

Small and large intestine. Liver and pancreas

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Small intestine: duodenum, jejunum, ileum

The small intestine is the main place of digestion and absorption

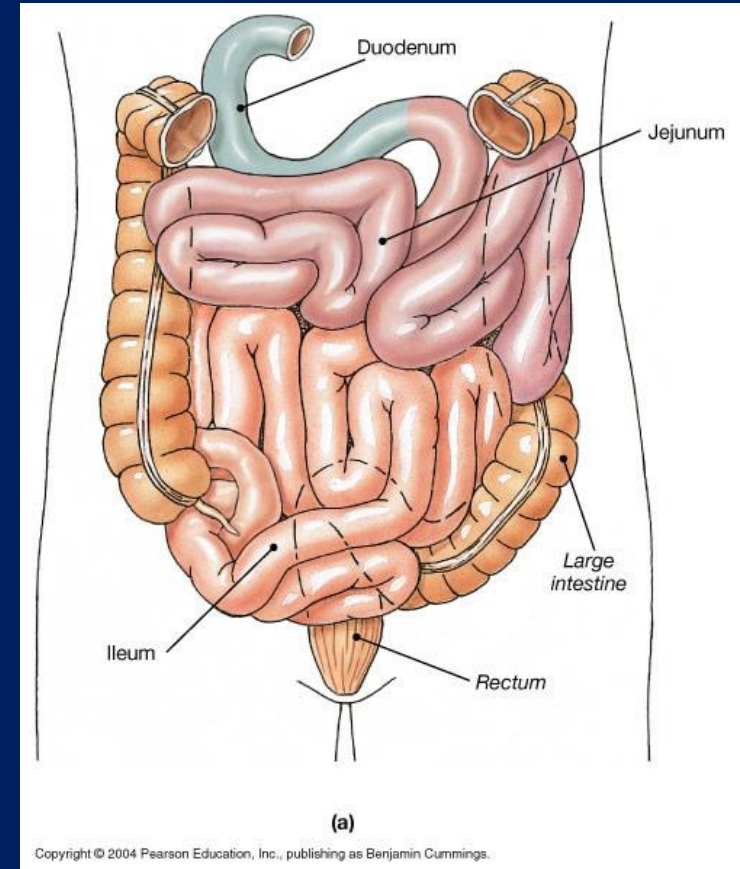
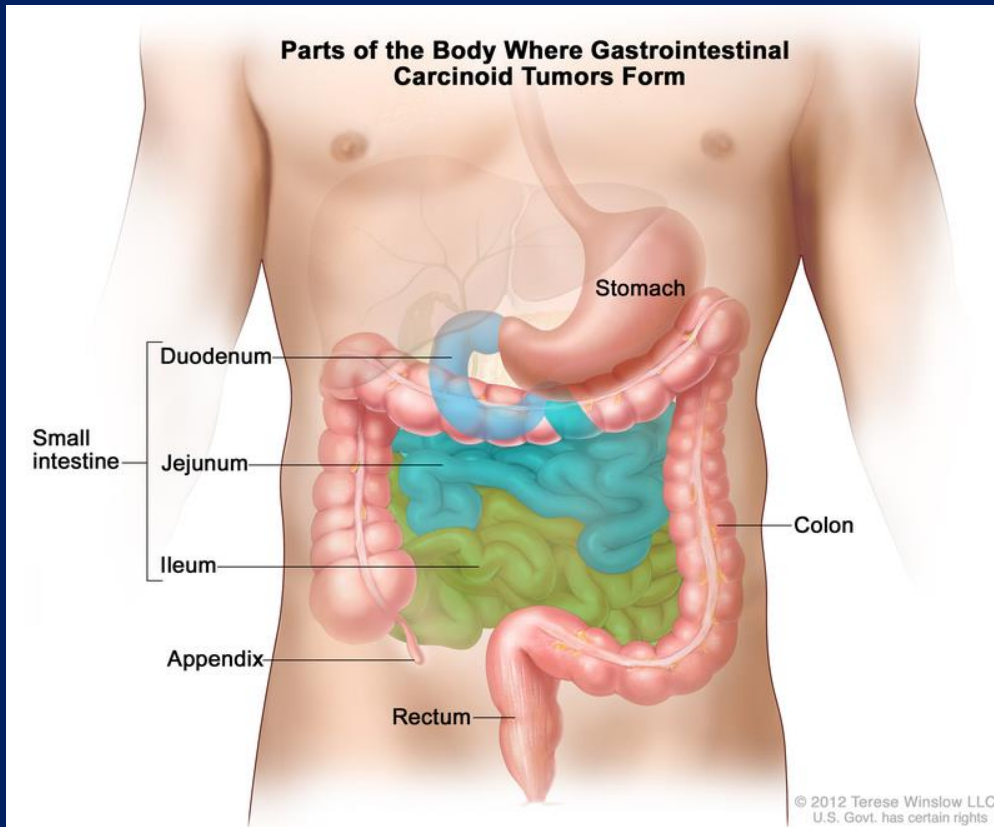
It has 3 parts:

duodenum: direct continuation of the stomach, it is the main part of the digestion
largest part of it is retroperitoneal

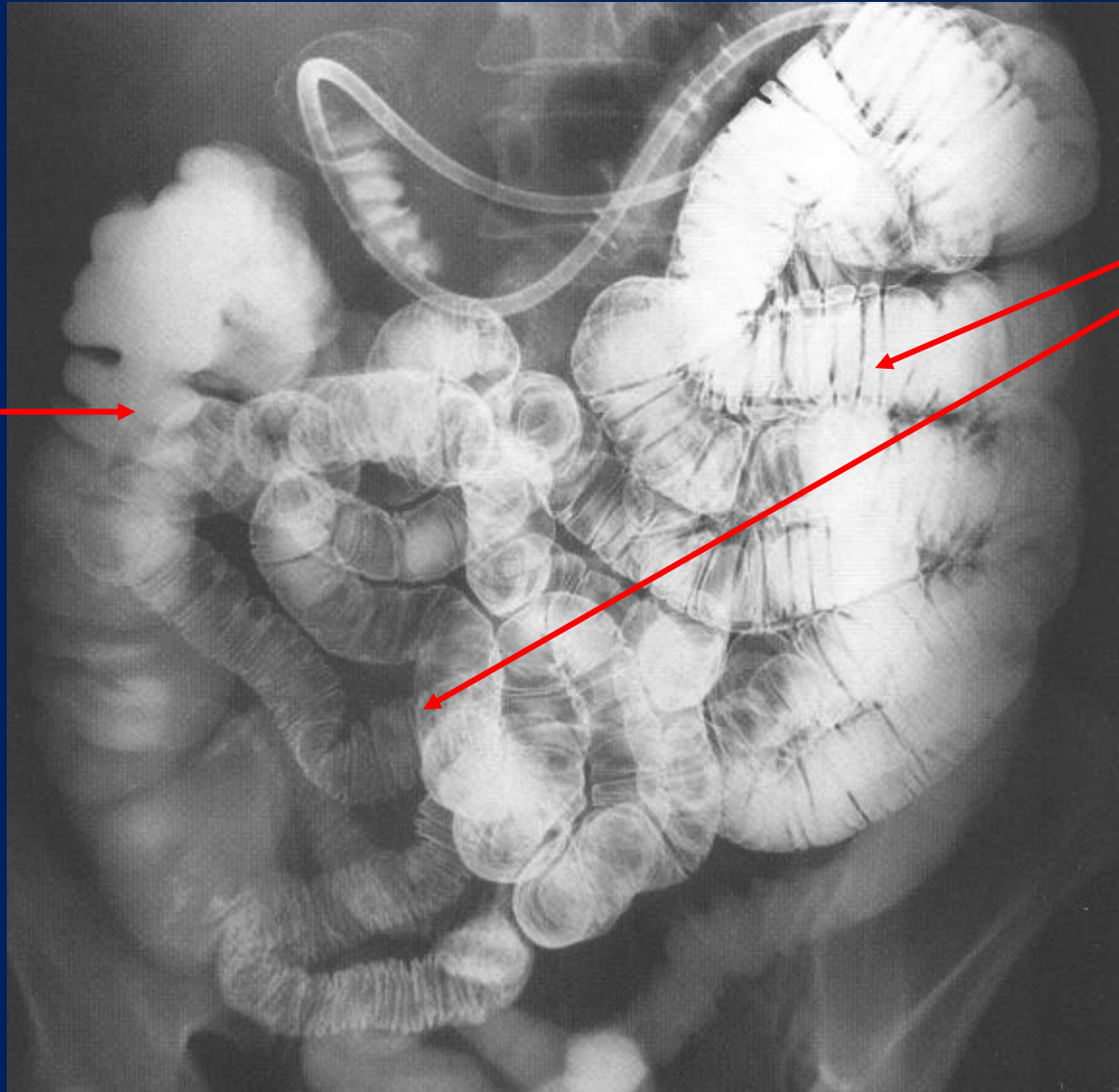
jejunum: occupies the umbilical region of the abdominal cavity, it is the main part of the absorption
entirely intraperitoneal, its peritoneum is called *mesentery*

ileum: occupies the iliac and pelvic region, absorption occurs there
entirely intraperitoneal, covered by the *mesentery*

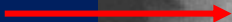
Small intestine: duodenum, jejunum, ileum



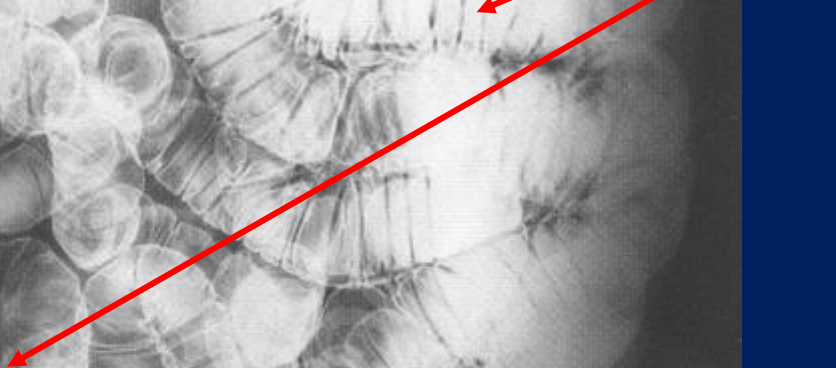
Small intestine: jejunum and ileum



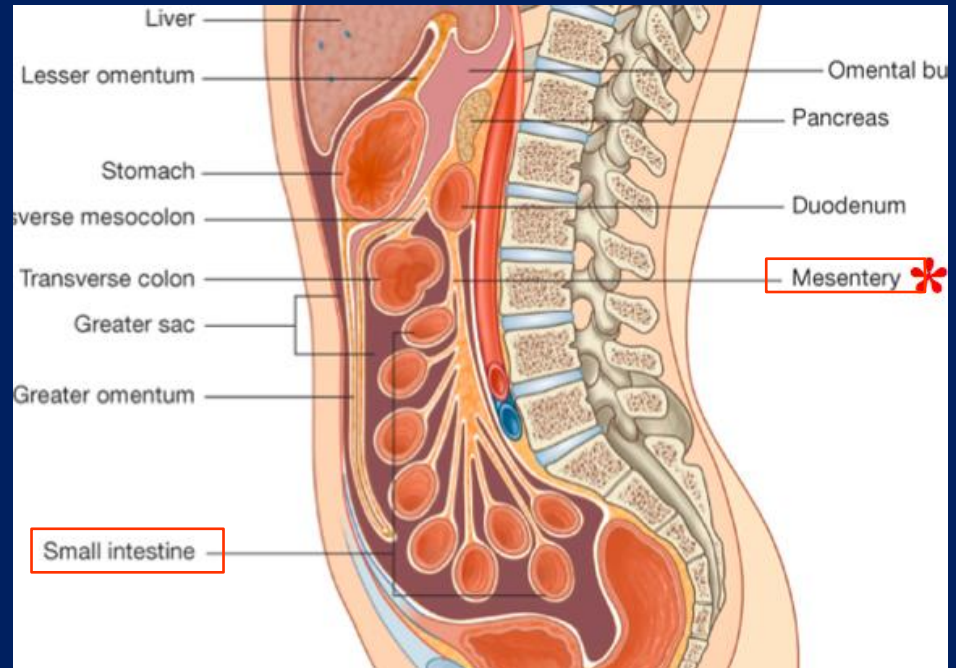
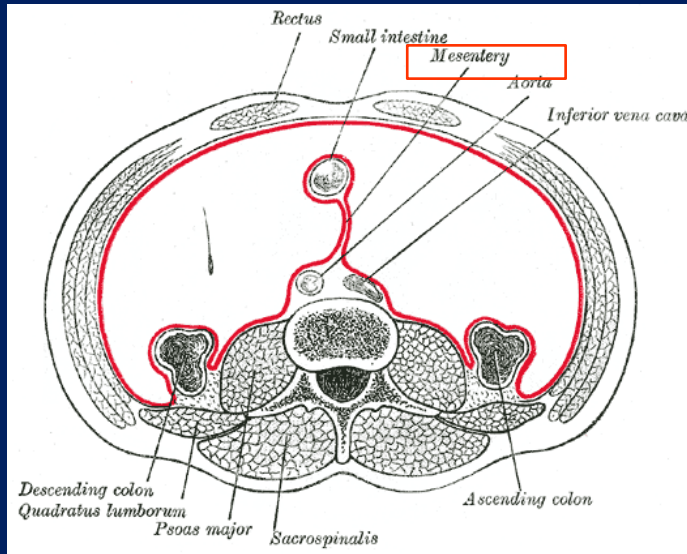
ascending
colon



jejunum+ileum

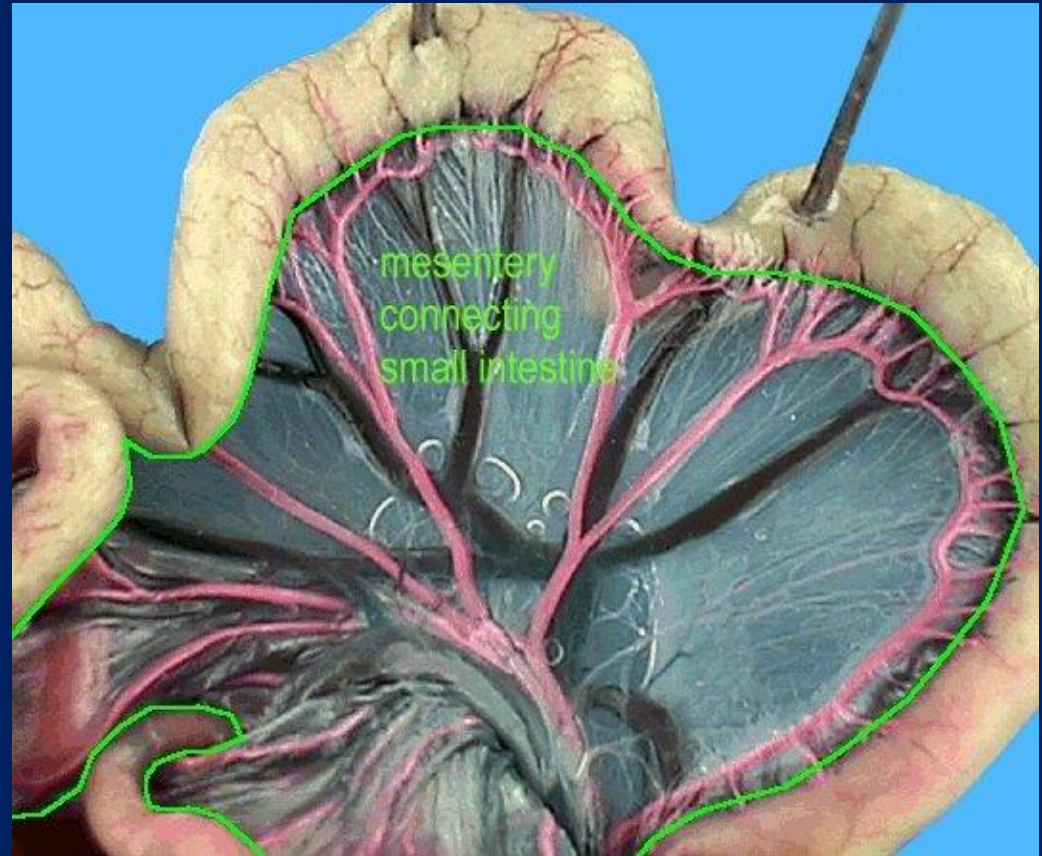


Peritoneal relationship of the small intestine



Mesentery: carries the blood vessels to the intestine

Since the abdominal aorta is retroperitoneal, blood vessels supplying the small intestine are running toward the intestine in the peritoneum



