



Digestive system

Two pure beef patties with an unbeatable sauce, lettuce, onions, pickle, cheese and sesame seed bun



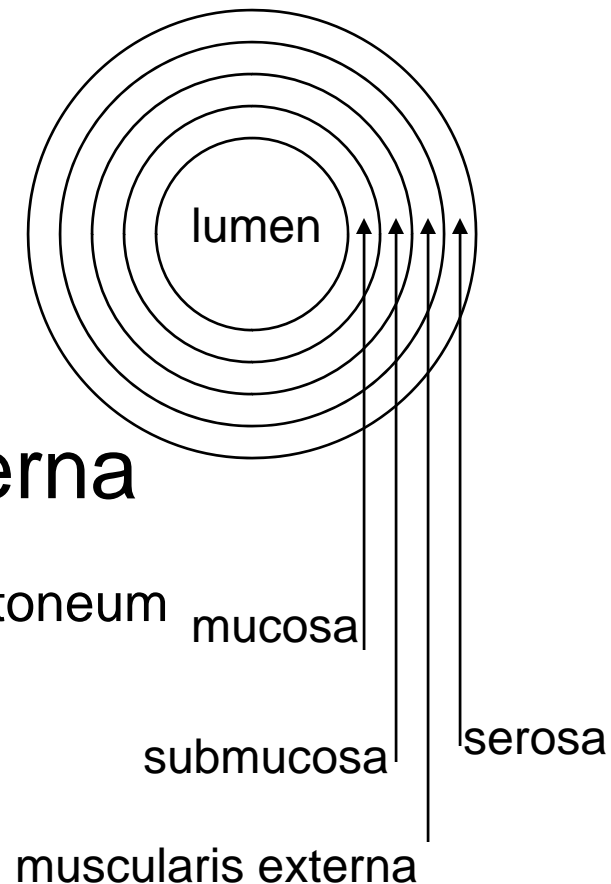
Functions of the digestive system

- Digestion-mechanical and chemical breakdown of material
- Motility-movement of material from the oral cavity to the anus-swallowing / peristalsis
- Secretion-exocrine release of enzymes into the lumen of the digestive tract for chemical digestion
- Absorption-movement of material from the lumen into the blood stream

- Alimentary canal or GI-tract- a continuous tube
 - about 30 feet in length
 - oral cavity→esophagus→stomach→small intestines→large int.→ rectum
- Accessory organs- digestive organs outside of canal
 - communicate with GI tract via ducts
 - salivary glands, pancreas, liver, gallbladder, teeth, tongue

Gastrointestinal tract-

- Four layers:
- Superficial
- Tunica mucosa
- Tunica submucosa
- Tunica muscularis externa
- Tunica serosa-visceral peritoneum
- Deep



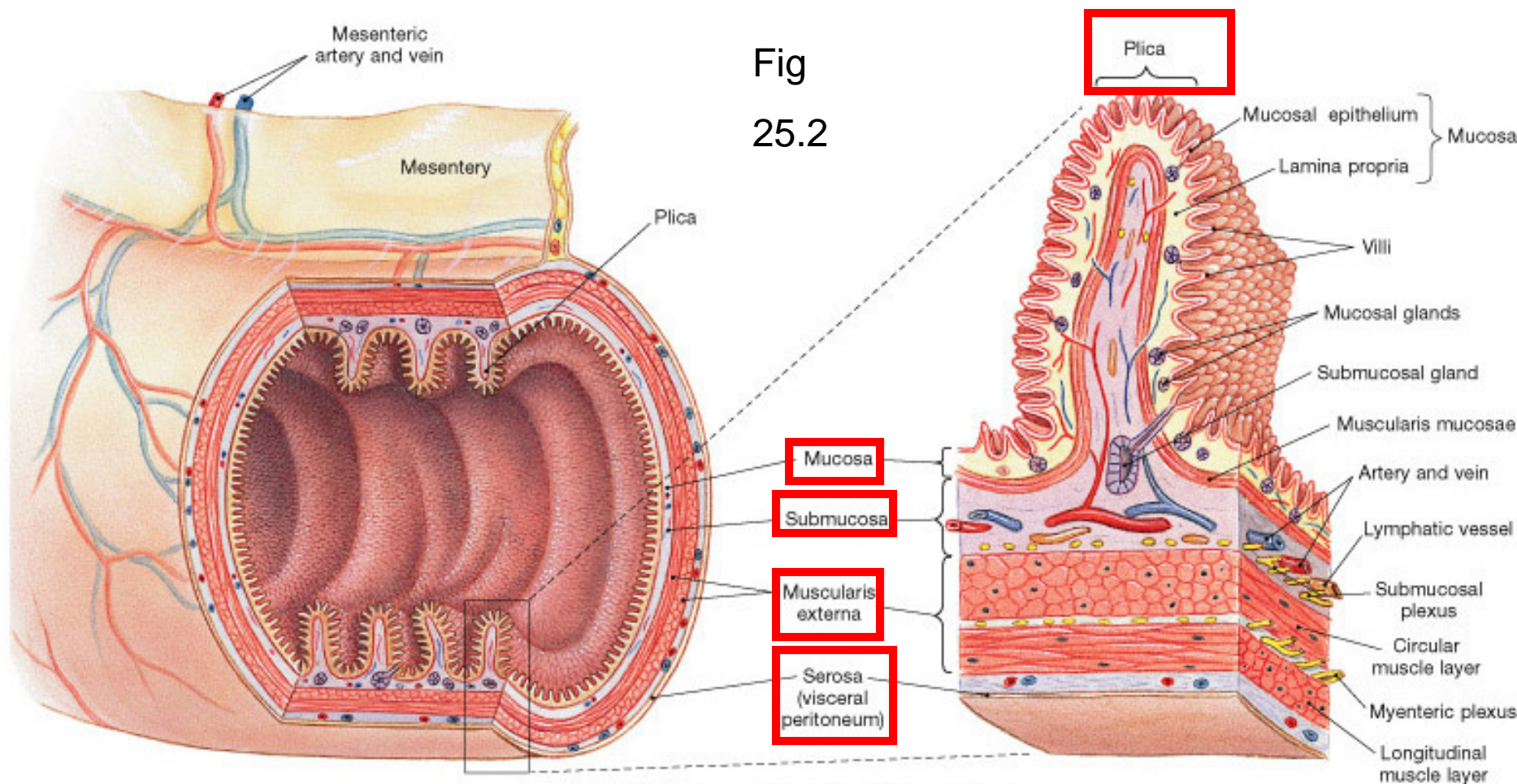


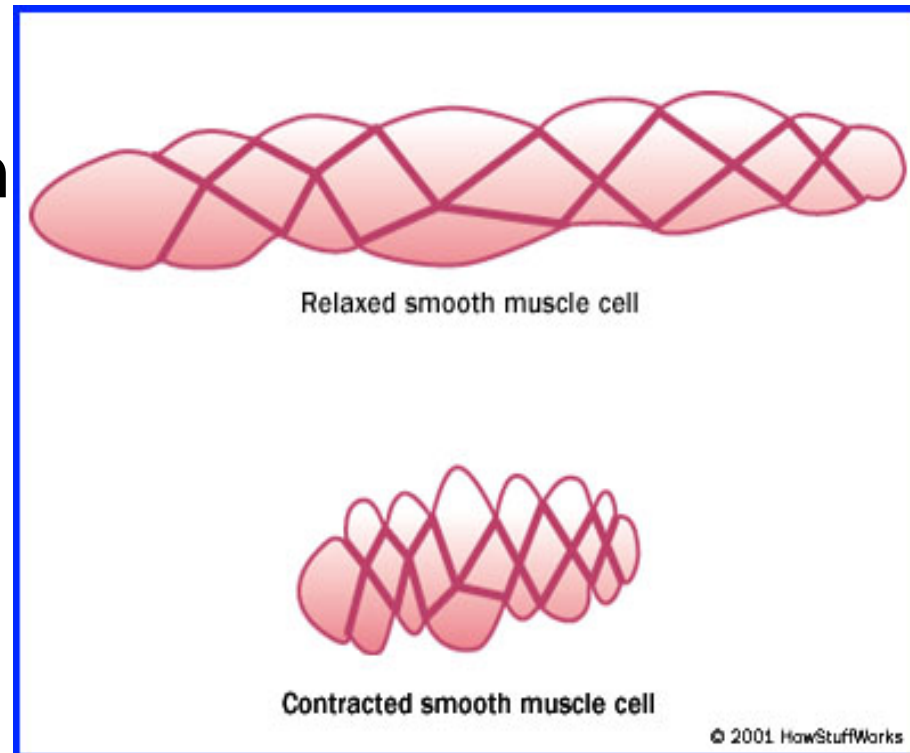
Fig
25.2

(a) Histological organization of the digestive tract

- Tunica mucosa-mucus membrane= moist epithelial tissue (different types) + loose connective tissue
 - Folding increases surface area
- Tunica submucosa-areolar connective tissue usually contains glands
- Tunica muscularis externa -2 or 3 layers of smooth muscle (3 in stomach only)
- Tunica serosa-connective tissue serous membrane NOT in esophagus/rectum-adventitia

Smooth muscle

- No sarcomere arrangement, No striations
- Many have no efferent innervation
- Gap junctions, Arranged in sheets
- Ability to stretch
- Two forms of contraction
 - Peristalsis
 - segmentation



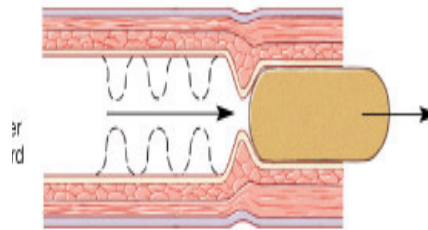
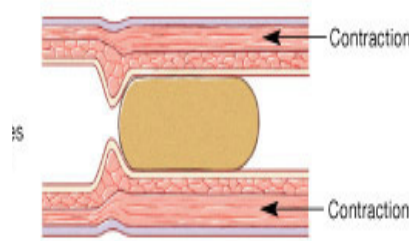
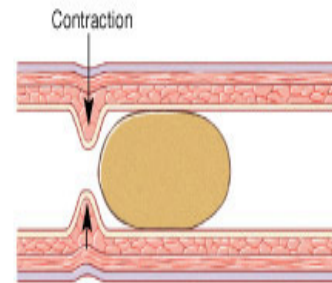
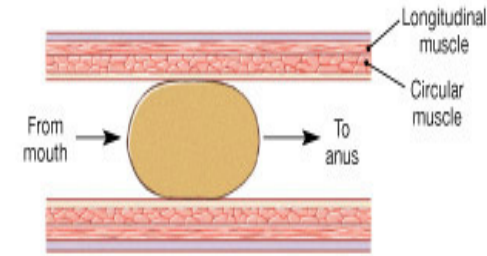
Peristalsis

Net movement of material towards the rectum

Segmentation

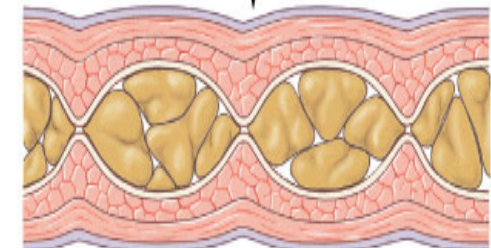
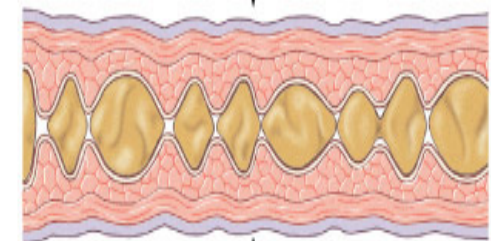
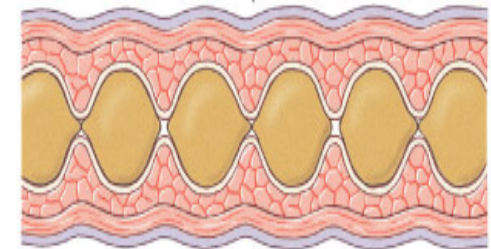
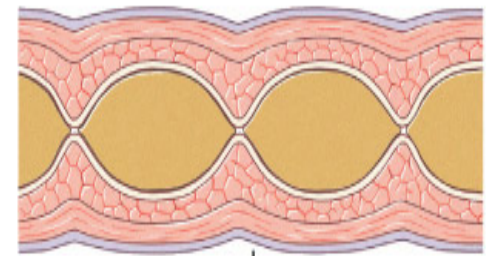
No net movement of material, mixing and churning

Enteric nervous system-nerves network that control digestive reflexes



(a) Peristalsis

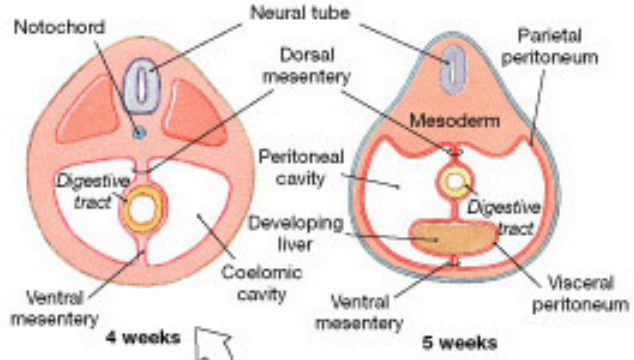
Fig 25.3



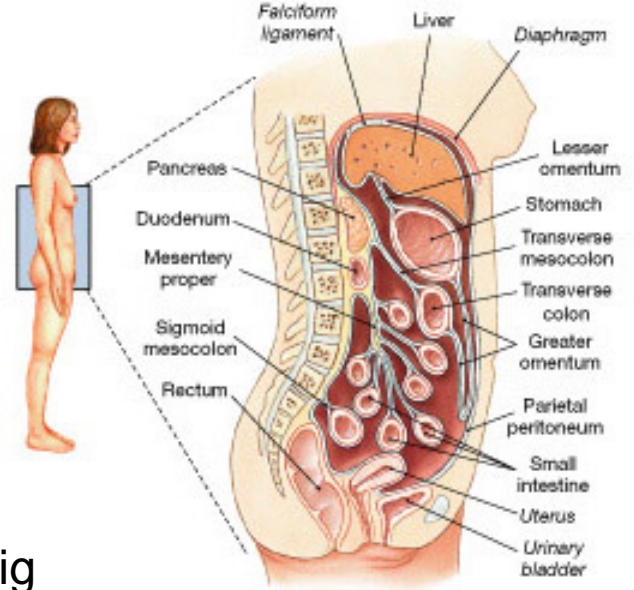
(b) Segmentation

Visceral/parietal peritoneum in-folding that suspend organs

- Falciform ligament
 - connect liver to diaphragm and anterior wall
- Greater omentum
 - fold laying over-top of the large intestines
 - connected the greater curvature of the stomach to the transverse colon
 - it is filled with fat globules and lymph nodules
- lesser omentum
 - from liver to lesser curvature of stomach
- mesentery proper
 - stomach & sm. intestines to posterior abdominal wall
- mesocolon
 - suspends lg. intestines from posterior abdominal wall

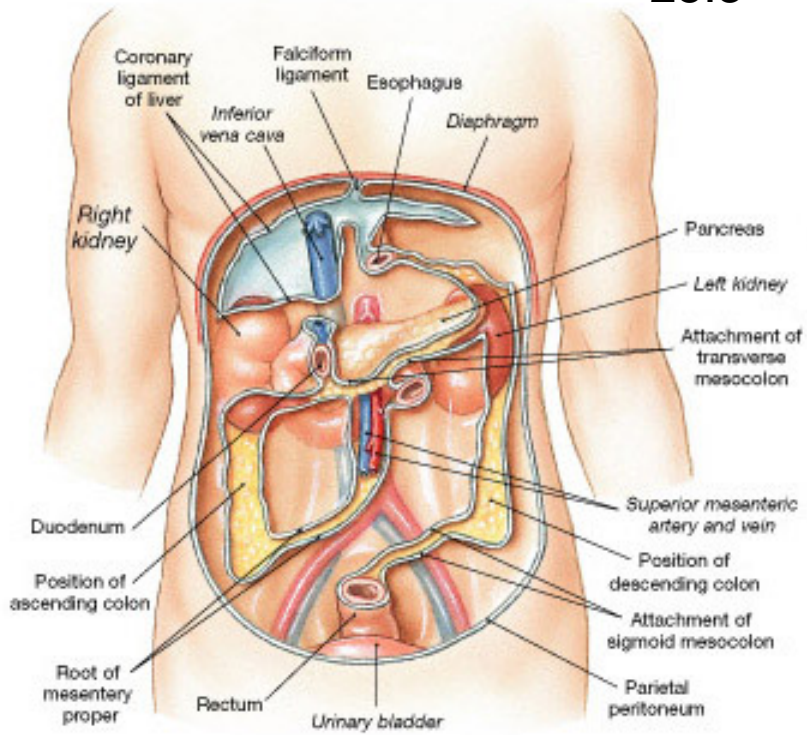


(a) Embryonic development of the digestive tube

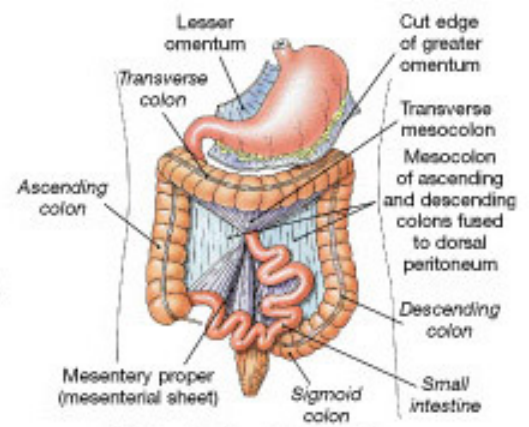


(b) Sagittal section, showing adult mesenteries

Fig
25.3



(c) Mesentery attachments, anterior view



(d) Organization of mesenteries, anterior view

Fig

25.1 Digestive tract & accessory organs

ORAL CAVITY, TEETH, TONGUE
Mechanical processing, moistening, mixing with salivary secretions

