heart and blood and lymph vessels);
- **Defense system** (the blood, lymphatics and bone marrow);

The organs are divided into **tubular (hollow)** and **parenchymatous organs.**

Cavitary organs have a common tubular structure;

The wall of the cavitary organs consist of few layers:

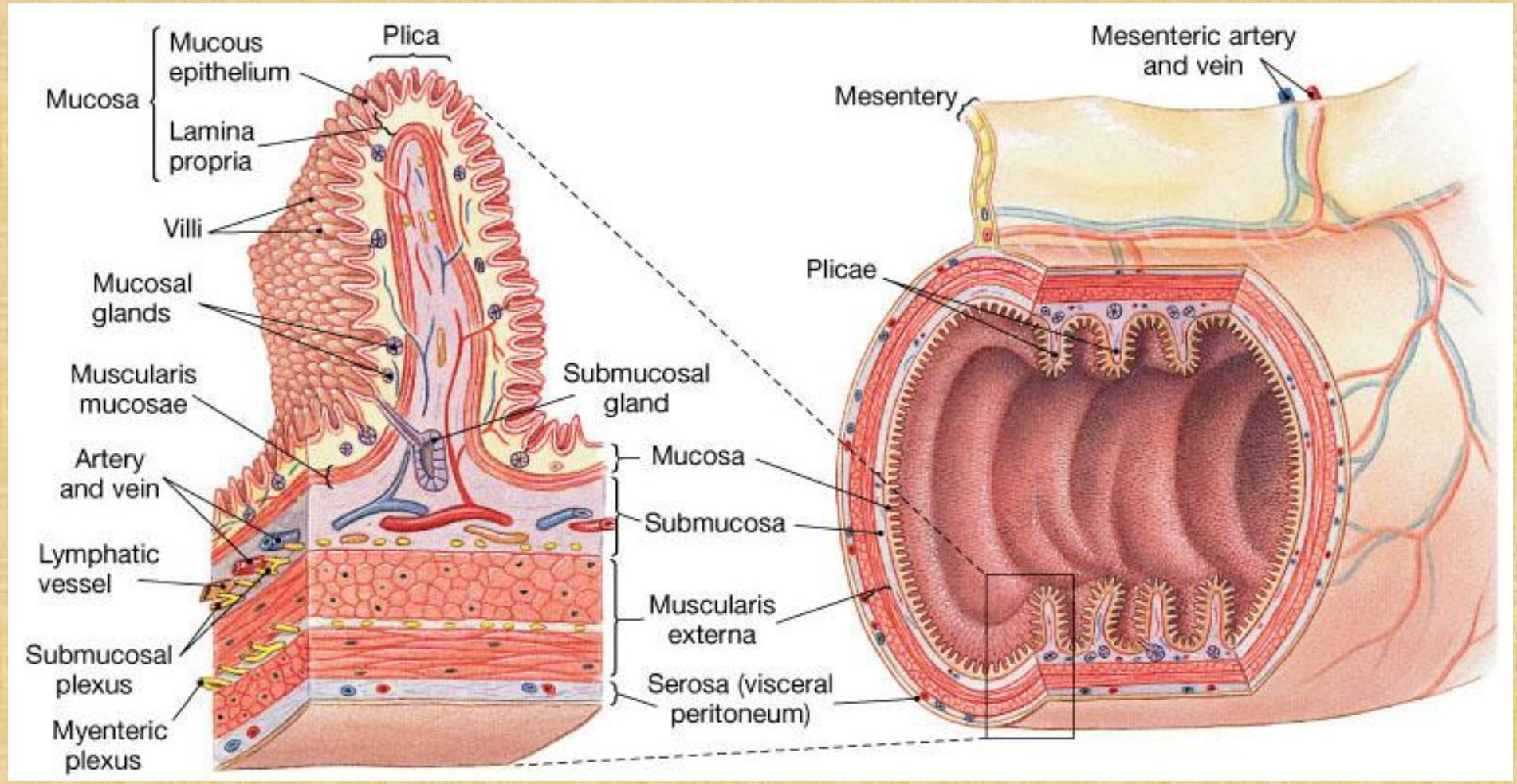
- **The mucous coat** (tunica mucosa)
- **The submucous layer** (tela submucosa)
- **The muscular coat** (tunica muscularis)
- **The serous coat** (tunica serosa), or the **adventitious coat** (tunica adventitia)

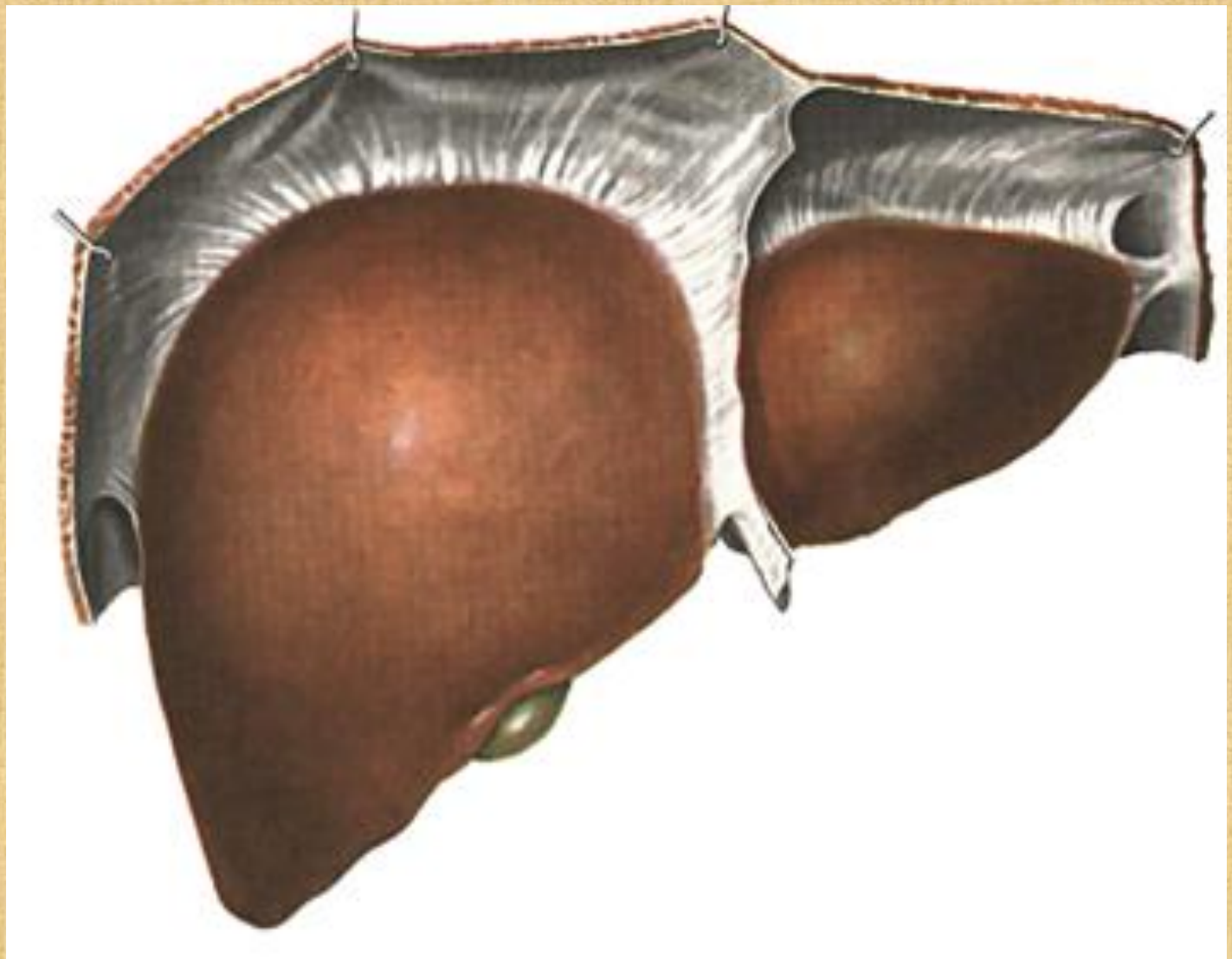

Intrinsic nerve plexuses:
• Myenteric nerve plexus
• Submucosal nerve plexus
Glands in submucosa
Mucosa:
• Epithelium
• Lamina propria
• Muscularis mucosae
Submucosa
Muscularis externa:
• Longitudinal muscle
• Circular muscle
Serosa:
• Epithelium
• Connective tissue
Lumen
Mucosa-associated lymphoid tissue
Duct of gland outside alimentary canal
Gland in mucosa
Nerve
Artery
Vein
Mesentery

The **parenchymatous organs** consist of **parenchyma** and **stroma**.

- The *parenchyma*, which is formed from specific elements, that assure the function of organs;
- The *stroma*, which has a connective tissue origin sustains the parenchyma and leads the vessels and nerves.

The Structure of the Digestive Tract



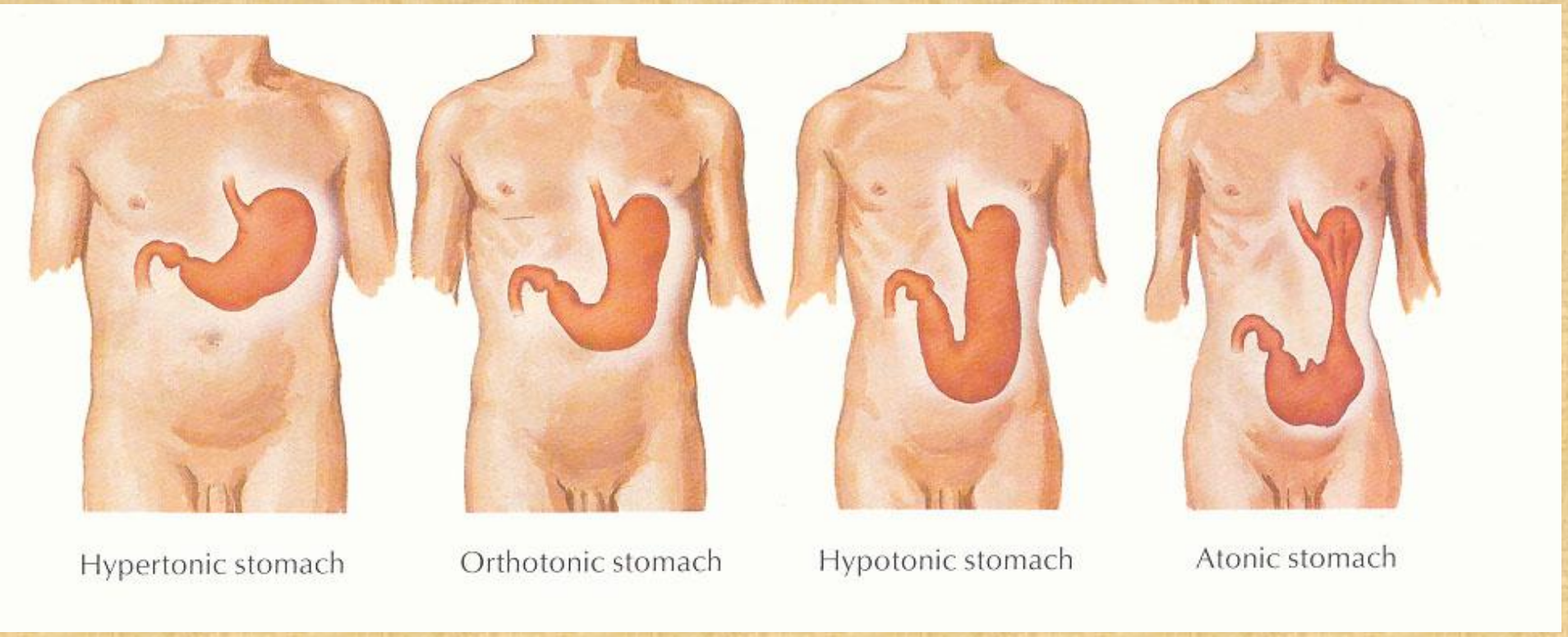


- ***Classification of the viscera dependent on their development, topography, structure, and functions***
-
- ***a) According to the development organs are divided into:***
- I. Organs derived from **endoderm**
- II. Organs derived from **somatic mesoderm**
- III. Organs derived from **ectoderm**

- ***b) According to the topographical principle organs are divided into:***
- I. Organs of the head
- II. Organs of the neck
- III. Organs of the thoracic cavity
- IV. Organs of the abdominal cavity
- V. Organs of the pelvis.

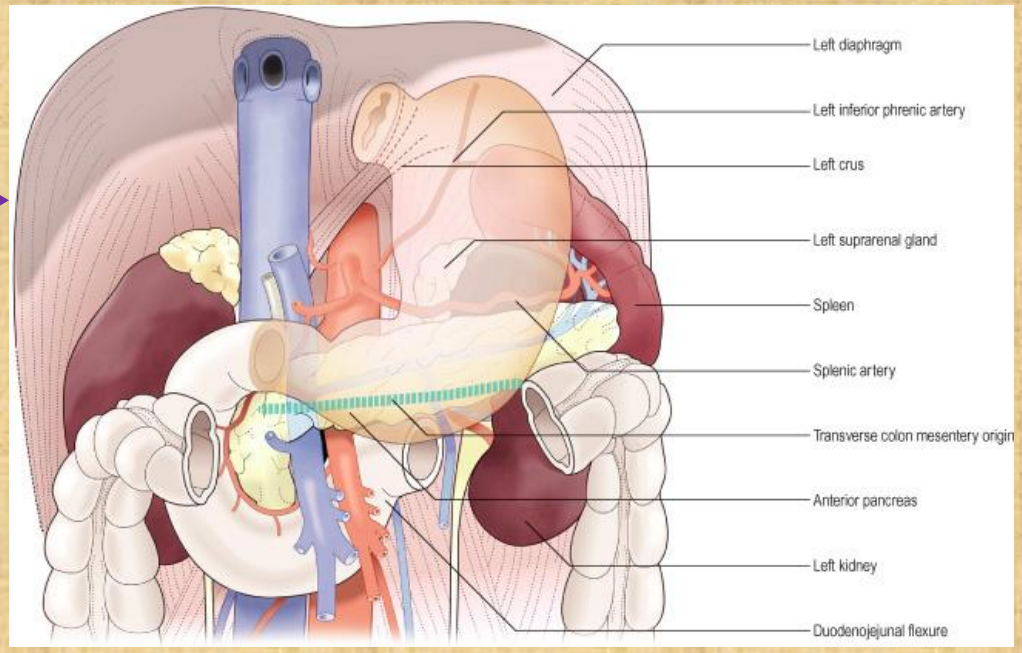
Viscera and constitutional types of the human body

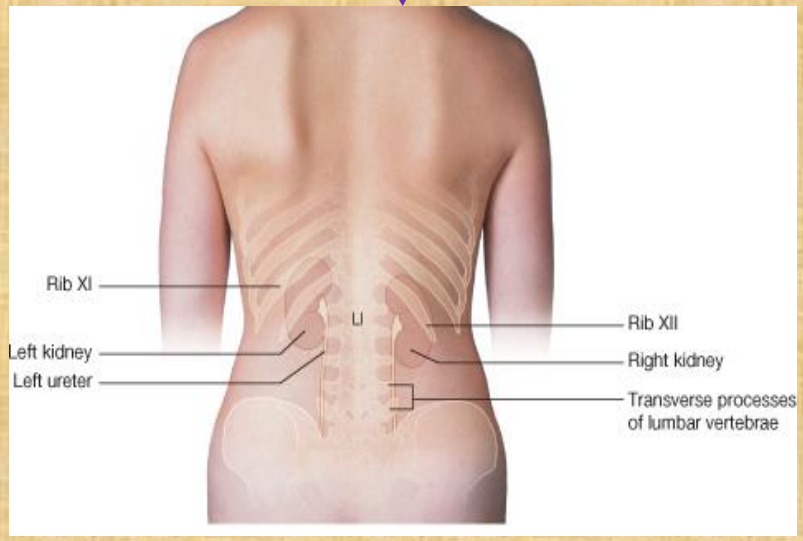
- The size, shape and position of the organs and vessels depend on constitutional type.
- In **asthenics** the viscera are smaller and have a lower position as they were ptotic. The lungs are longer, because the thoracic cage is longer. The heart has a vertical position and the aorta is narrow. The stomach has almost a vertical position as well as the loops of the small intestine. The liver, spleen and the pancreas and the kidney are small.
- In **hypersthenics** the heart is relatively large and has almost a horizontal position and the aorta is large. The lungs are short. The stomach has a transverse position as well as the loops of the small intestine. The liver, spleen and the pancreas and the kidney are large.
- The **normosthenic** type is an intermediate between the hypersthenic and asthenic type, and the organs have an intermediate position according to the characteristics accounted above.