Blood supply of the GI tract

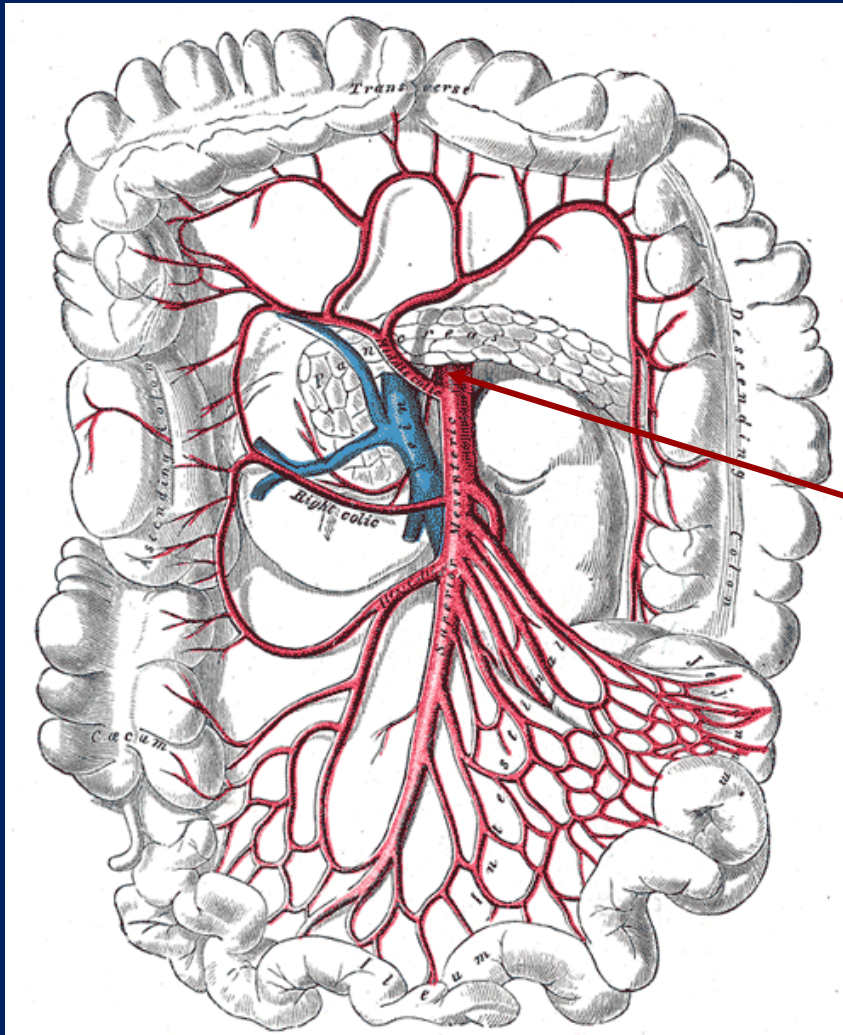
Abdominal aorta: 3 unpaired branches:

1.) *celiac trunc*: supplying stomach, spleen, liver, part of the duodenum

2.) *sup. mesenteric artery*: supplying the , pancreas, duodenum jejunum, ileum ileocecal junction, ascending colon, transverse colon

3.) *inferior mesenteric artery*: supplying the descending and sigmoid colon and the upper 1/3 of the rectum

Blood supply of the small intestine



Unpaired visceral branches of the abdominal :

Duodenum: celiac trunc:
gastroduodenal and sup.
pancreaticoduodenal art.

Sup. mesenteric art.: inf.
pancreaticoduodenal art.

**Jejunum and ileum: sup.
mesenteric art.**

- aa. jejunales et ilei
- very rich anastomosis (arcades) between the branches

Portal vein system

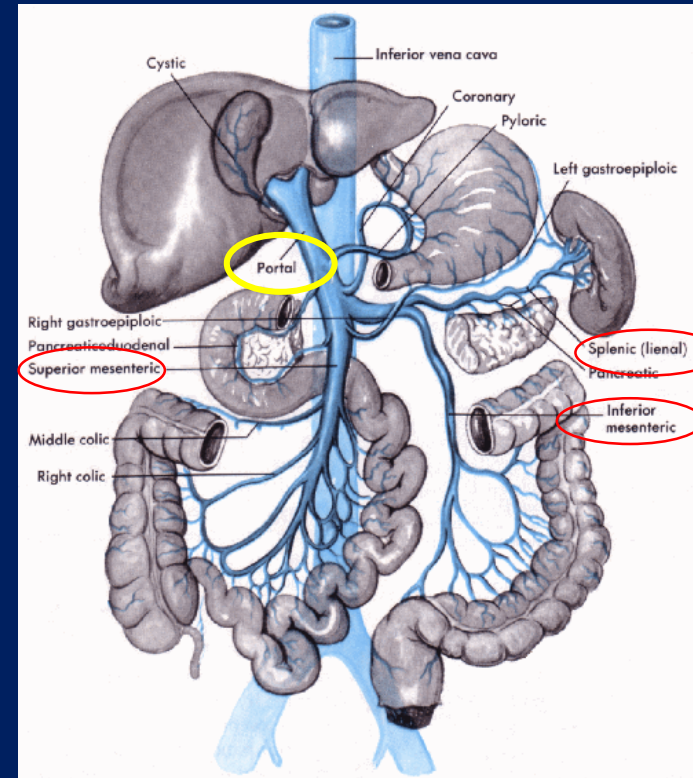
Veins are draining toward the *liver* through the *portal vein*

Portal vein is formed by 3 main veins:

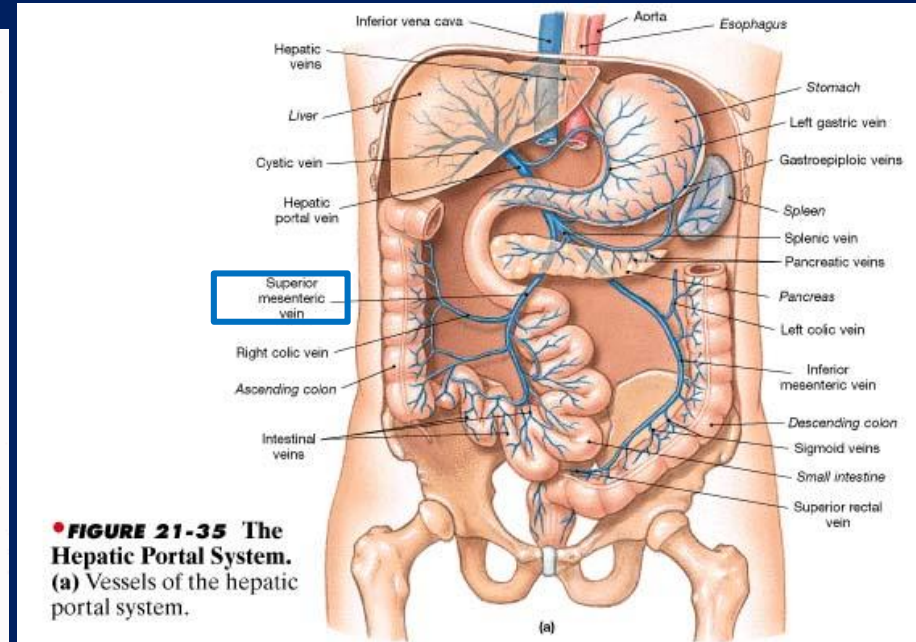
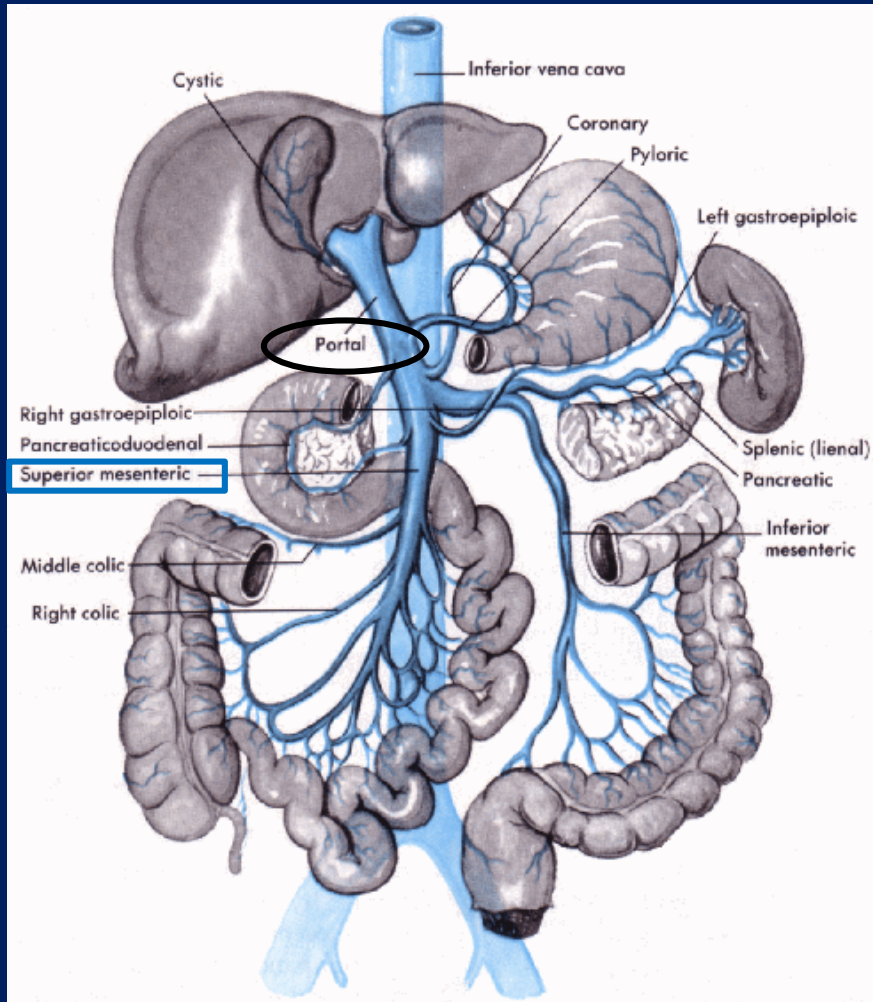
splenic vein: collecting the venous blood of the area supplied by the celiac trunc

superior mesenteric vein: collecting the venous blood of the area supplied by the sup. mesenteric artery

inferior mesenteric vein: collecting the venous blood of the area supplied by the inferior mesenteric artery system



Venous drainage of the small intestine: sup. mesenteric vein toward the portal vein



Histology of the small intestine

T. mucosa:

- epithelium: simple columnar (goblet cells: mucus secreting unicellular glands)
- propria (lymphoreticular connective tissue): glands (Lieberkhün crypts)
- muscularis mucosae (2 layered smooth muscle)

Submucosa: loose connective tissue; *submucosus (Meissner) plexus:* regulation of the mucosa; glands, lymphatic follicles)

External muscle layer (t. muscularis): smooth muscle: inner circular, outer longitudinal)

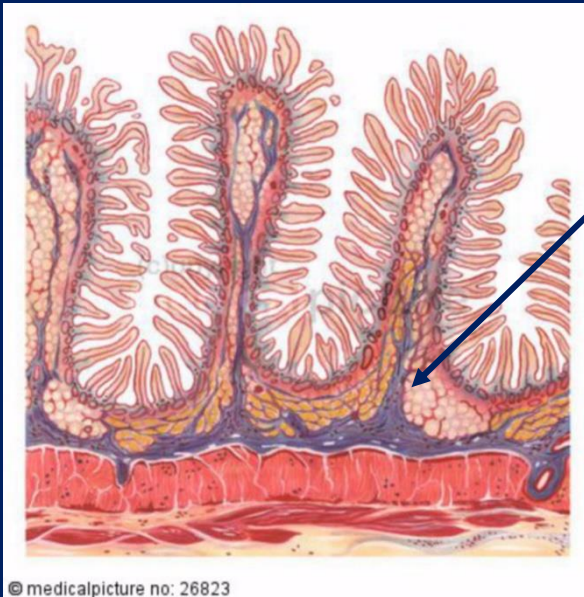
myenteric (Auerbach) plexus: in the intermuscular connective tissue regulation the peristaltic movement

Serosa or adventitia

Histology of the small intestine

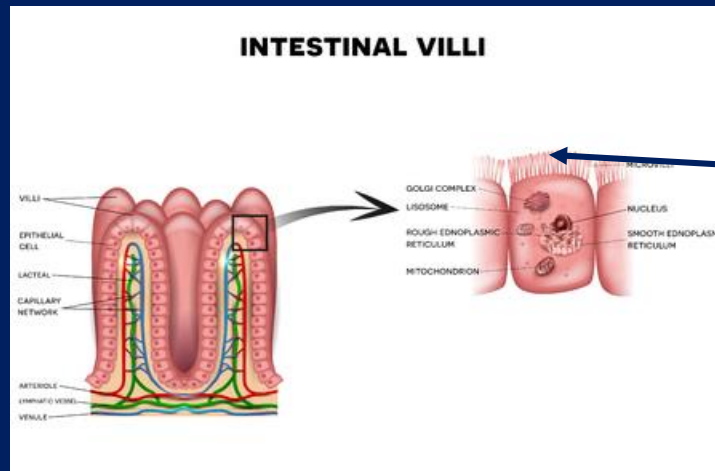
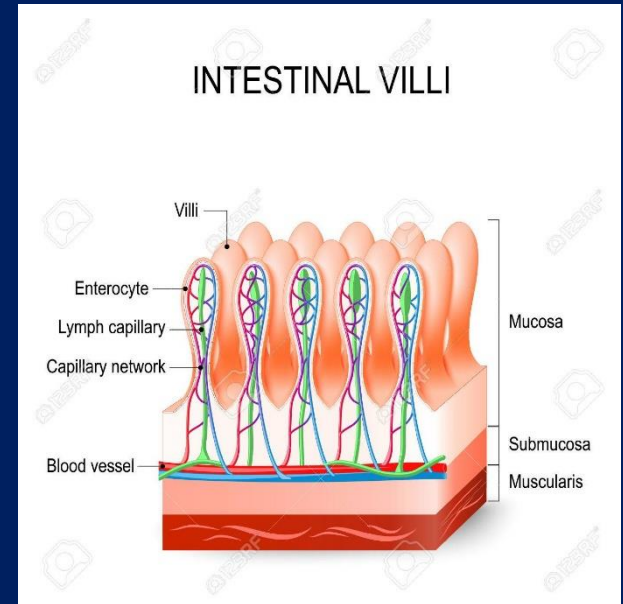
- main part of the digestion and absorption
- Histologically: accomodation to the function: *increase the surface*
- surface increasing structures:
 - Kerkring folds: plicae circulares made by submucosa
 - villi: made by mucosa
 - microvilli: made by the apical plasma membrane of the enterocytes