SALIVARY GLANDS
Secretion of lubricating fluid containing enzymes that break down carbohydrates

PHARYNX
Pharyngeal muscles propel materials into the esophagus

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

GALLBLADDER
Storage and concentration of bile

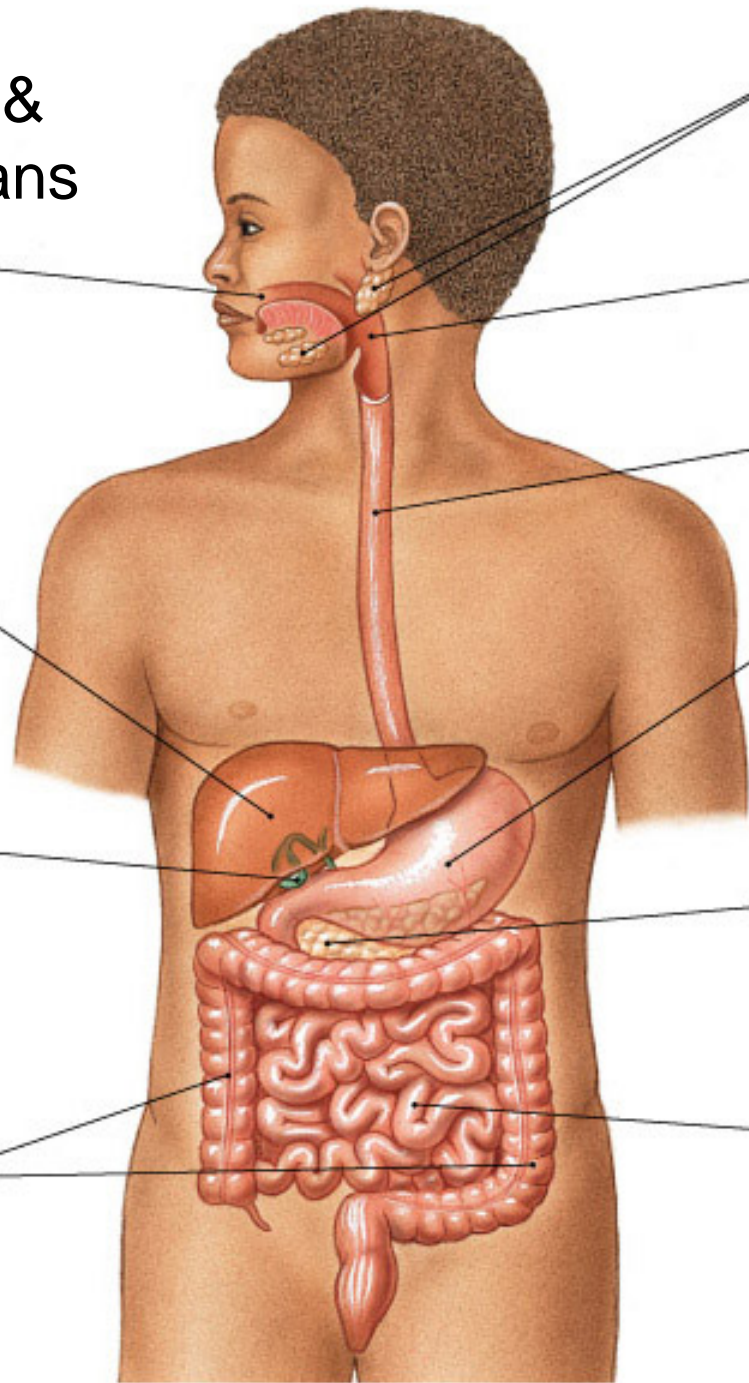
ESOPHAGUS
Transport of materials to the stomach

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

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

LARGE INTESTINE
Dehydration and compaction of undigestible materials in preparation for elimination

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



Salivary glands

- Slightly different secretions
- Stimulated by parasympathetic
- Release enzymes
- Lubrication oral cavity
- Submandibular S.G.-release majority of saliva, 70%

Dentin of teeth is similar to the inorganic portion of bone

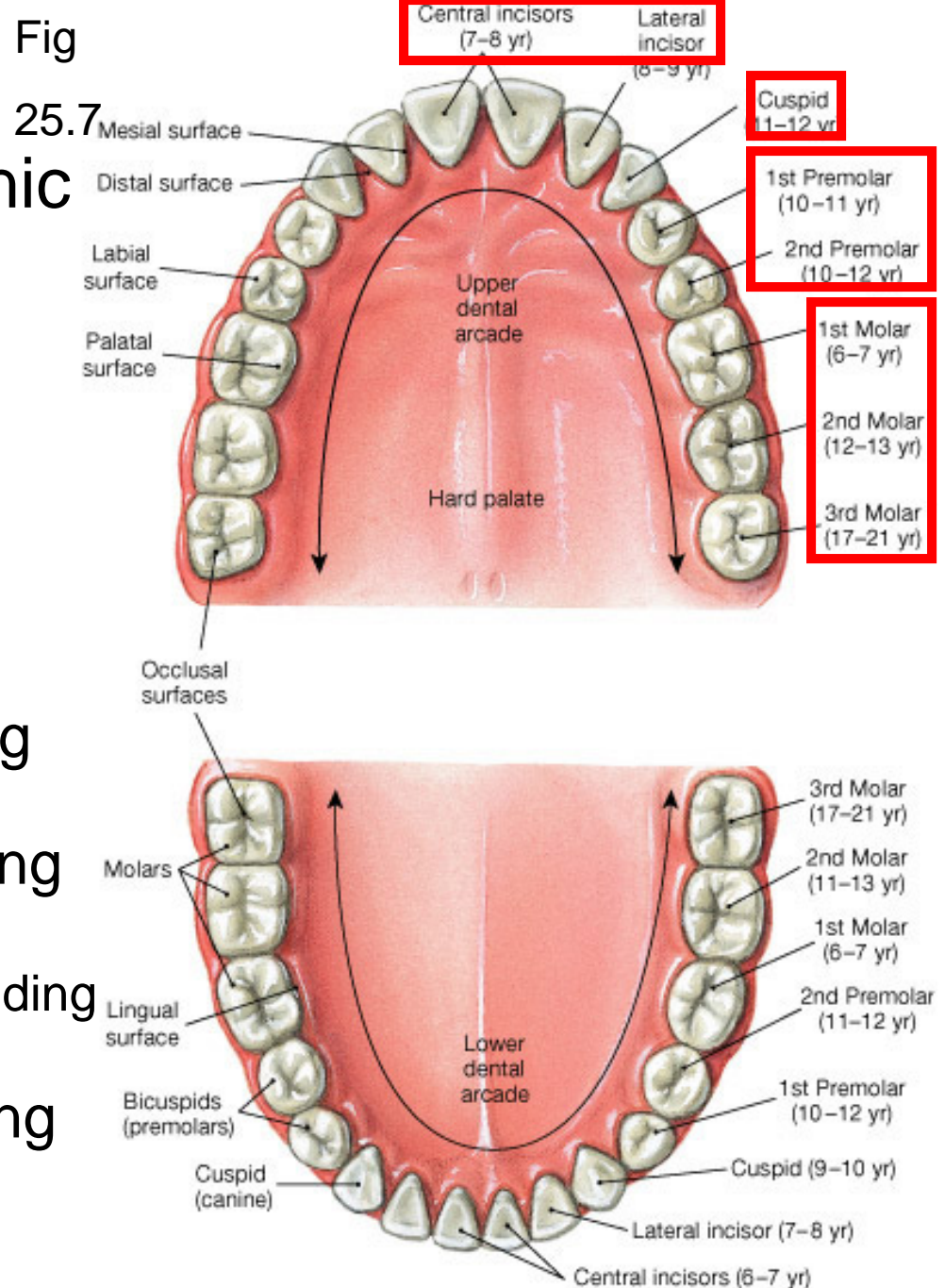
Only example of gomphosis joint

Incisors-clipping/cutting

Canines-tearing/slashing

Premolars- mashing/grinding

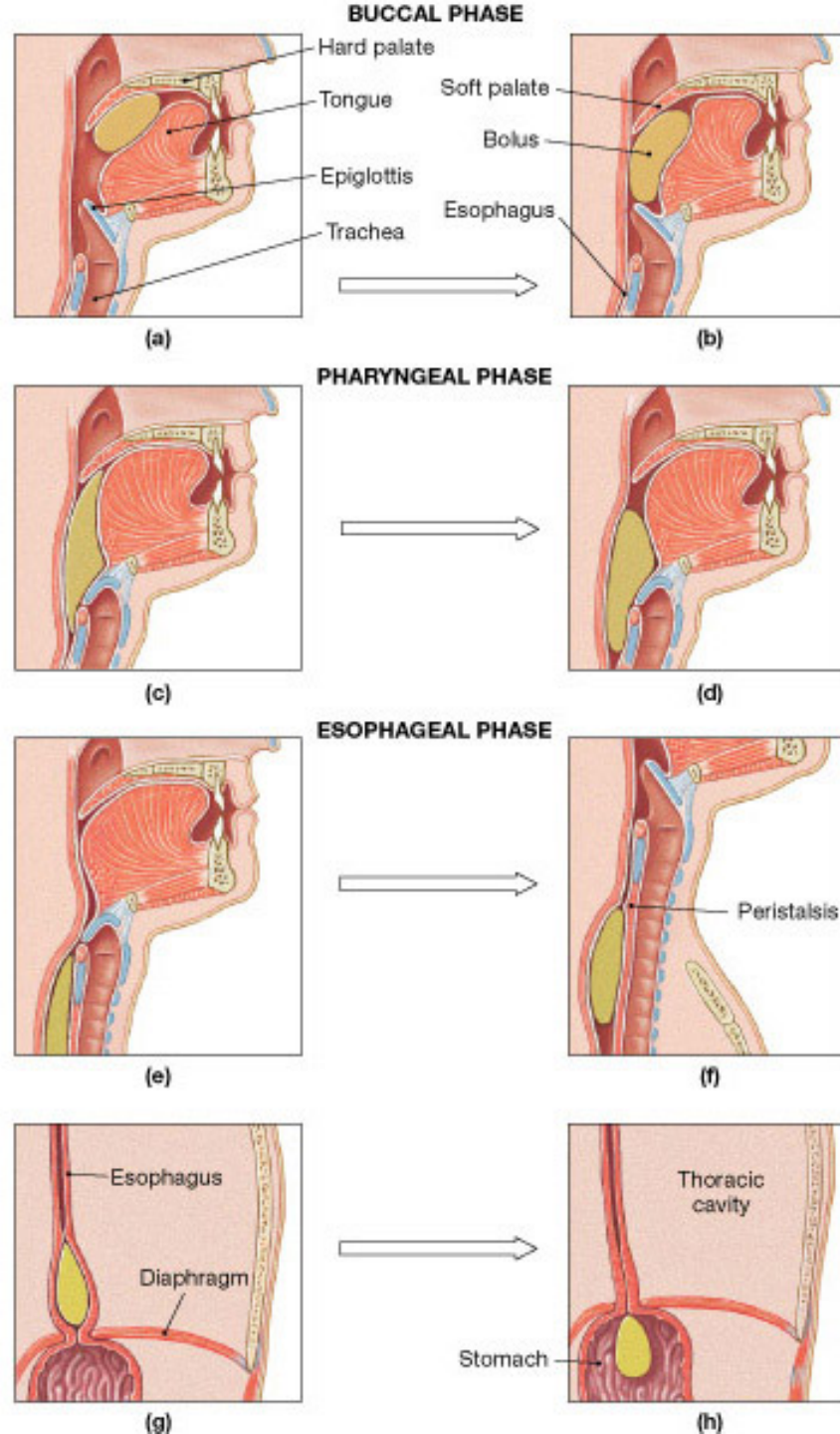
Molars mashing/grinding



(c) Adult teeth, upper and lower jaws

- 20 Deciduous teeth-baby teeth
- Permanent dentition-32 adult teeth (molars)
- Wisdom teeth-posterior molars

Epiglottis
closes
over
larynx



Voluntary
control

esophagus

- Tunica muscularis-superior 1/3 skeletal muscle
- No serosa instead adventitia
- About 1 ft long

Tunica muscularis has three layers of muscle

Fundus

Fig 25.11

Tunica mucosa has folds, rugae when empty

Esophagus

Cardia

Anterior surface

Longitudinal muscle layer
Circular muscle layer
Oblique muscle layer overlying mucosa

Lesser curvature (medial surface)

Body

Pyloric sphincter

Duodenum

Pyloric region

Left gastroepiploic vessels

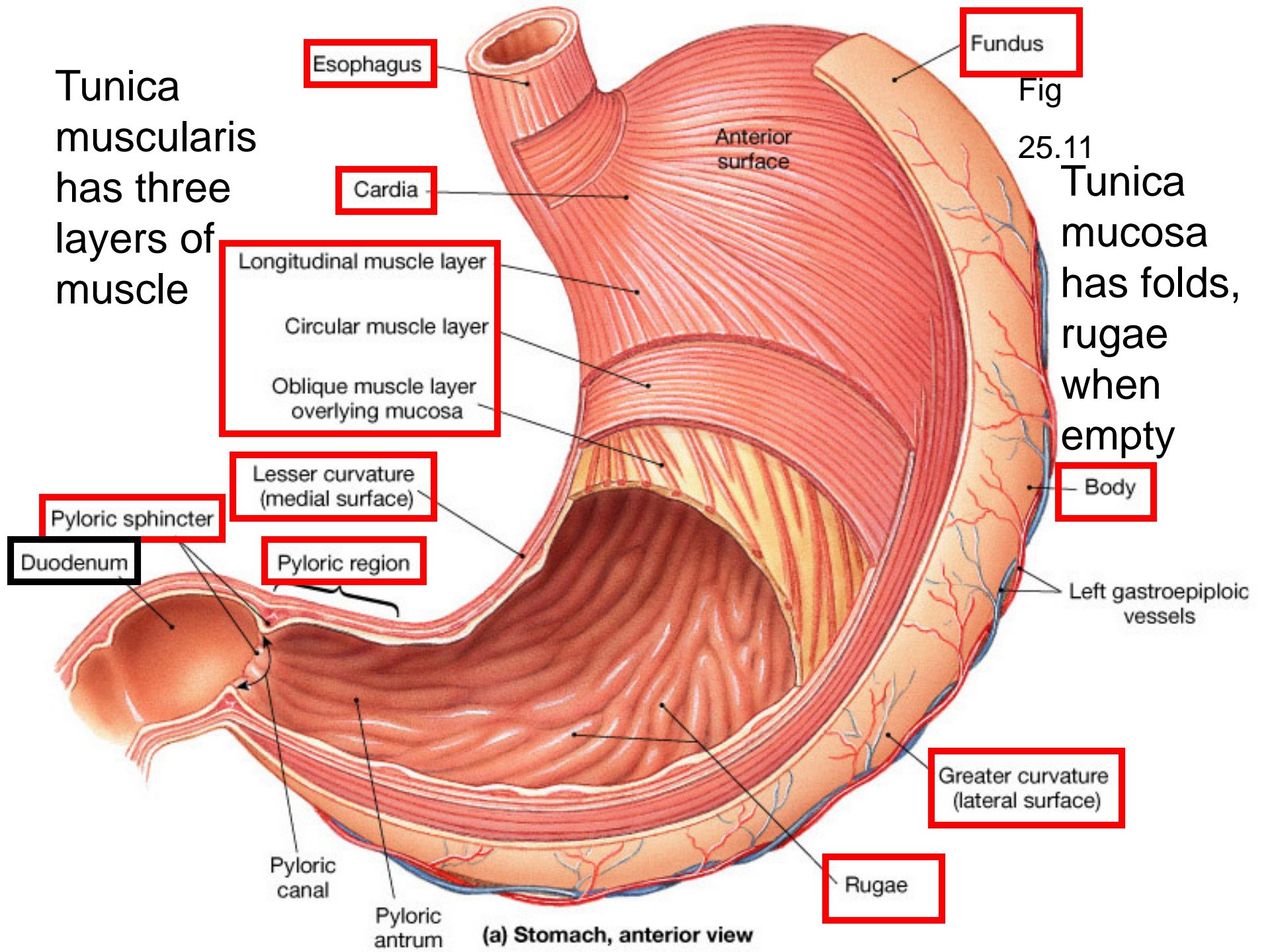
Greater curvature (lateral surface)