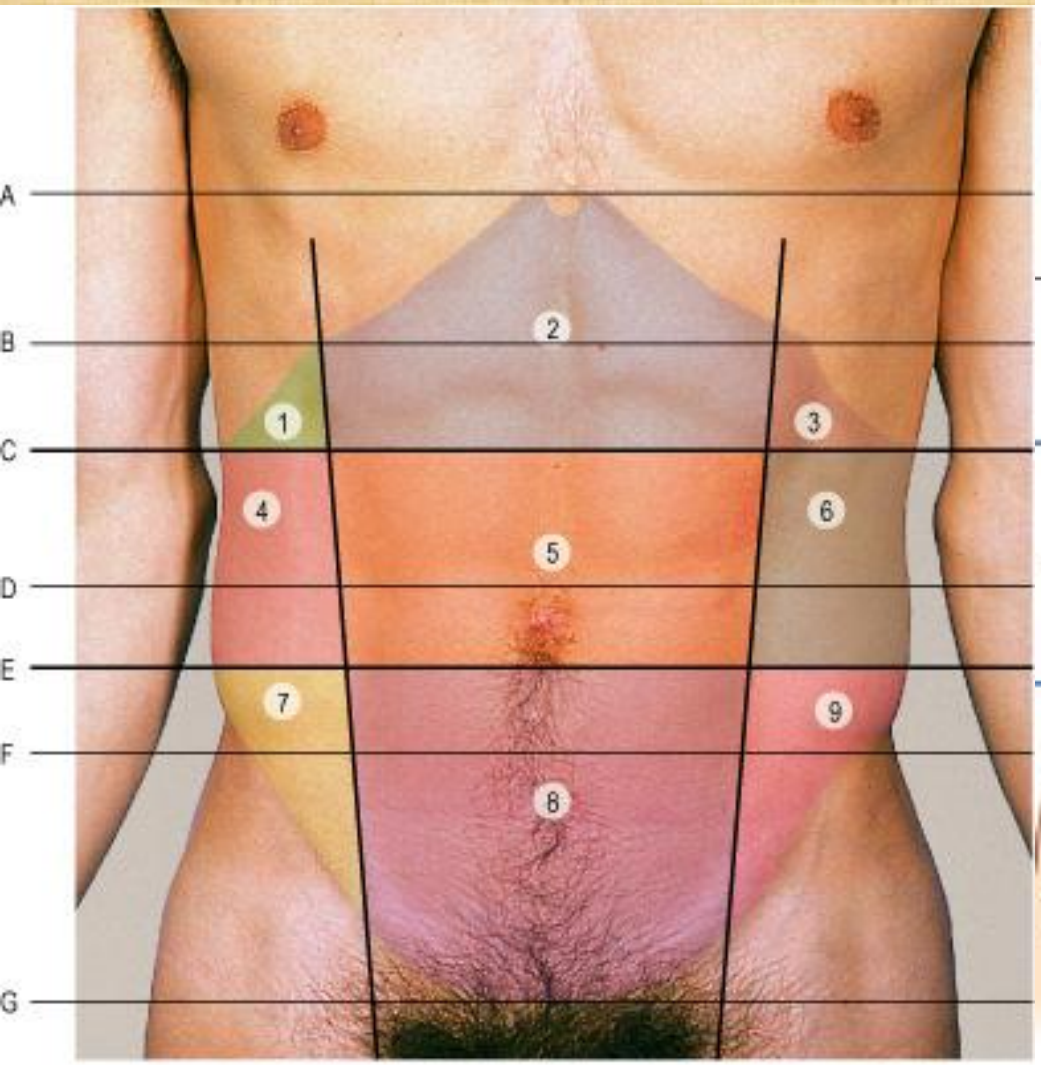

Hypertonic stomach
Orthotonic stomach
Hypotonic stomach
Atonic stomach

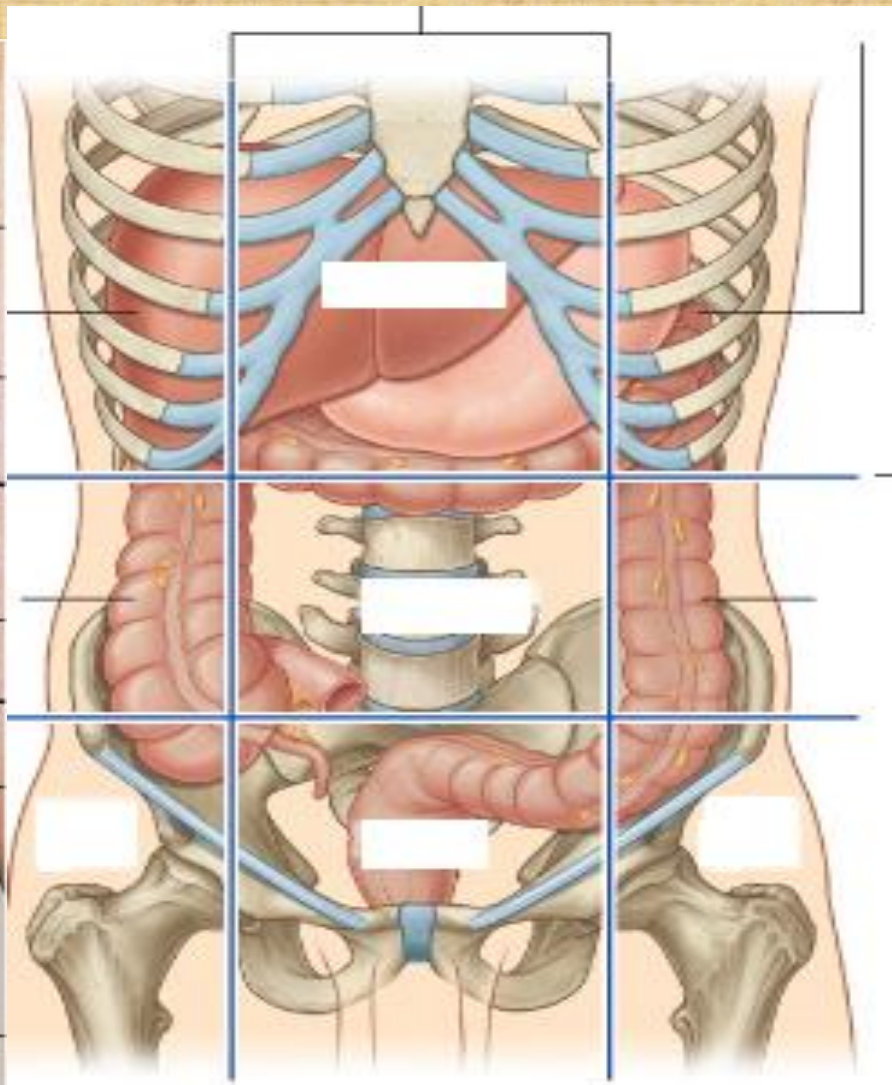
Topography

- Syntopy
- Skeletotopy
- Holotopy



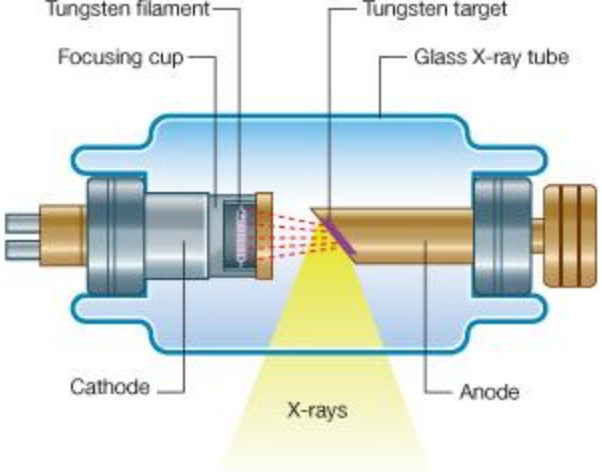


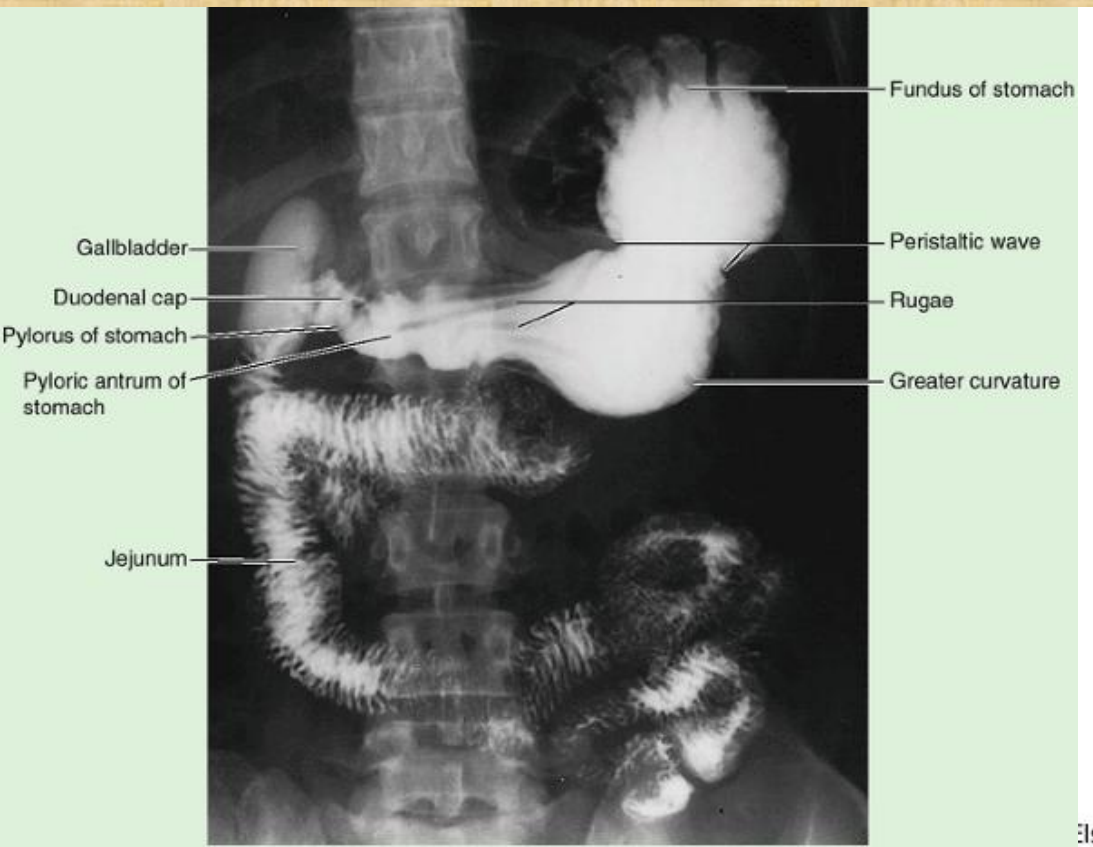


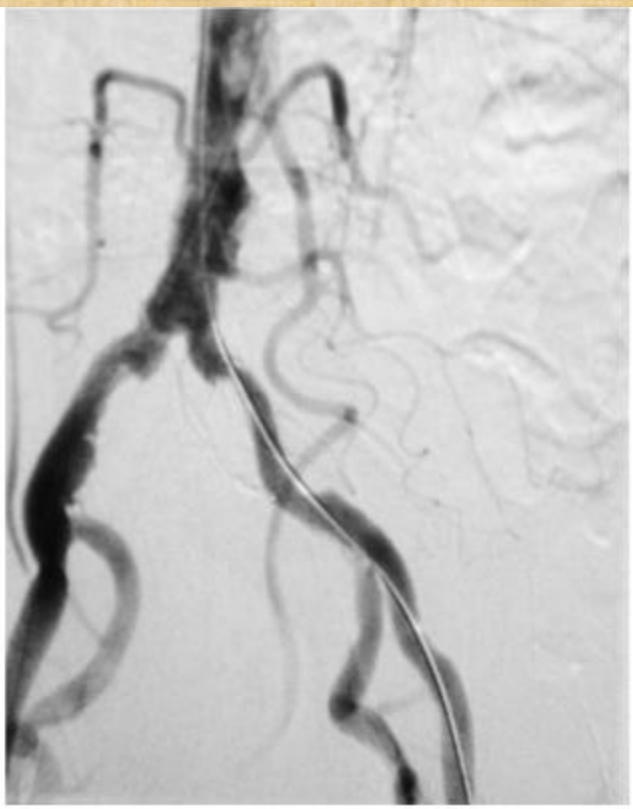


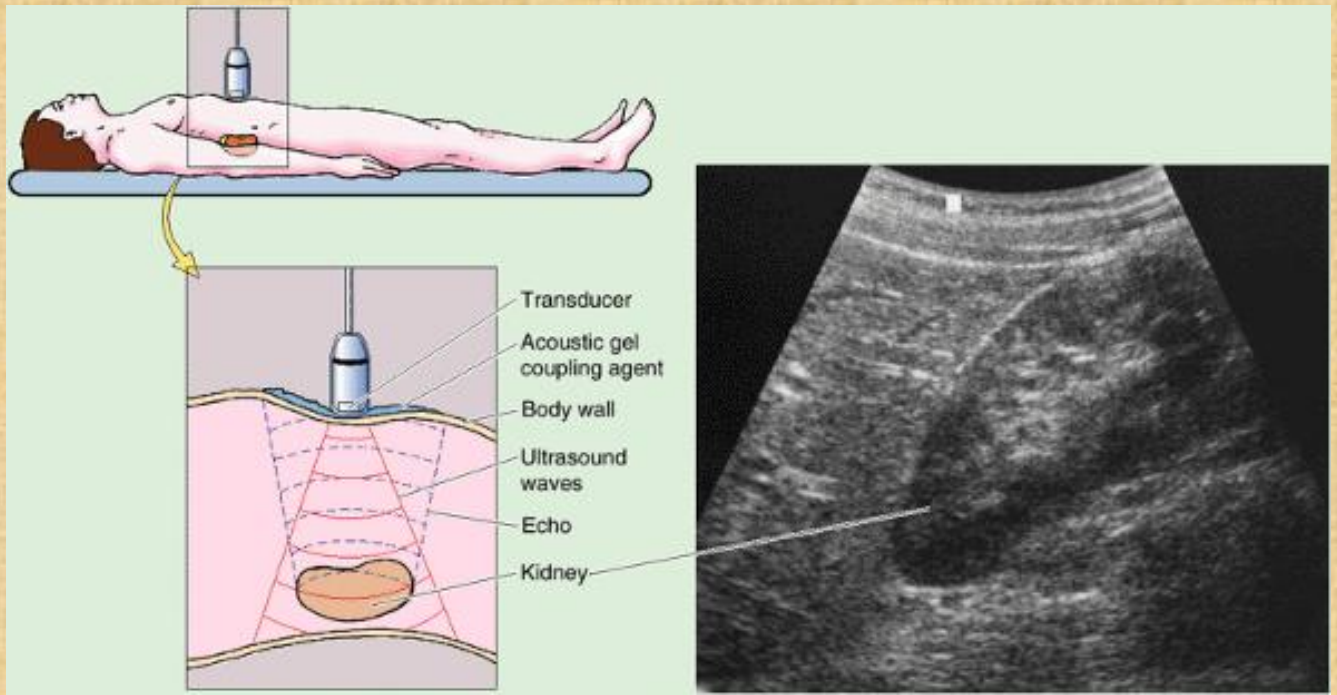
Key for planes:
A. Xiphisternal plane. **B.** Transpyloric plane. **C.** Subcostal plane. **D.** Supracristal plane. **E.** Transtubercular plane. **F.** Interspinous plane. **G.** Pubic crest plane.

Key for nine regions of the abdomen:
1. Right hypochondrium. **2.** Epigastric. **3.** Left hypochondrium. **4.** Right lumbar. **5.** Central/umbilical. **6.** Left lumbar. **7.** Right iliac fossa. **8.** Suprapubic/hypogastrium. **9.** Left iliac fossa.