Surface increasing structure in the GI tract



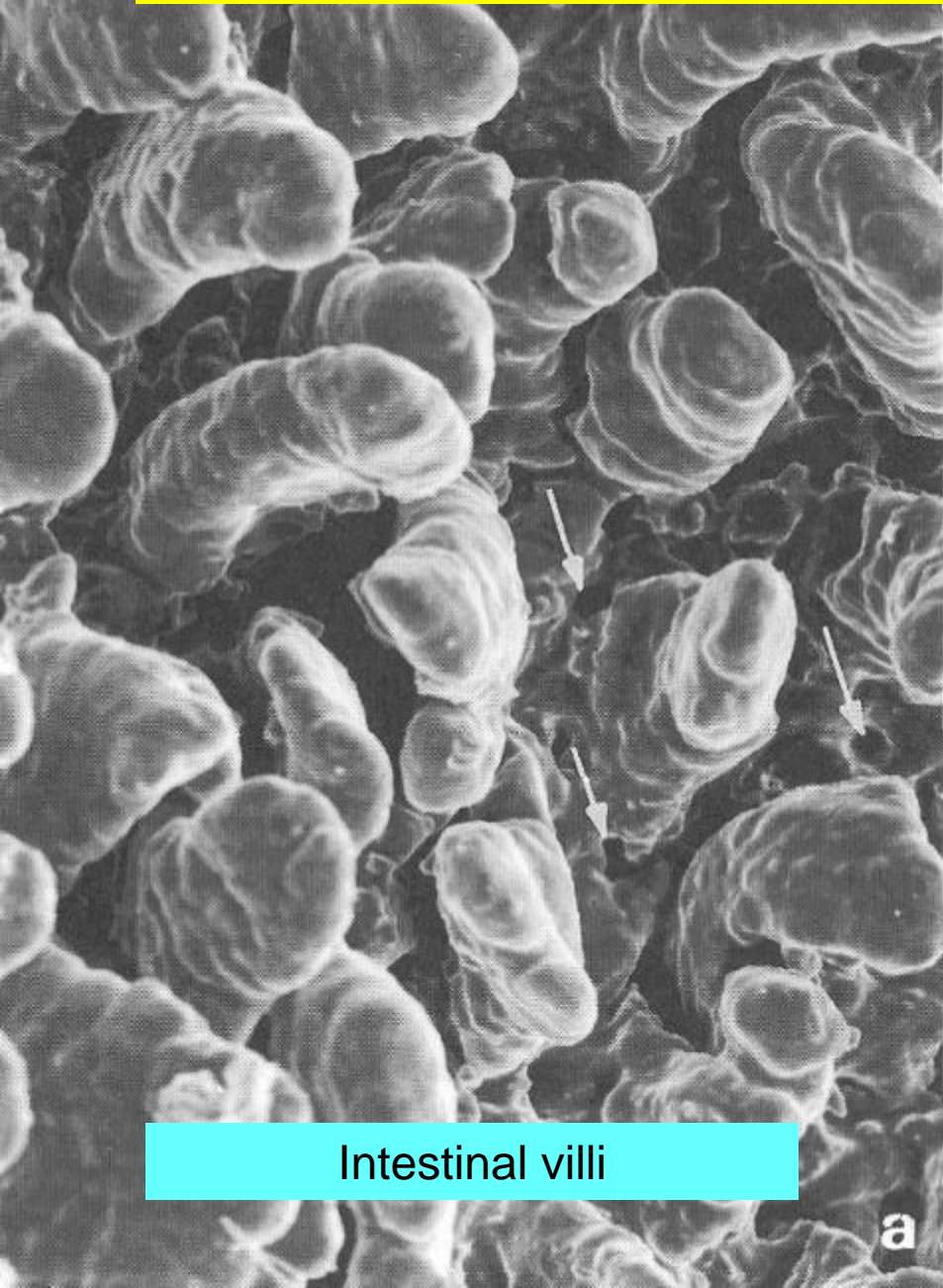
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Kerkring folds
made by submucosa



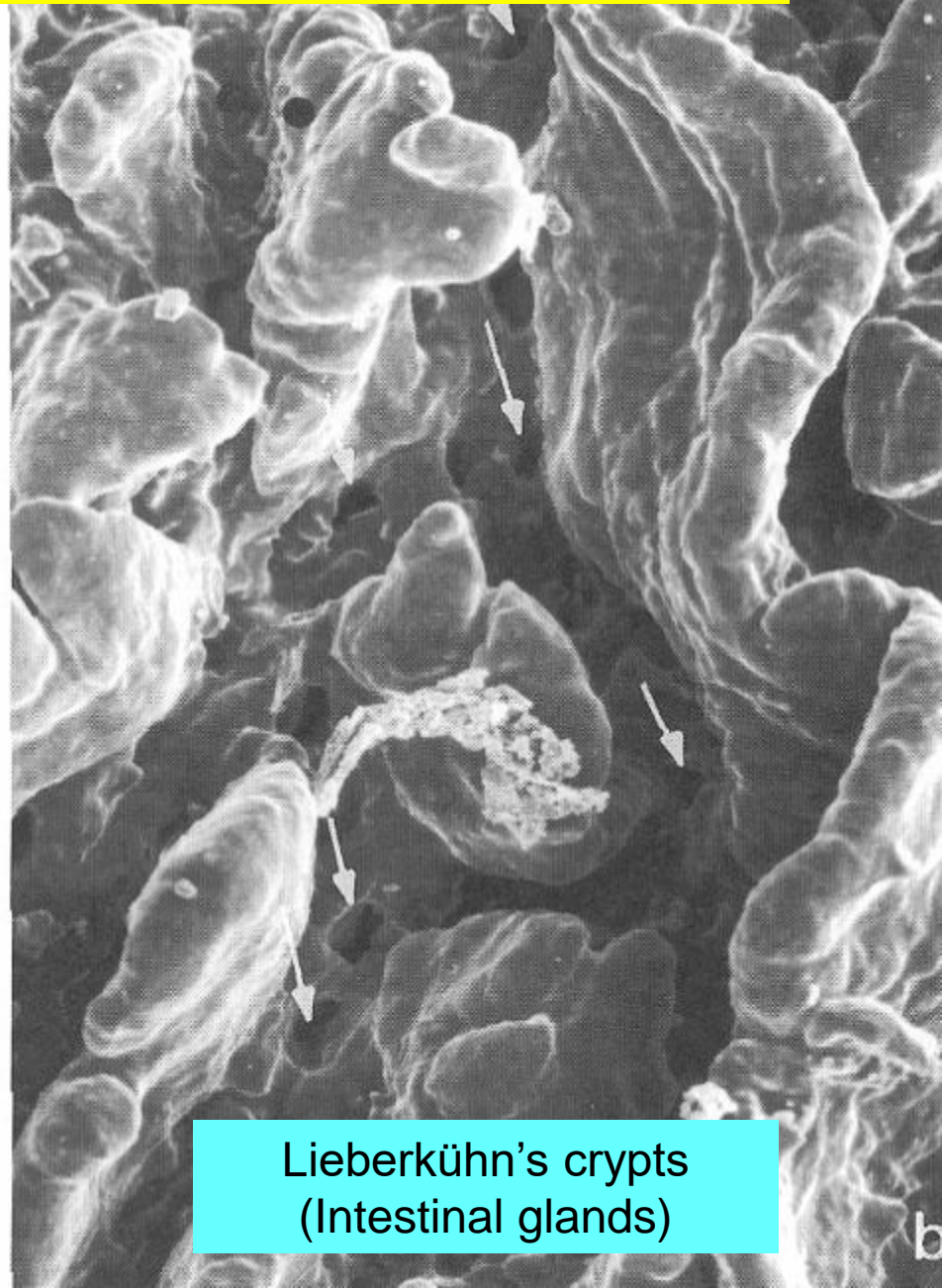
microvilli

Intestinal Villi (Scanning Electron Microscopy)



Intestinal villi

a



Lieberkühn's crypts
(Intestinal glands)

b



LP

Ep

L

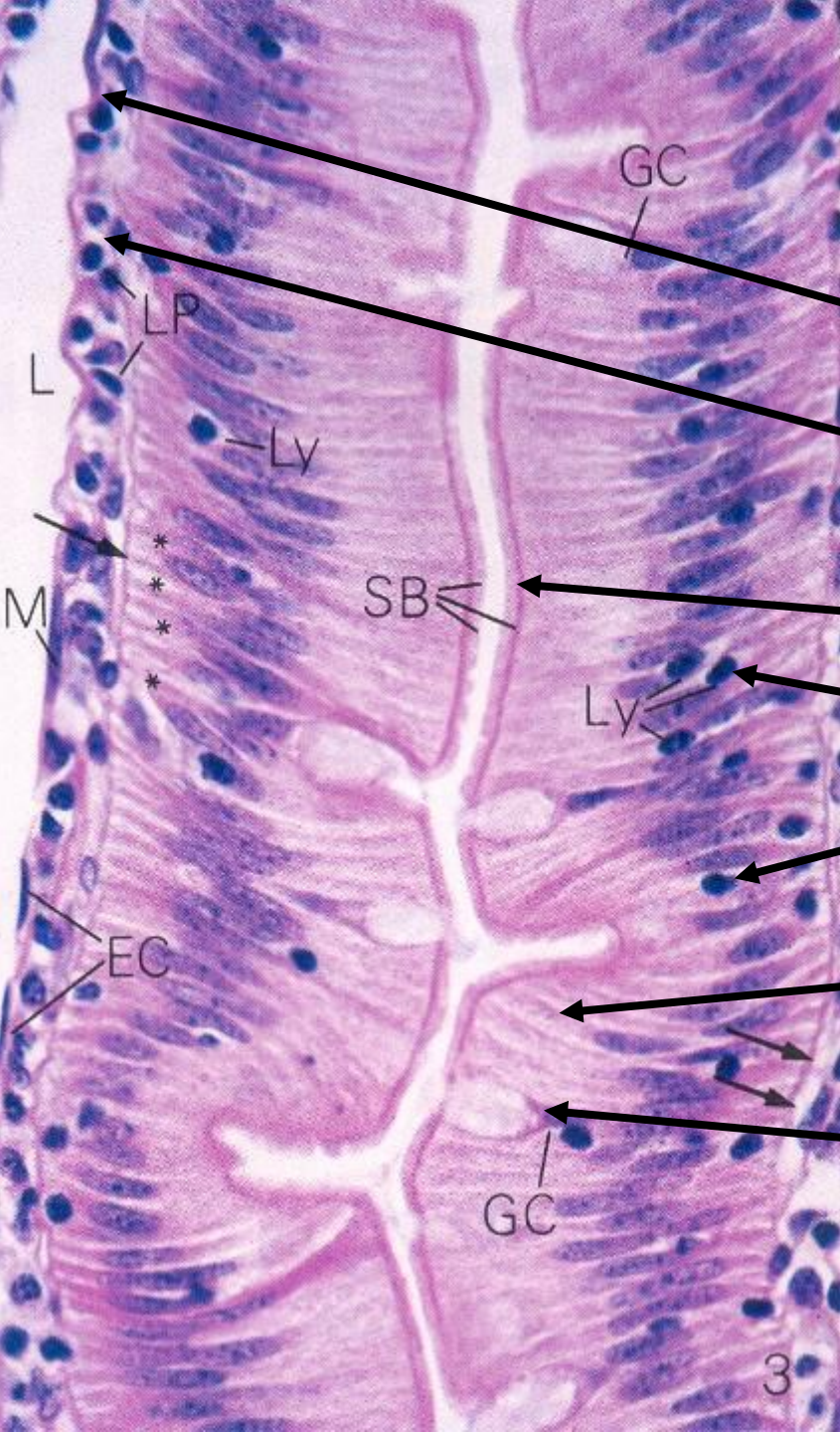
LP

L

GC

Intestinal Villi

Two Neighboring Ileal Villi



endothel cells (lymphatic vessel)

propria (lymphocytes)

brushborder (microvilli)

lymphocytes (infiltration)

epithelial cells (enterocytes)

goblet cells (GC)