Rugae

Pyloric canal

Pyloric antrum

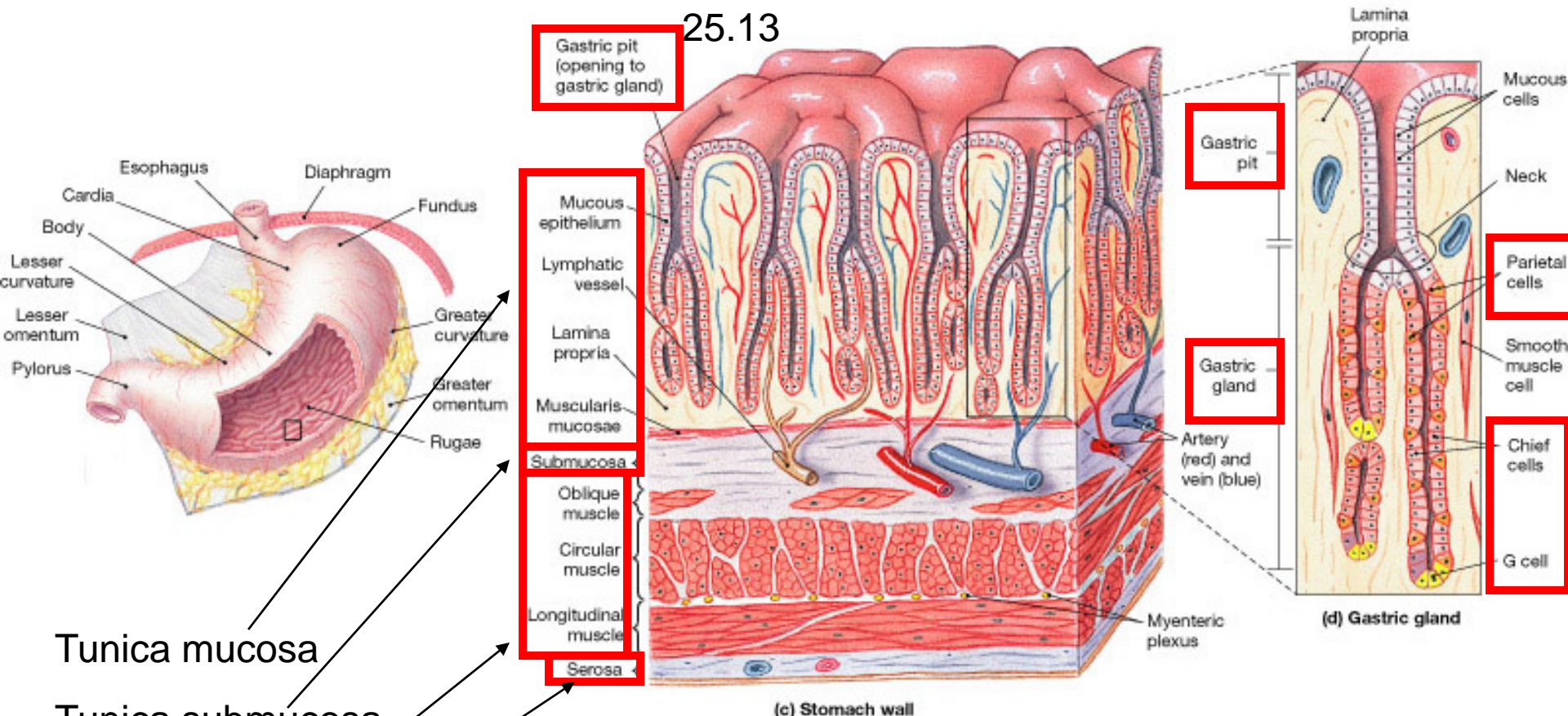
(a) Stomach, anterior view



Mucous layer protects epithelia of stomach from stomach acids

G cells release hormone, Gastrin

Fig 25.13



Tunica mucosa

Tunica submucosa

Tunica externa

Tunica serosa

Fluid leaving stomach is acid chyme

Small intestines

- 90 percent of nutrient absorption (most in jejunum)
- Contains plicae, villi, microvilli to increase surface area
- Releases hormones CCK & secretin
- Lacteal absorption of lipids
- mucus and buffers (neutralize acid chyme)

Fig
25.14

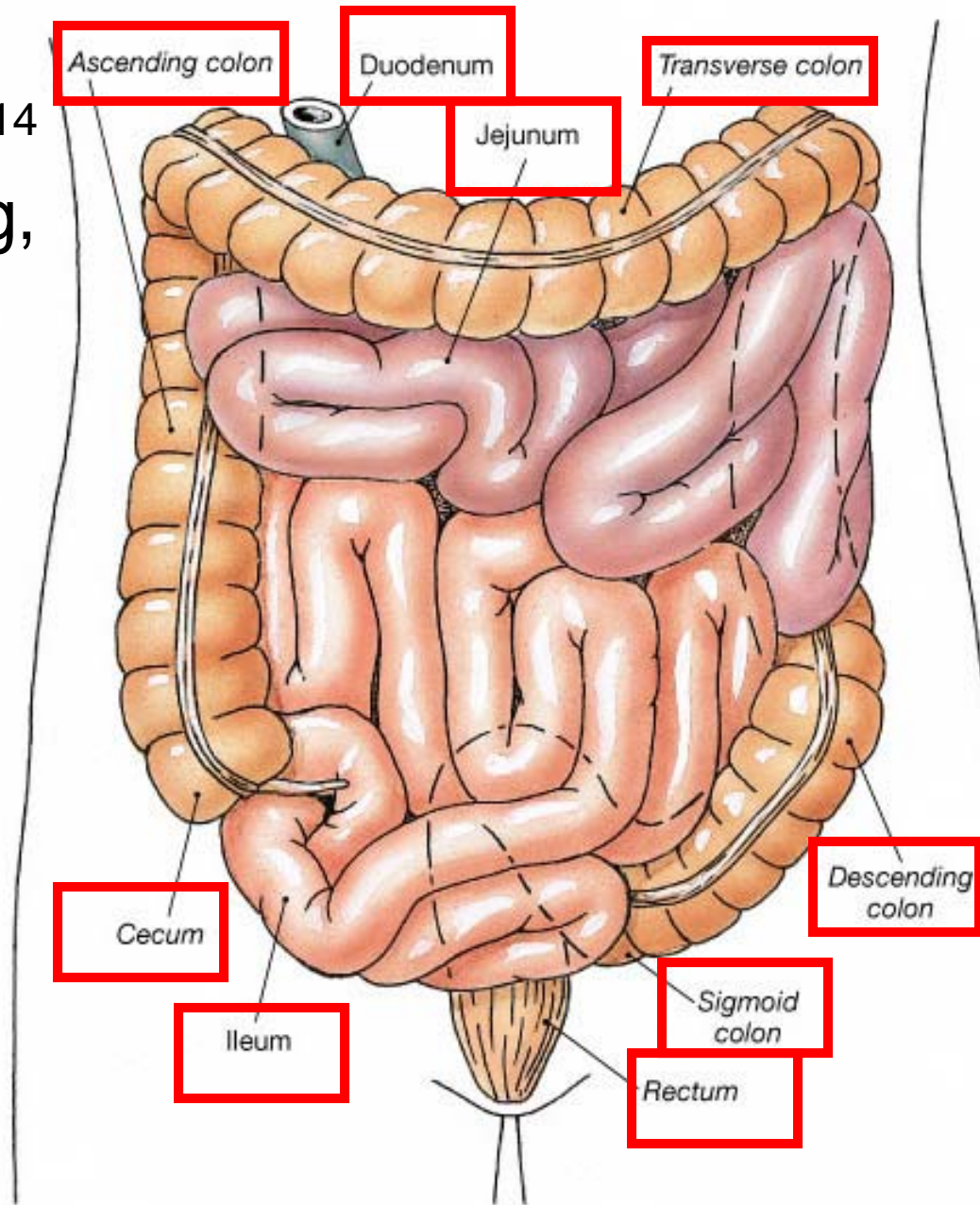
Duodenum is 10 in long,

Receives digestive
juices from
liver/pancreas

jejunum is 8 ft long

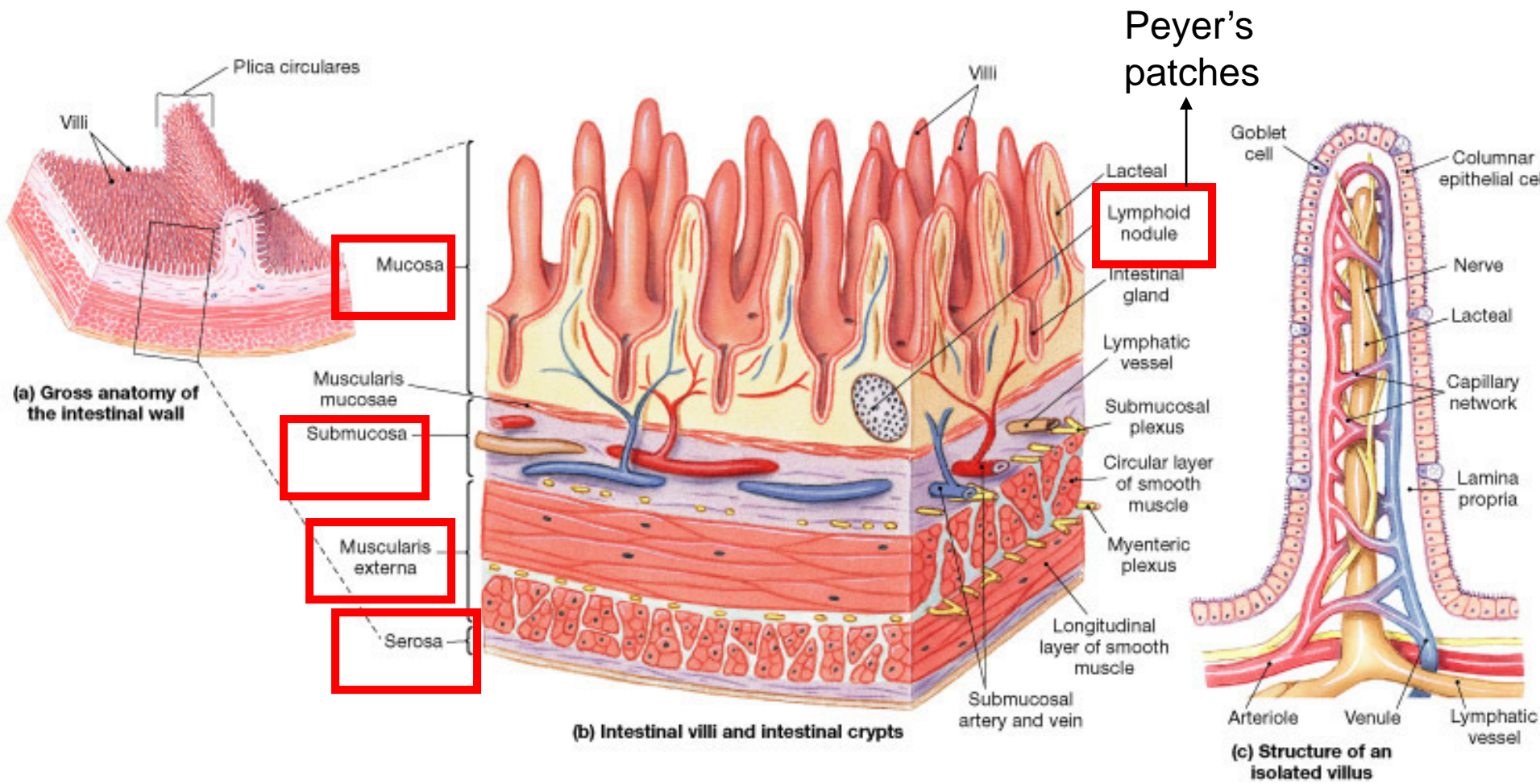
ileum is 12 ft long

Peyers patch more
common



(a)

Fig
25.15



5 ft long

Larger diameter

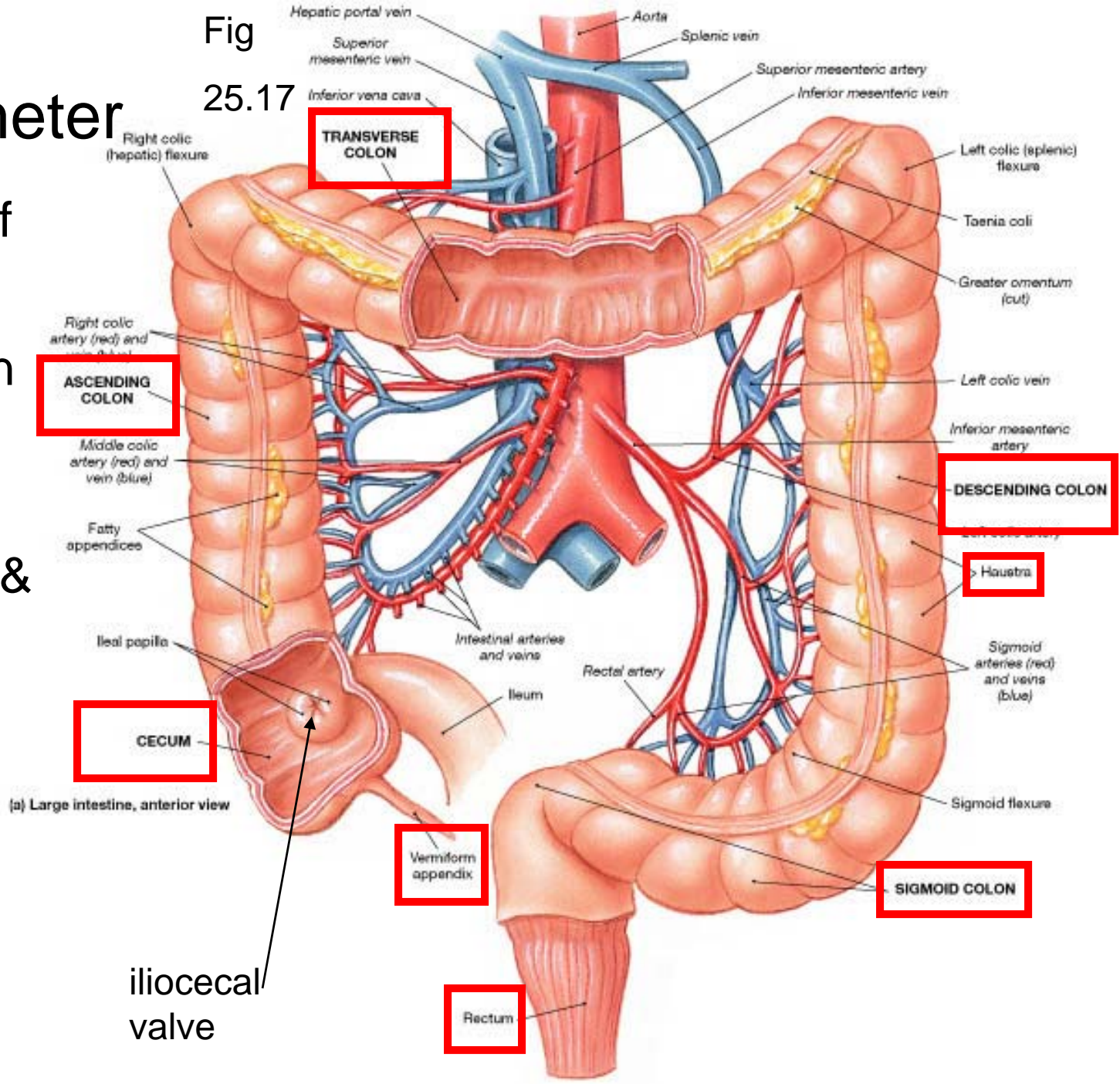
Absorption of vitamins

Reabsorption of water & electrolytes

Compaction & storage of feces

Fig

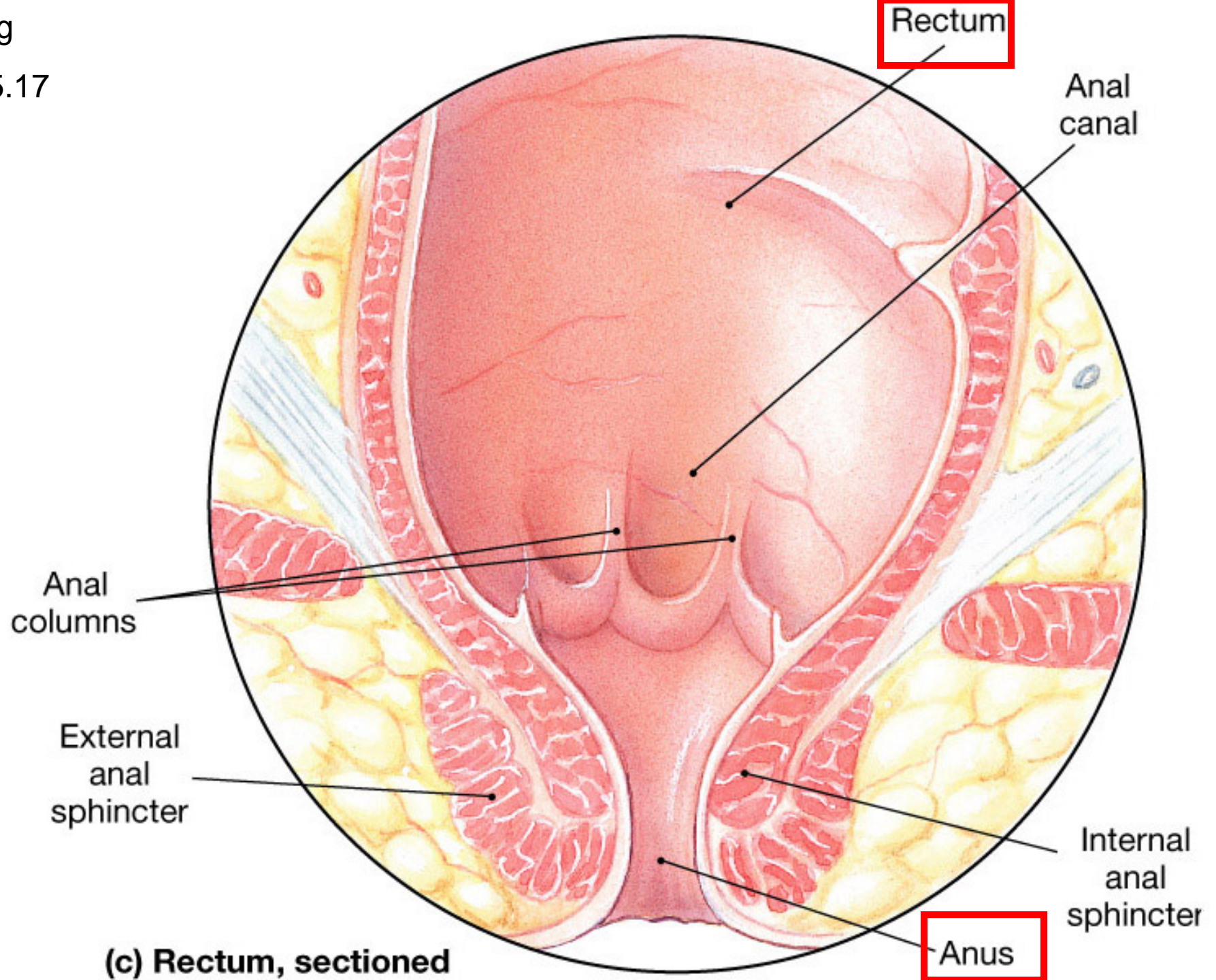
25.17



(a) Large intestine, anterior view

ileocecal valve

Fig
25.17



(c) Rectum, sectioned

valves

- Valves regulate passage of material from segment to segment
- pharynx/esophagus
- Esophagus/stomach-cardiac sphincter
- Stomach/small intestines-pyloric sphincter
- Small/large intestines-ileocecal valve
- Anus/environment