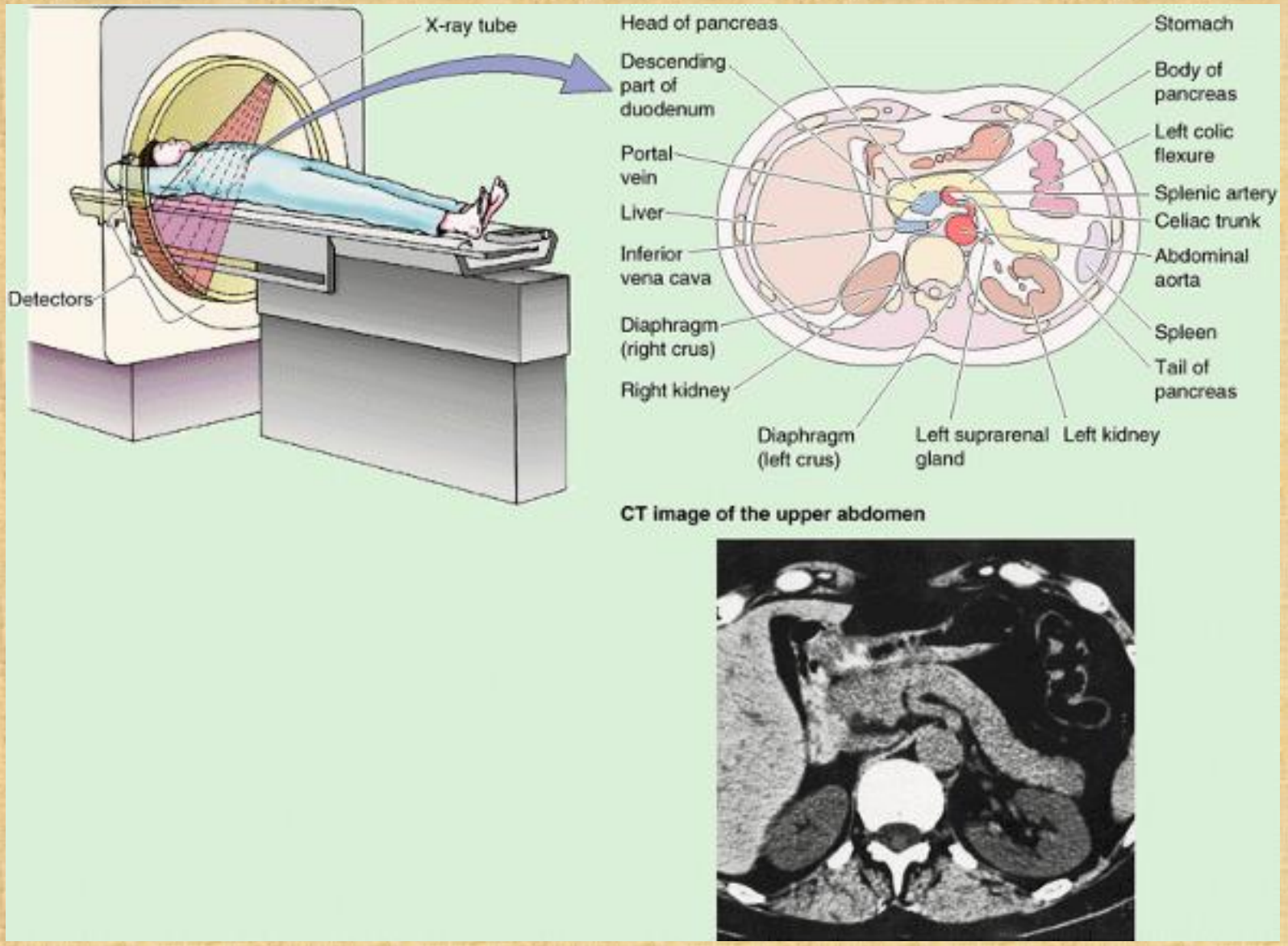


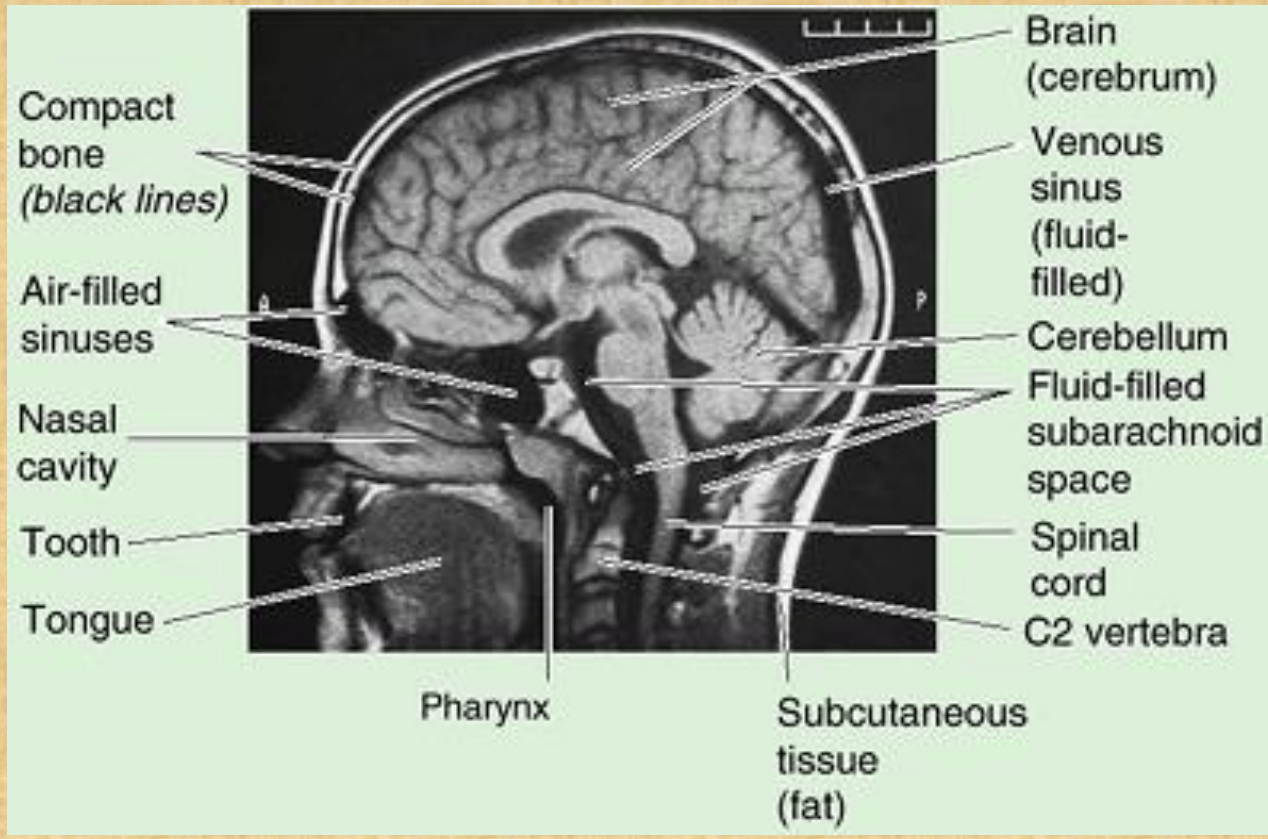






Examination on alive person

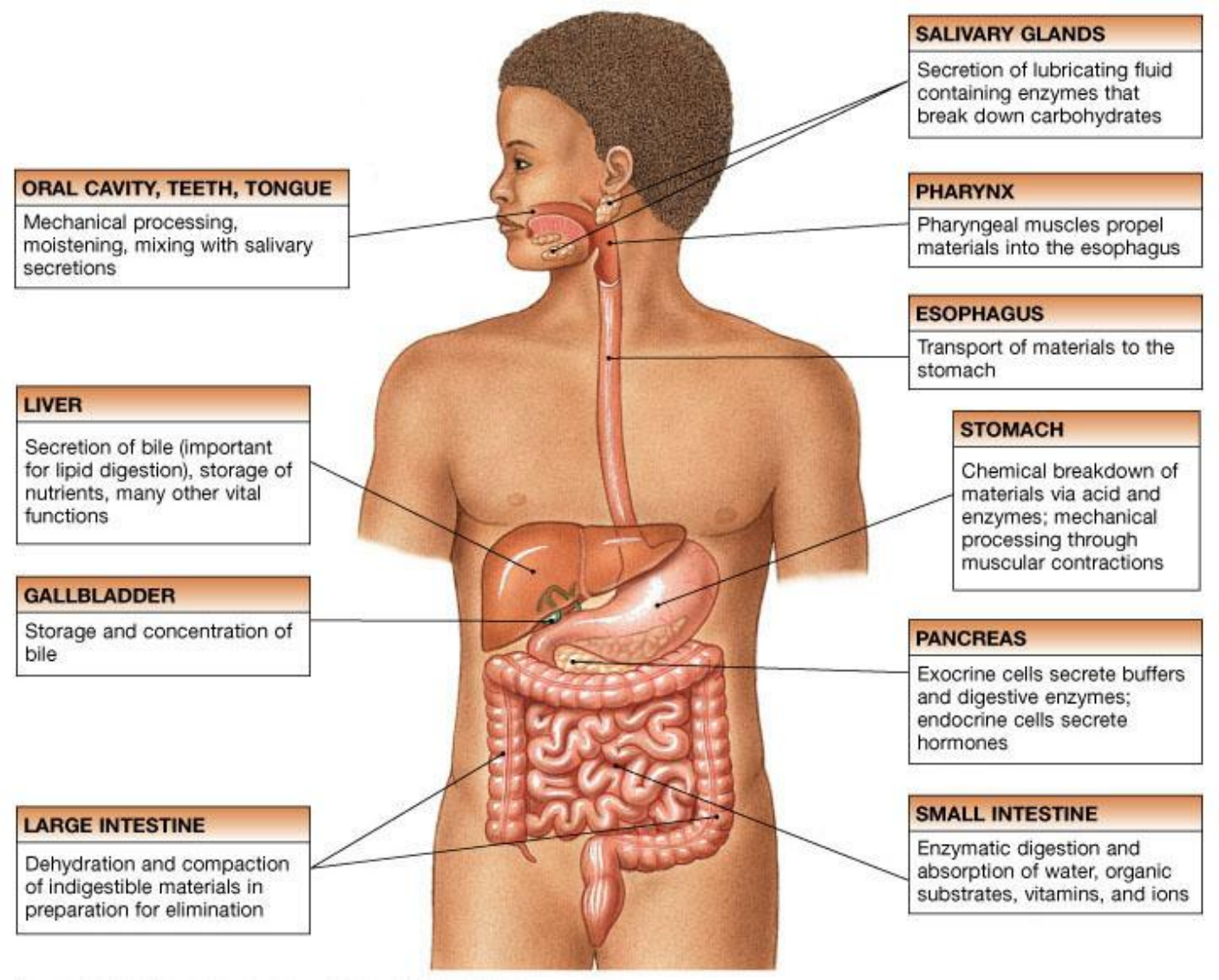


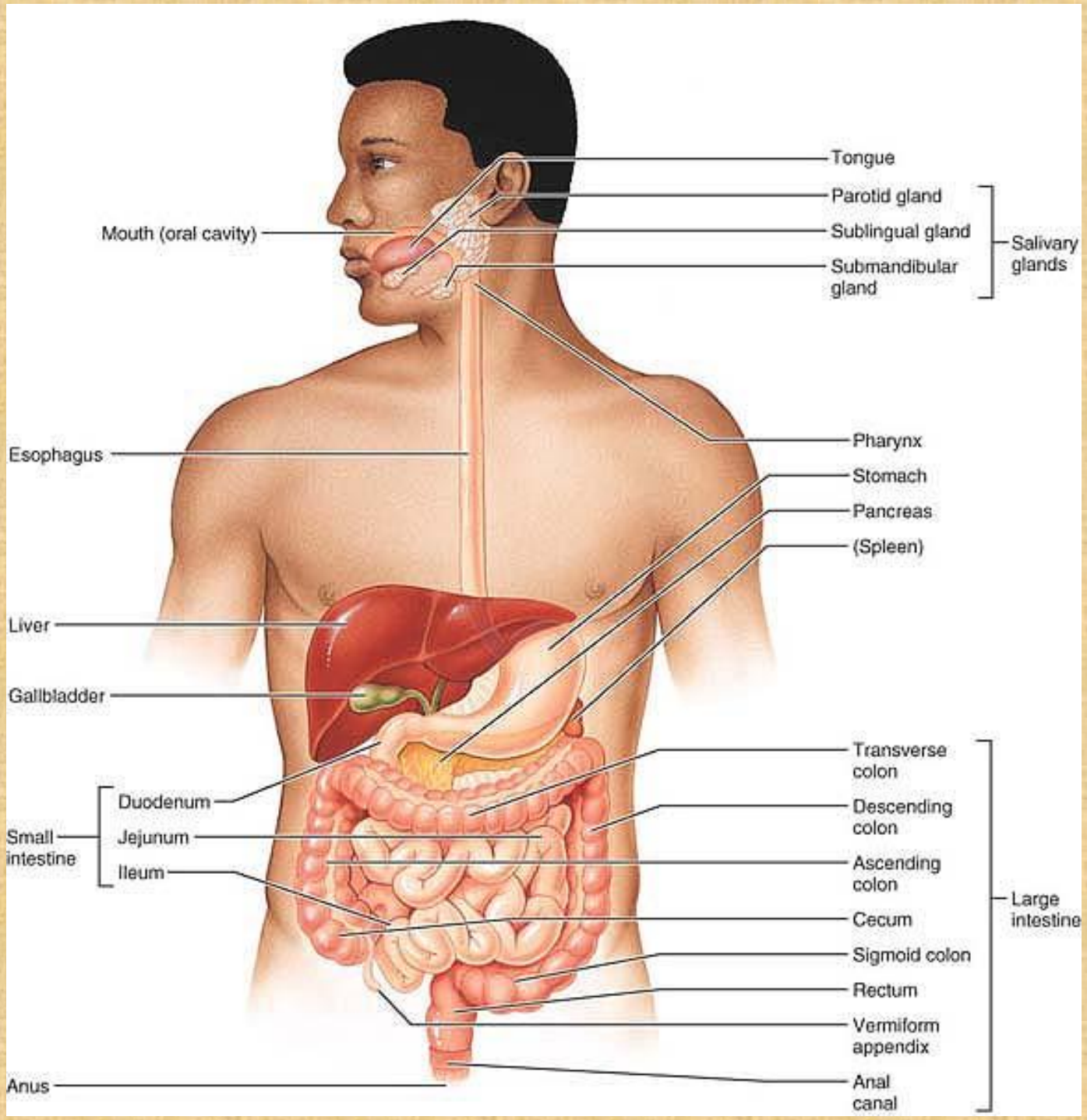

Brain (cerebrum)
Compact bone (black lines)
Venous sinus (fluid-filled)
Air-filled sinuses
Cerebellum
Fluid-filled subarachnoid space
Nasal cavity
Tooth
Spinal cord
Tongue
C2 vertebra
Pharynx
Subcutaneous tissue (fat)

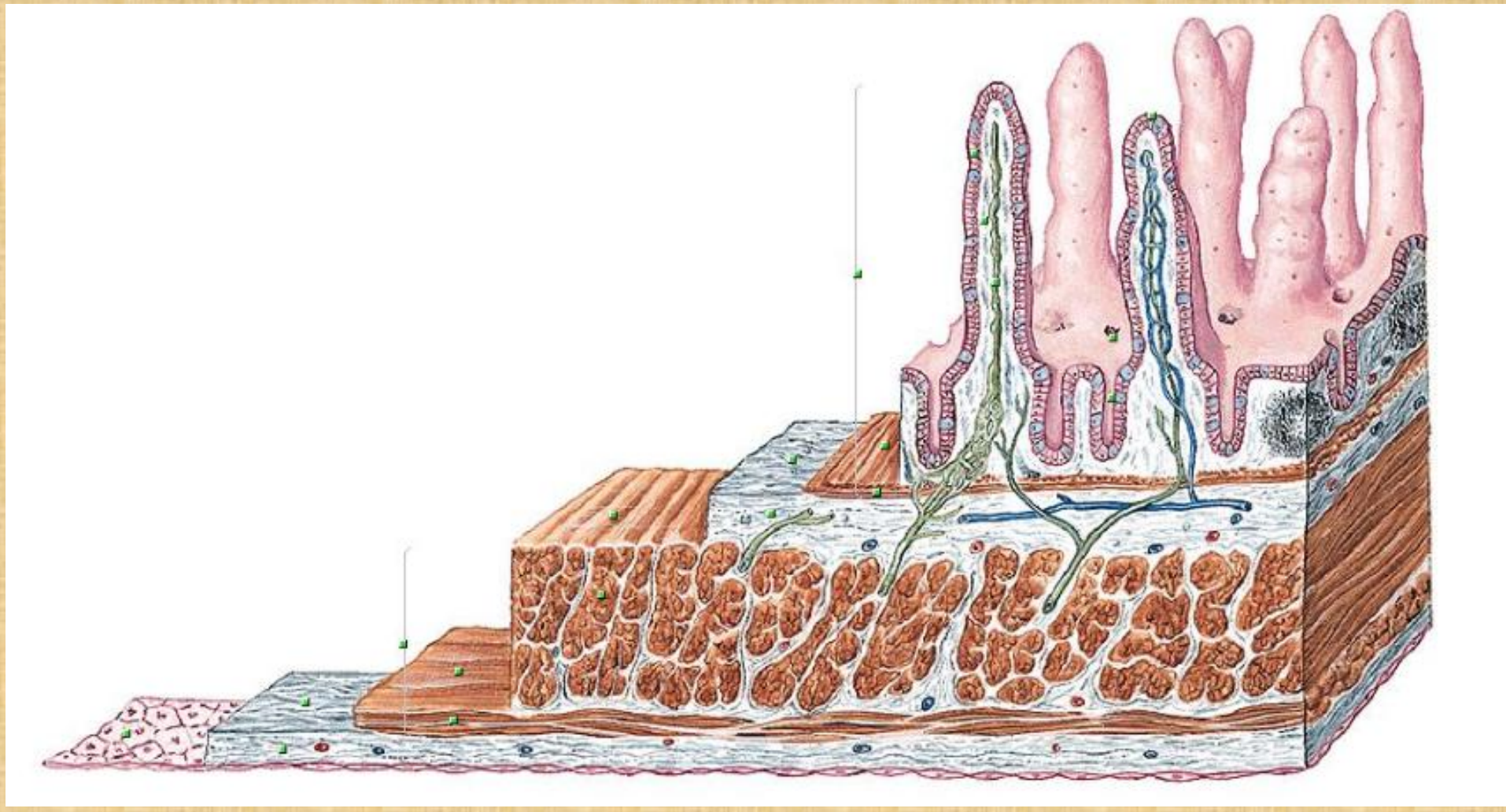
Digestive Sysytem

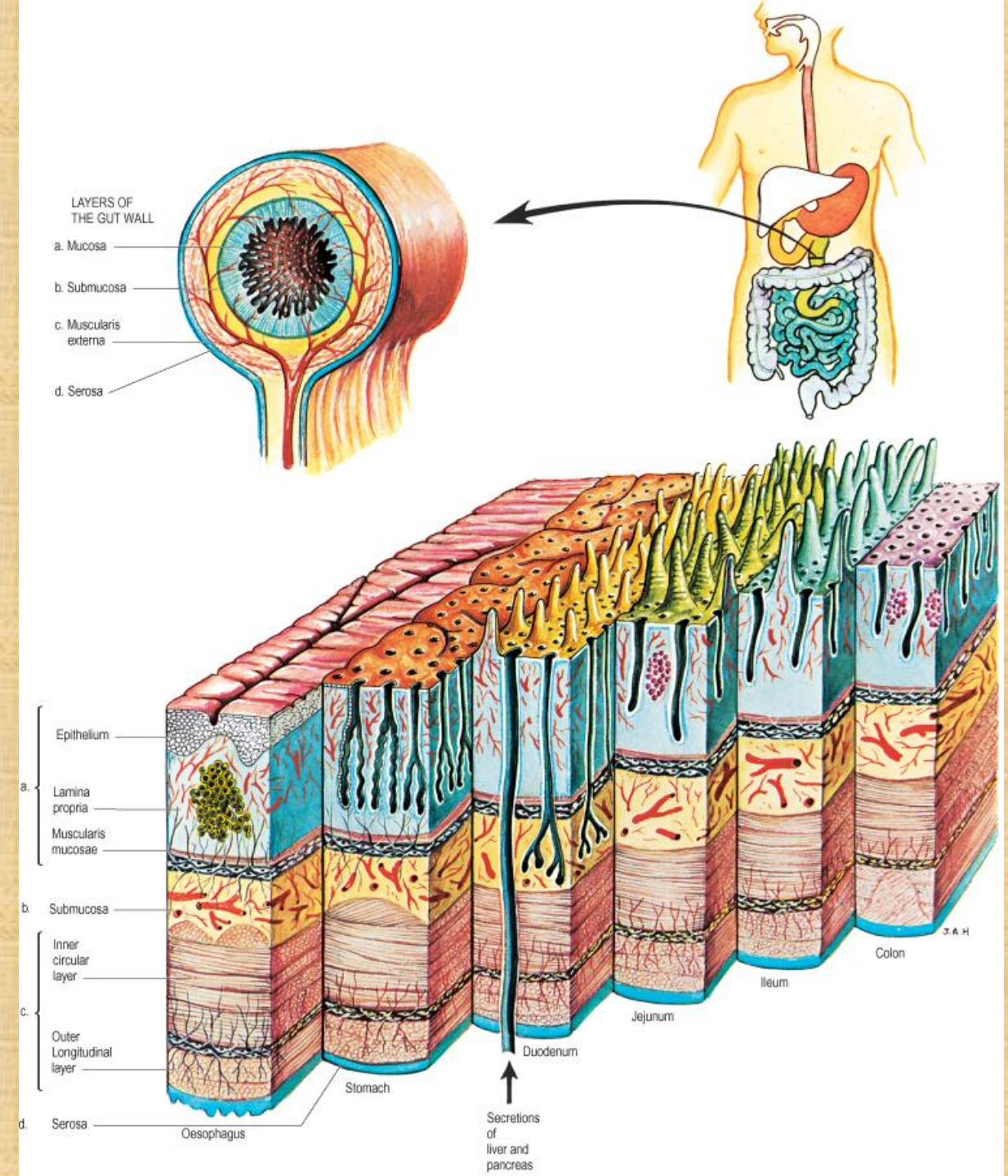
the digestive system, or alimentary system (*systema digestorium*) is a complex of organs which provides mechanical and chemical treatment of food, absorption of the treated nutrients, and excretion of undigested remnants of the food.

The Components of the Digestive System




Tongue
Parotid gland
Mouth (oral cavity)
Sublingual gland
Salivary glands
Submandibular gland
Pharynx
Esophagus
Stomach
Pancreas
(Spleen)
Liver
Gallbladder
Transverse colon
Duodenum
Descending colon
Small intestine
Jejunum
Ascending colon
Ileum
Large intestine
Cecum
Sigmoid colon
Rectum
Vermiform appendix
Anus
Anal canal



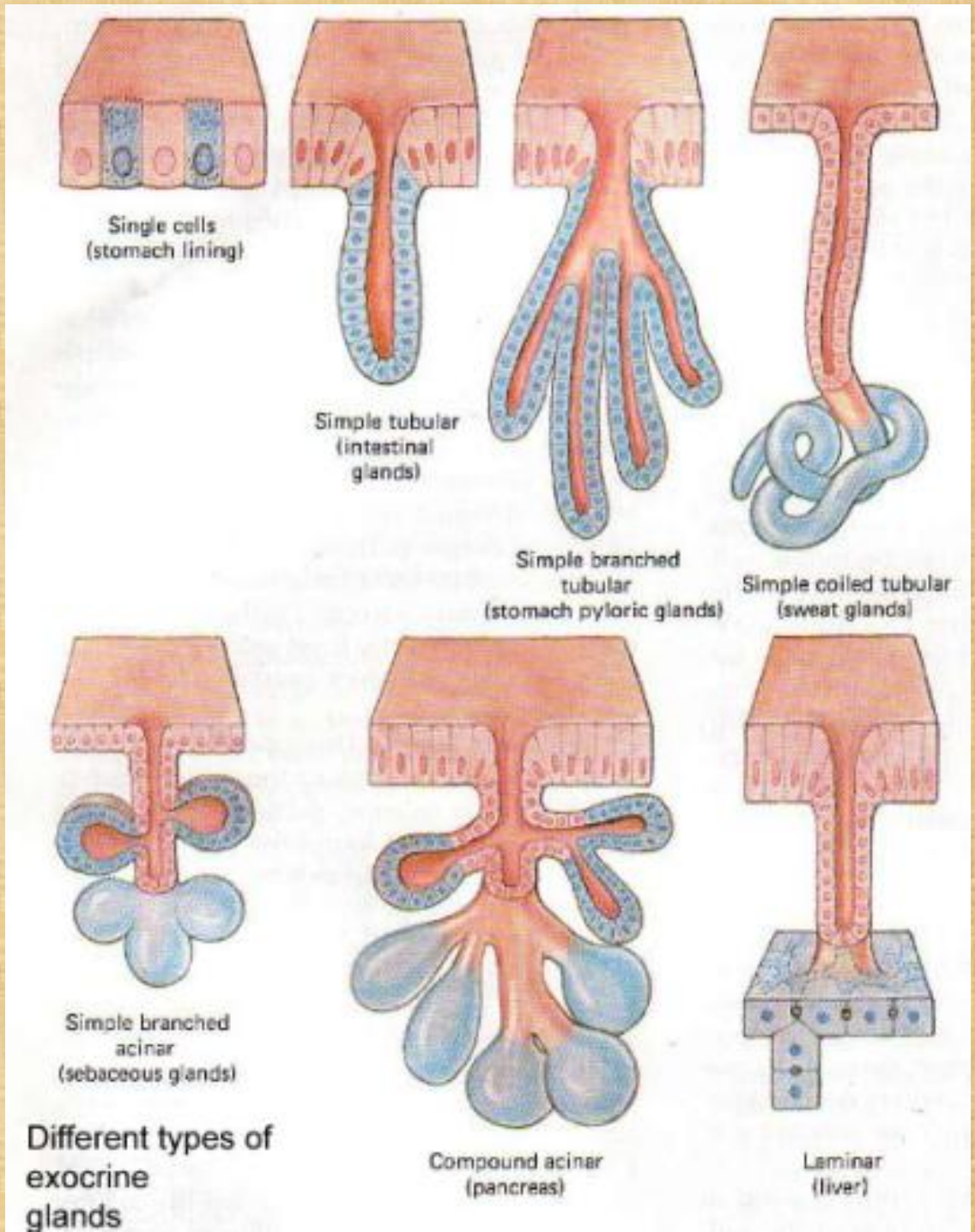

LAYERS OF
THE GUT WALL
a. Mucosa
b. Submucosa
c. Muscularis
externa
d. Serosa
a.
Epithelium
Lamina
propria
Muscularis
mucosae
b.
Submucosa
c.
Inner
circular
layer
Outer
Longitudinal
layer
d.
Serosa
Oesophagus
Stomach
Duodenum
Jejunum
Ileum
Colon
J. A. H.
Secretions
of
liver and
pancreas