GC

LP

L

Ly

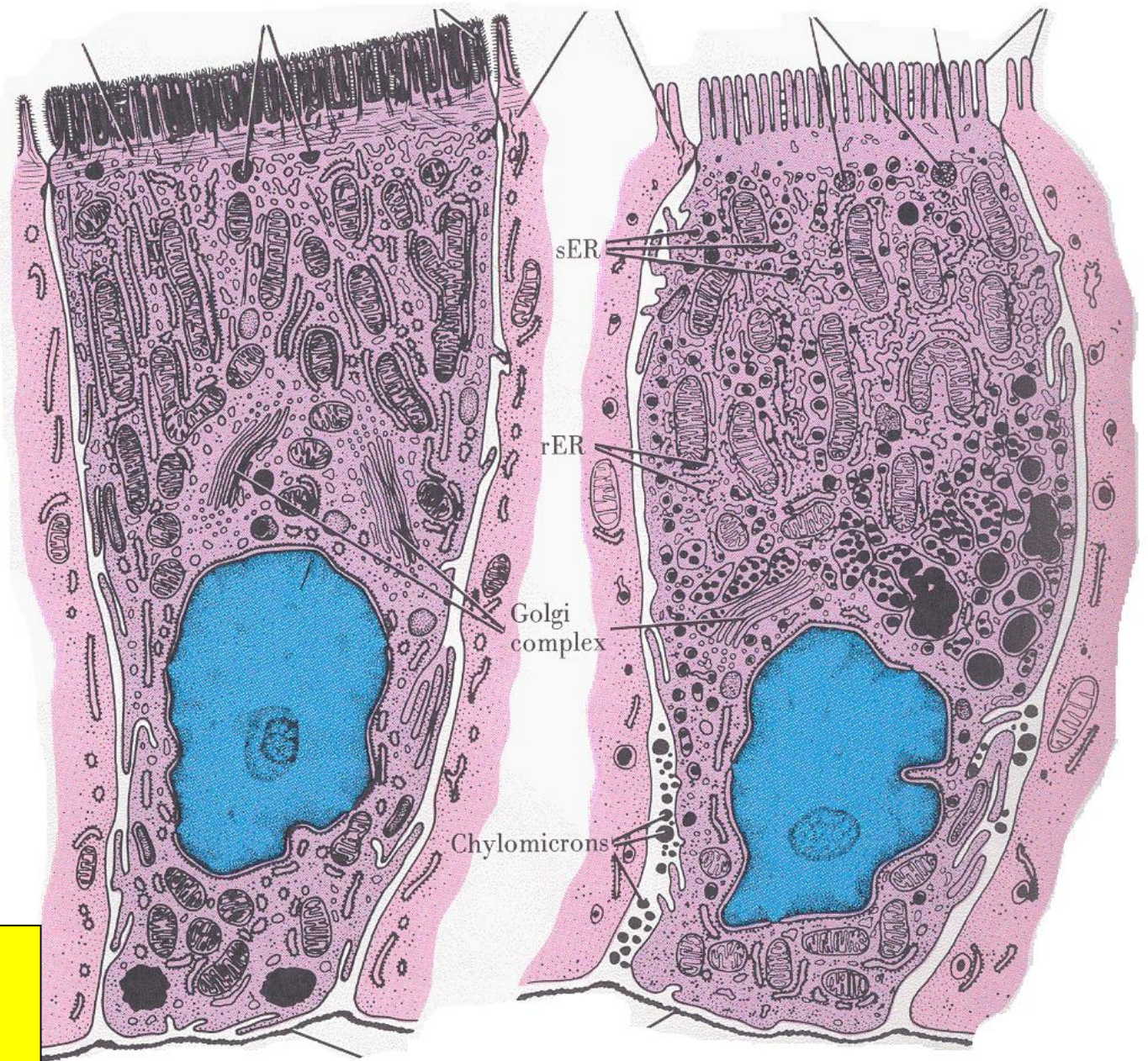
SB

Ly

EC

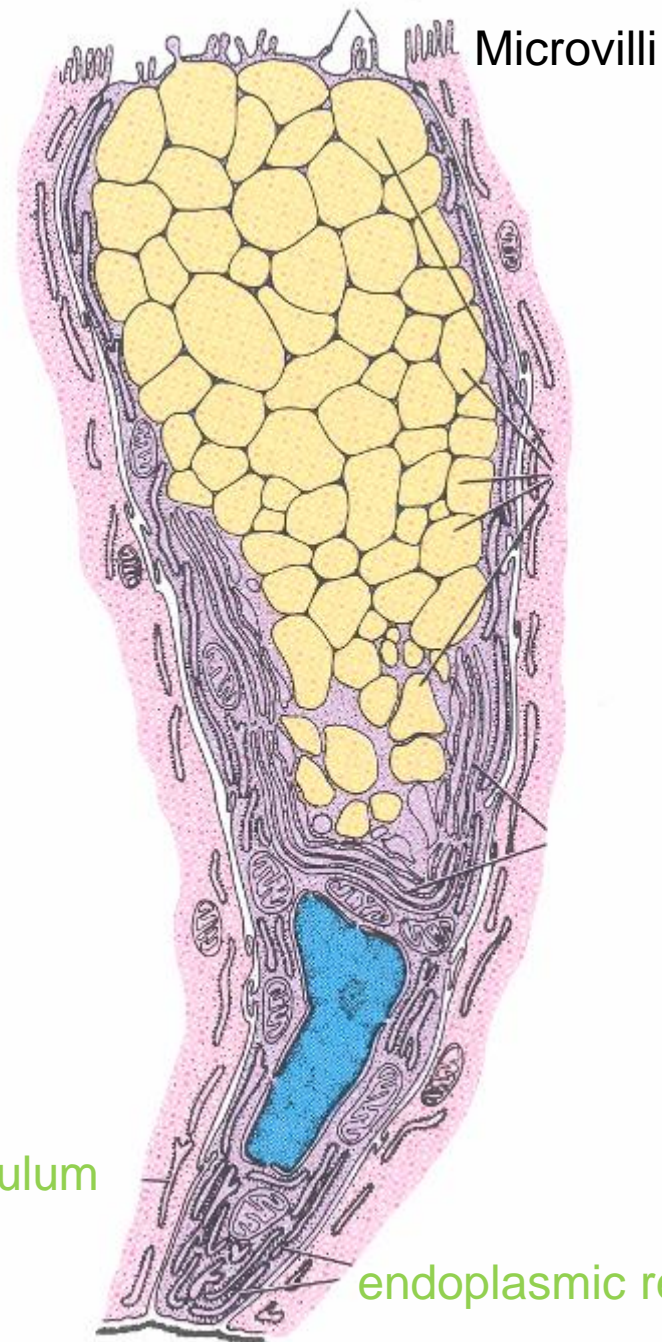
GC

3



*Enterocytes with
brushborder or
microvilli*

Goblet Cells

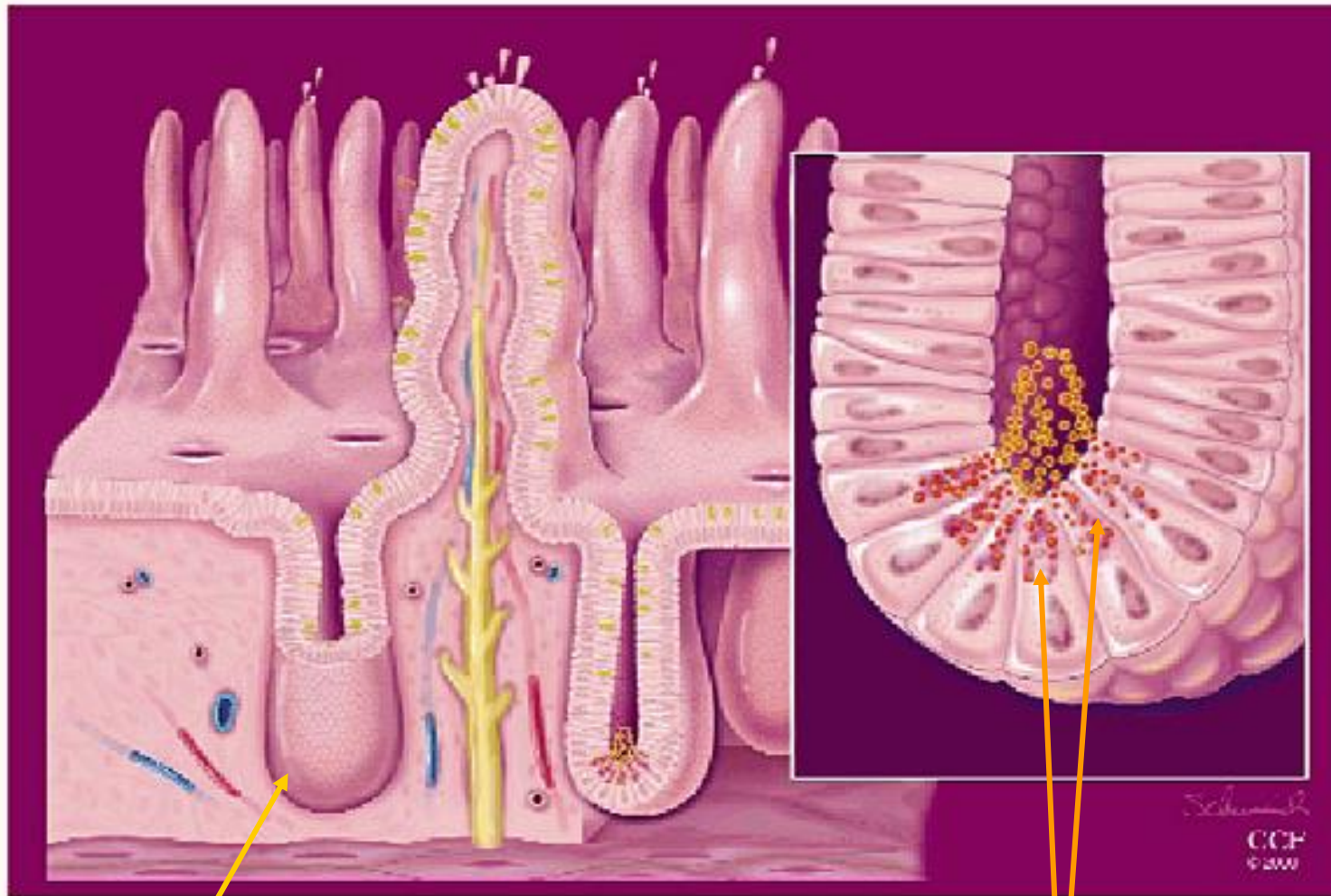


Mucinogenic granules

Golgi-apparatus

endoplasmic reticulum

endoplasmic reticulum



Cleveland Clinic Foundation

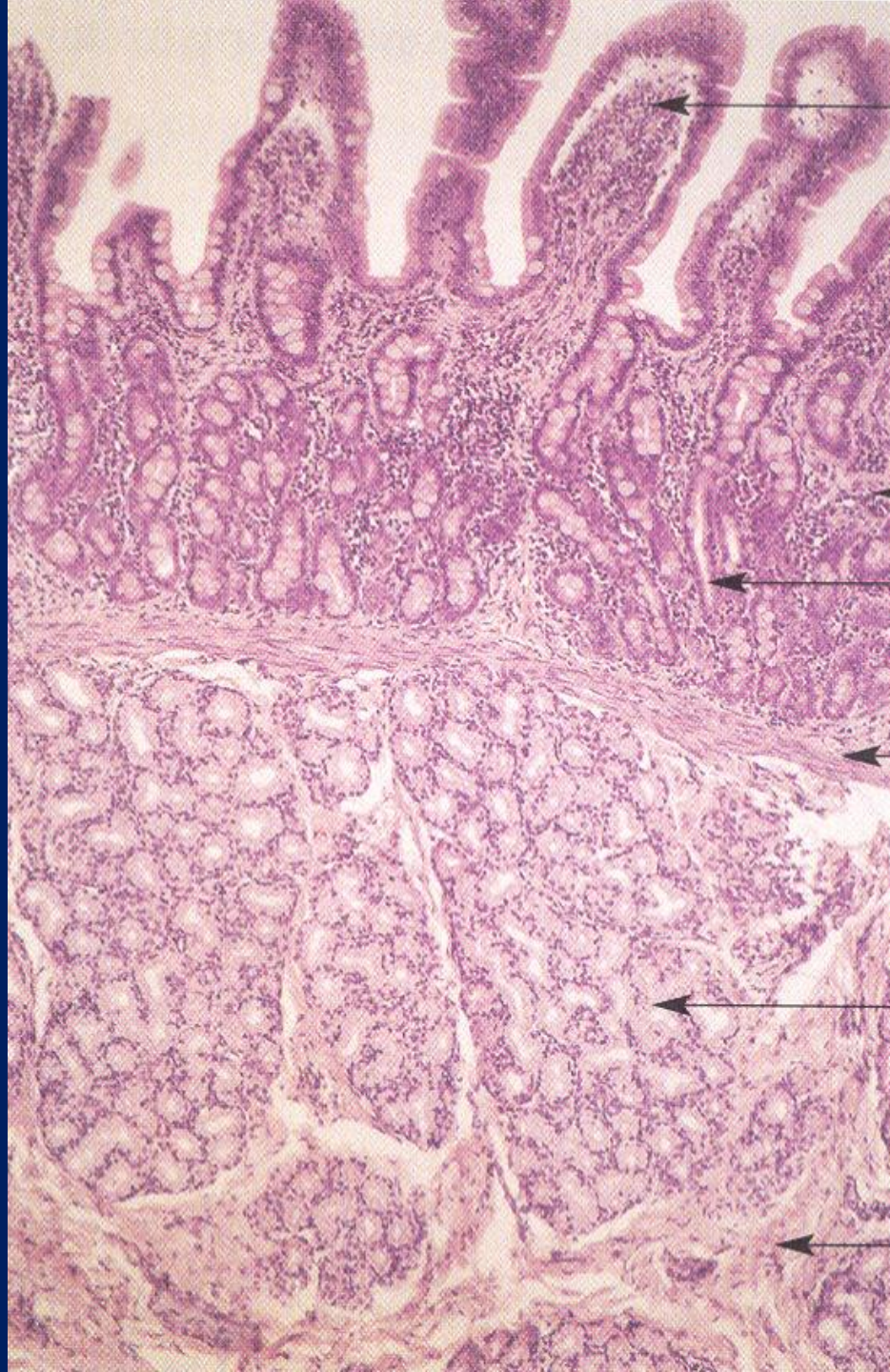
Schmitt
CCF
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Paneth cells: secrete antibacterial enzyme: lysozime

Lieberkühn crypts in
the propria layer
(glands)

Duodenum

Brunner glands: secrete alkalic substance to neutralise the acidic pH



villi

epithelium
(enterocytes)

propria

Lieberkühn's
crypts(glands)

muscularis
mucosae

Brunner's
glands
(submucosa)

submucosa

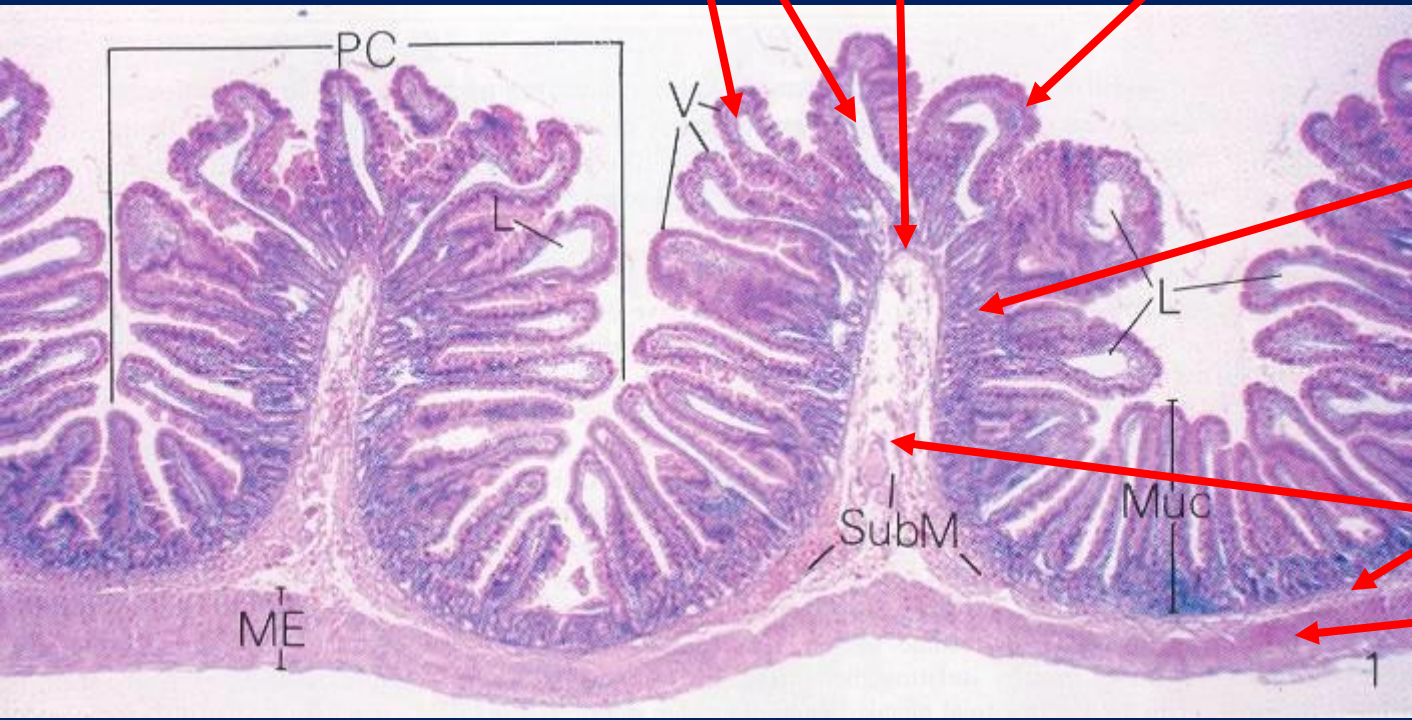
Jejunum

muscularis
mucosae

intestinal villi

epithelium of mucosa

Kerkrings's folds



mucosa

submucosa

tunica muscularis
+ serosa

Jejunum

(longitudinal section
of a villus)