Fig

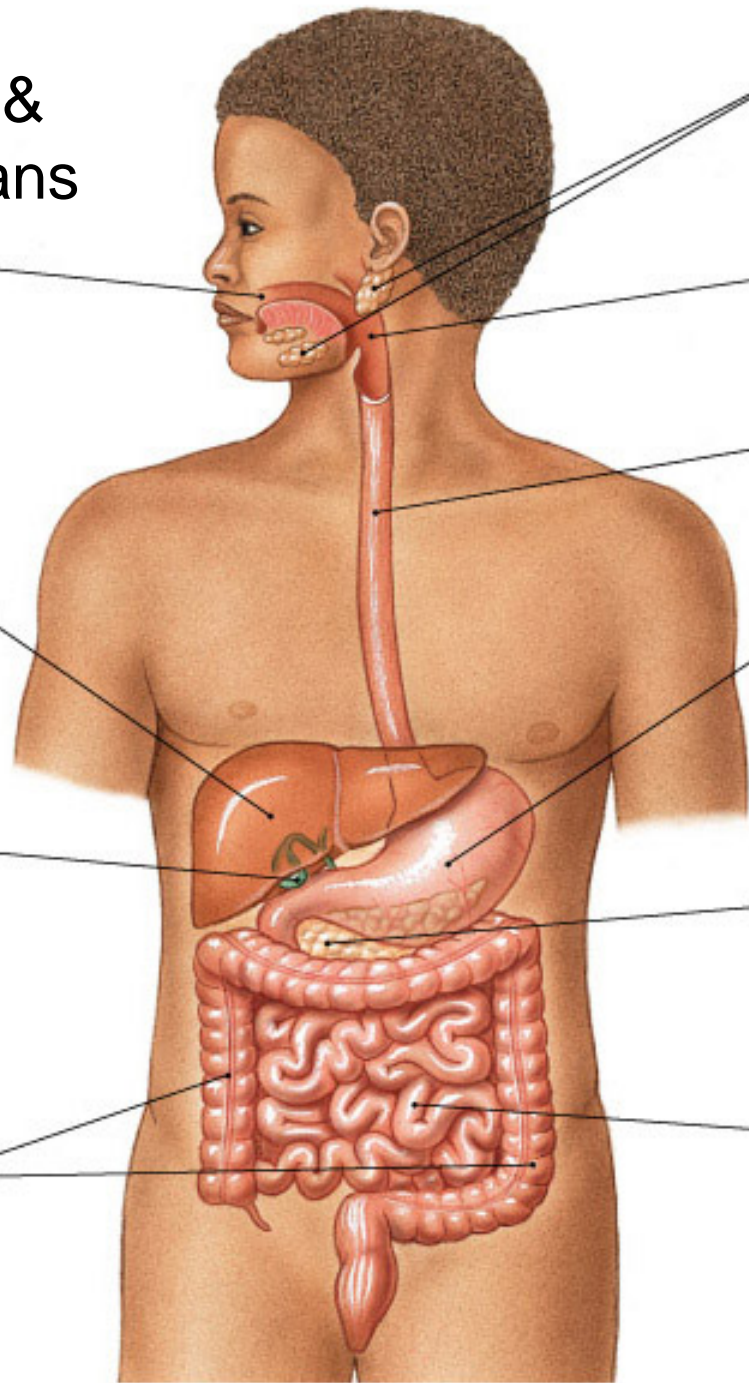
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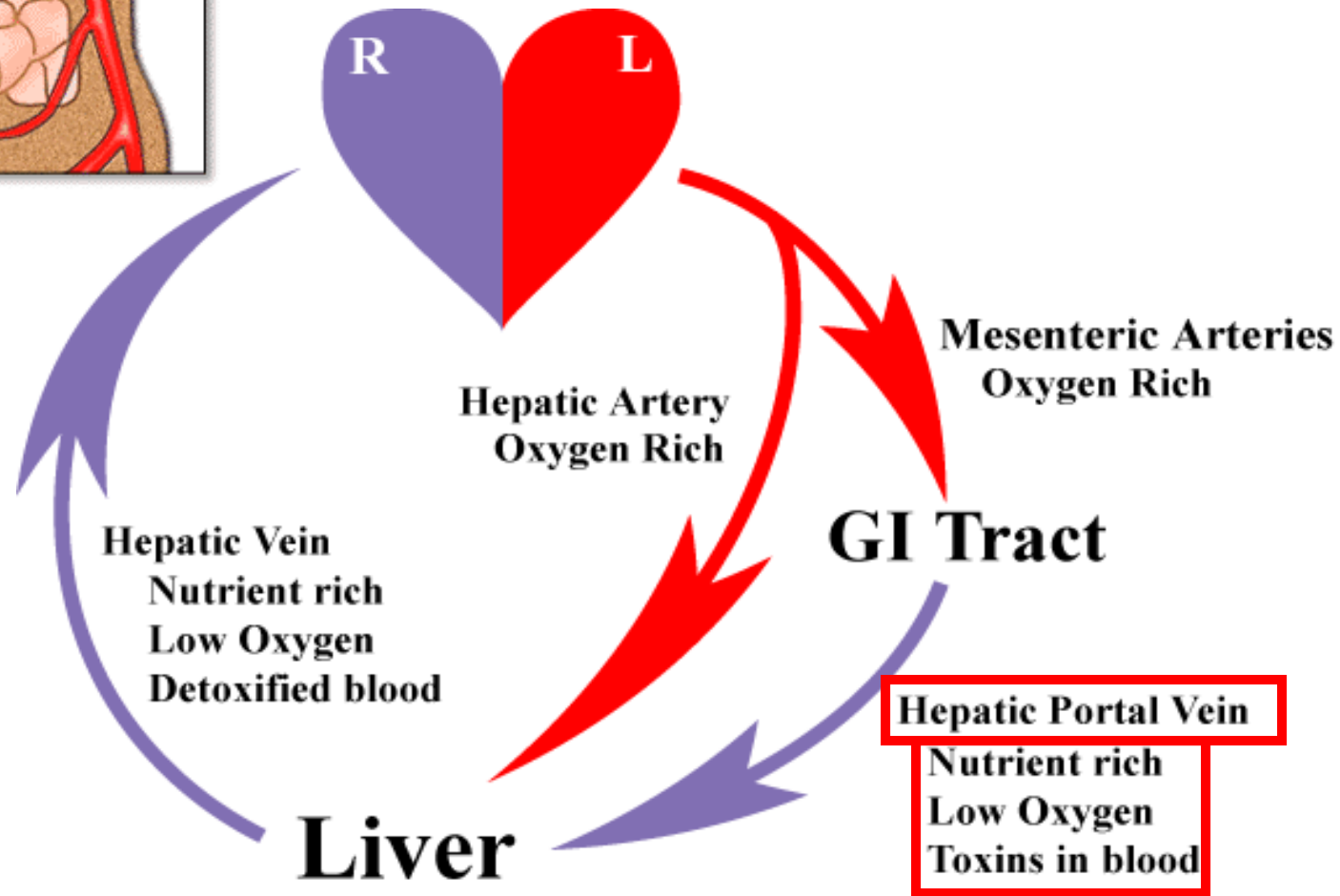
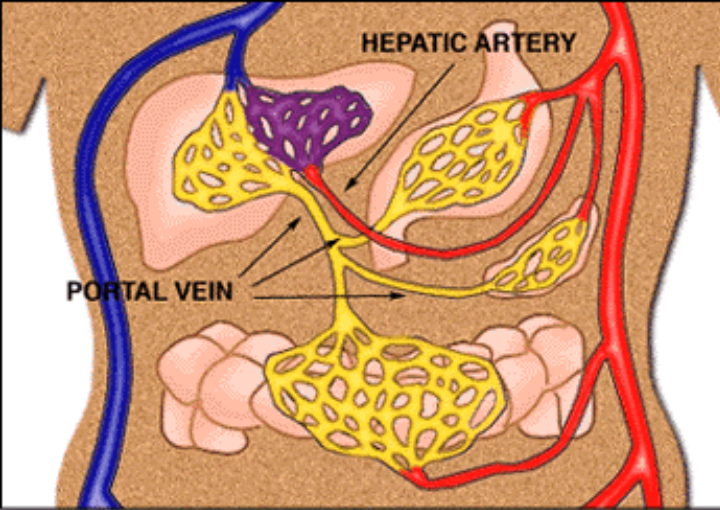
PANCREAS
Exocrine cells secrete buffers and digestive enzymes; endocrine cells secrete

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

Liver

- Metabolic regulation
 - absorbed nutrients are further metabolized in the liver
 - Toxins brake down
 - Fat soluble vitamins stored in liver
- Hematological regulation
 - Liver receives 25% of blood from aorta
 - breakdown of old/damaged blood cells
 - Makes plasma proteins
- Synthesis of bile/bile salts
 - Bile-pH buffer neutralize stomach acid
 - Bile salts-aids in break down of lipids

Circulation thru the digestive system



With continued exposure to ethanol, sections of the liver will die, as evidenced by these micronodules.

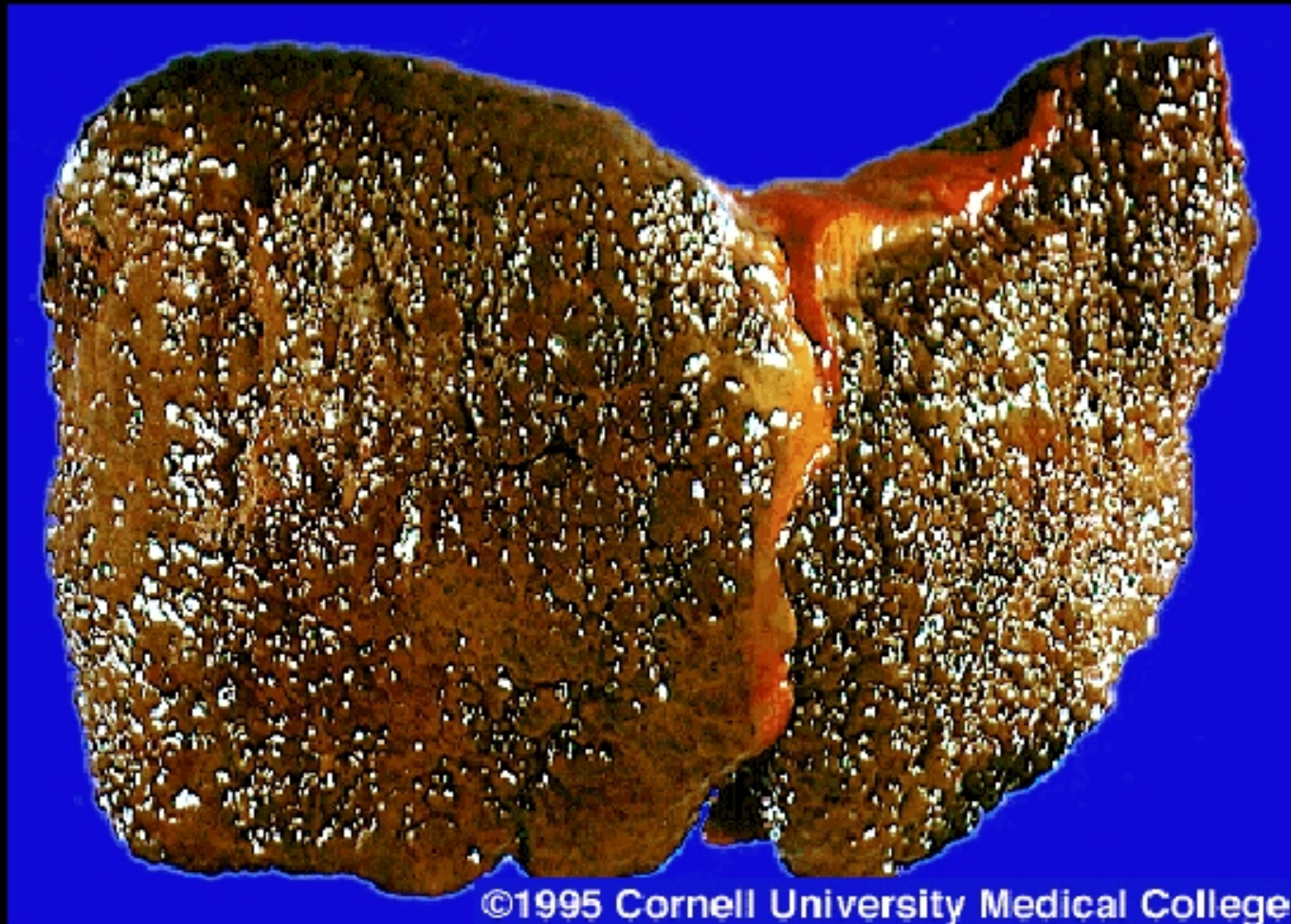
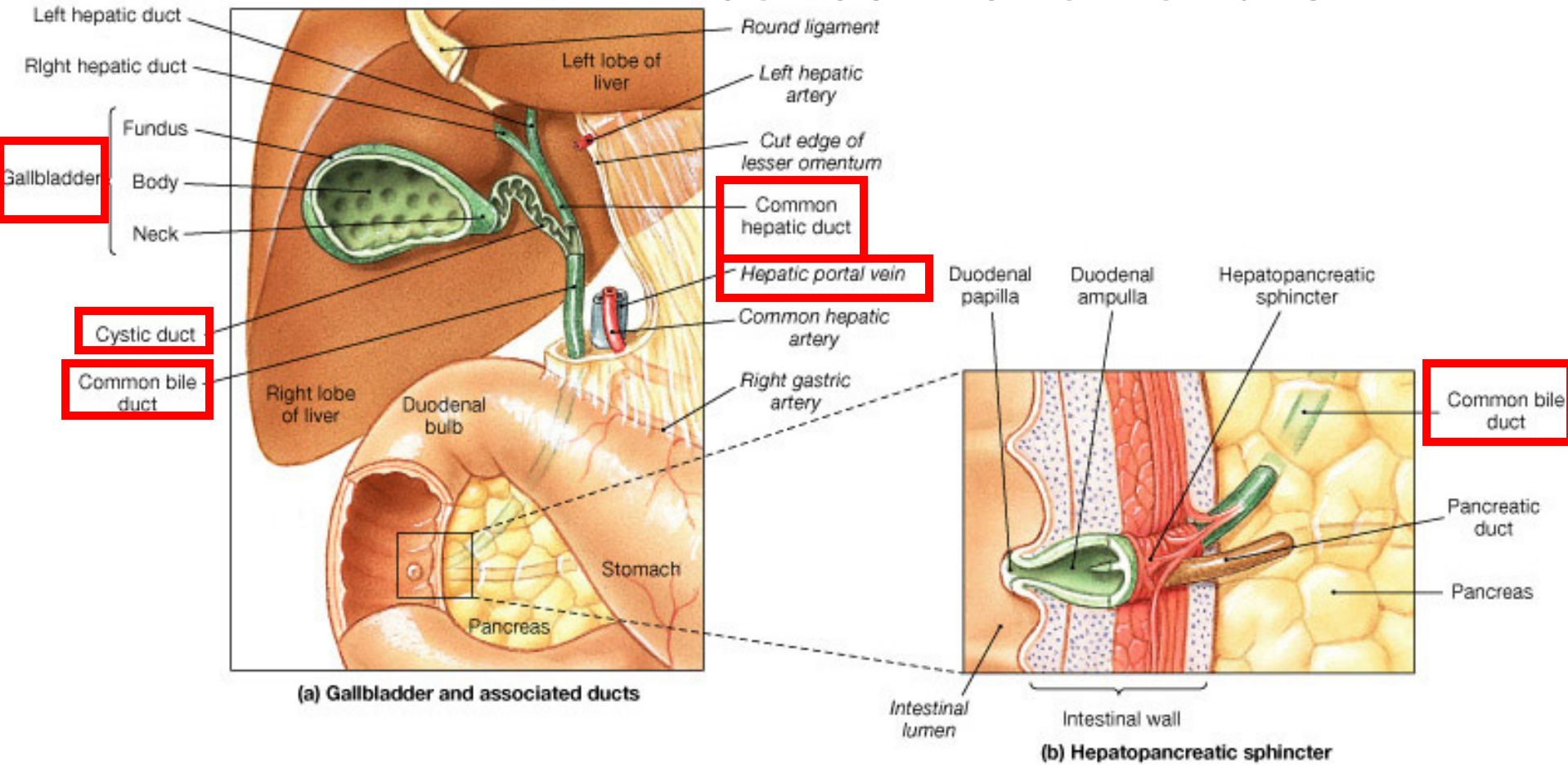
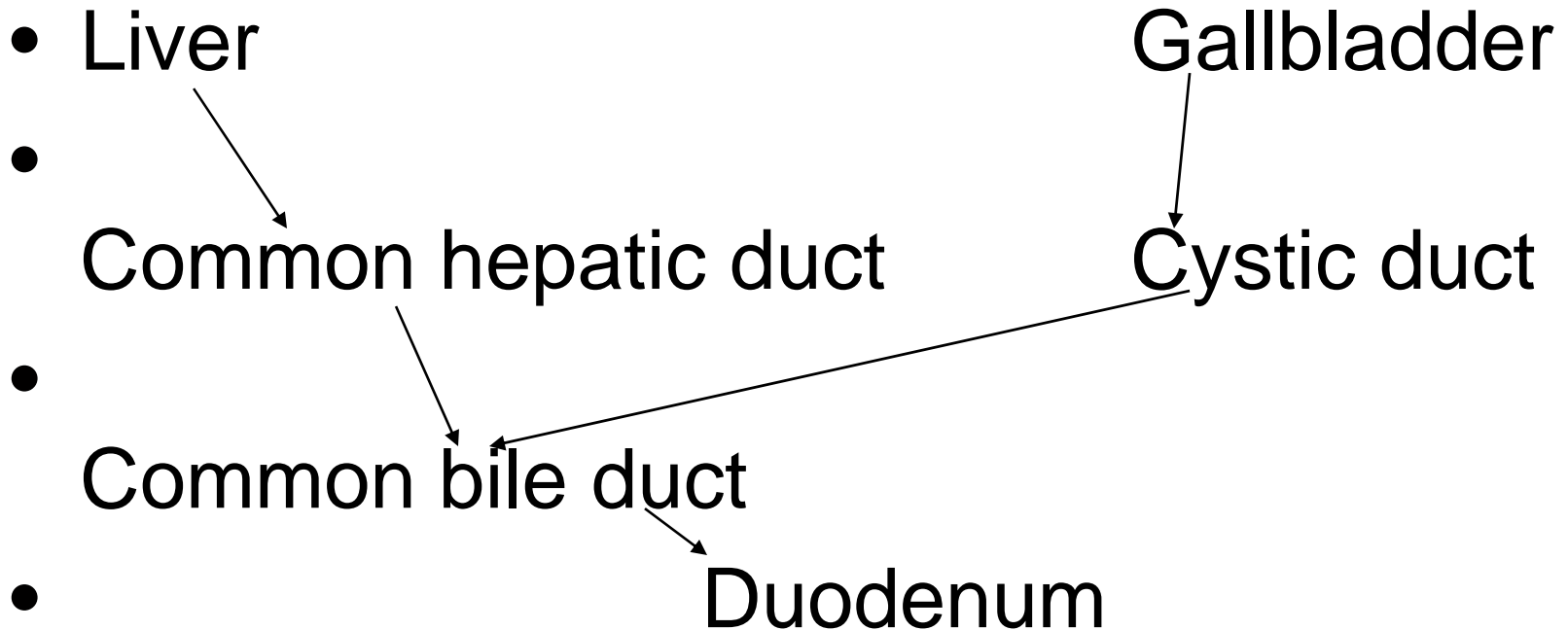