Functions of the digestive system

- Ingestion
- Mechanical processing
- Digestion
- Secretion
- Absorption
- Excretion

Glands

exocine
endocrine



Different types of exocrine glands

Movement of digestive materials

- Visceral smooth muscle shows rhythmic cycles of activity
  - Pacemaker cells
- Peristalsis
  - Waves that move a bolus
- Segmentation
  - Churn and fragment a bolus

Peristalsis

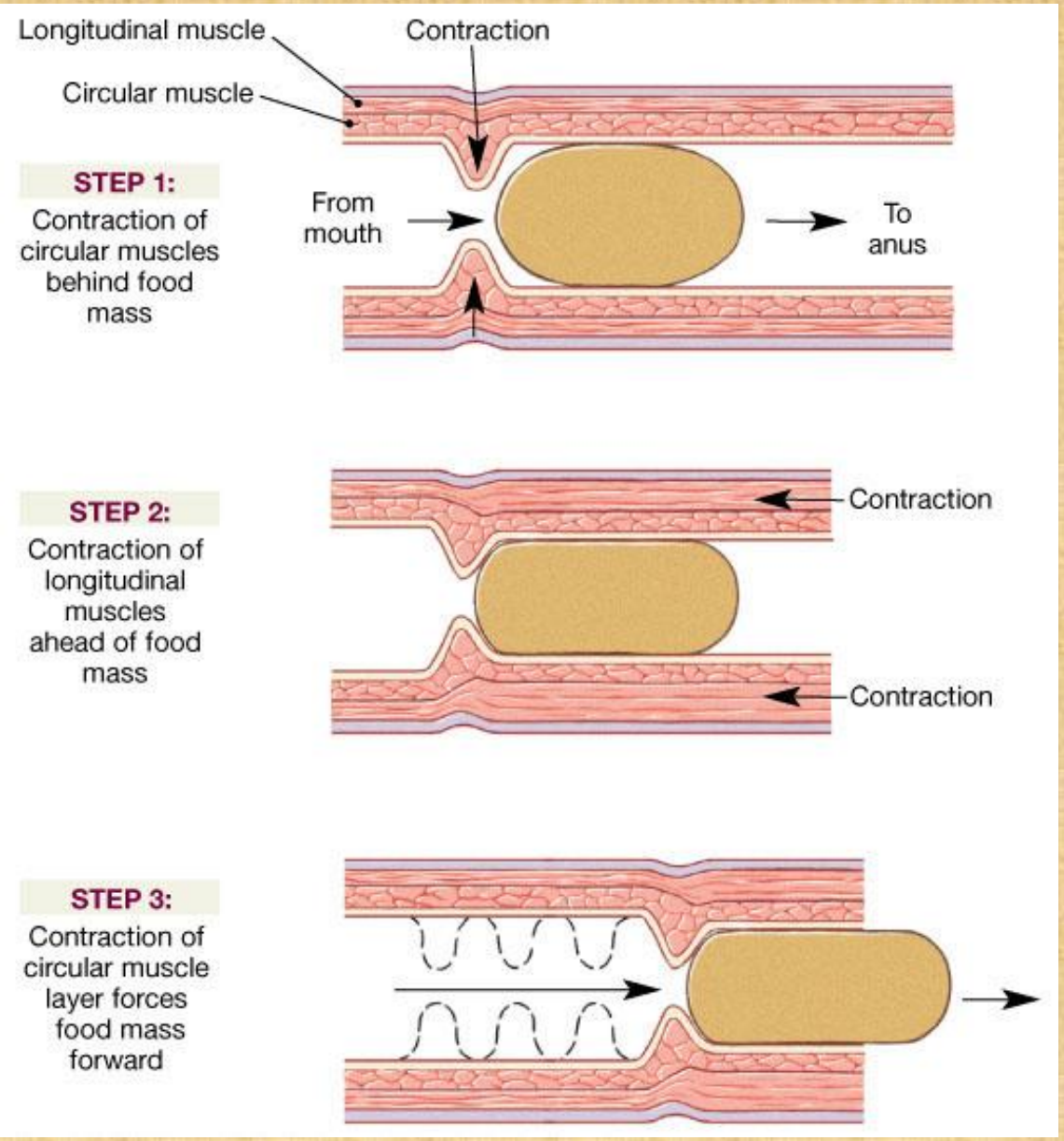
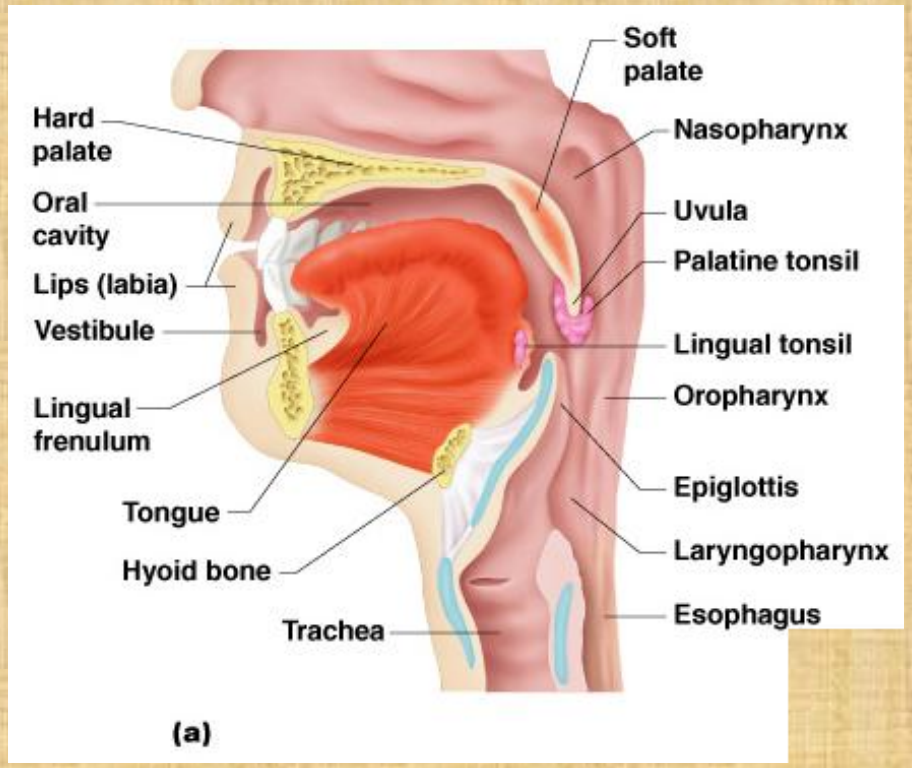


Figure 24.4

- Lips (labia) – protect the anterior opening
- Cheeks – form the lateral walls
- Hard palate – forms the anterior roof
- Soft palate – forms the posterior roof
- Uvula – fleshy projection of the soft palate



The tongue

- primary functions include:
  - Mechanical processing
  - Assistance in chewing and swallowing
  - Sensory analysis by touch, temperature, and taste receptors

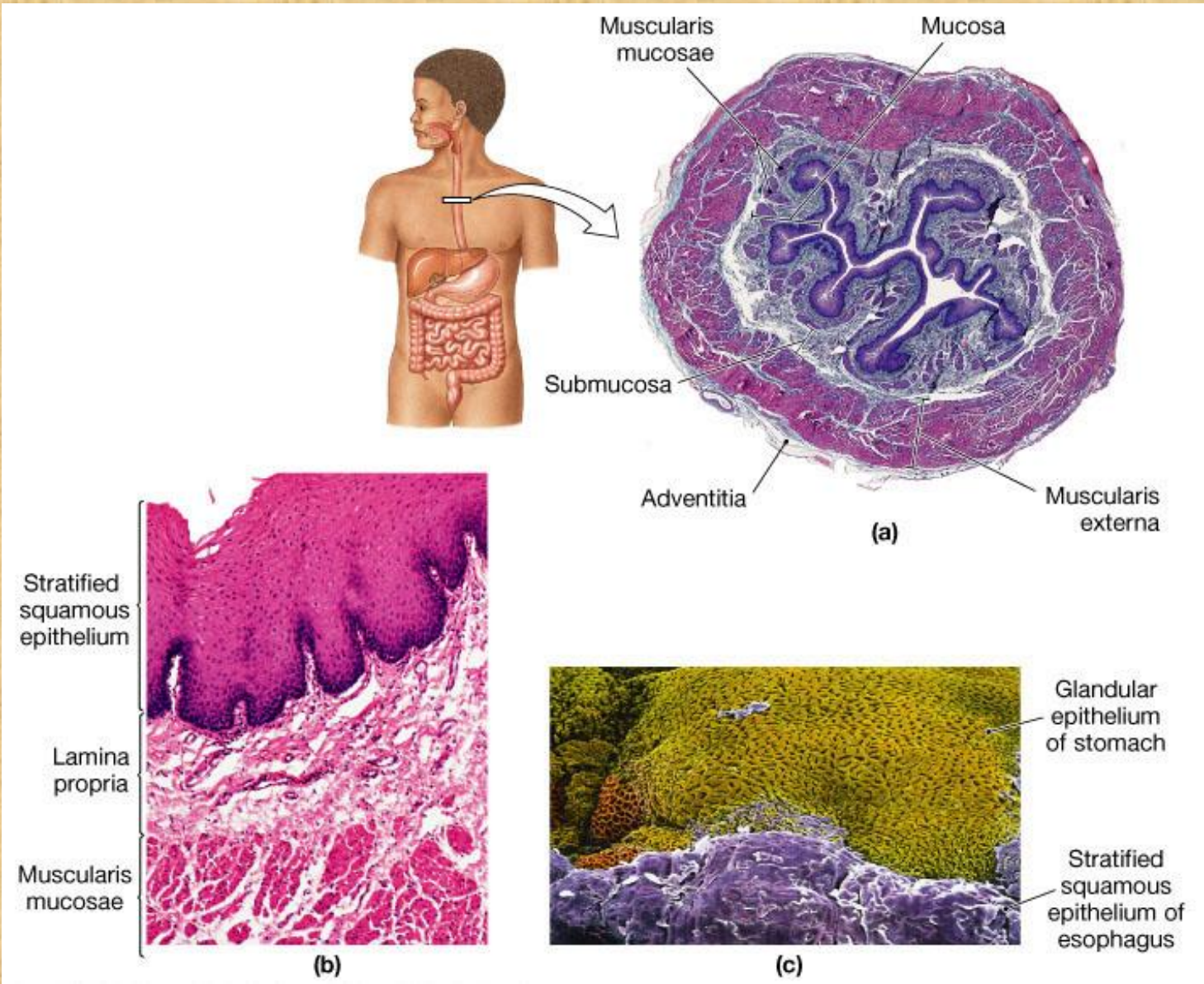
The pharynx

- Common passageway for food, liquids, and air
- Lined with stratified squamous epithelium
- Pharyngeal muscles assist in swallowing
  - Pharyngeal constrictor muscles
  - Palatal muscles

Histology of the esophagus

- Distinctive features of the esophageal wall include
  - Nonkeratinized, stratified squamous epithelium
  - Folded mucosa and submucosa
    - Mucous secretions by esophageal glands
  - A muscularis with both smooth and skeletal muscle portions
  - Lacks serosa
    - Anchored by an adventitia

The Esophagus



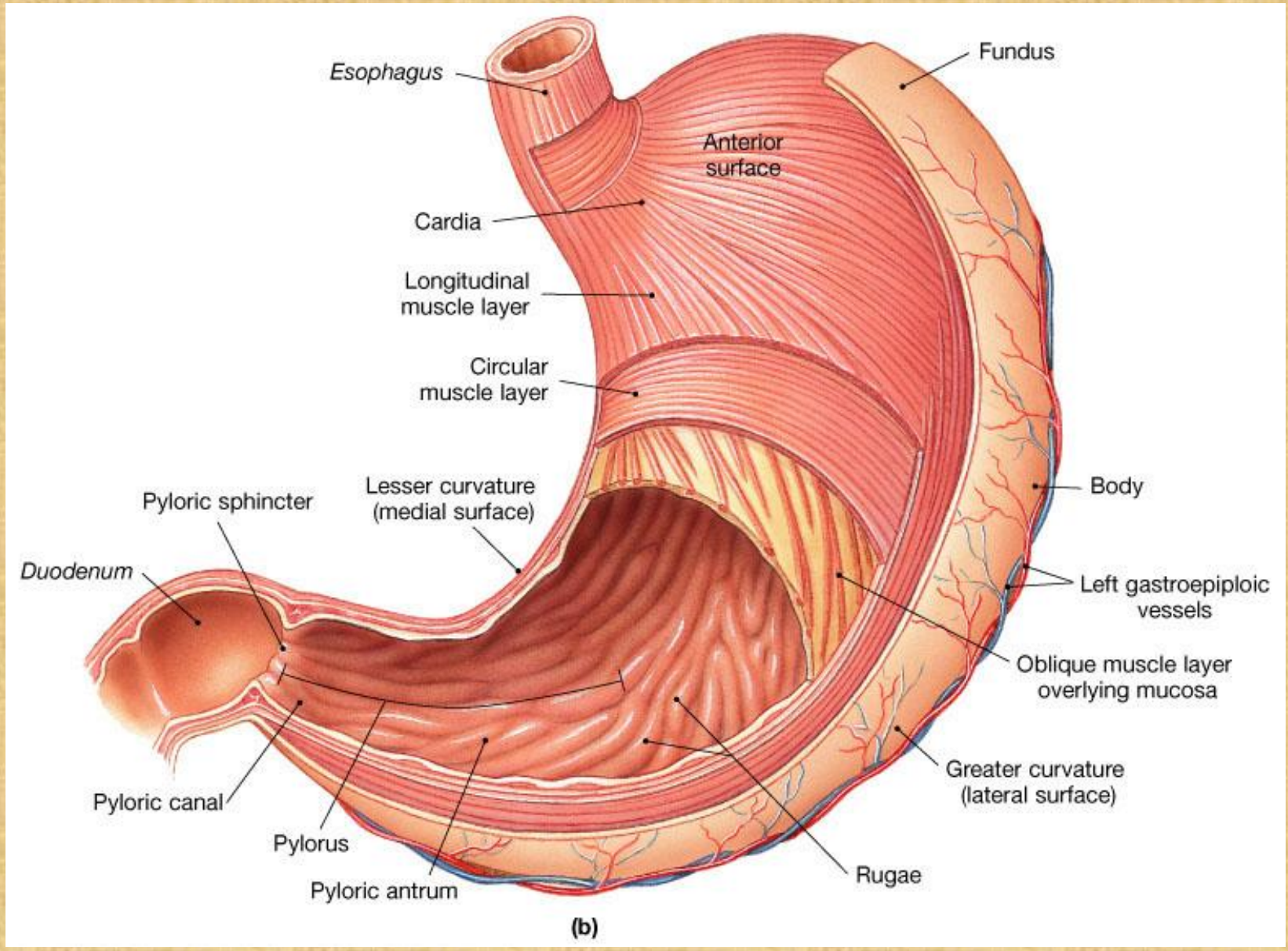
Functions of the stomach

- Bulk storage of undigested food
- Mechanical breakdown of food
- Disruption of chemical bonds via acids and enzymes
- Production of intrinsic factor

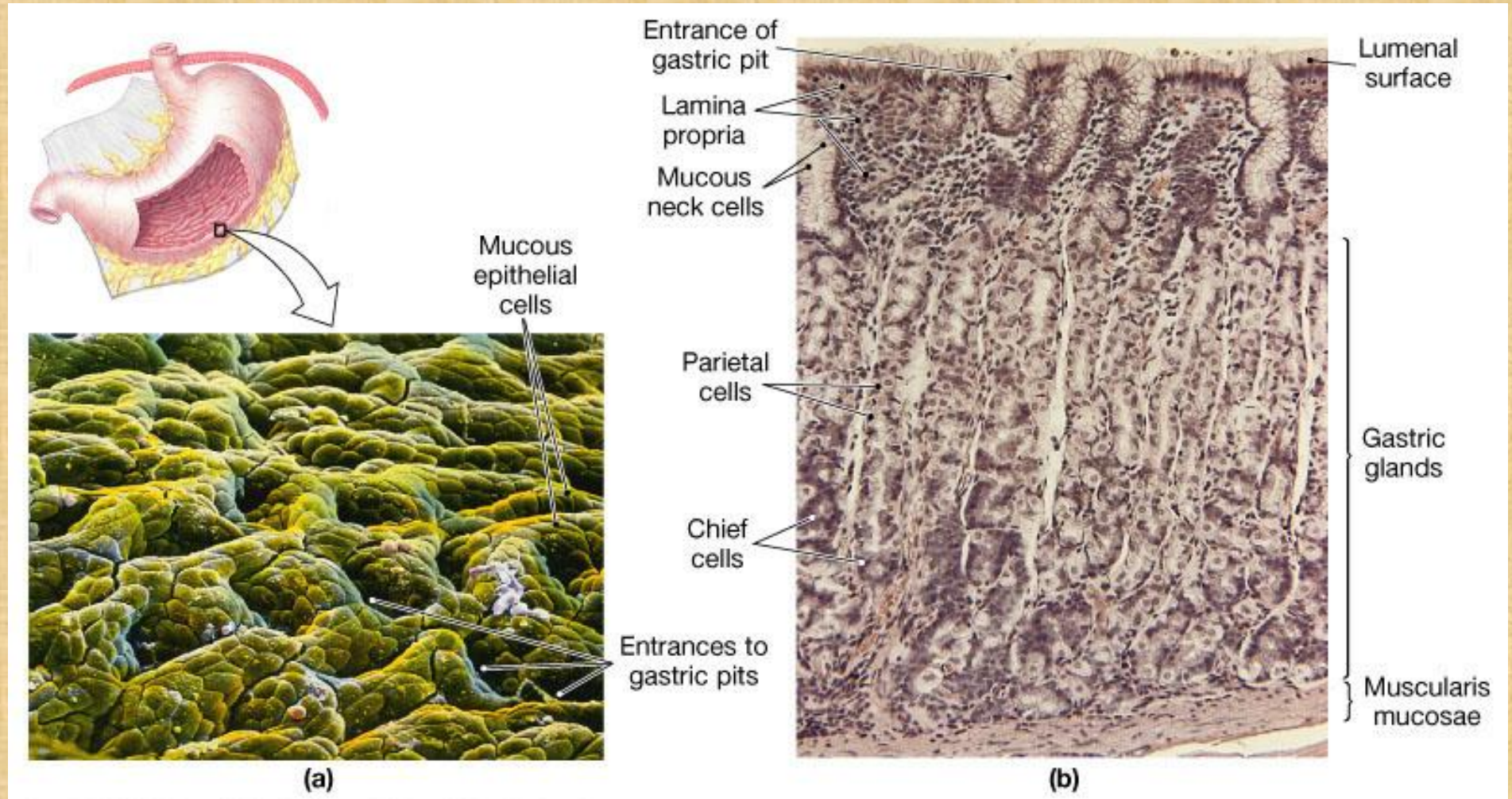
Digestion and absorption in the stomach

- Preliminary digestion of proteins
  - Pepsin
- Permits digestion of carbohydrates
- Very little absorption of nutrients
  - Some drugs, however, are absorbed
  - Mucous secretion containing several hormones
- Enteroendocrine cells
  - G cells secrete gastrin
  - D cells secrete somatostatin