Goblet cells

1.) *epithelium*

stroma of villus

Lieberkühn's crypts:
glands in the propria
layer



Mucosa layer

2.) *propria*: wide,
contains
Lieberkühn
crypts: glands

3.) *muscularis
mucosae*

Submucosa

Ileum

Peyer's
plaques

(aggregated
lymphatic
follicles)



villi

crypts

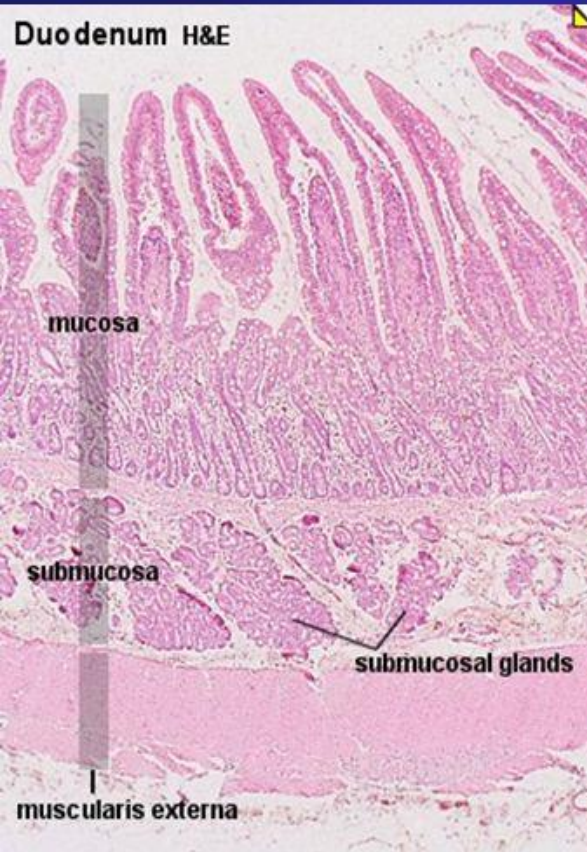
submucosa

muscle layer

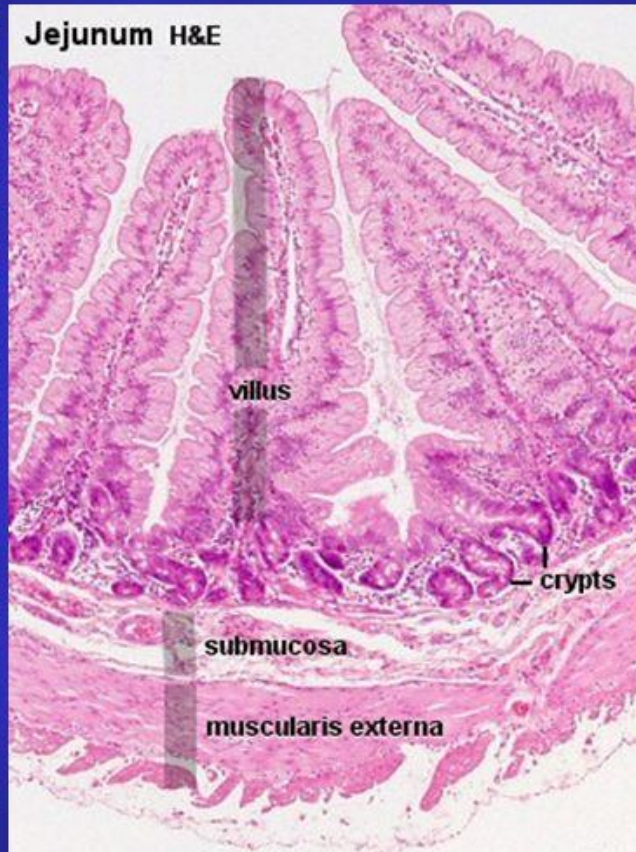
serosa

COMPARISON

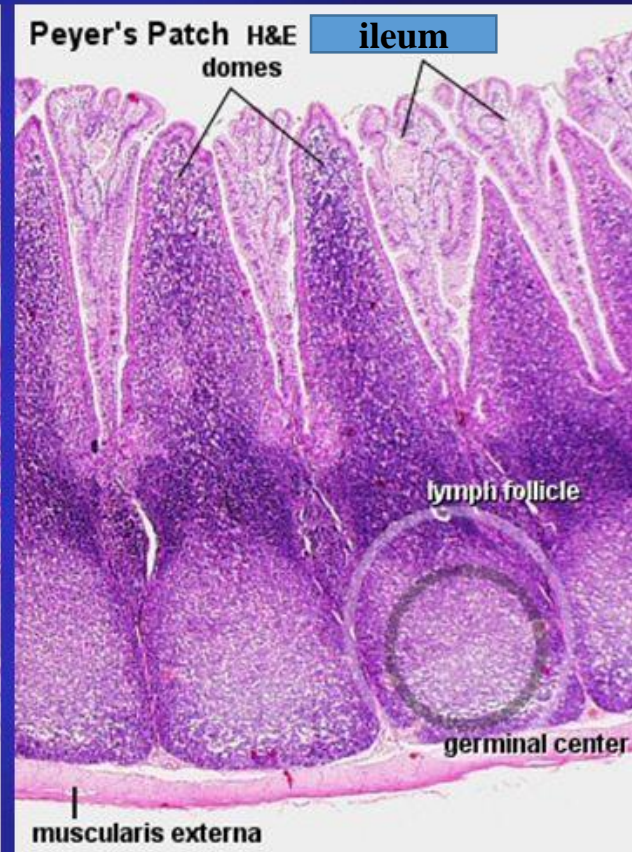
Duodenum H&E



Jejunum H&E



Peyer's Patch H&E



Large intestine

ileocecal junction: is the continuation of the ileum

cecum (appandix: lymphatic organ)

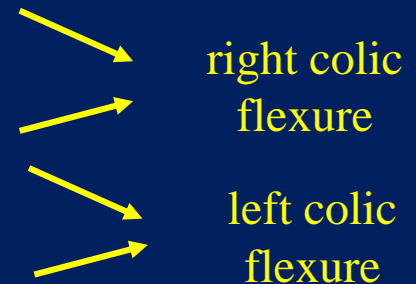
ascending colon: right side of the abdominal cavity

transverse colon: middle upper part of the abdominal cavity

descending colon: left side of the abdominal cavity

sigmoid colon: pelvic region

rectum



Ileocoecal transition

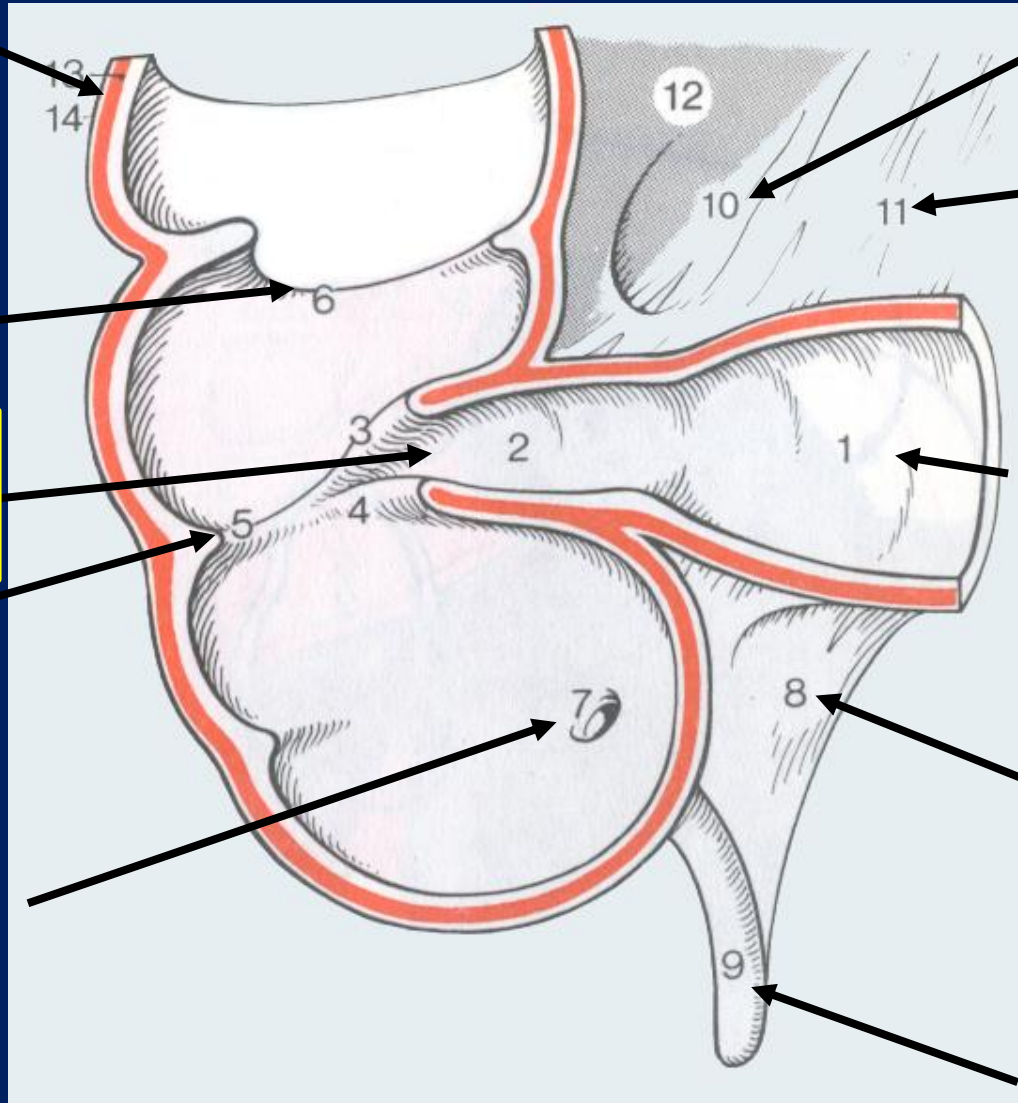
tunica
muscularis et
serosa

plica
semilunaris

Ileocoecal valve
(Bauhin-valve)