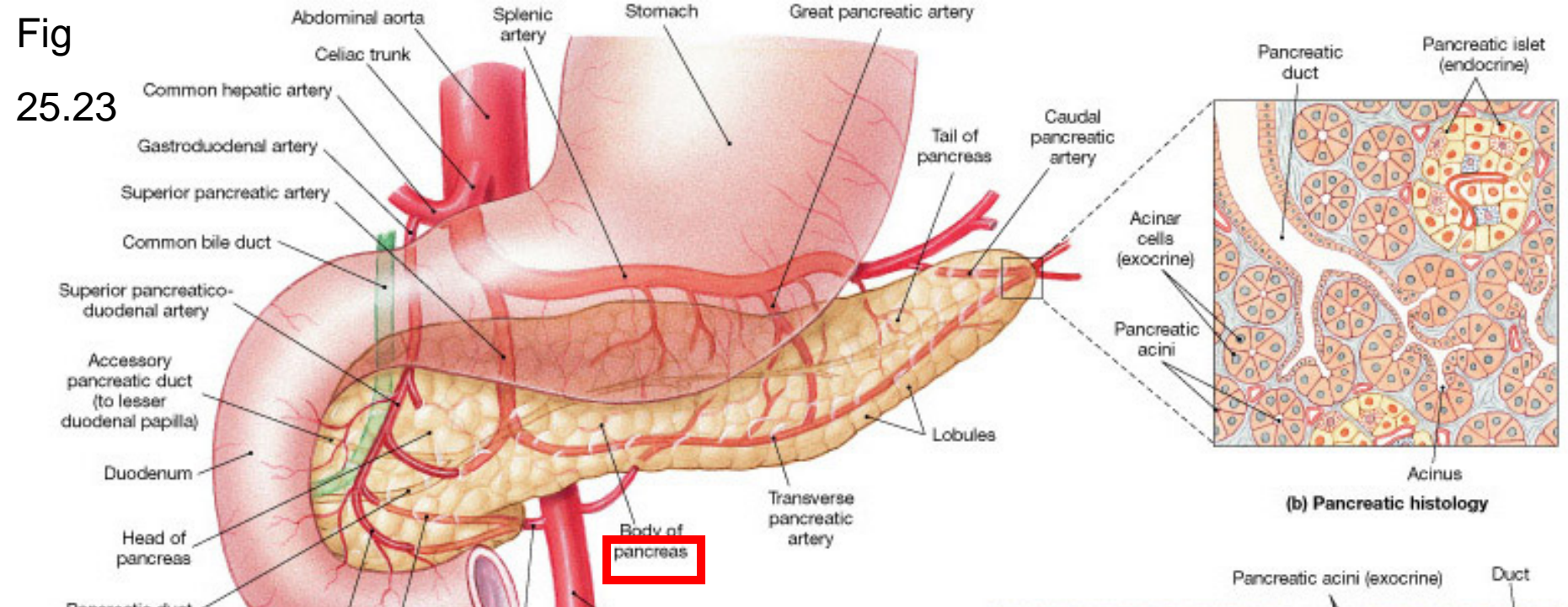
Fig
25.22

Stores and increases the concentration of bile

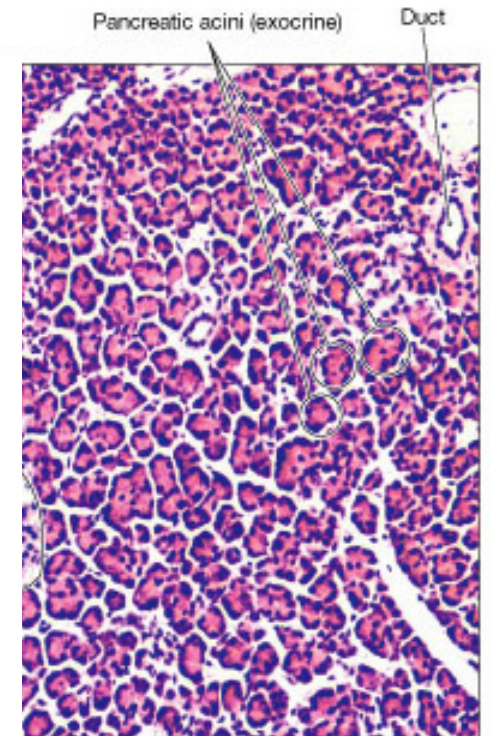


Release of bile

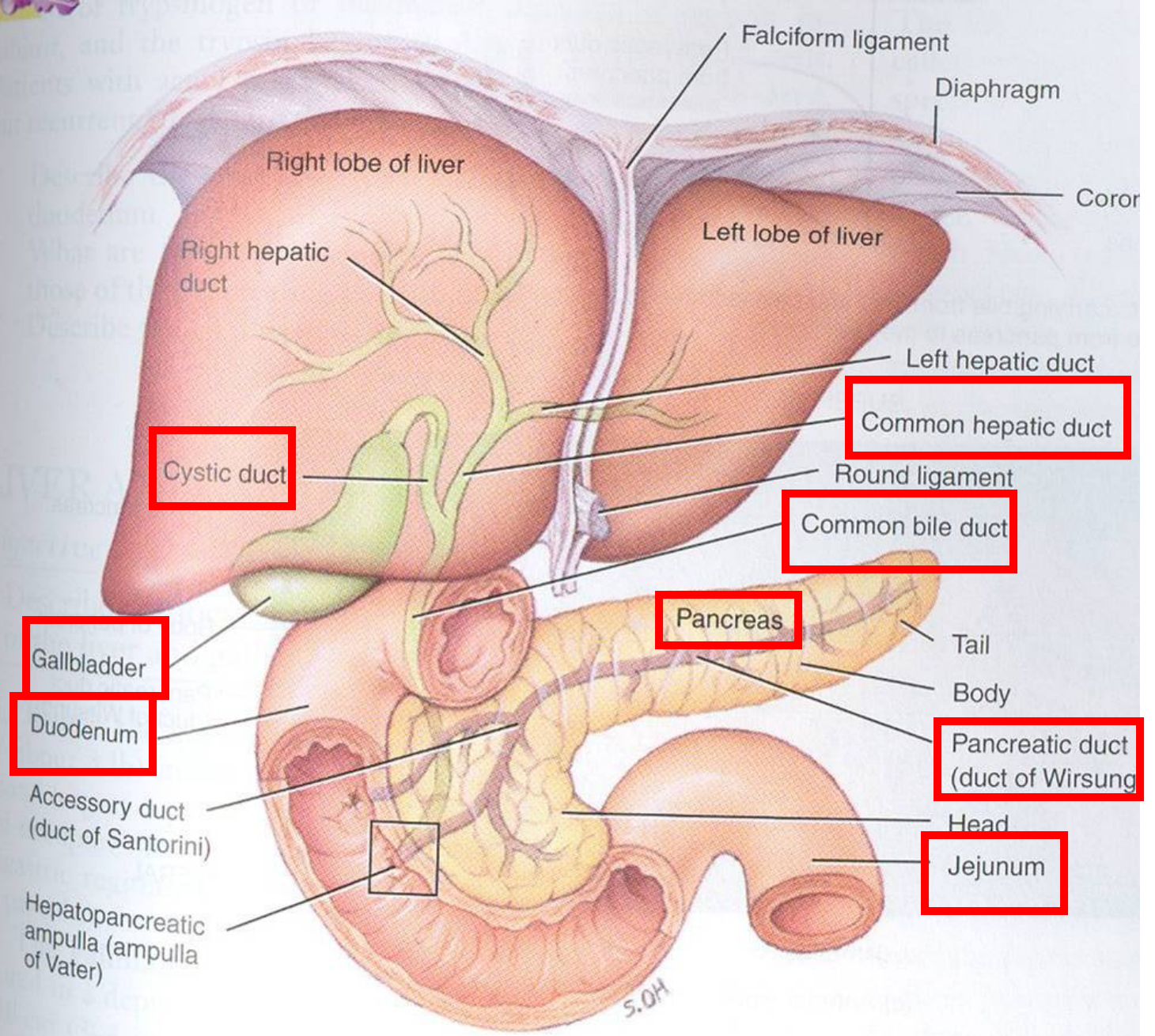




Majority of pancreas has digestive (exocrine) function
 Releases pancreatic juice to the duodenum via pancreatic duct
 Majority of chemical digestion



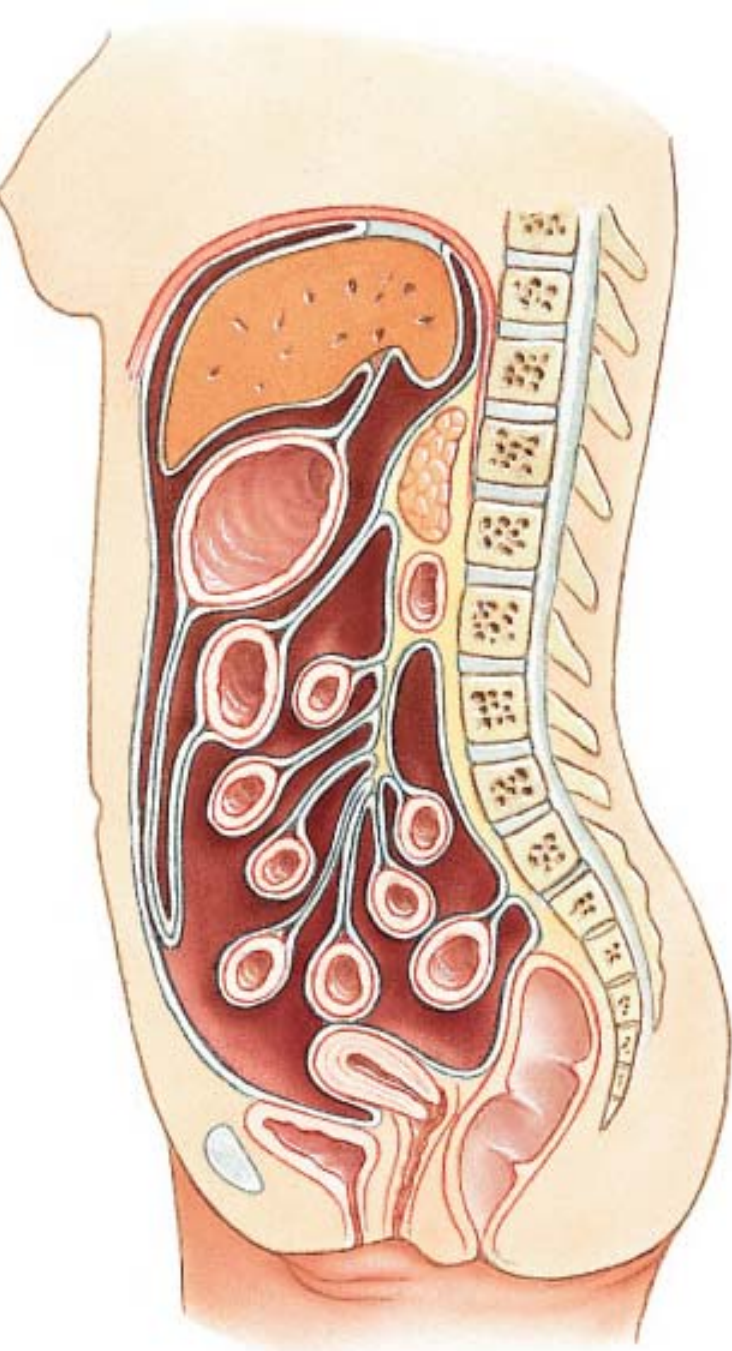
Exocrine and endocrine cells (LM x 120)



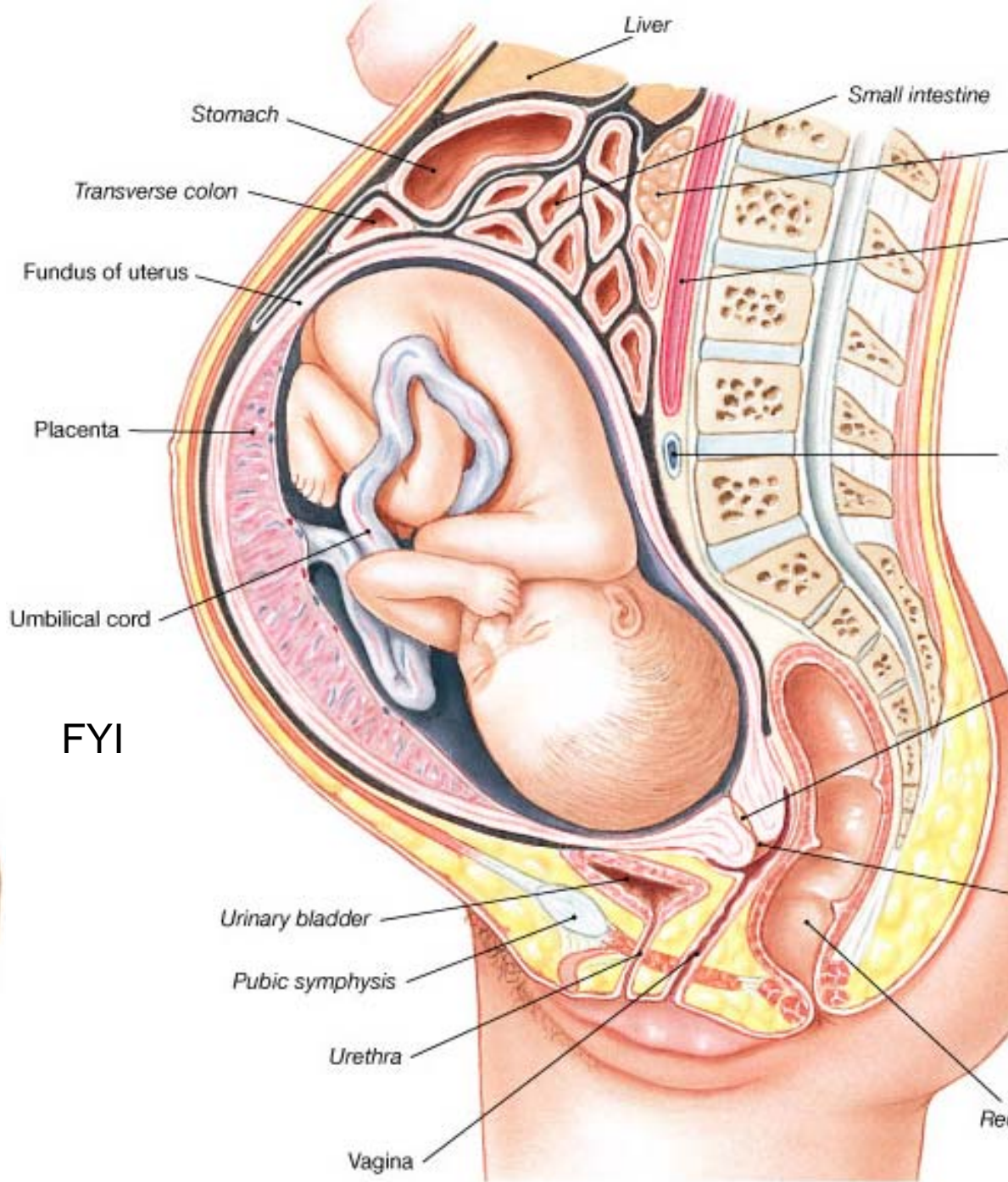
Falciform ligament
 Diaphragm
 Right lobe of liver
 Left lobe of liver
 Right hepatic duct
 Left hepatic duct
 Common hepatic duct
 Cystic duct
 Round ligament
 Common bile duct
 Gallbladder
 Duodenum
 Accessory duct (duct of Santorini)
 Hepatopancreatic ampulla (ampulla of Vater)
 Pancreas
 Tail
 Body
 Head
 Jejunum
 Pancreatic duct (duct of Wirsung)

(a) Anterior view





(d) Nonpregnant female



(c) Pregnancy at full term

FYI

- Break
- Histology

- [http://www.barixclinics.com/how_it_works/
animated_surgery.jsp](http://www.barixclinics.com/how_it_works/animated_surgery.jsp)

- Food Pyramid

- <- point of release enzyme name (what it metabolizes) = organ secreting enzymes
- Oral cavity <-Amylase (carbohydrates), Lipase (lipids) = Salivary Glands
- Oropharynx
- Laryngopharynx
- Esophagus
- Stomach <-Pepsinogen (proteins) = Chief Cells, HCL = Parietal Cells
- Duodenum <-Pancreatic Juice (lipids, carbos, proteins) = Pancreas,
- Jejunum Brush-border Enzymes (lipids, carbos, proteins) = Absorptive Cells
- Ileum Bile (emulsification of lipid) = Liver & Gallbladder
- Cecum
- Ascending Colon
- Transverse Colon
- Descending Colon
- Sigmoid Colon
- Rectum
- Anus

- Inside the stomach:
- Pepsinogen (inactive precursor) + HCL = Pepsin (active form, degrades proteins)
- Pancreatic Juice, Brush-border Enzymes, & Bile are released into the duodenum.