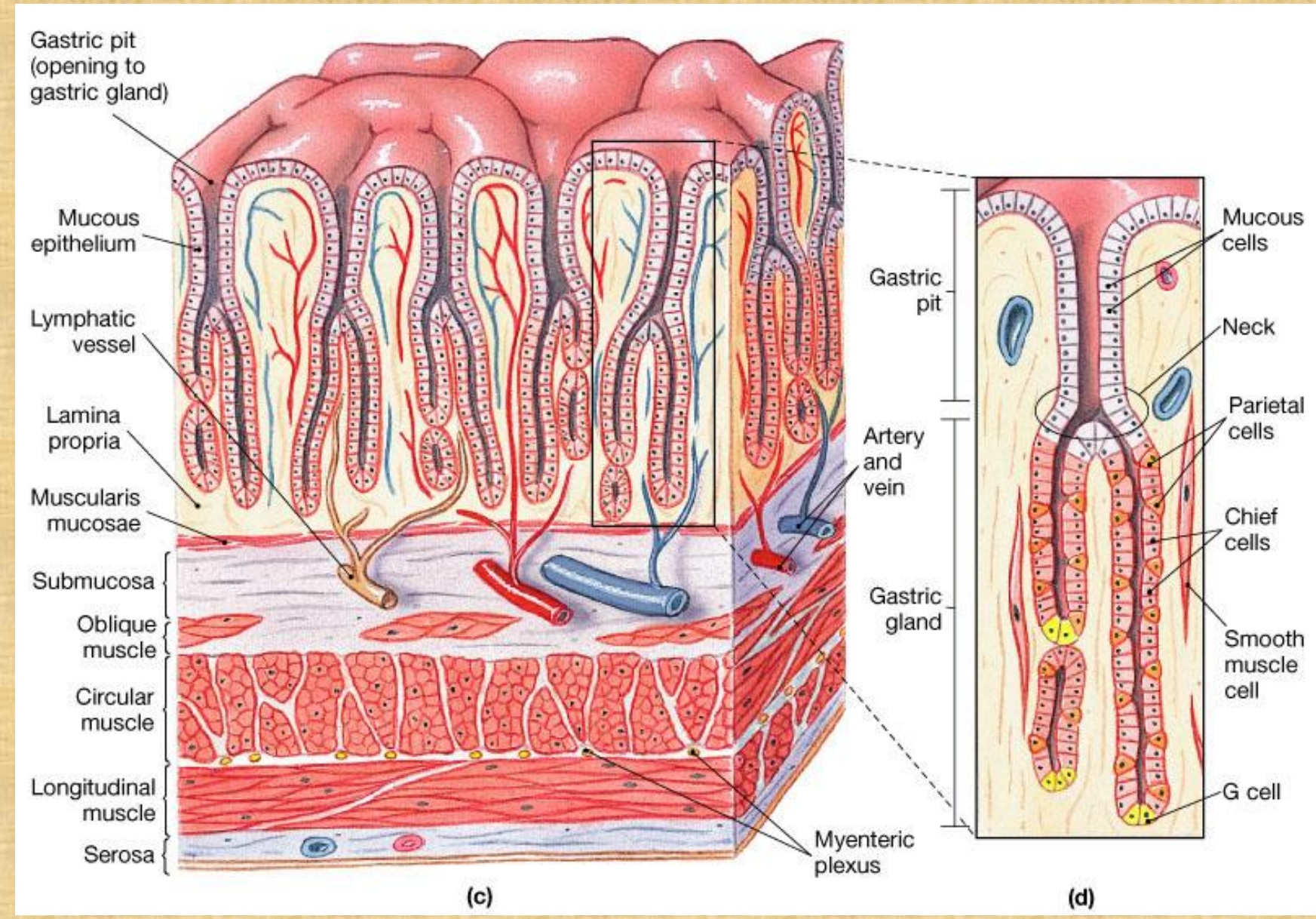
The Stomach


Esophagus
Fundus
Anterior surface
Cardia
Longitudinal muscle layer
Circular muscle layer
Lesser curvature (medial surface)
Pyloric sphincter
Duodenum
Body
Left gastroepiploic vessels
Oblique muscle layer overlying mucosa
Greater curvature (lateral surface)
Pyloric canal
Pylorus
Pyloric antrum
Rugae
(b)

The Stomach Lining



The Stomach Lining



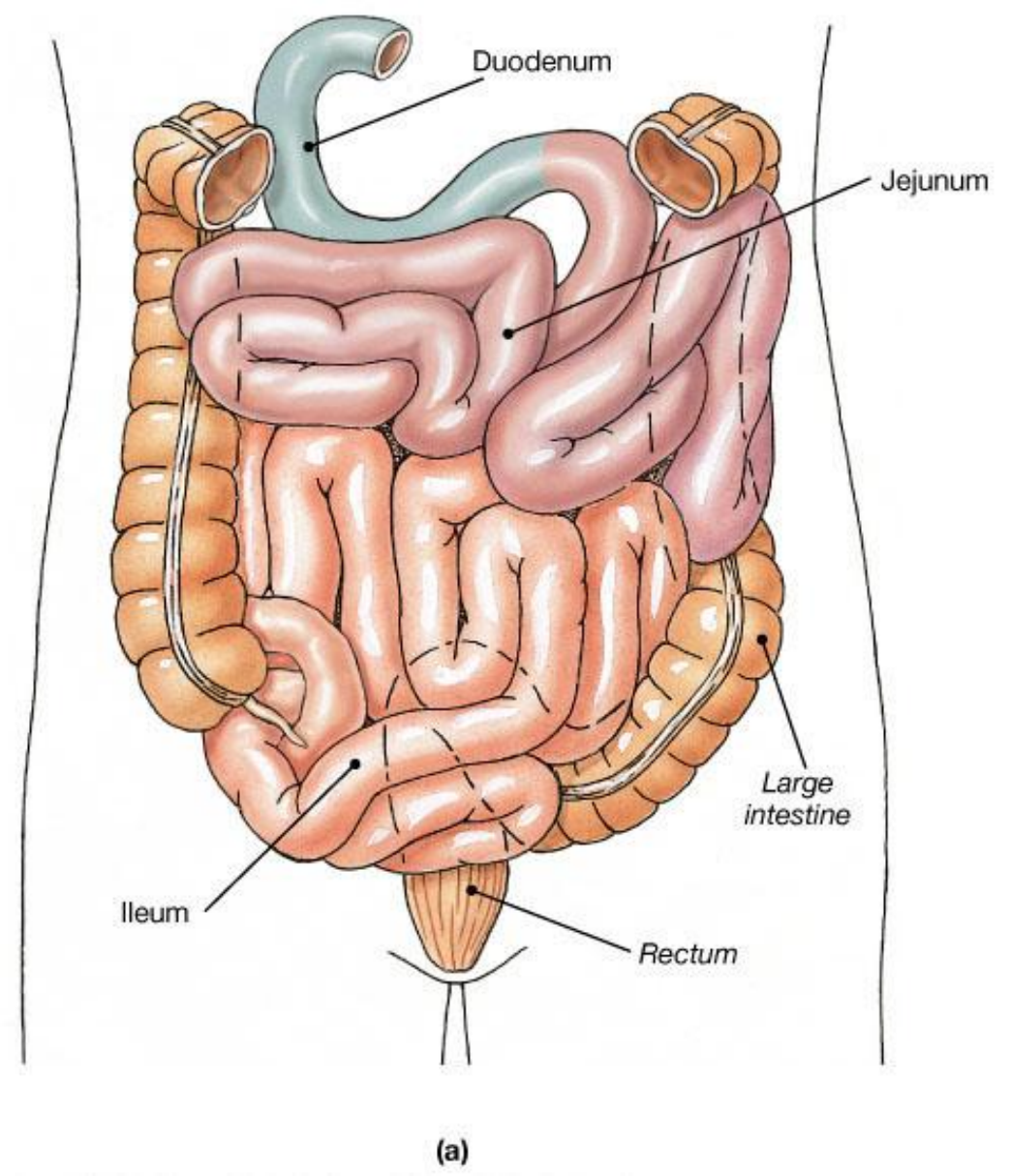
Histology of the stomach

- Gastric glands
  - Parietal cells
    - Intrinsic factor, and HCl
  - Chief cells
    - Pepsinogen
- Pyloric glands

Small intestine

- Important digestive and absorptive functions
  - Secretions and buffers provided by pancreas, liver, gall bladder
- Three subdivisions:
  - Duodenum
  - Jejunum
  - Ileum
- Ileocecal sphincter
  - Transition between small and large intestine

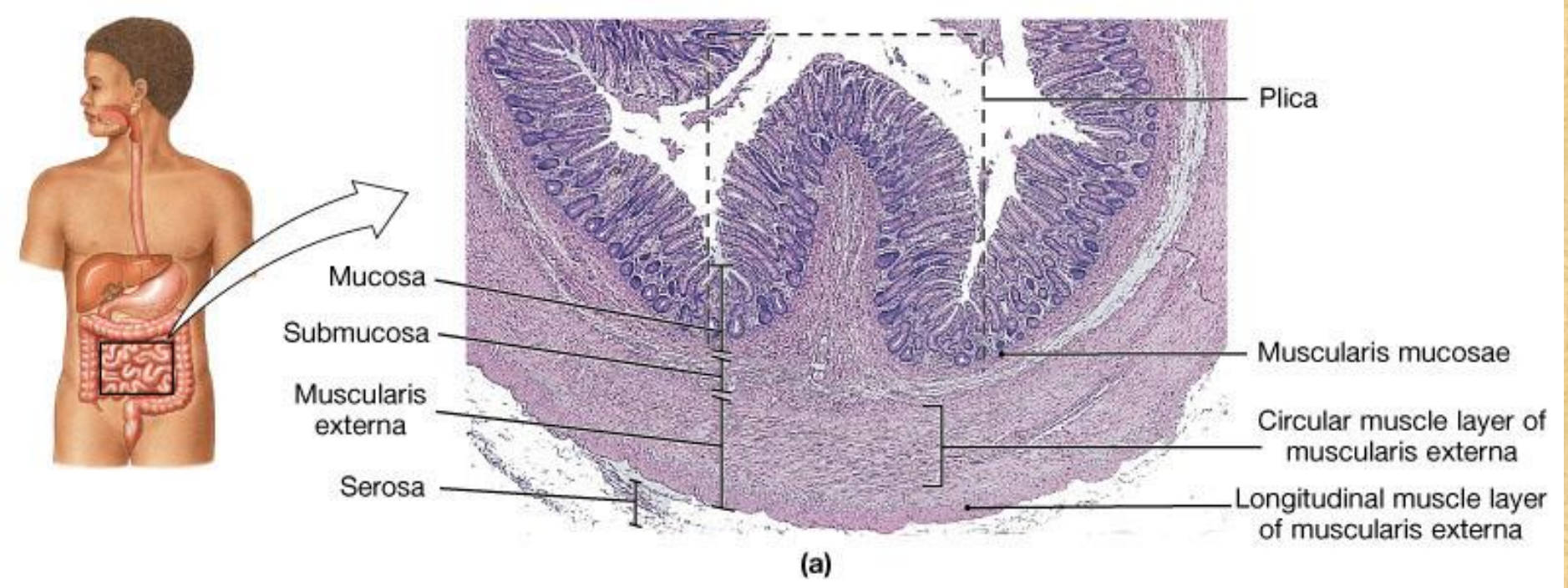
Regions of the Small Intestine



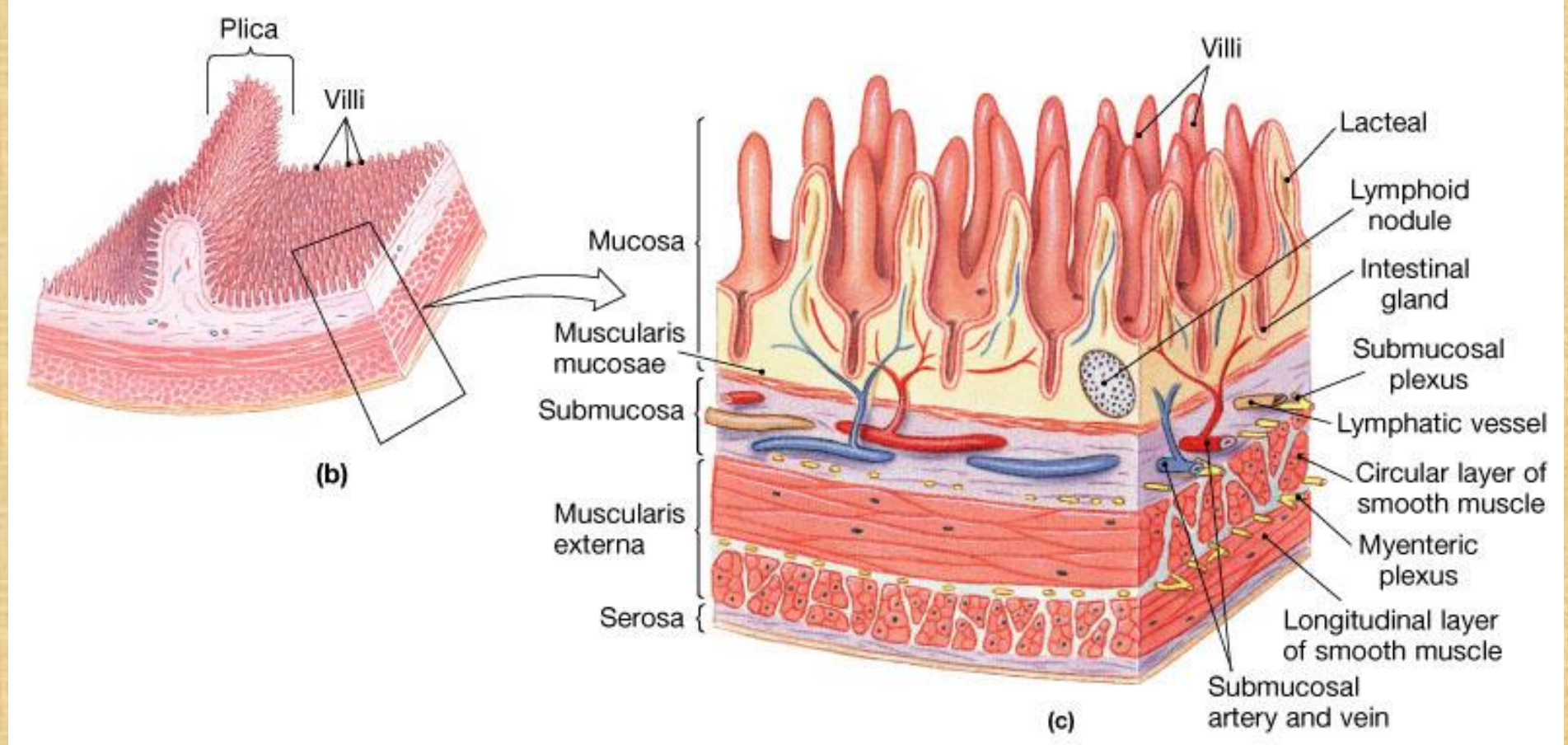
Histology of the small intestine

- Plicae
  - Transverse folds of the intestinal lining
- Villi
  - Fingerlike projections of the mucosa
- Lacteals
  - Terminal lymphatic in villus
- Intestinal glands
  - Lined by enteroendocrine, goblet and stem cells

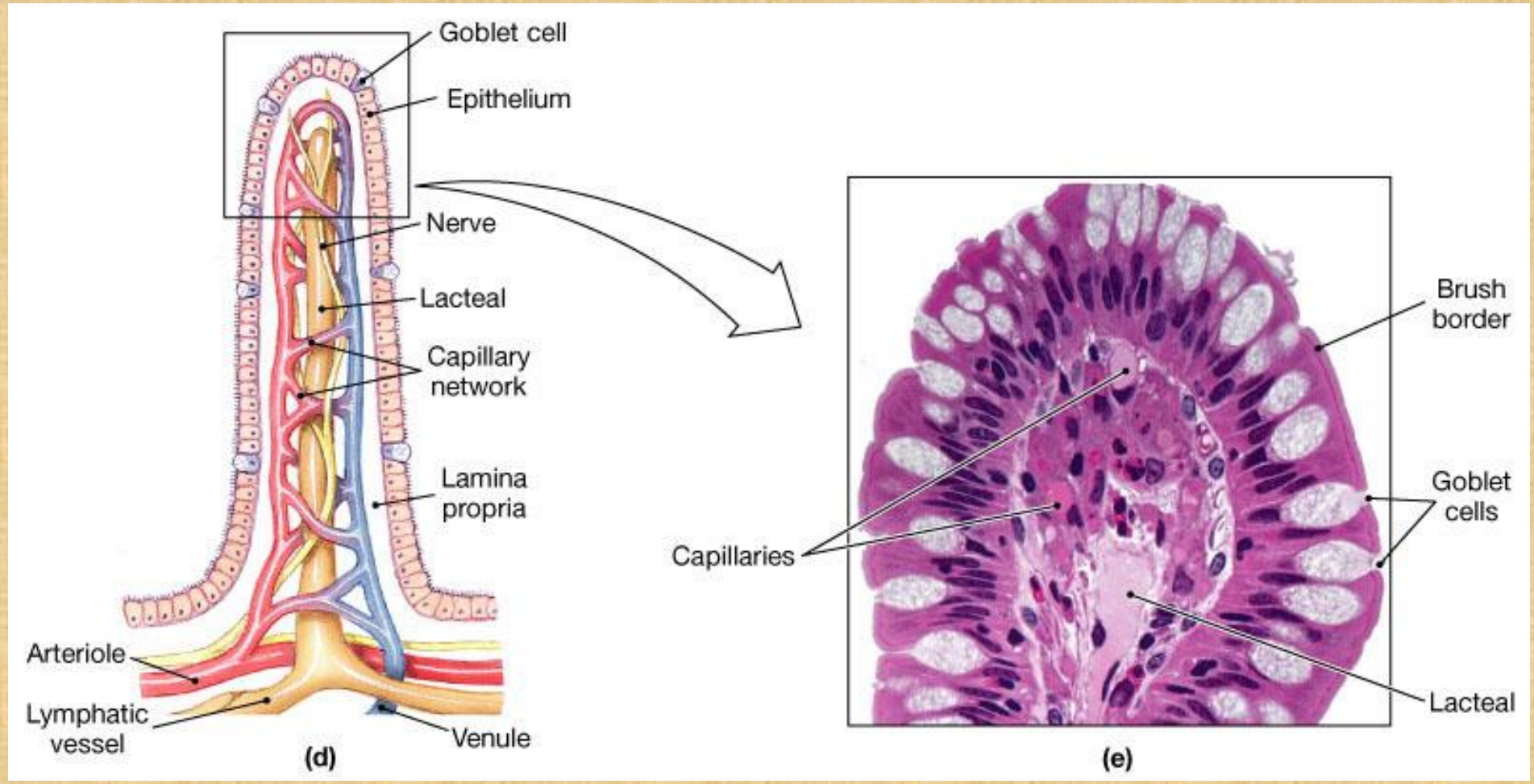
The Intestinal Wall



The Intestinal Wall



The Intestinal Wall



Small Intestine

- Duodenal glands (Brunner's glands)
  - produce mucus, buffers, urogastrone
- Ileum
  - aggregated lymphoid nodules (Peyer's patches)