frenulum

ostium
appendicularis



root of the
mesentery

mesentery

Ileum terminale

mesoappendix

appendix
vermiformis

Large intestine

Right colic flexure

Left colic flexure

ascending colon

transverse colon

descending colon

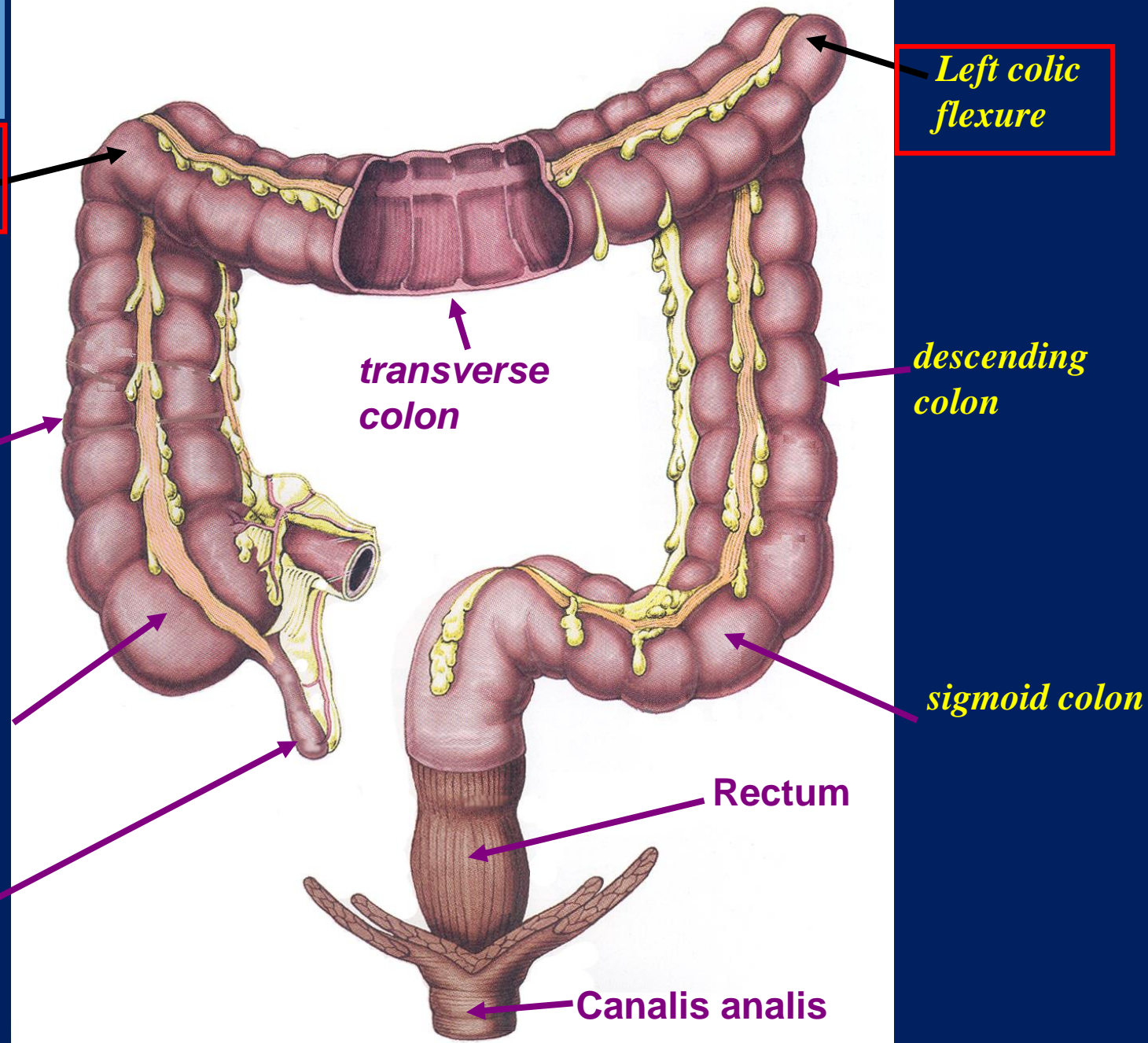
coecum

sigmoid colon

appendix vermiformis

Rectum

Canalis analis



right colic flexure

ascending colon

caecum

ileum

appendix

rectum

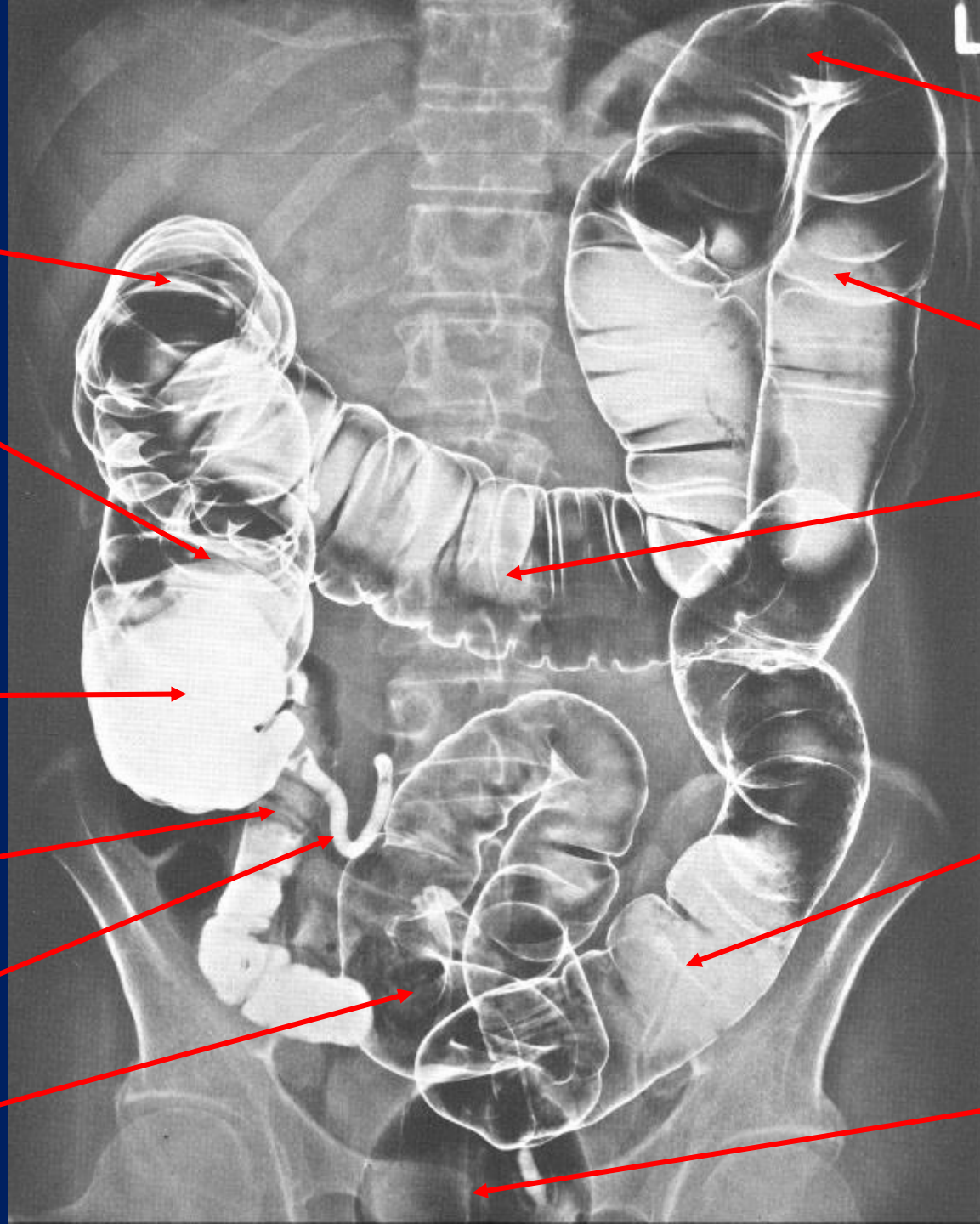
left colic flexure

descending colon

transverse colon

sigmoid colon

symphysis



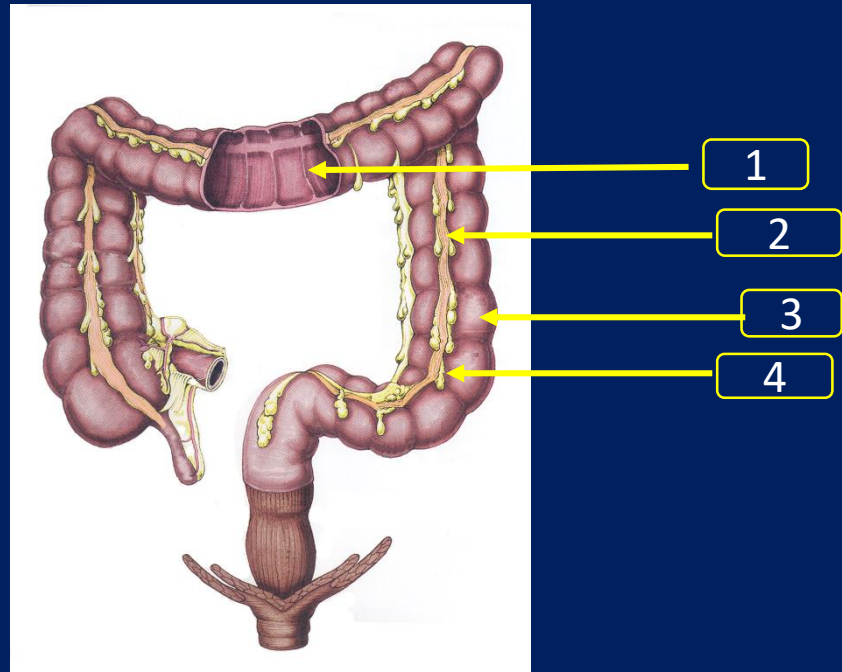
Chracterisitcs of the large intestine

Plicae semilunares: tela muscularis, circular layer (inside) 1.

Teniae coli: tela muscularis, longitudinal layer (outside) 2.

Haustra: outpouches between teniae and plicae semicirculares 3.

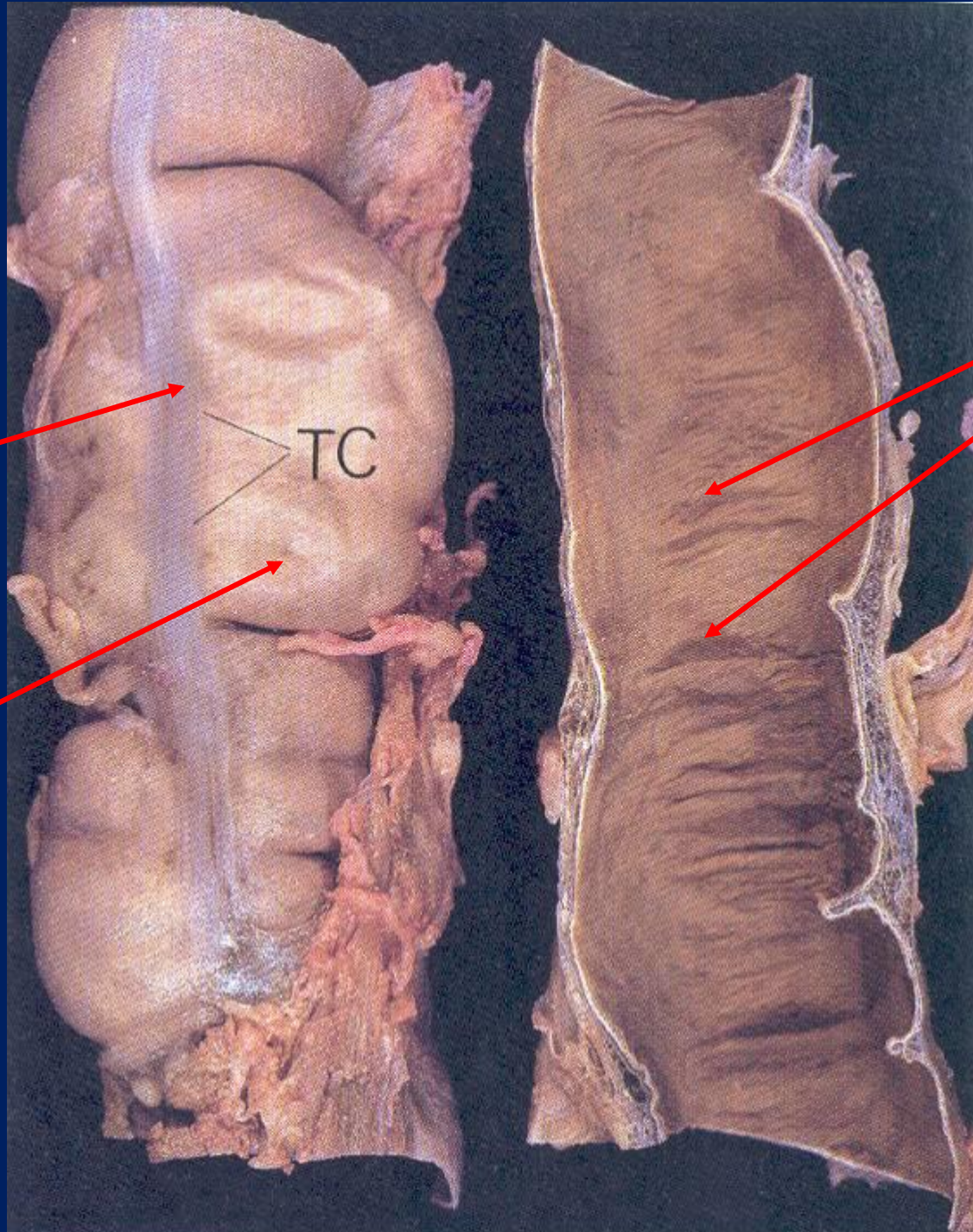
Appendices epiploicae (omentales): fatty pouches in the subserose layer 4.