Anatomy of Digestive System



Small intestine
(duodenum)

Pancreas

Urethra

Diaphragm

Liver

Gallbladder

Lesser omentum

Stomach

Spleen

Ascending colon

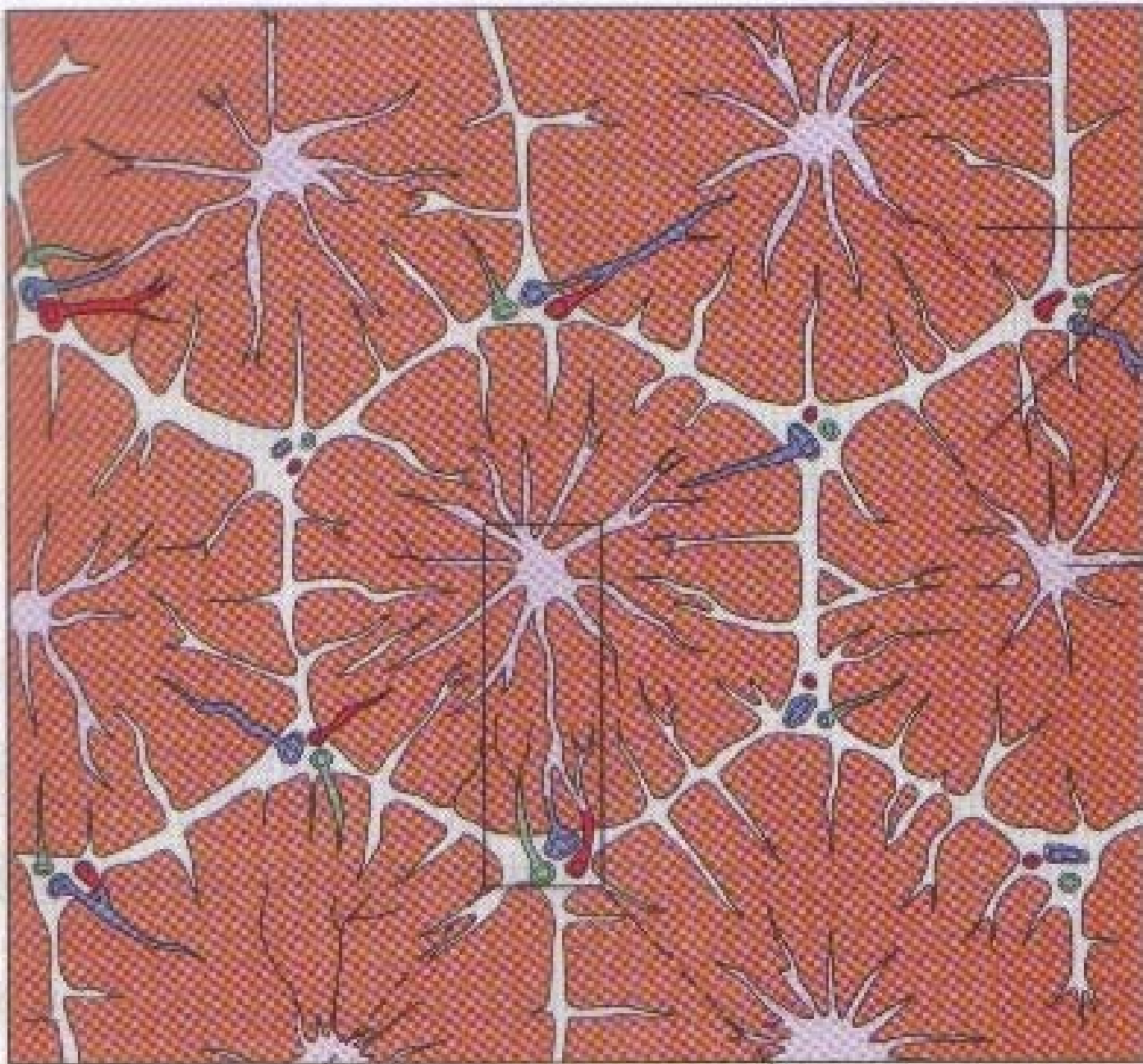
Small intestine
(ileum)

Mesentery

Urinary bladder

Rectum

(b)