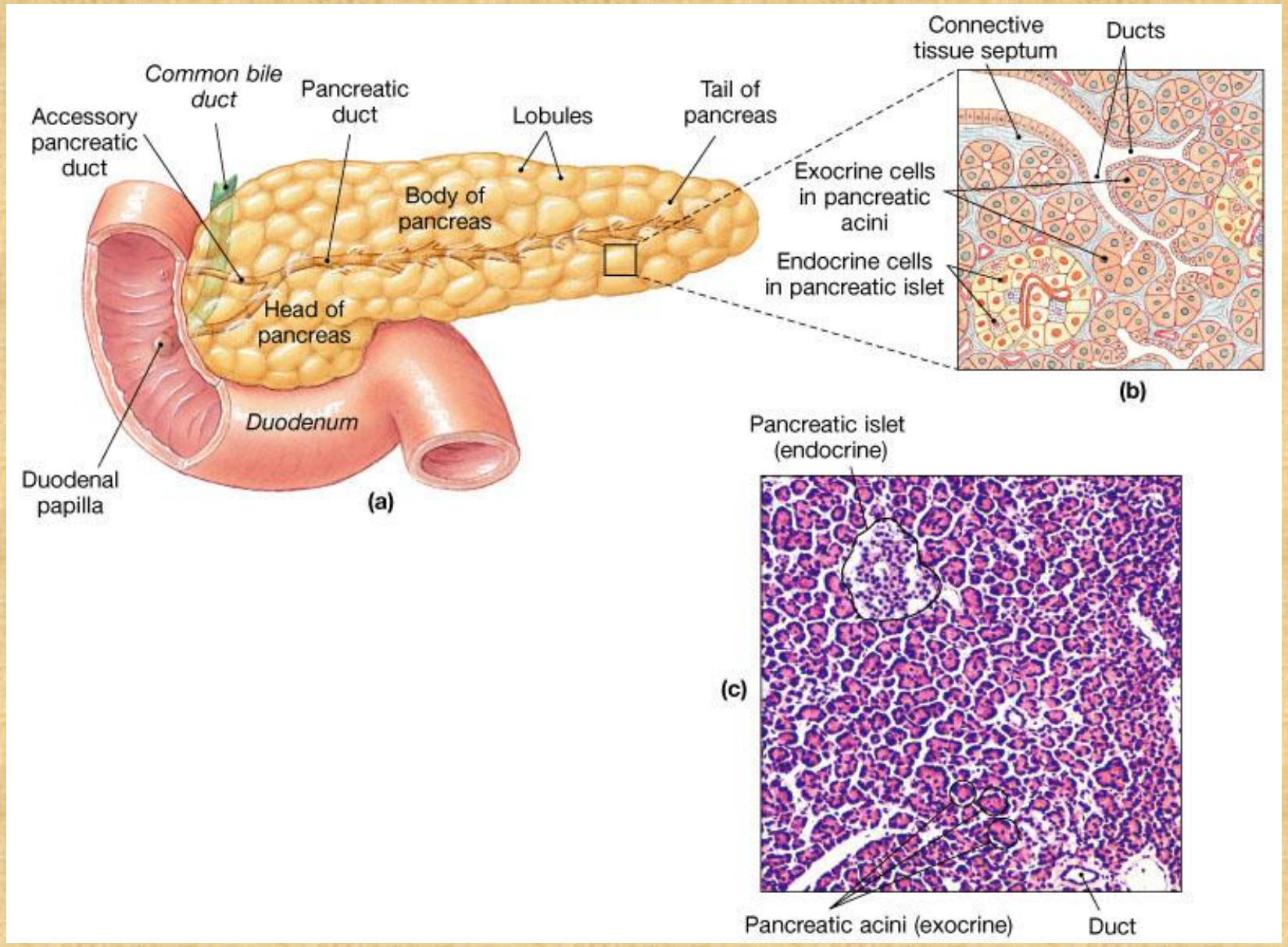
Intestinal movements

- Peristalsis
- Segmentation
- Gastroenteric reflexes
  - Initiated by stretch receptors in stomach
- Gastroileal reflex
  - Triggers relaxation of ileocecal valve

The pancreas

- Pancreatic duct penetrates duodenal wall
- Endocrine functions
  - Insulin and glucagons
- Exocrine functions
  - Majority of pancreatic secretions
  - Pancreatic juice secreted into small intestine
    - Carbohydrases
    - Lipases
    - Nucleases
    - Proteolytic enzymes

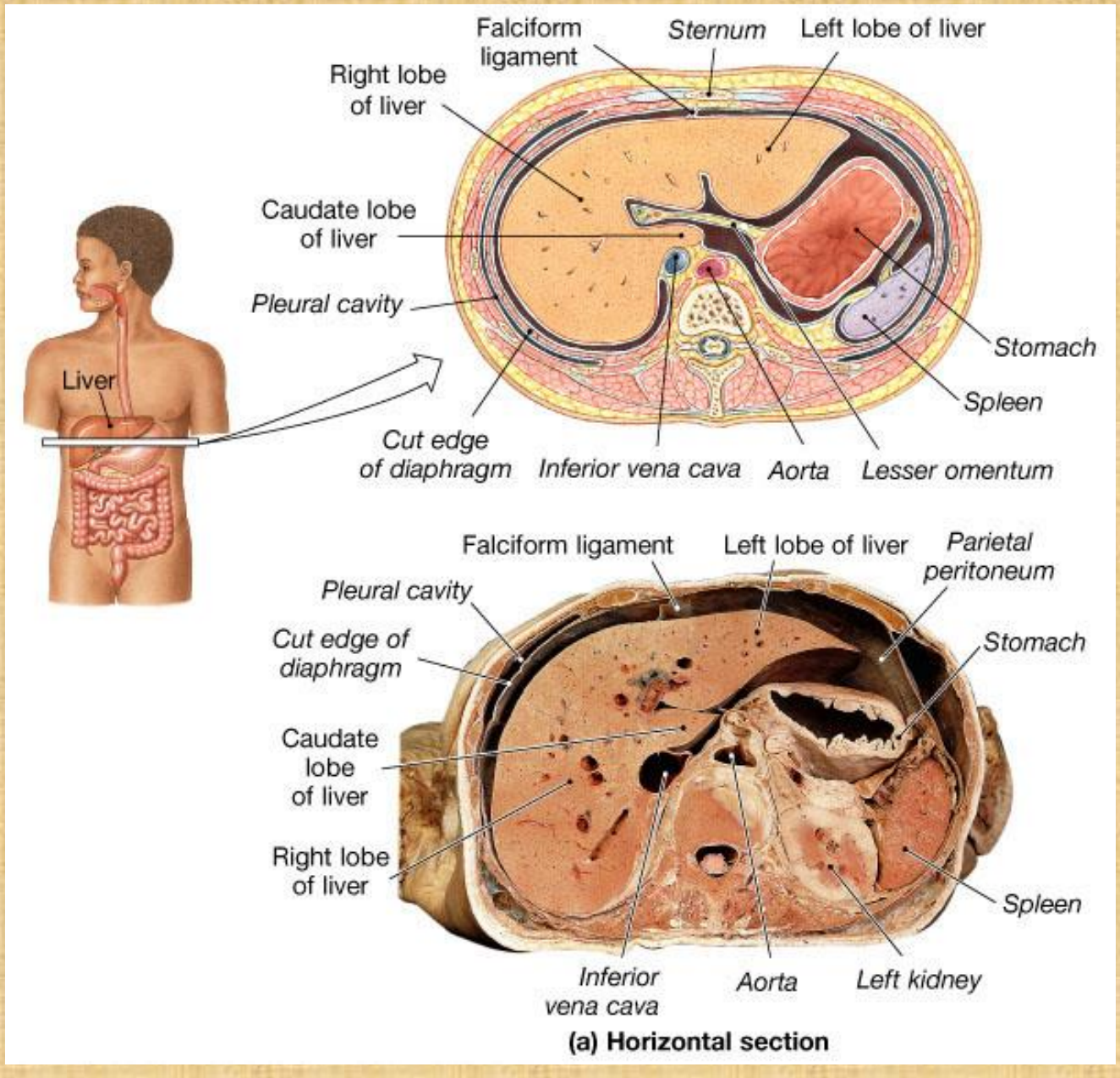
The Pancreas



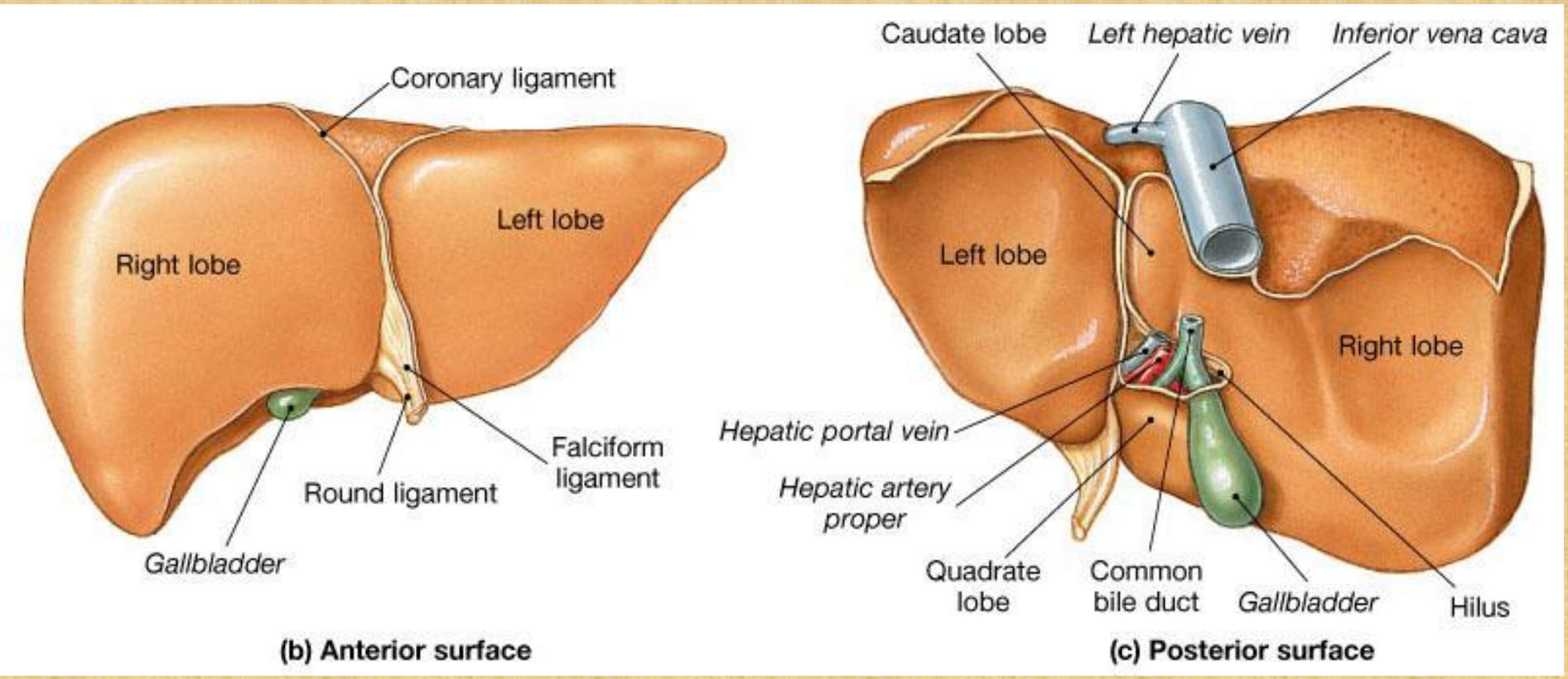
The Liver

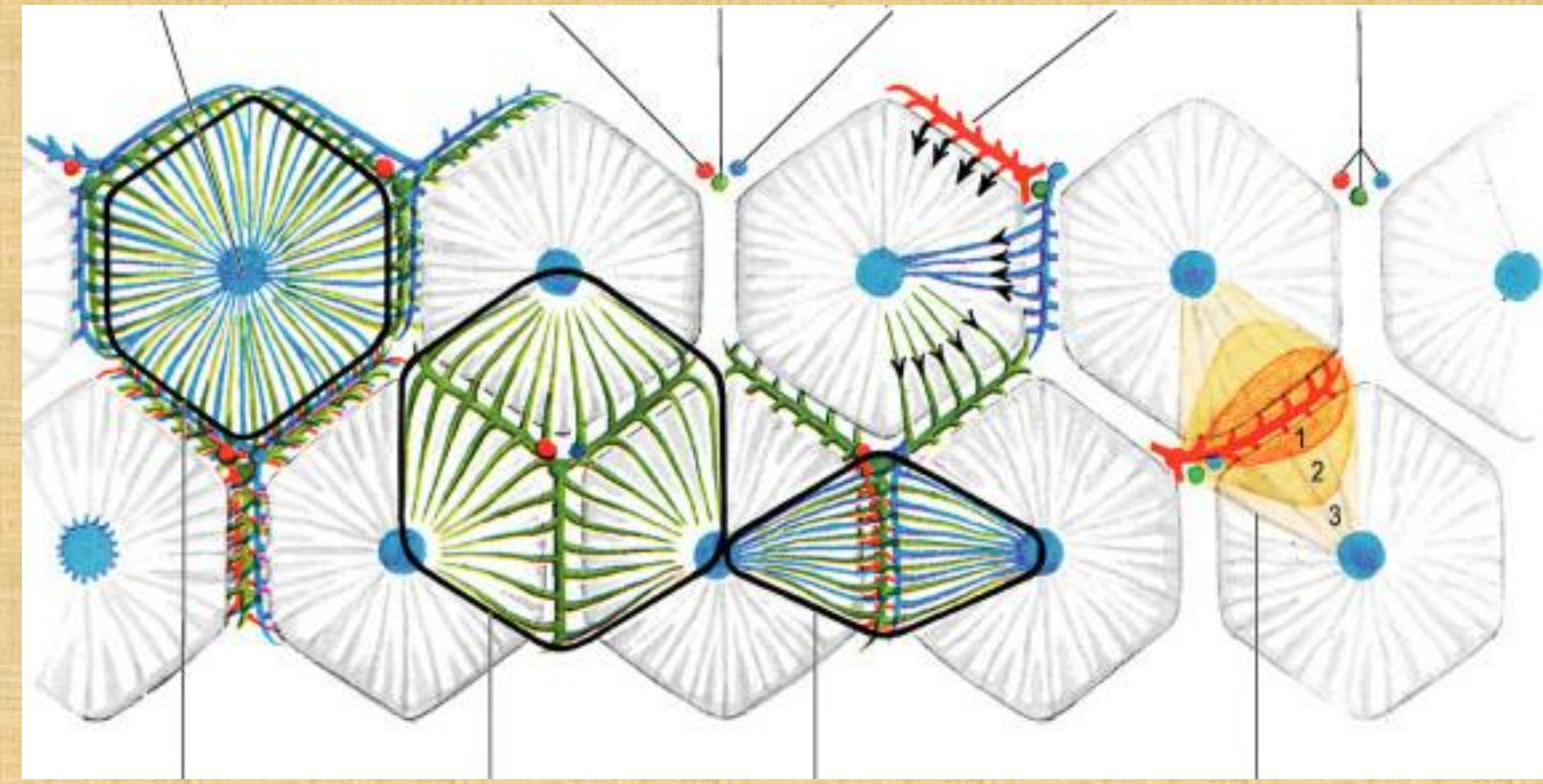
- Performs metabolic and hematological regulation and produces bile
- Histological organization
  - Lobules containing single-cell thick plates of hepatocytes
  - Lobules unite to form common hepatic duct
    - Duct meets cystic duct to form common bile duct