Large Intestine
from the outside
and from the
Inside

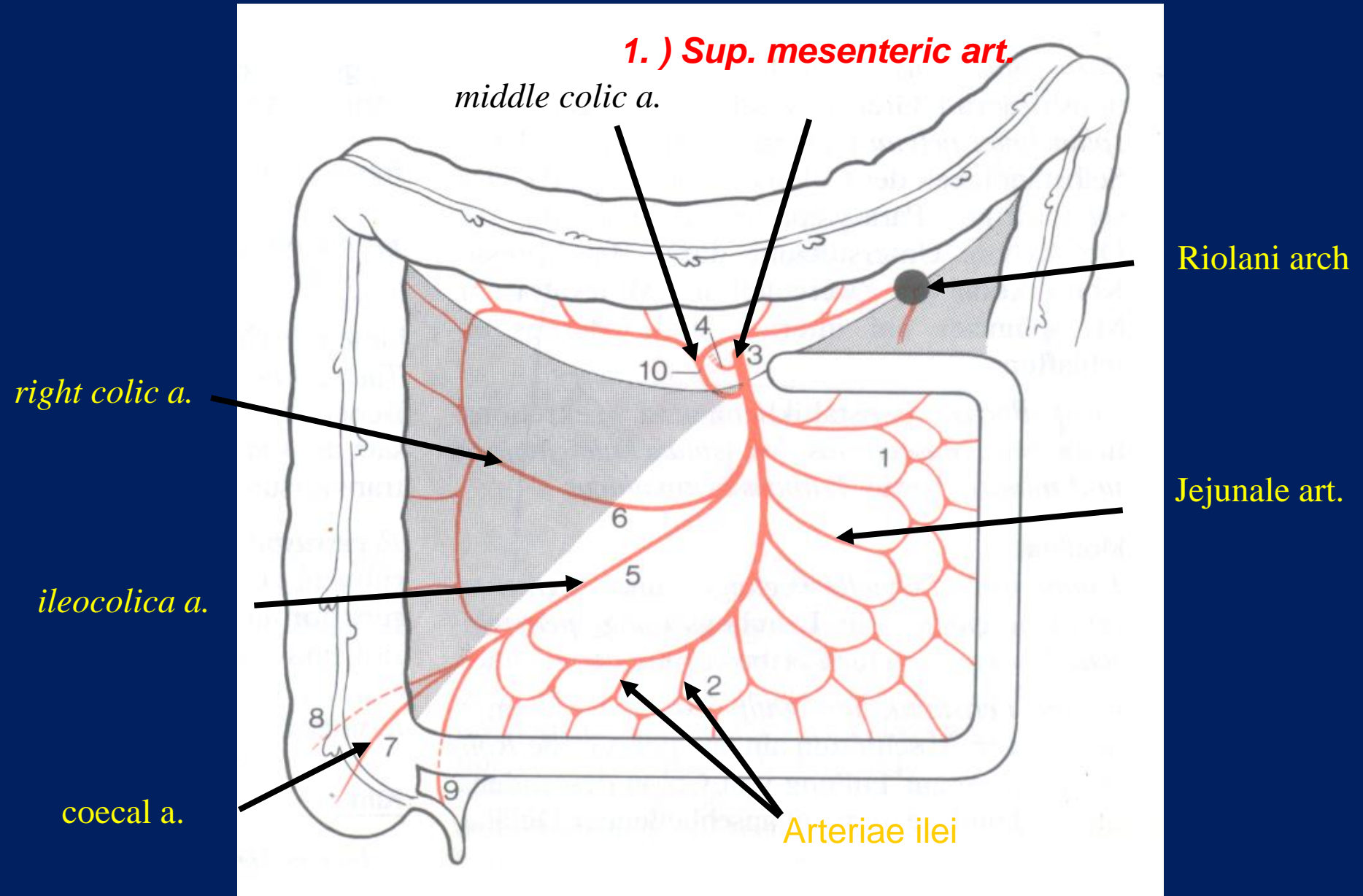
tenia

haustum

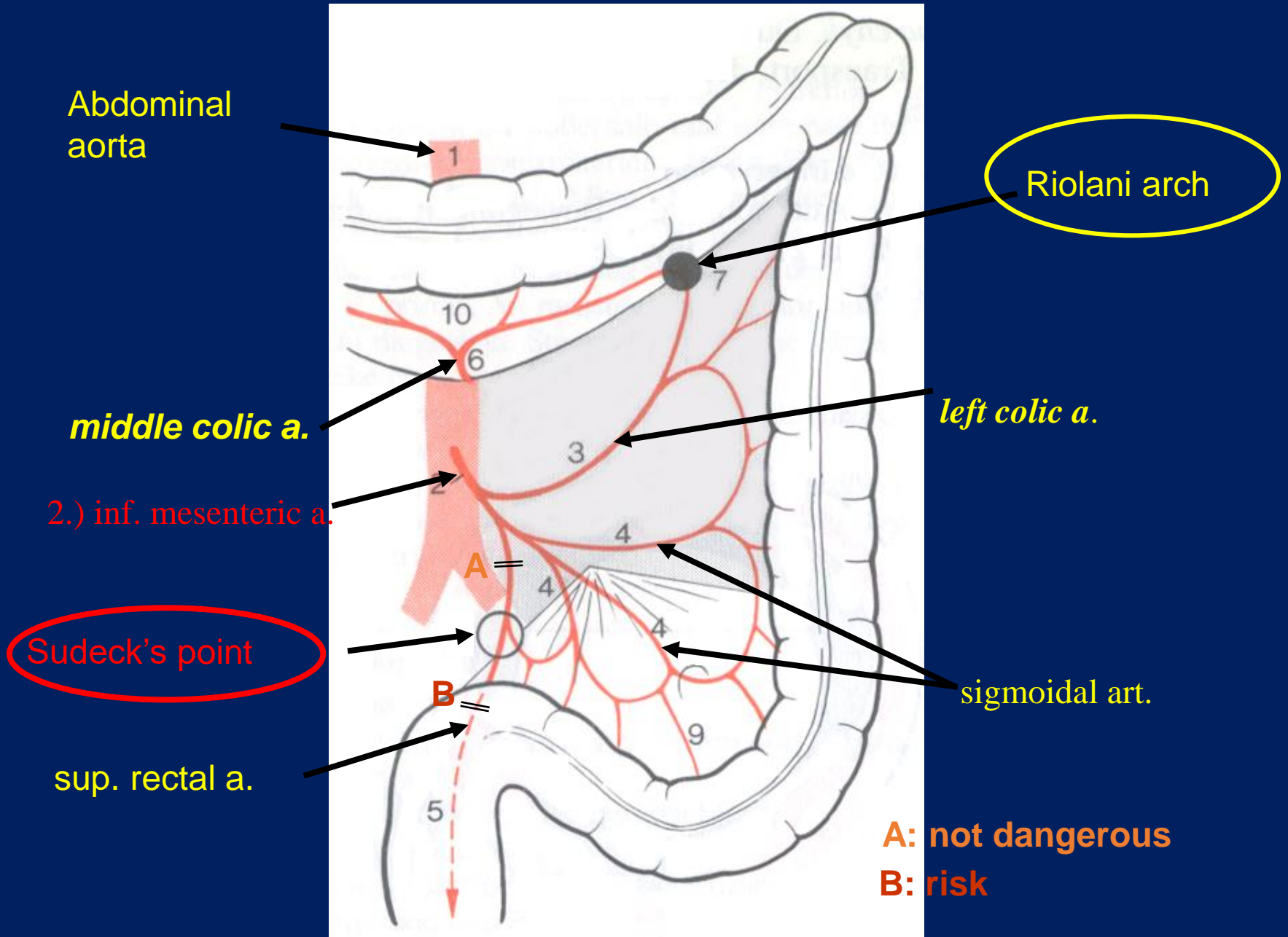


plicae
semilunaris

Blood supply of the large intestine



Blood supply of the large intestine



Blood supply of the large intestine

1.) *Superior mesenteric artery:*

ileocolic artery: ileocolic junction

cecal artery: cecum

right colic artery: ascending colon

middle colic artery: transverse colon

2.) *Inferior mesenteric artery:*

left colic artery: descending colon

sigmoidal arteries: sigmoid colon

superior rectal artery: superior part of the rectum

Riolani arch: anastomosis

Sudeck point:
anastomosis

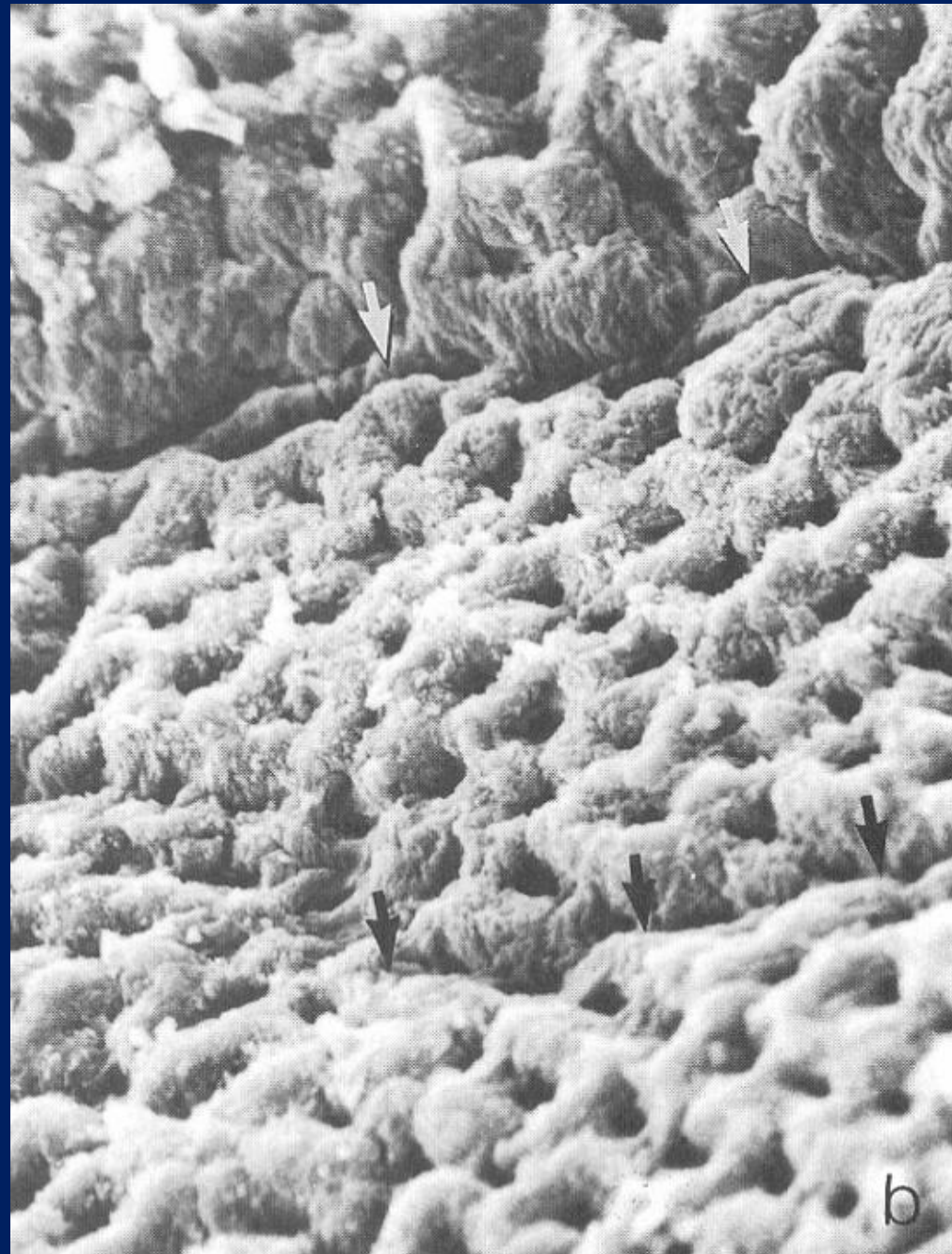


Histology of the large Intestine

Histological characteristics of the large Intestines

(compared with the small intestines)

- lack of villi
- deeper straight crypts
- rich in goblet cells
- adipose tissue in the submucosa and subserosa
- only single lymph nodes (solitary lymphatic follicles)



Wall of Large Intestines

Epithelium of mucosa

Tunica muscularis of mucosa

Lamina propria (+
Lieberkühn's crypts)

Tela
submucosa

TC

Tenia coli

Muc

SubM

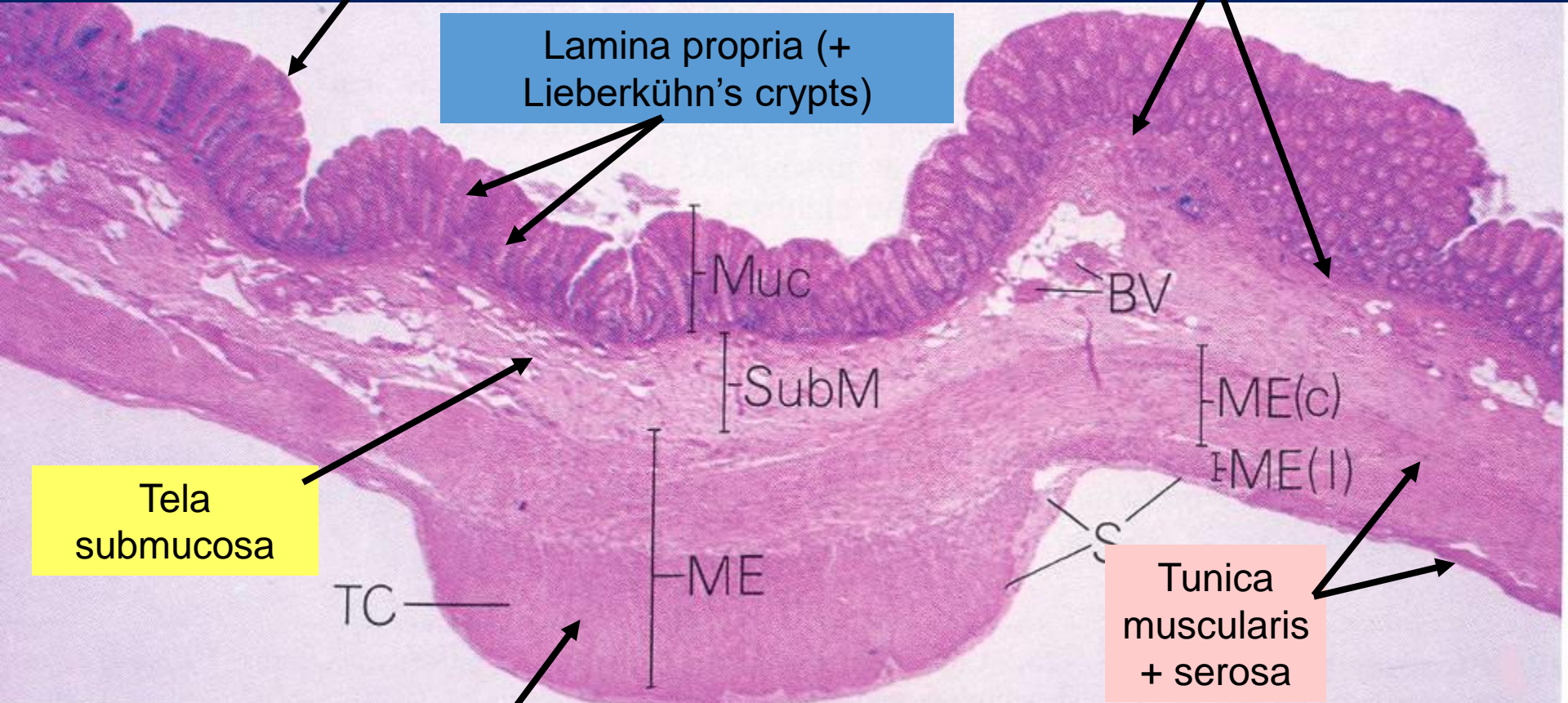
ME

BV

ME(c)

ME(l)

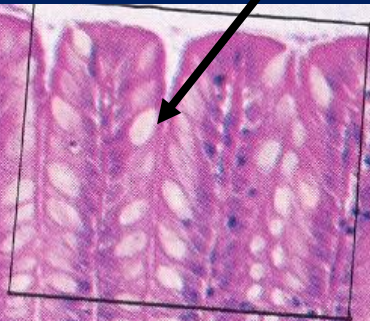
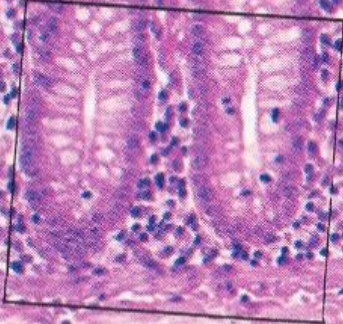
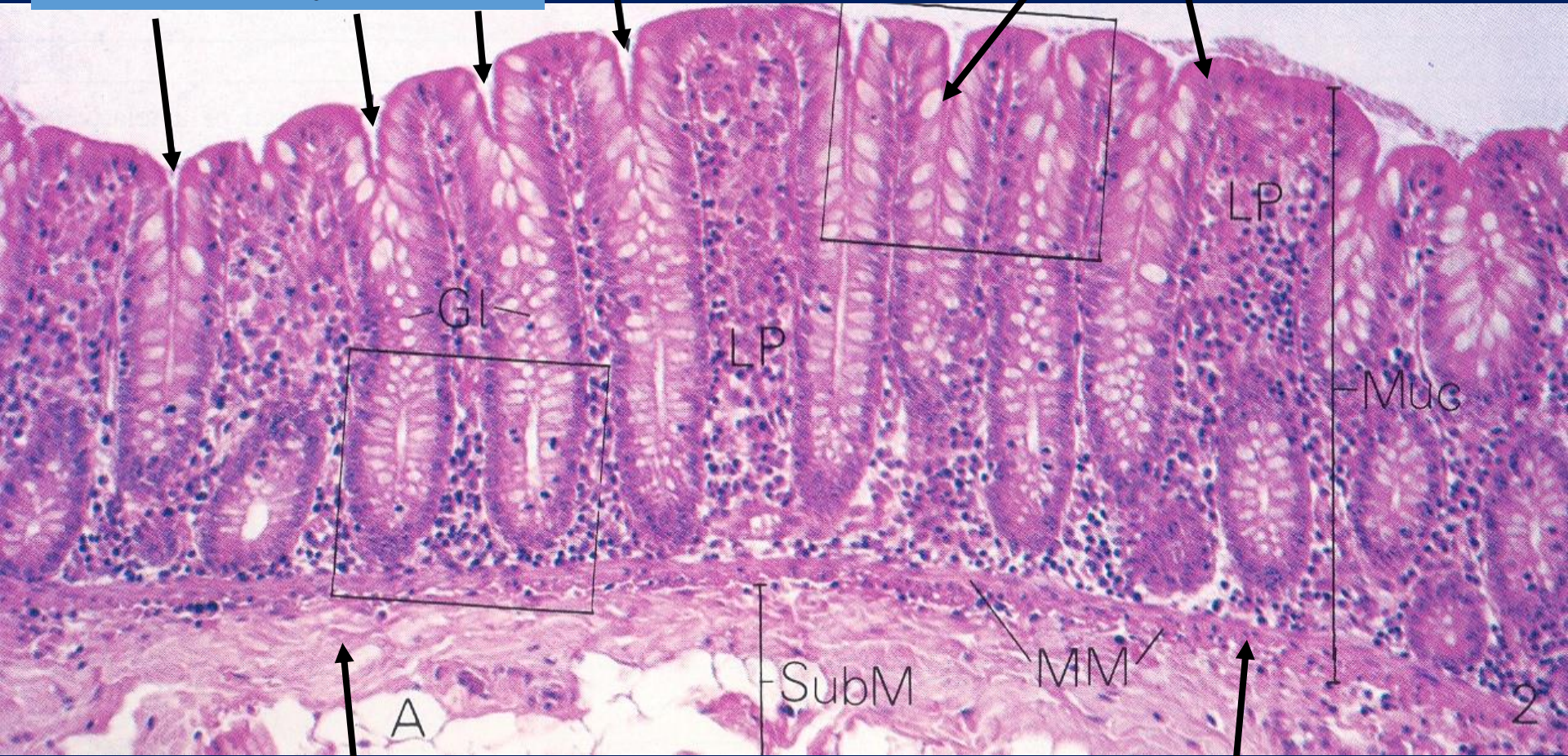
Tunica
muscularis
+ serosa



Histology of the wall of the large intestine

Lamina propria mucosae (+ Lieberkühn's crypts)

Epithelium mucosae, goblet cells



Tela submucosa

Tunica muscularis mucosae

A

SubM

MM

LP

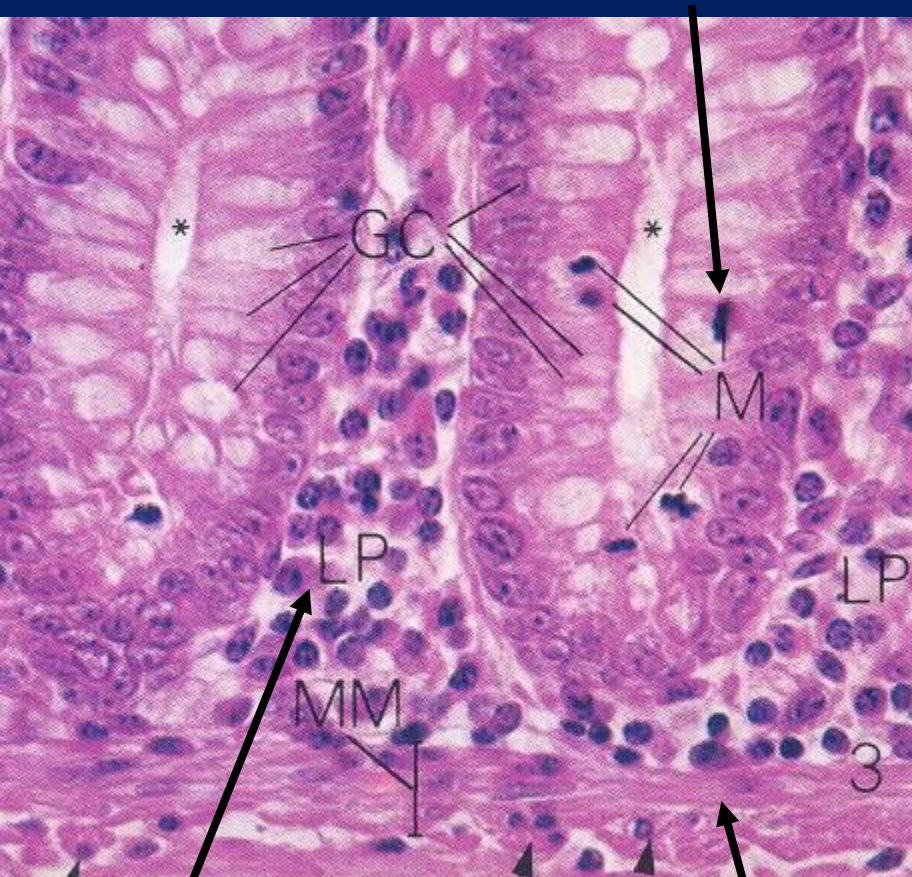
LP

Muc

2

Wall of Large Intestines

Mitotic cells (M)