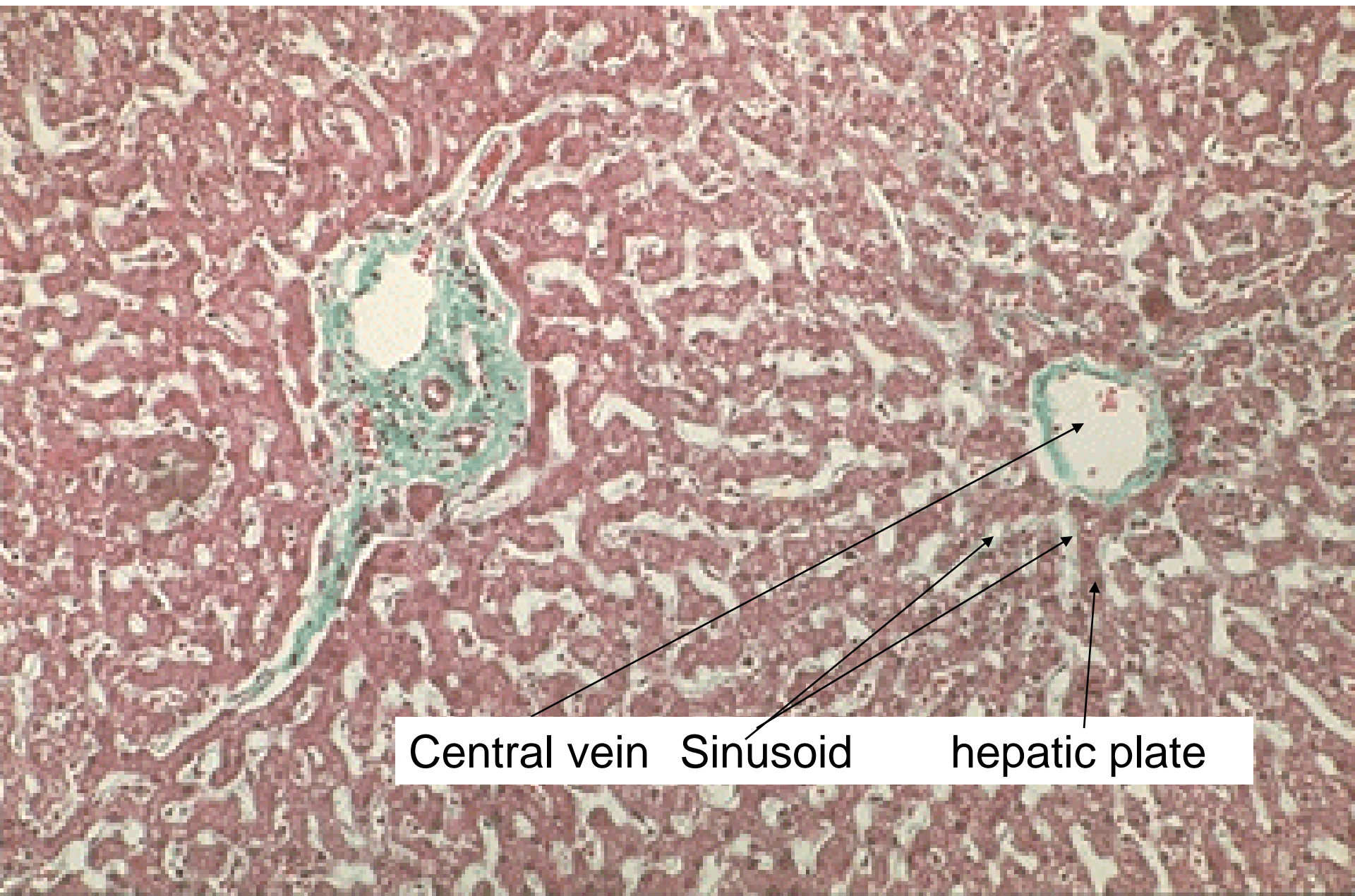


Liver lobules

Central vein

Centr

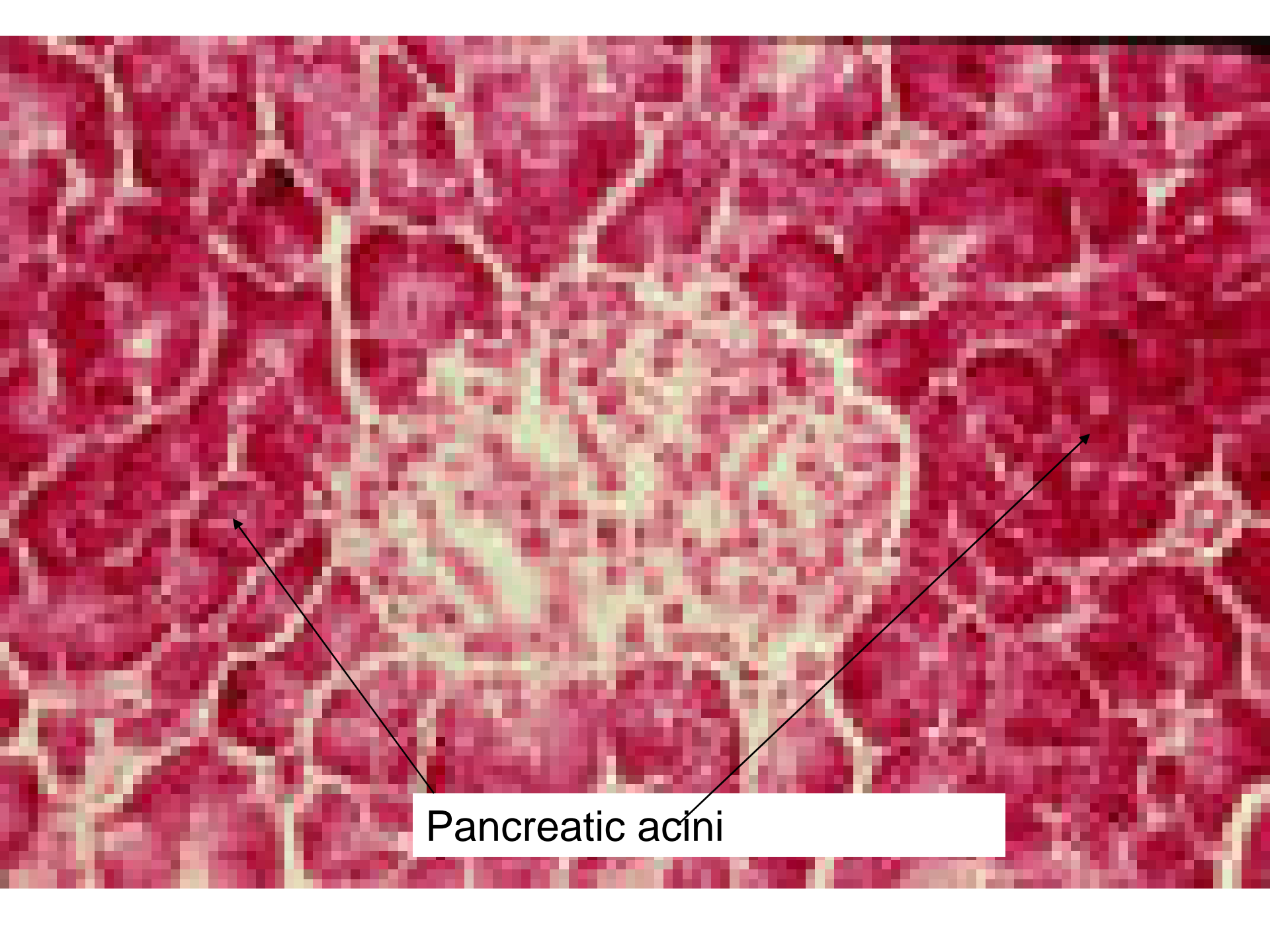
Sinus



Central vein

Sinusoid

hepatic plate



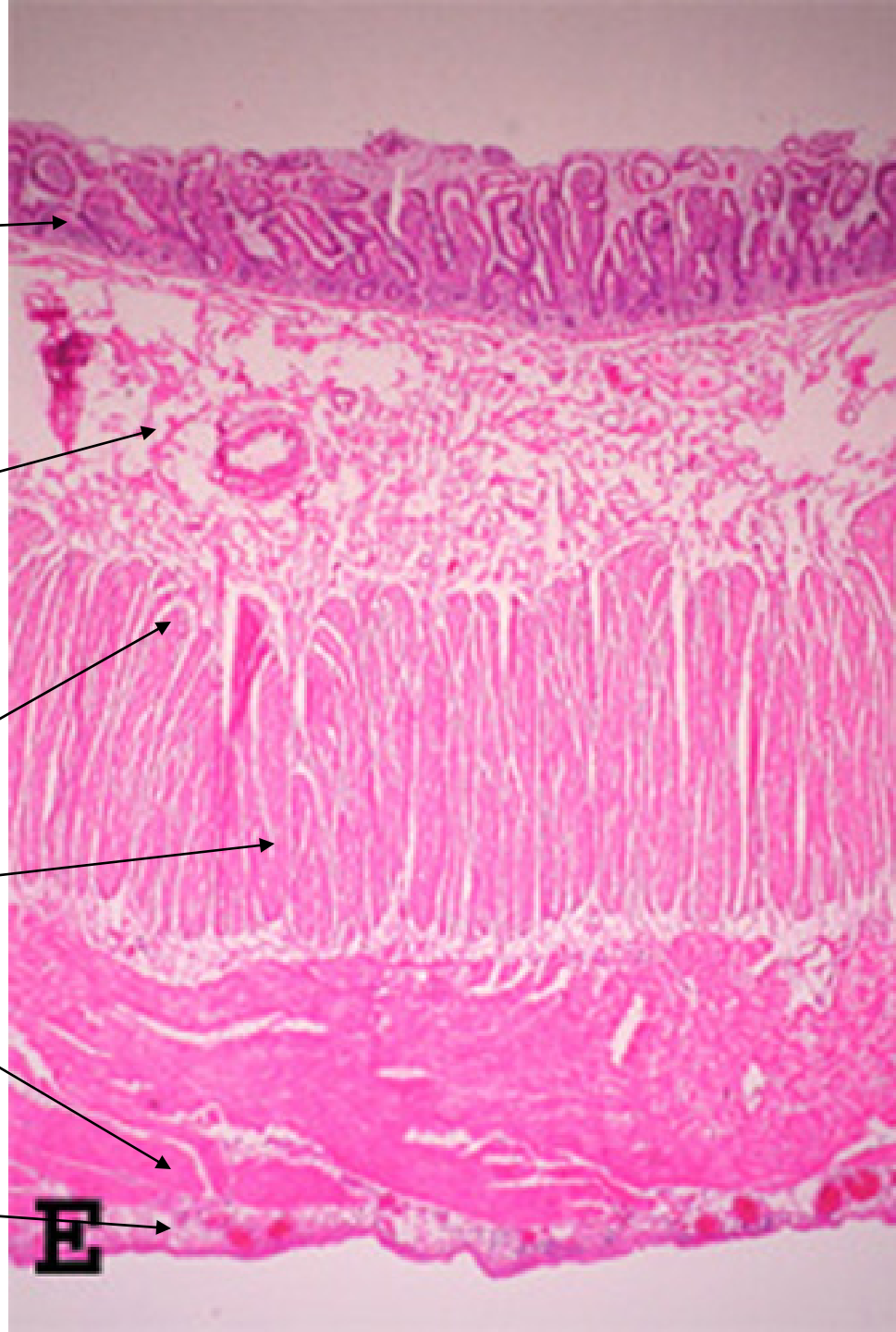
Pancreatic acini

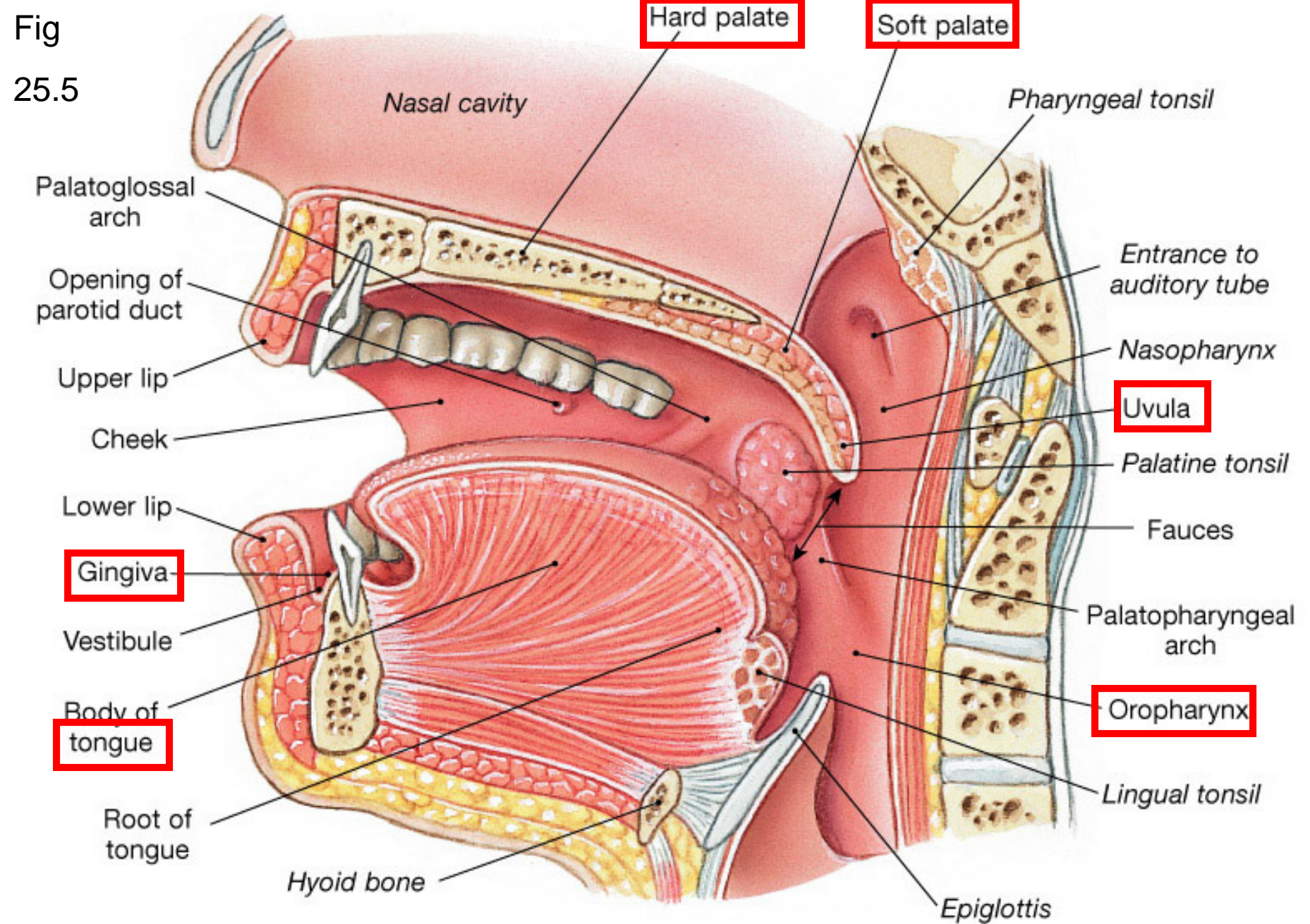
Tunica
mucosa

Tunica
submucosa

Tunica
muscularis
externa

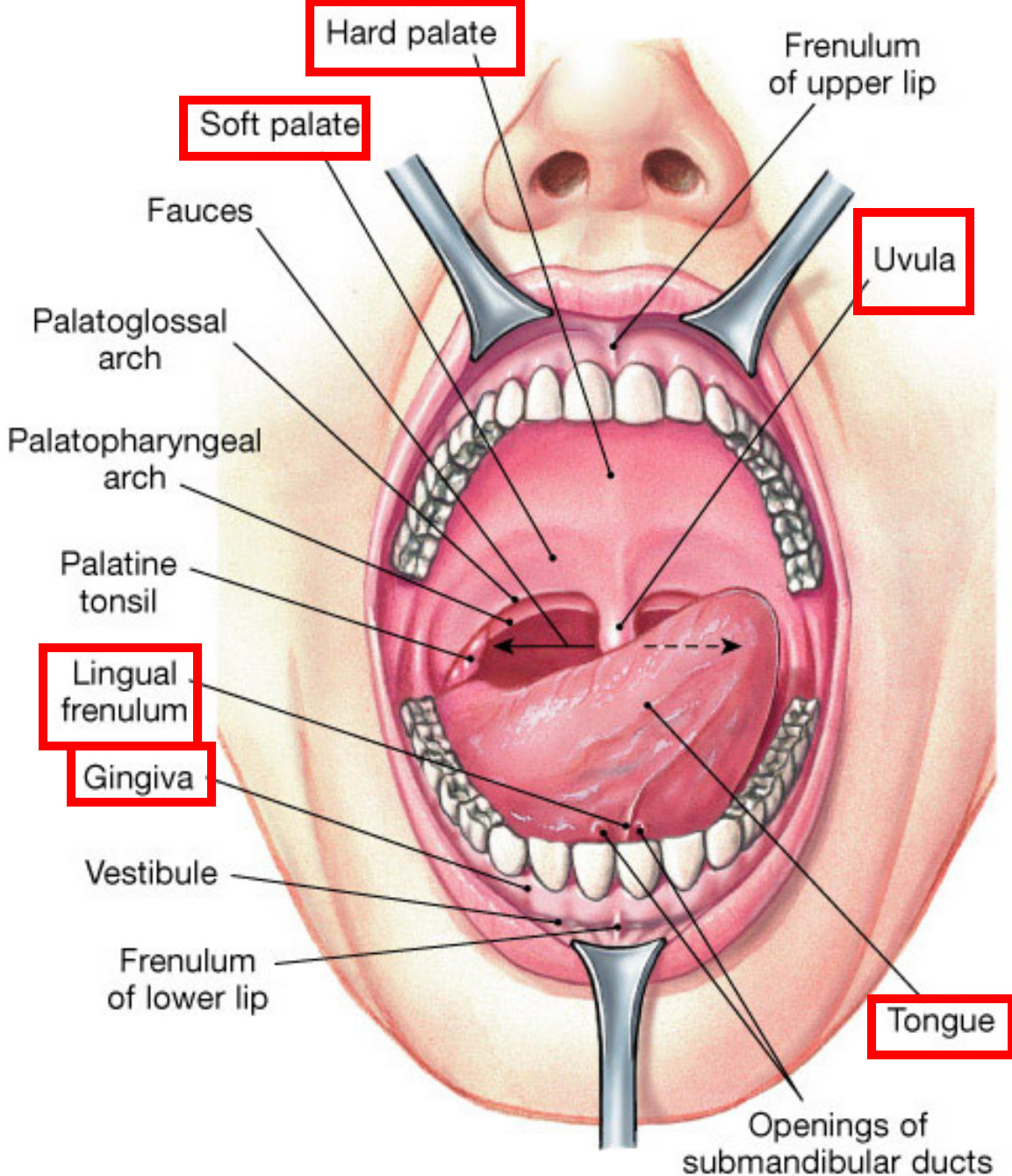
Tunica
serosa





(a) Oral cavity, sagittal section

Fig
25.5



(b) Oral cavity, anterior view

Fig
25.6

Openings
of sublingual
ducts

Lingual
frenulum

Opening of left
submandibular
duct

Sublingual
salivary gland

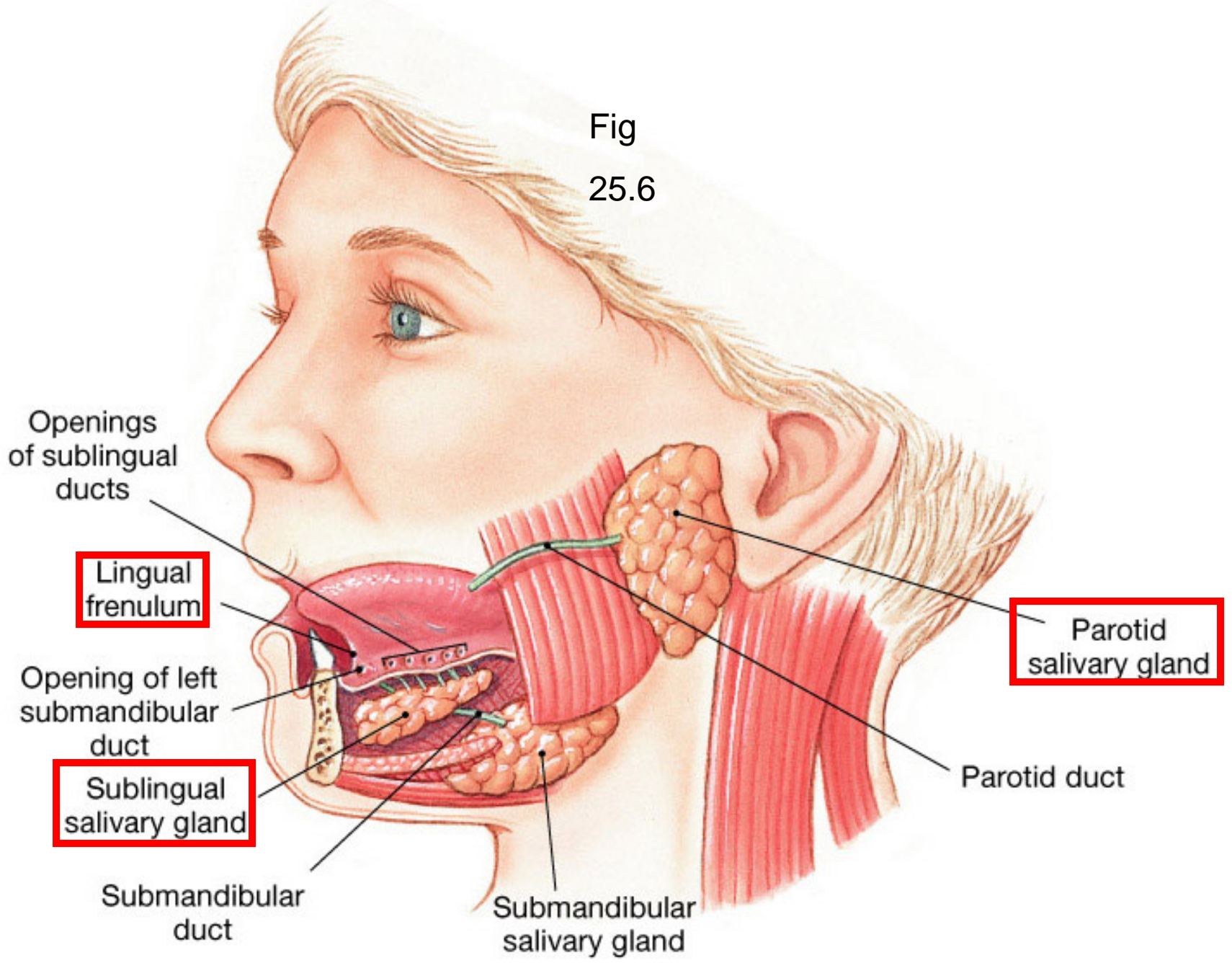
Submandibular
duct