The Anatomy of the Liver



The Anatomy of the Liver




1
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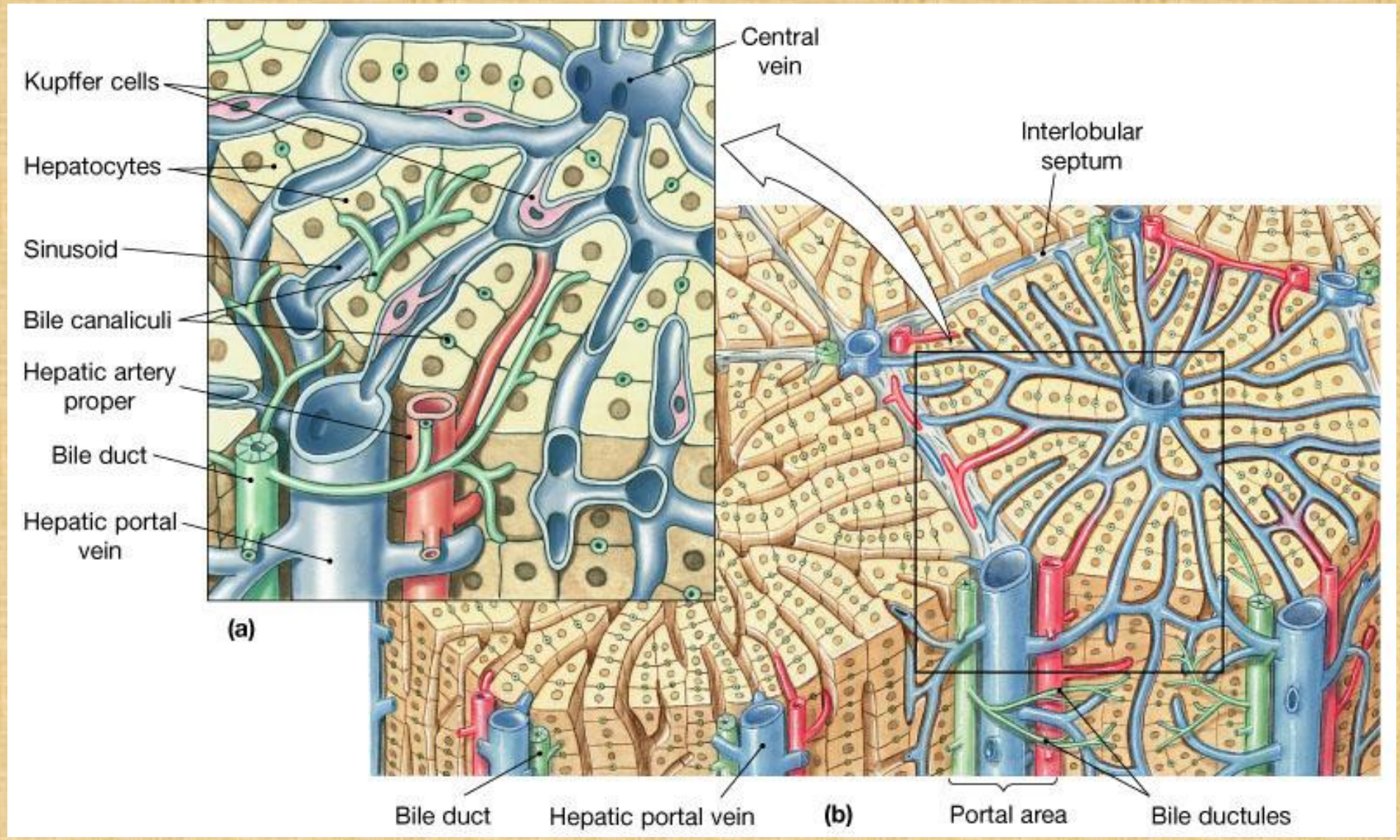
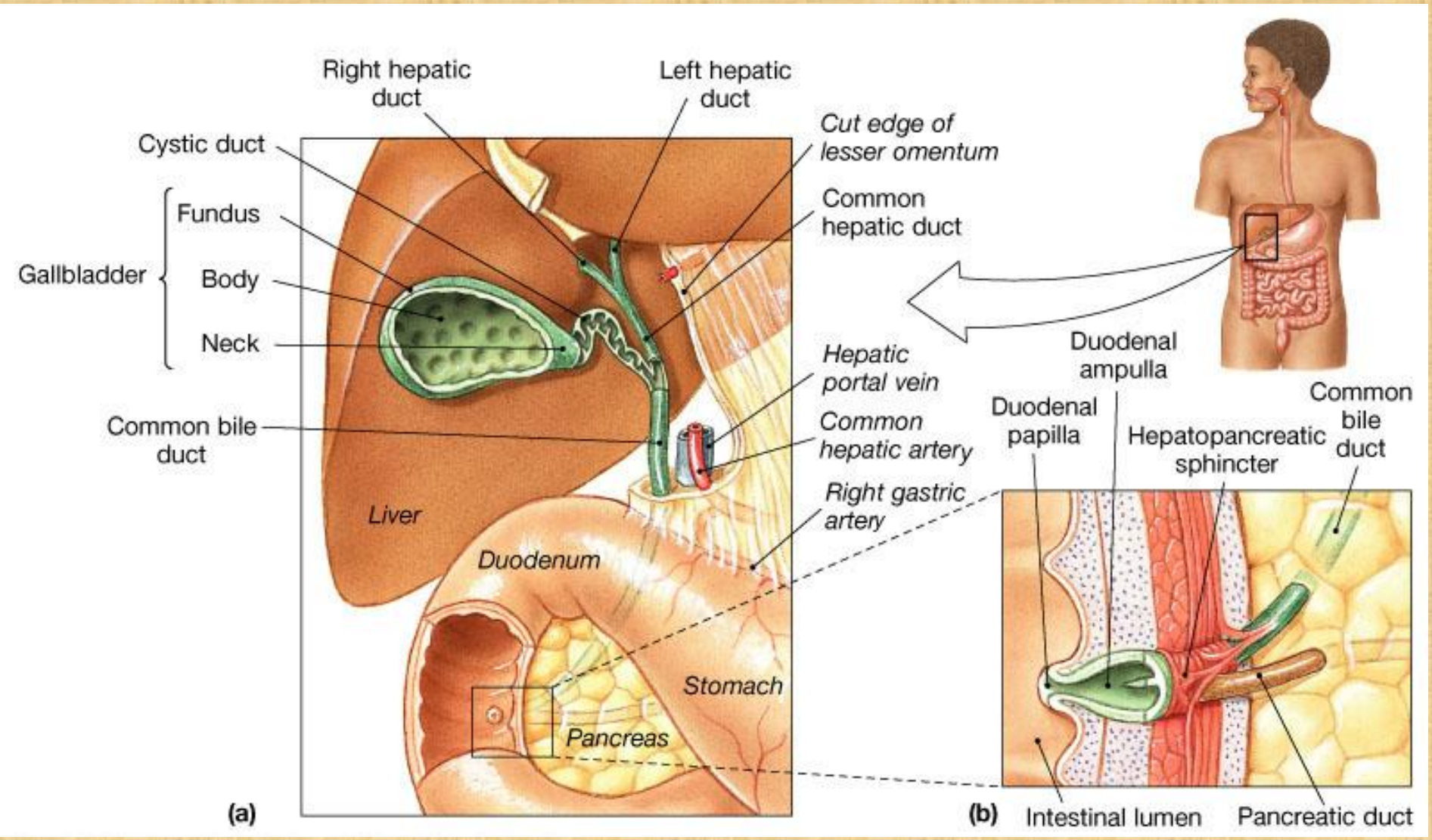
Liver Histology



The gallbladder

- Hollow, pear-shaped organ
- Stores, modifies and concentrates bile

The Gallbladder



Functions of the large intestine

- Reabsorb water and compact material into feces
- Absorb vitamins produced by bacteria
- Store fecal matter prior to defecation

The Large Intestine

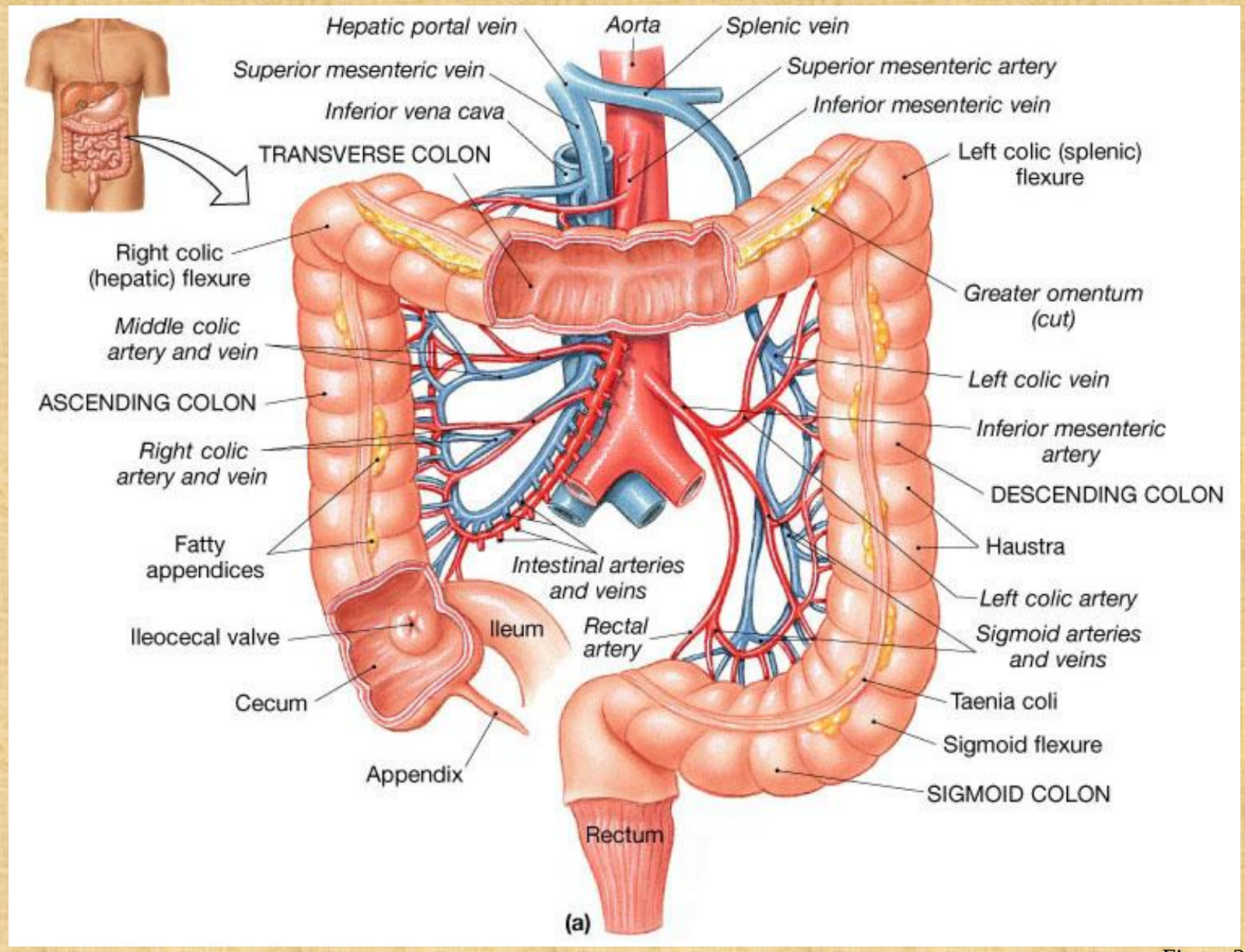
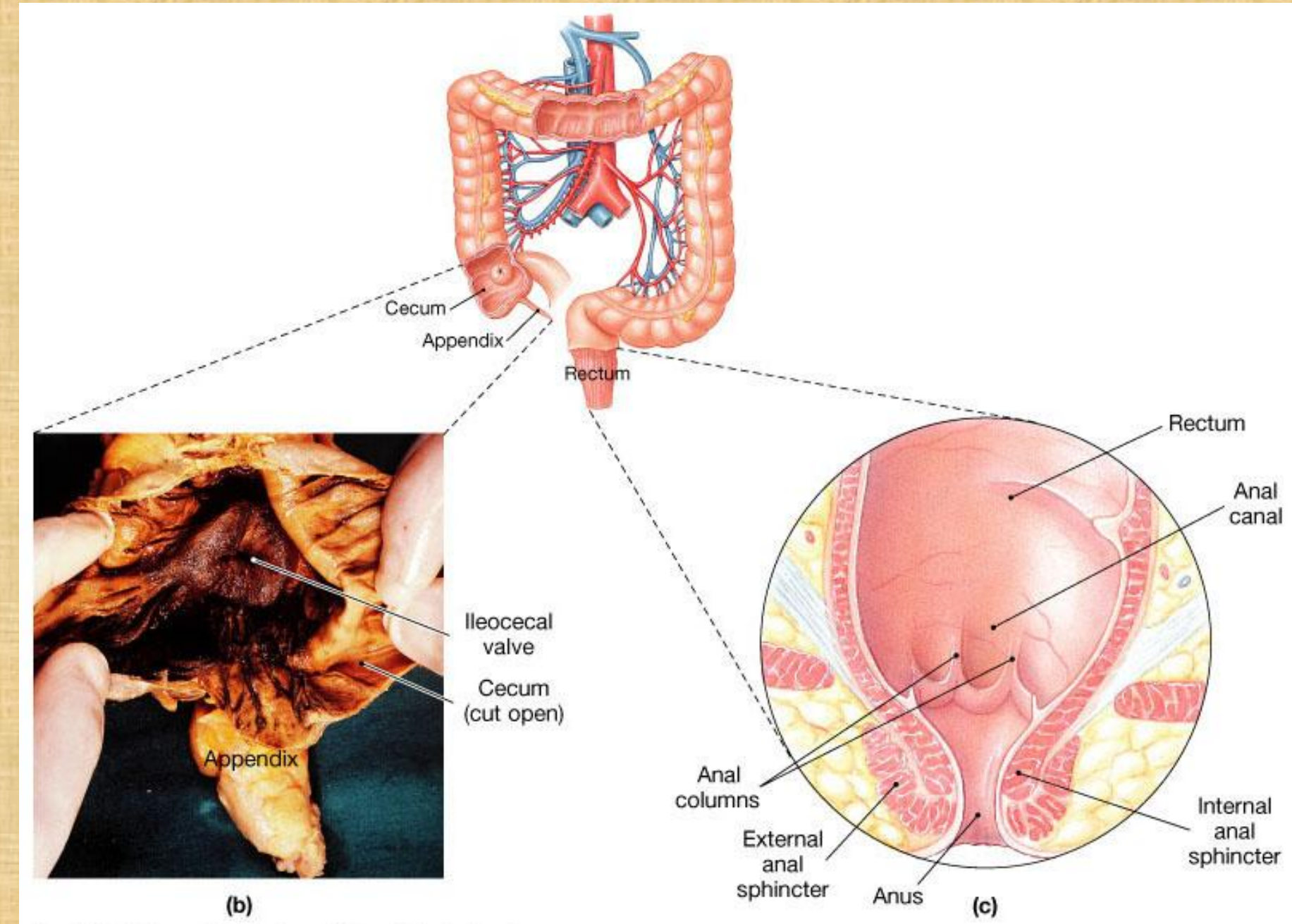
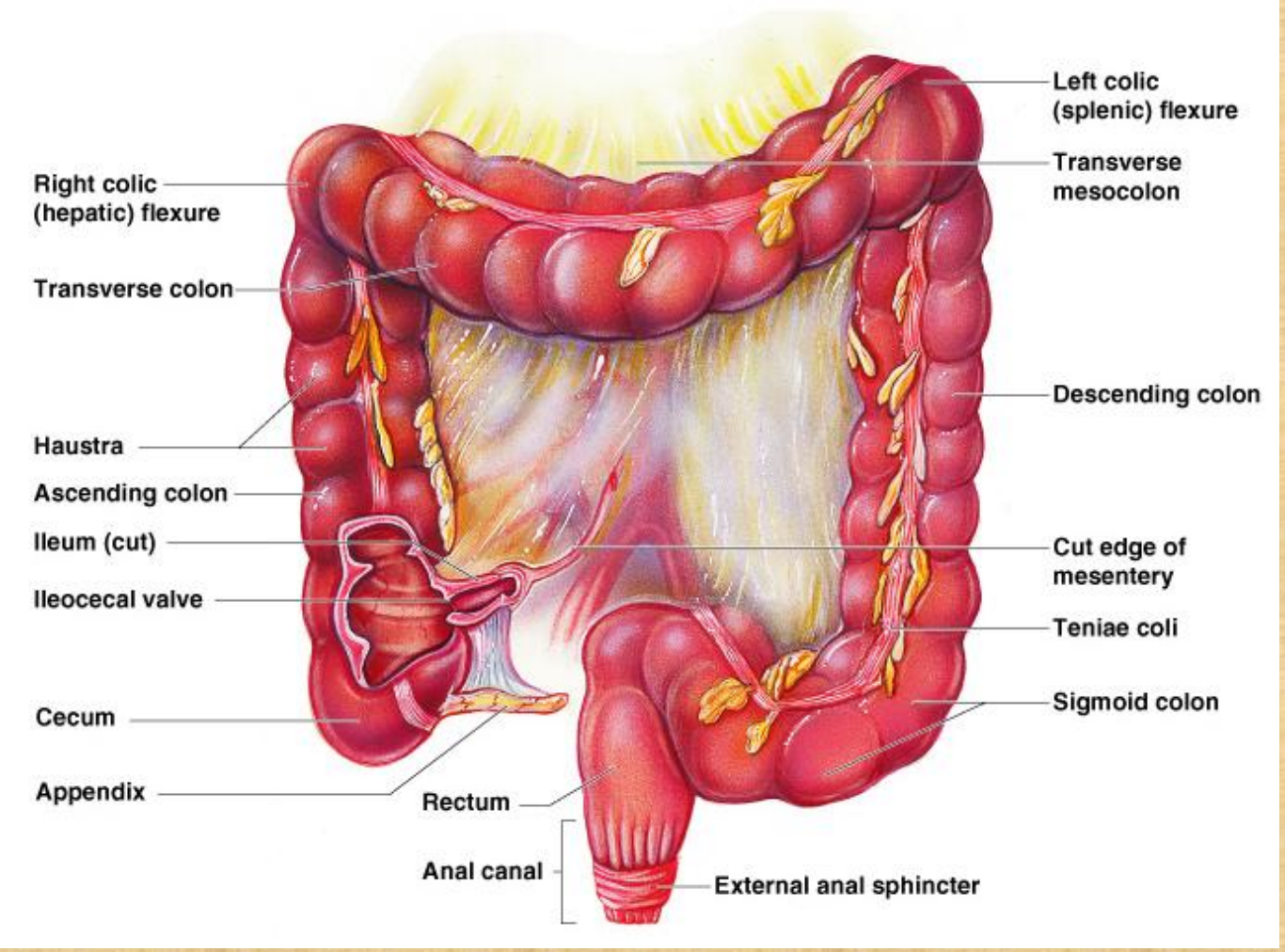
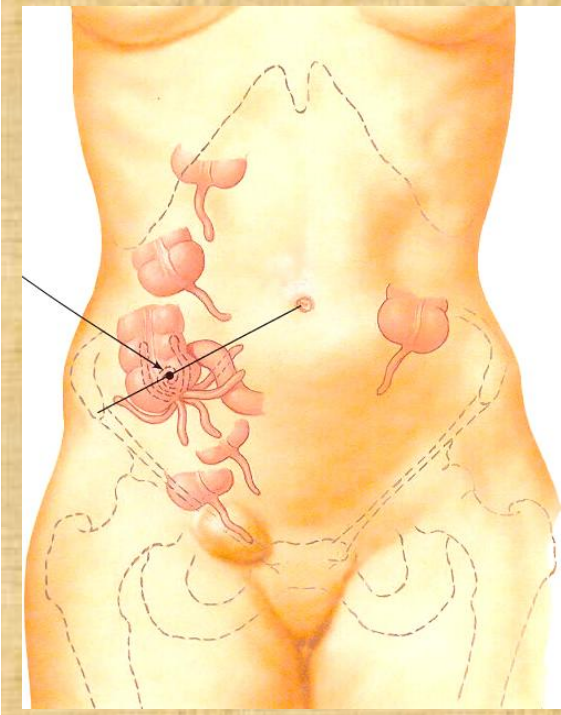


Figure 24.23a

The Large Intestine

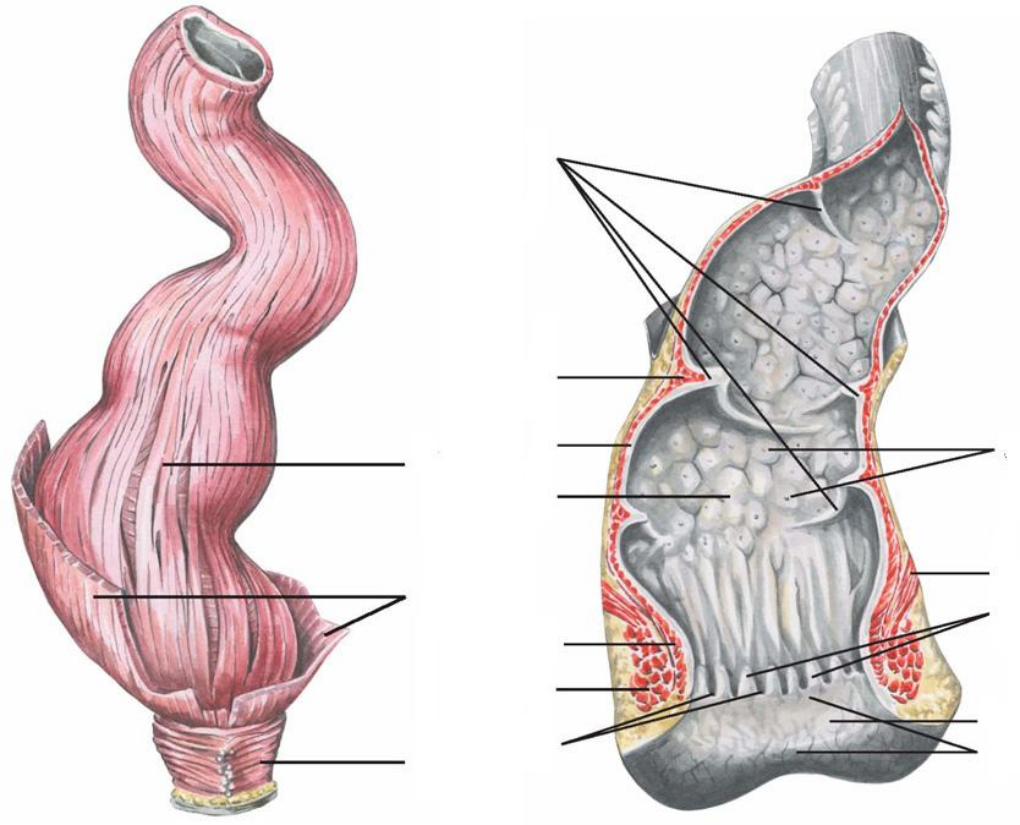



Left colic (splenic) flexure
Transverse mesocolon
Right colic (hepatic) flexure
Transverse colon
Descending colon
Haustra
Ascending colon
Ileum (cut)
Cut edge of mesentery
Ileocecal valve
Teniae coli
Sigmoid colon
Cecum
Appendix
Rectum
Anal canal
External anal sphincter