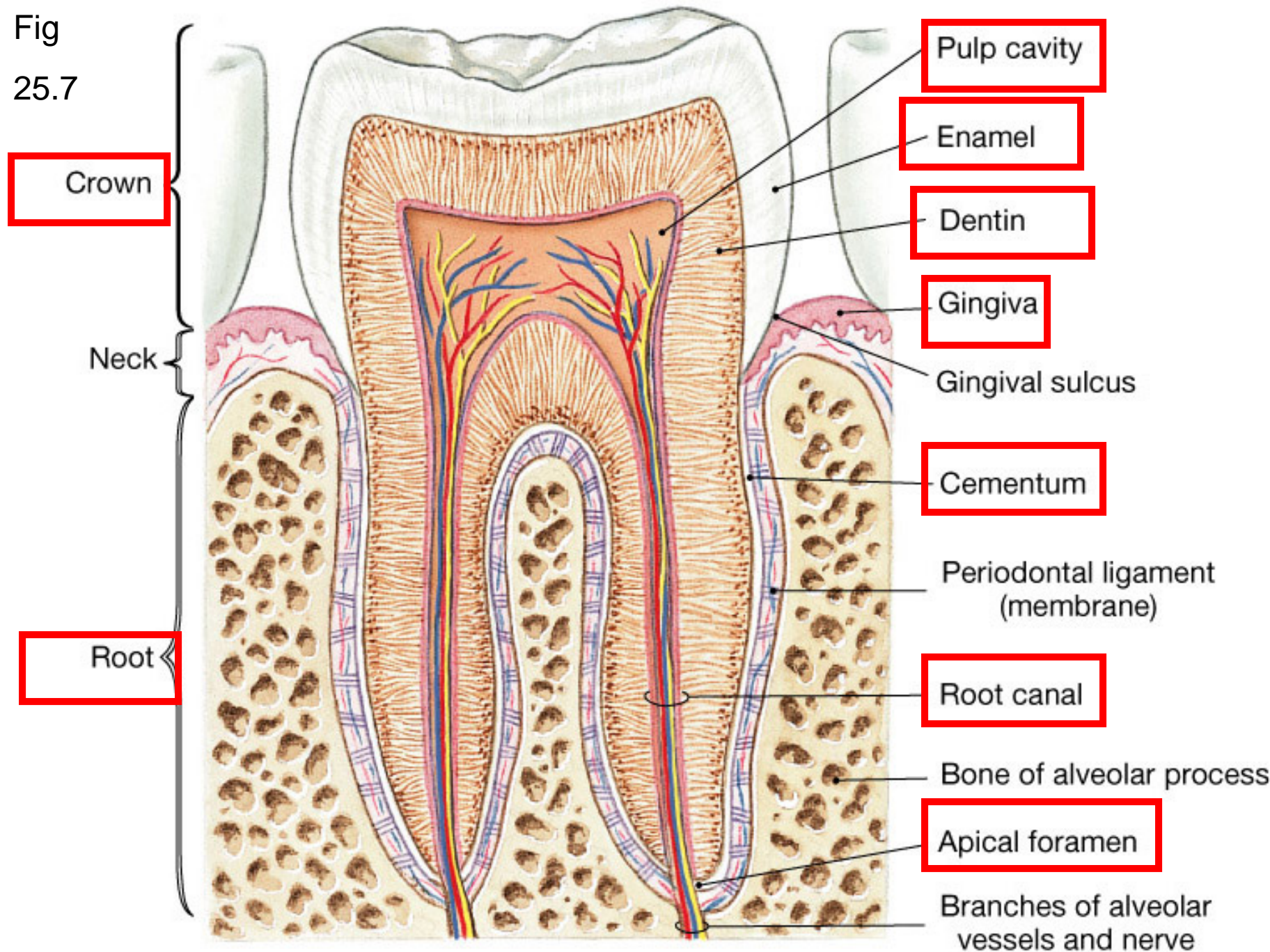
Submandibular
salivary gland

Parotid
salivary gland

Parotid duct

(a) Lateral view with left mandibular body and ramus removed



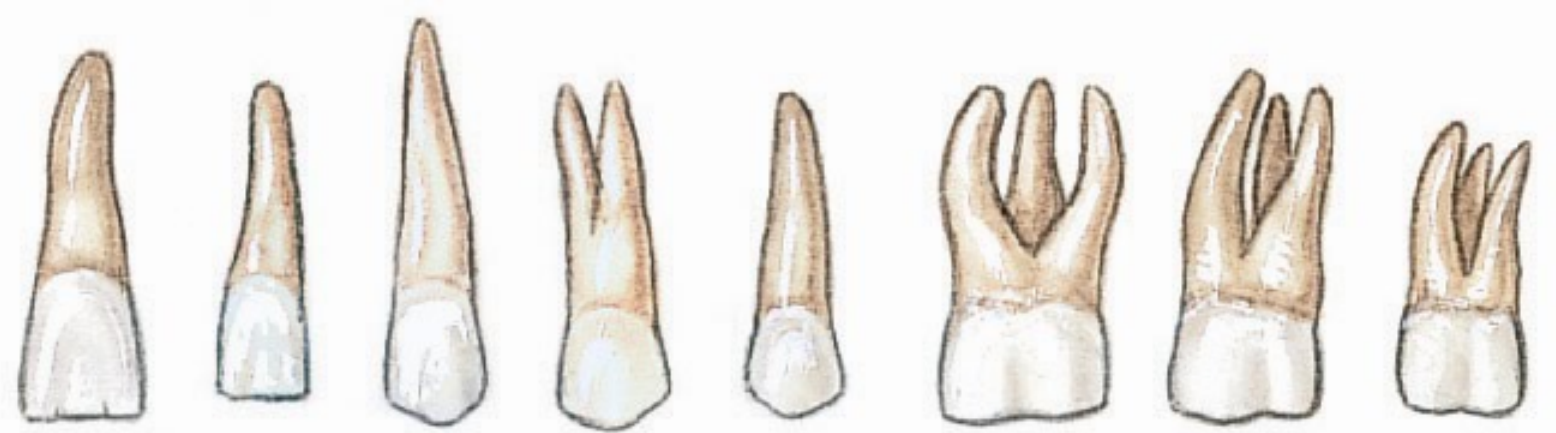


(a) Tooth, sectional view

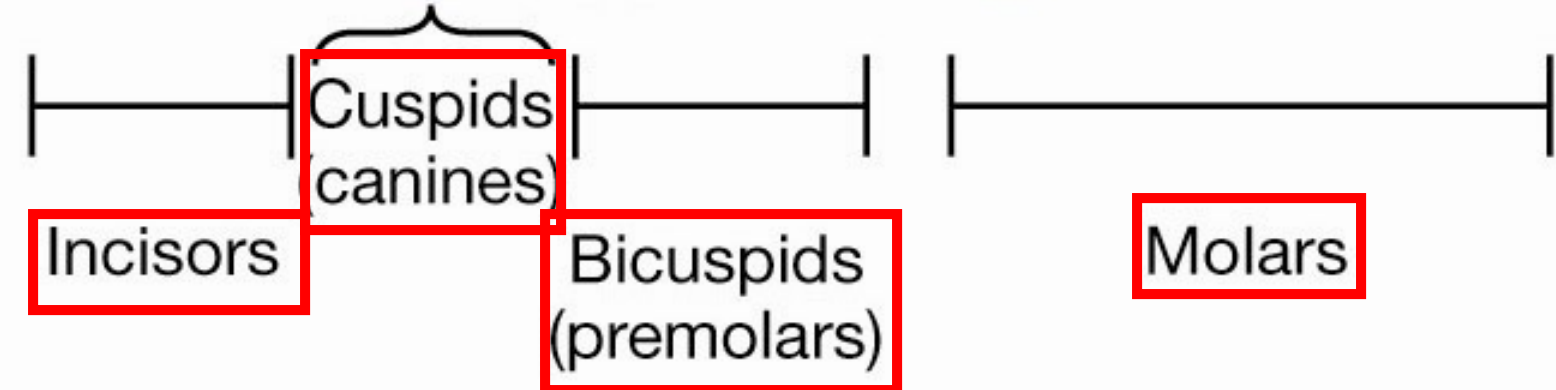
Fig

25.7

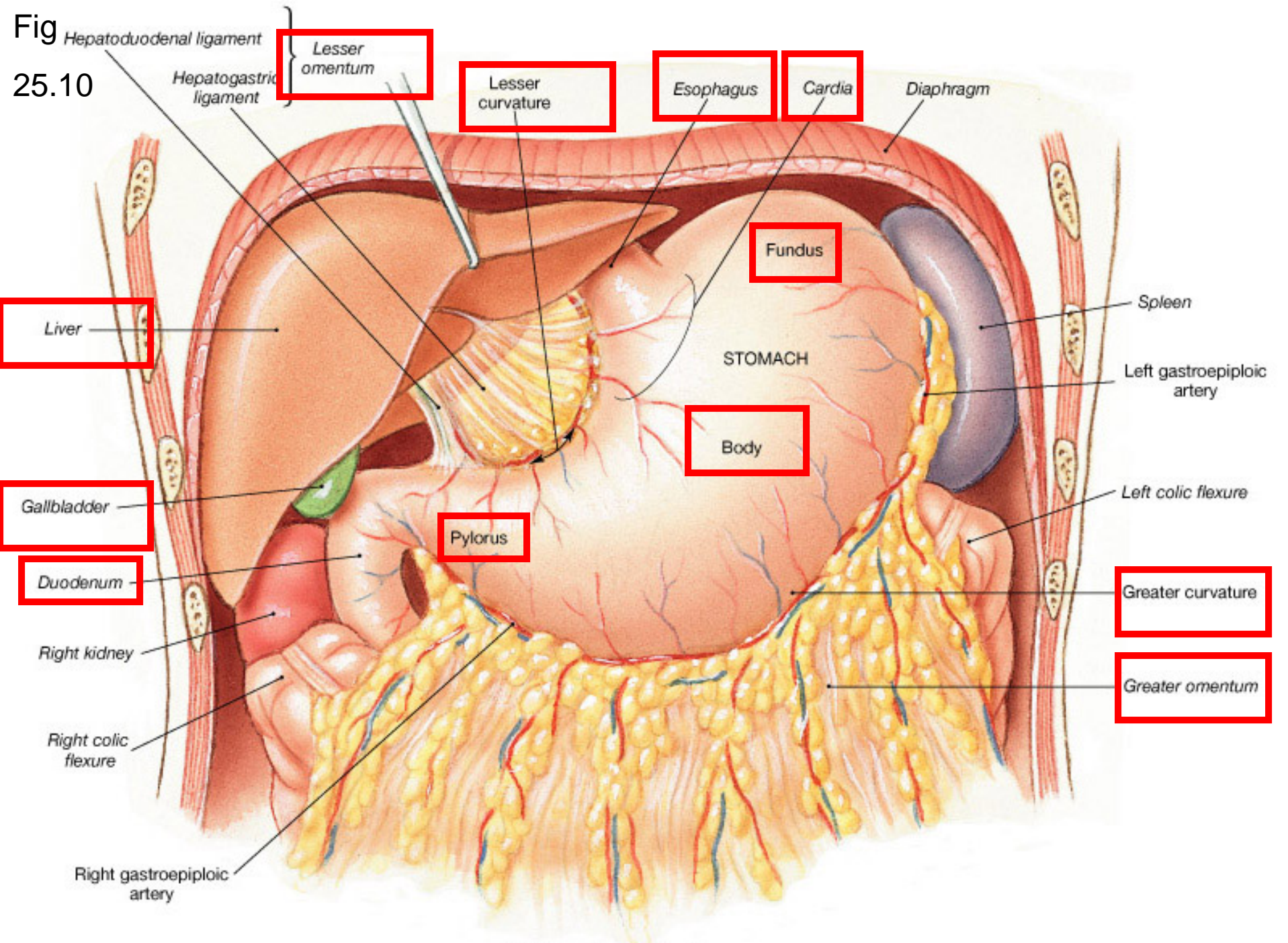
Upper
jaw



Lower
jaw



(b) Adult upper and lower teeth



(a) Stomach, anterior view

Fig 25.19

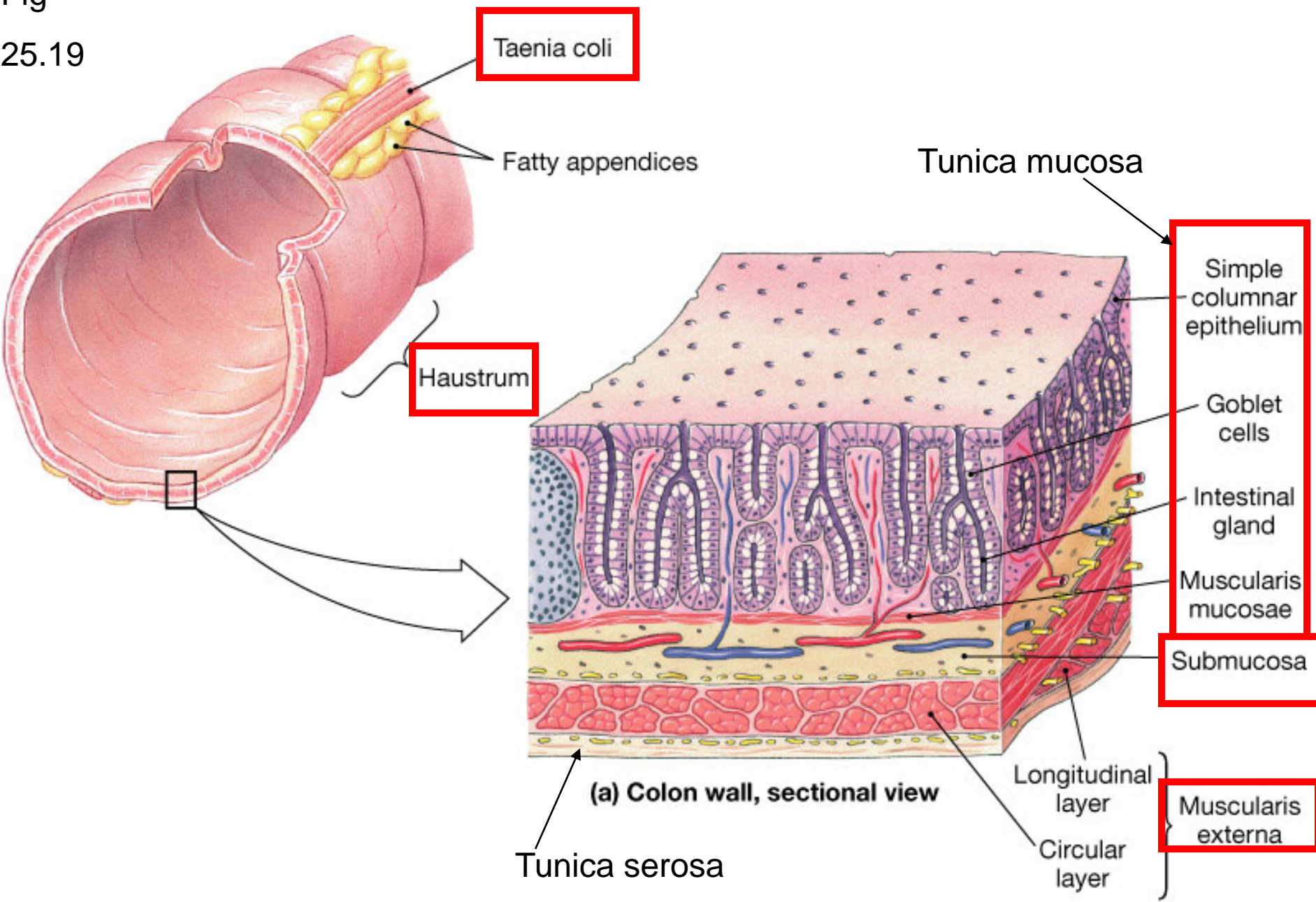
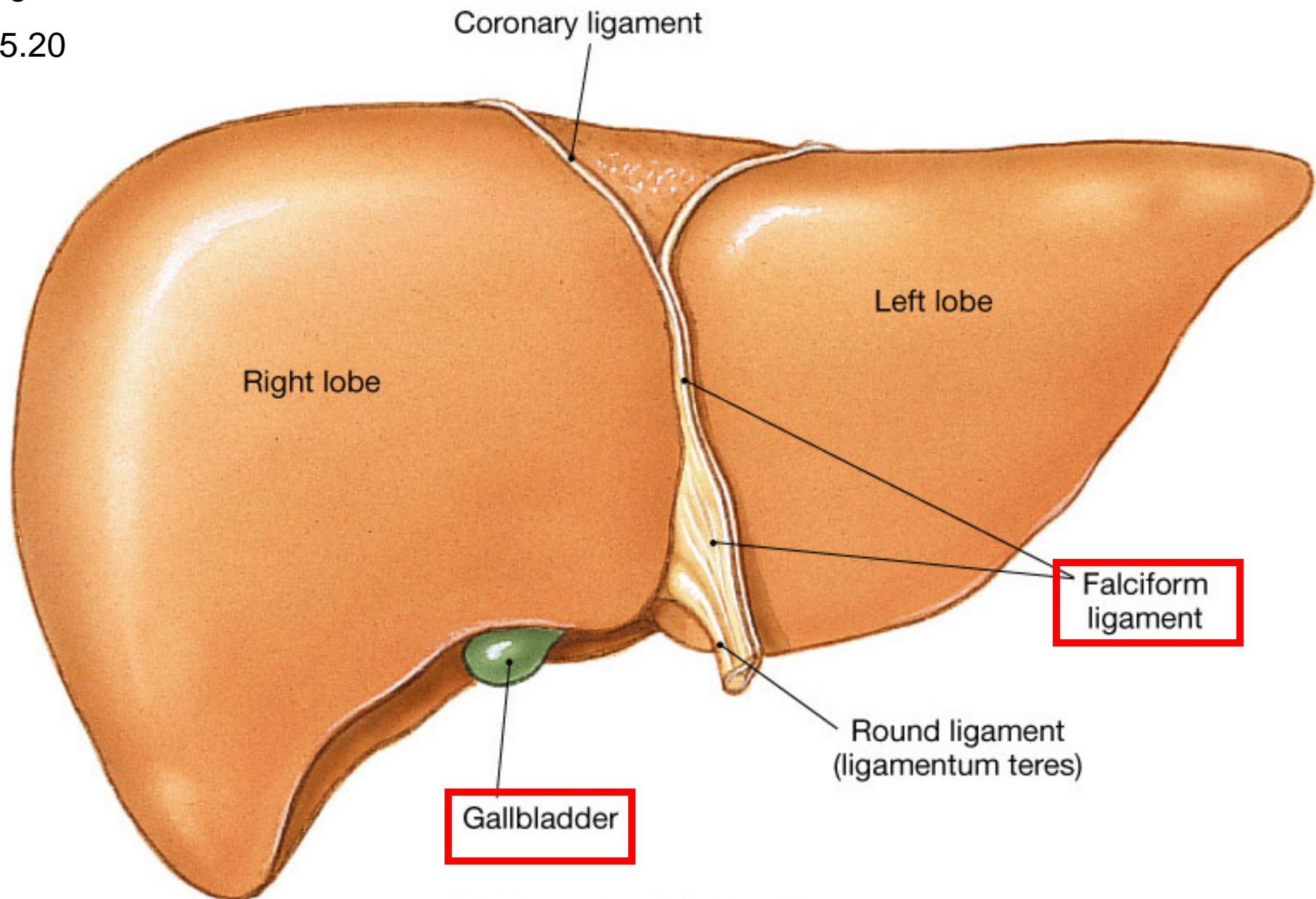
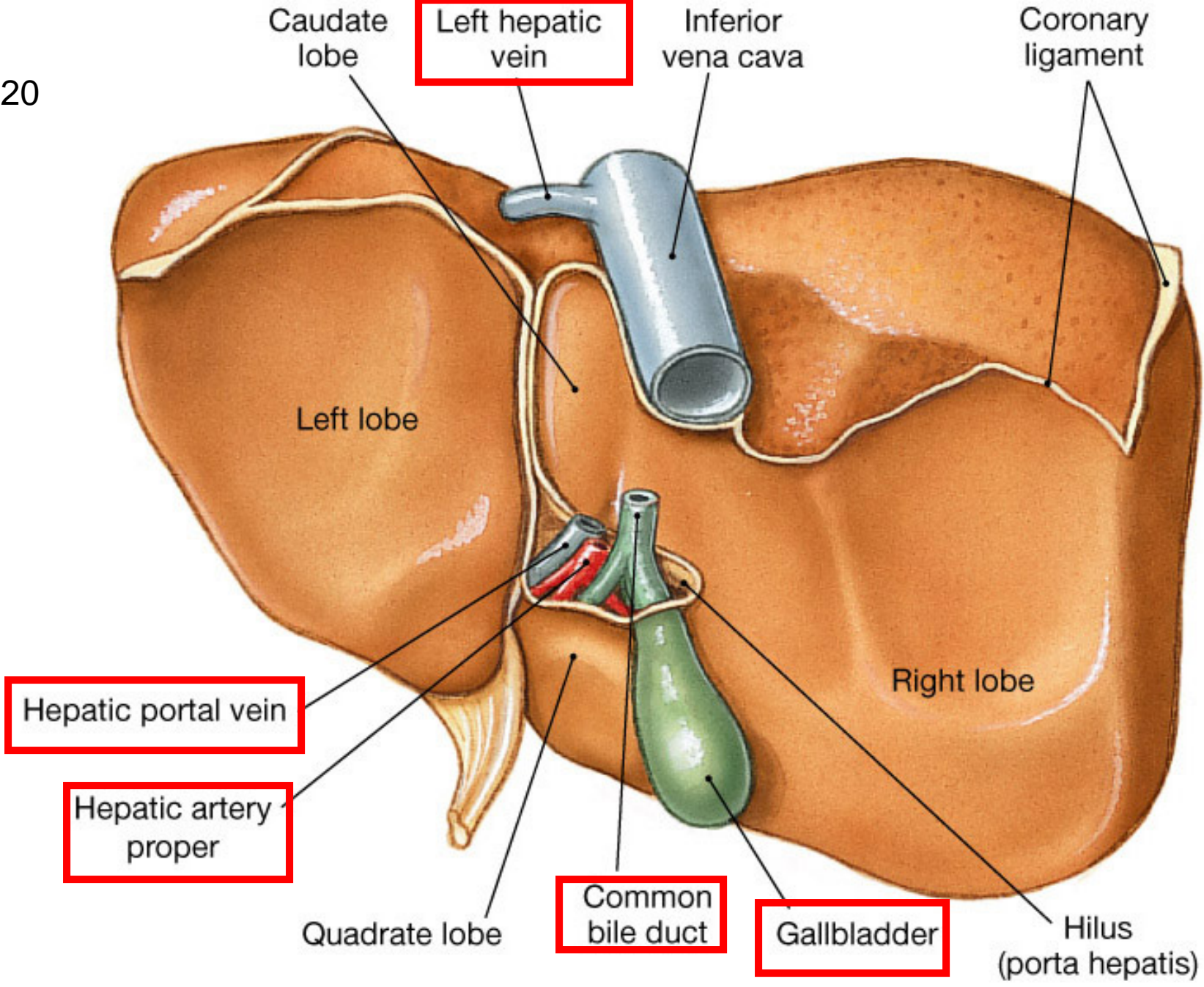


Fig
25.20



(c) Anterior (parietal) surface

Fig 25.20



(d) Posterior (visceral) surface