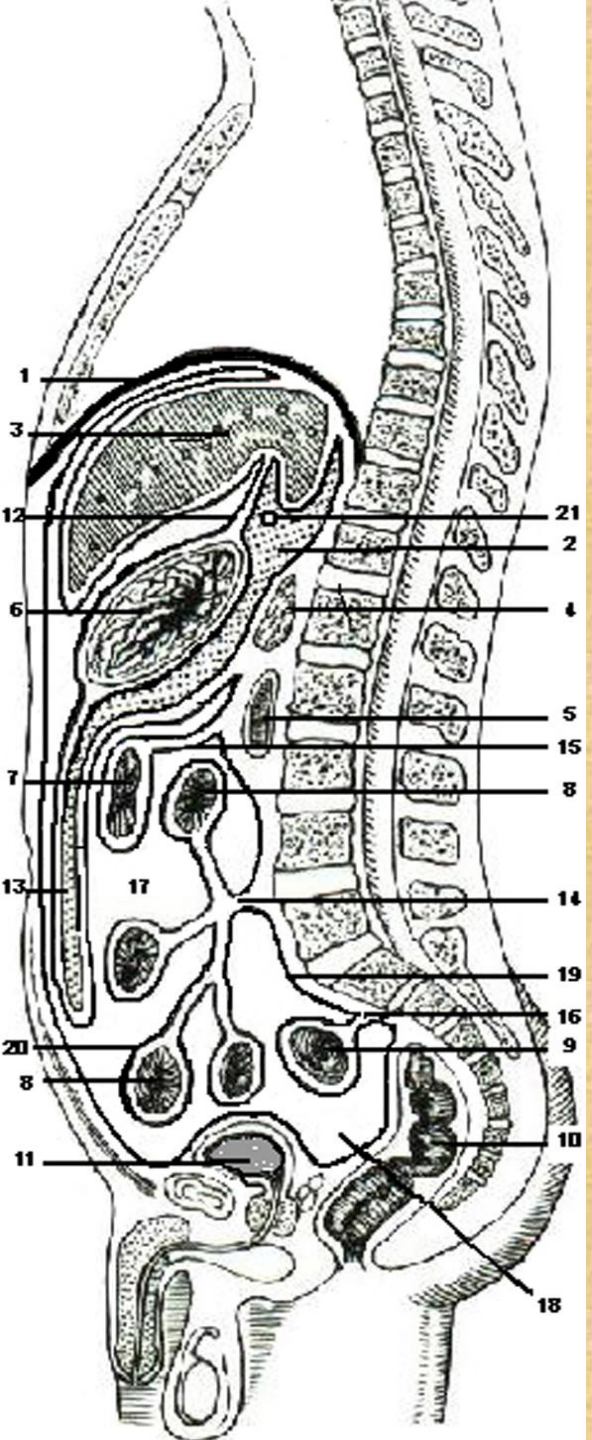
The rectum

- Last portion of the digestive tract
- Terminates at the anal canal
- Internal and external anal sphincters



Histology of the large intestine

- Absence of villi
- Presence of goblet cells
- Deep intestinal glands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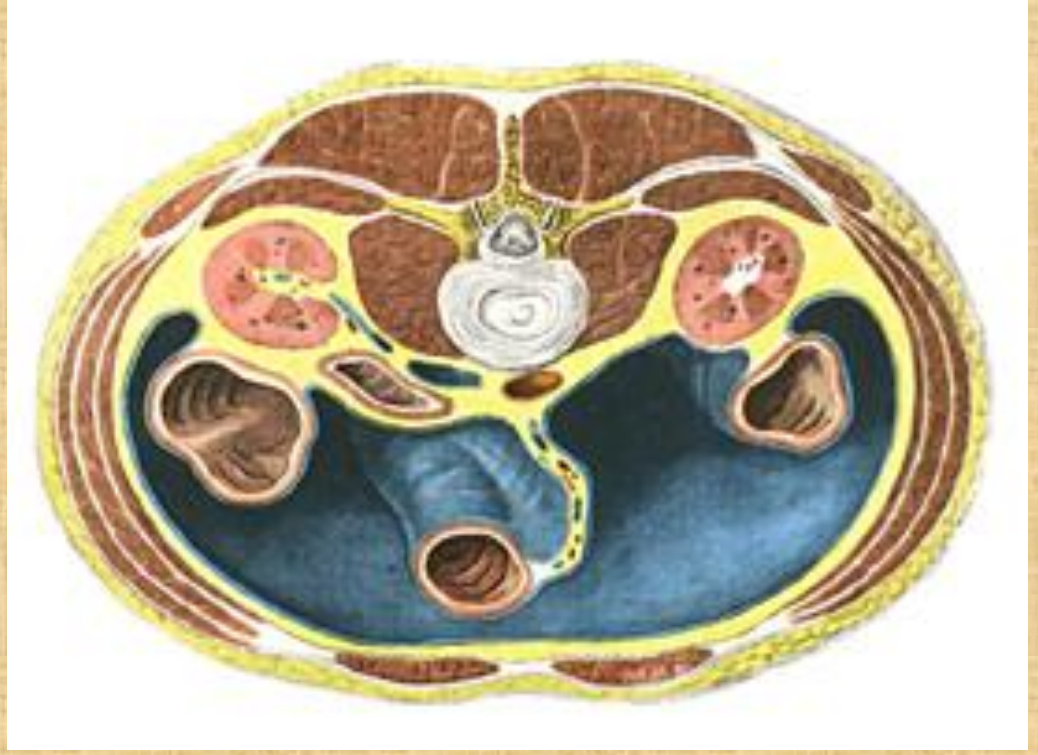


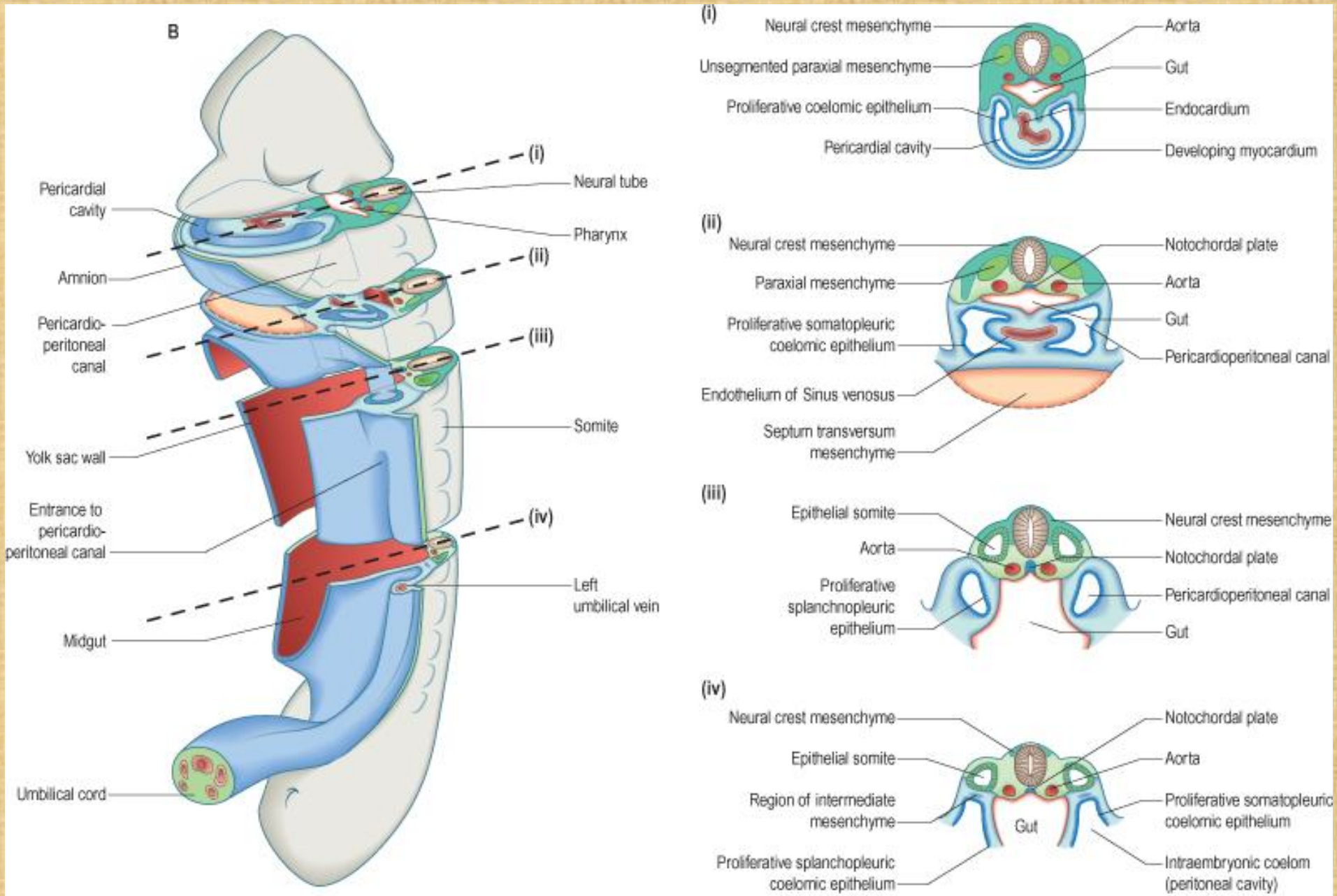
THE DEVELOPMENT OF THE DIGESTIVE SYSTEM

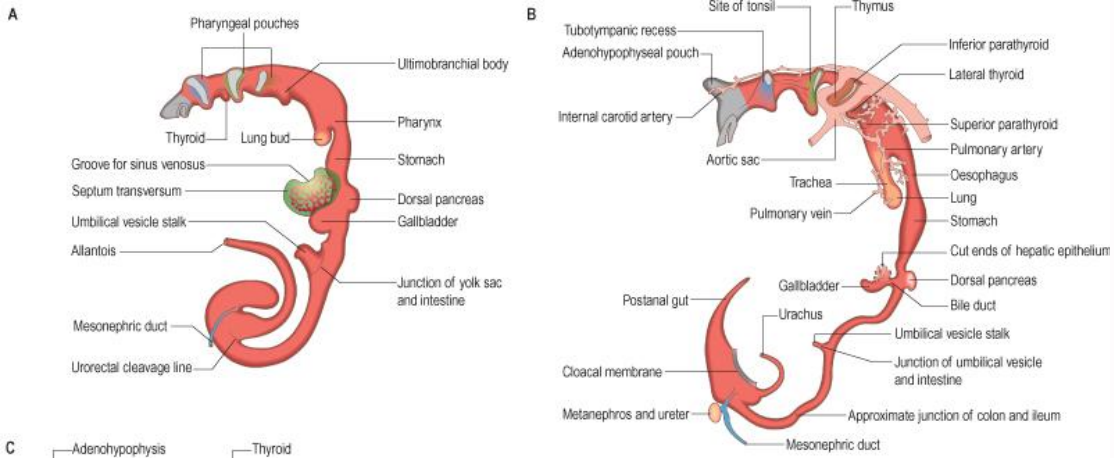
The digestive tube derives from the primitive gut. As a result of cephalocaudal and lateral folding of the embryo, a portion of the endoderm-lined yolk sac cavity is incorporated into the embryo to form the **primitive gut**. Two other portions of the endoderm-lined cavity, the yolk sac and the allantois, remain outside the embryo.

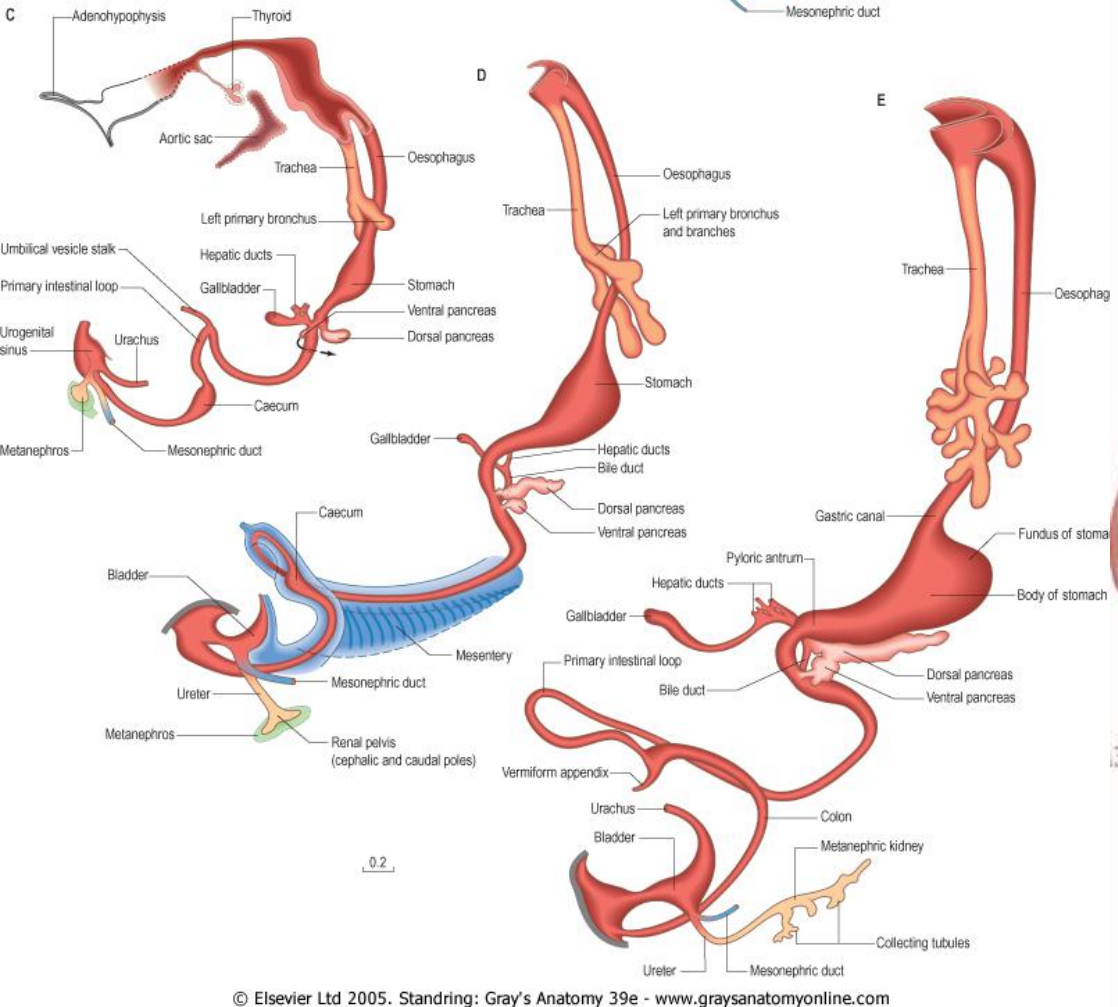
In the cephalic and caudal parts of the embryo, the primitive gut forms a blind-ending tube, the foregut and hindgut, respectively. The middle part, the midgut, remains temporary connected to the yolk sac by means of the viteline duct, or yolk stalk.

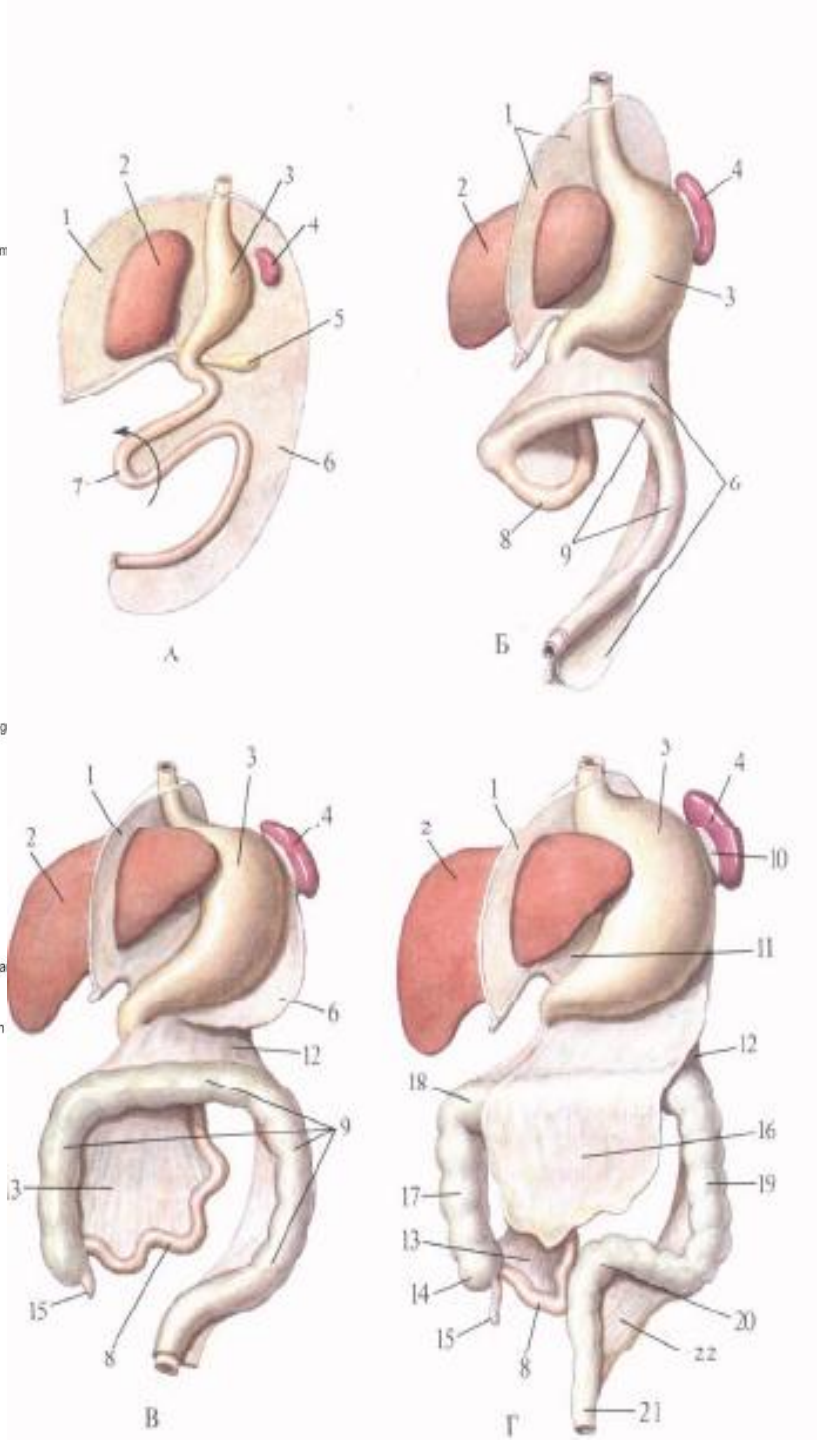
Development of the primitive gut and its derivatives:

- The **pharyngeal gut**, or pharynx, extends from the bucopharyngeal membrane to the tracheobronchial diverticulum;
- The **foregut** lies caudal to the pharyngeal tube and extends as far caudally as the liver outgrowth;
- The **midgut** begins caudal to the liver bud and extends to the junction of the right two-thirds and left third of the transverse colon in the adult;
- The **hindgut** extends from the left third of the transverse colon to the cloacal membrane.









VĂ MULȚUMESC PENTRU ATENȚIE!