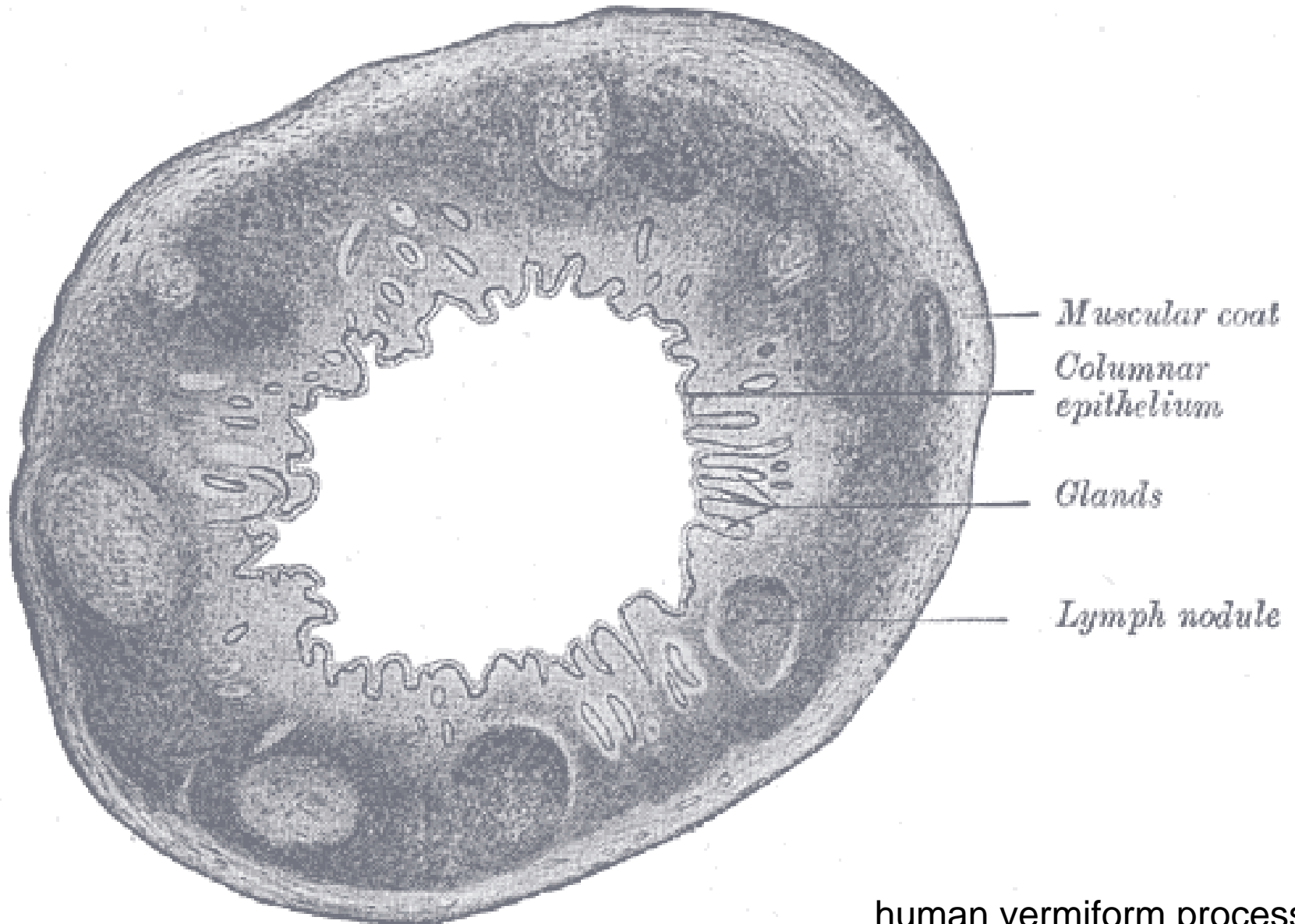


Lamina propria mucosae

Muscularis mucosae

Goblet cells

Appendix Vermiformis



Appendix vermiformis

Folliculi lymphatici

Tunica mucosa

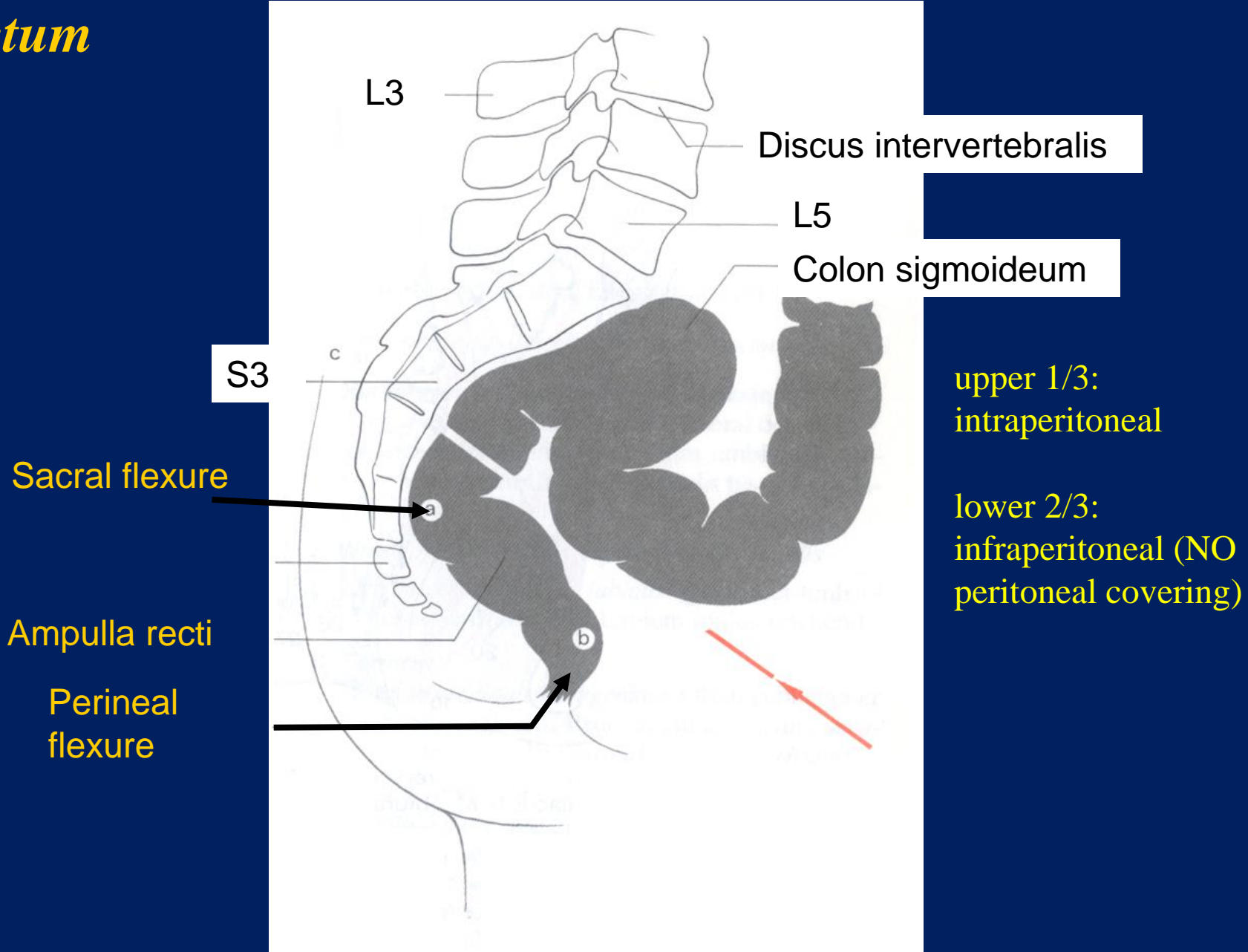
Tela submucosa



Tunica muscularis + Serosa

Lieberkühn's crypts

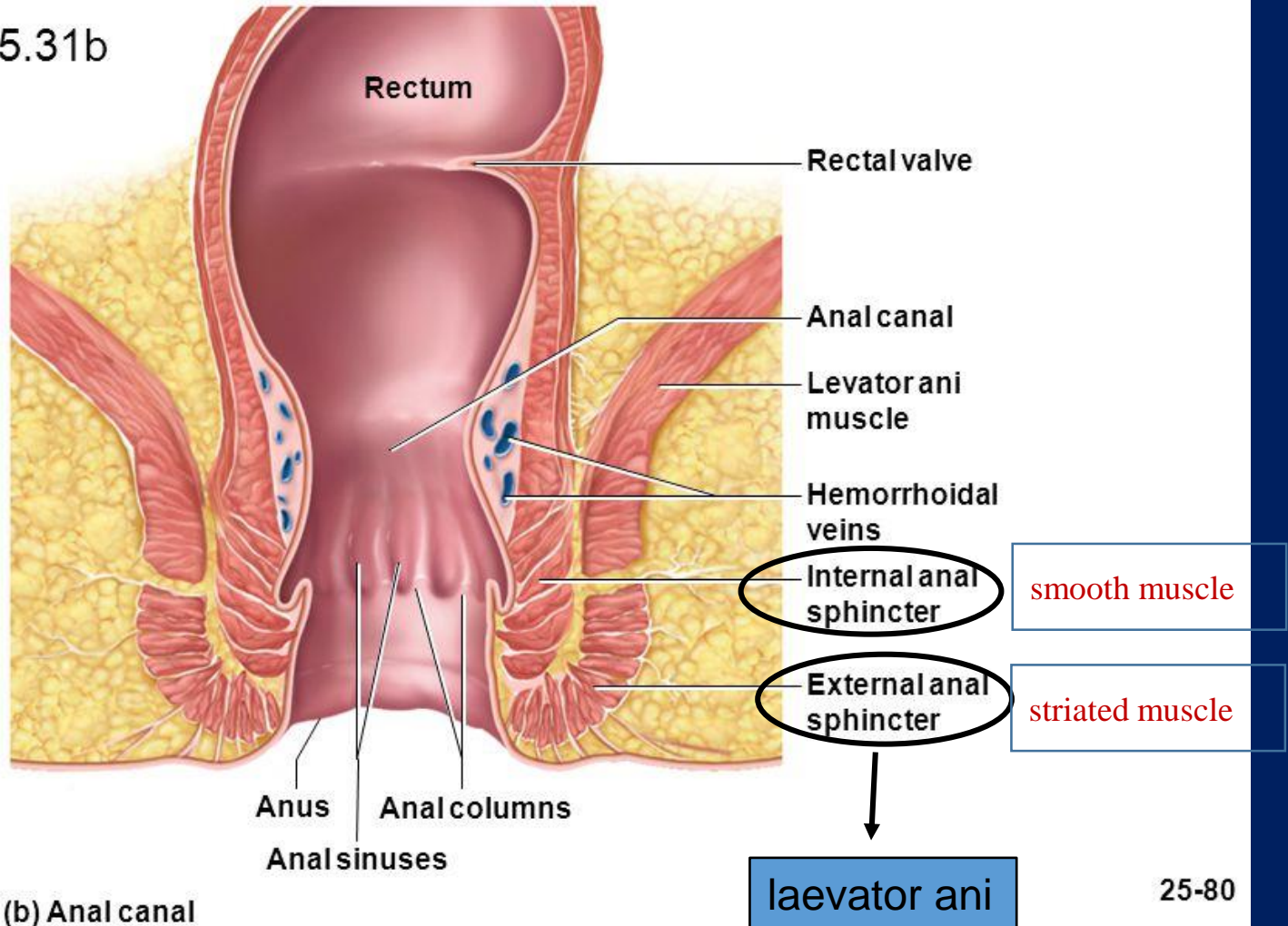
Rectum



Anatomy of Anal Canal

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Figure 25.31b



Blood supply and venous drainage of the rectum

- Since only the upper 1/3 of the rectum has peritoneal covering, the lower 2/3 NOT, the blood supply and the venous drainage is different:
- *sup. rectal art.* (unpaired, 1): **inf. mesentric art.**
- *middle rectal a.* (paired, 2): directly from the **int. iliac art.**
- *inf. rectalis art.* (paired 2): **int. pudendal art. (int. iliac art.)**
- **sup. rectal vein (1) (v. portae)**
- **middle rectal vv (2) (v. cava inf.)**
- **inf. rectal v. (2) (int. pudendal v. ; v. cava inf.)**

Hepatic vein

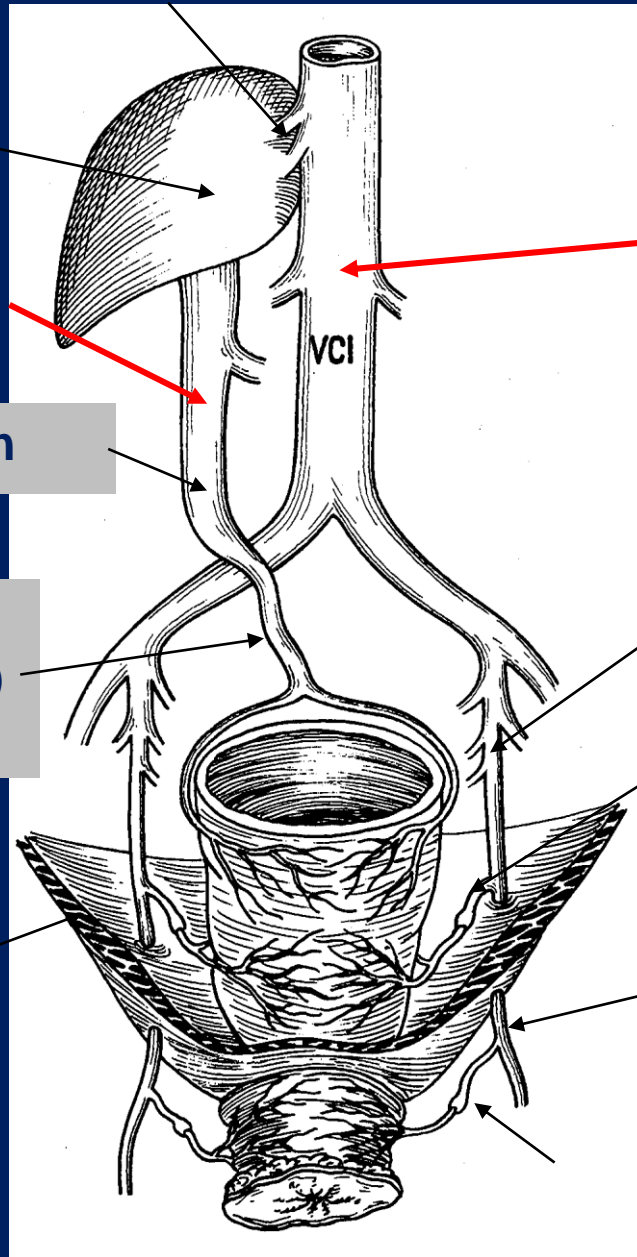
liver

1.) portal vein

inf. mesenteric vein

sup. rectal vein
(unpaired; NO valves!)

levator ani muscle



2.) int. iliac vein

Inf. vena cava

middle rectal vein
(paired; valves!)

int. pudendal vein

↑
inf. rectal vein (paired;
valves !)

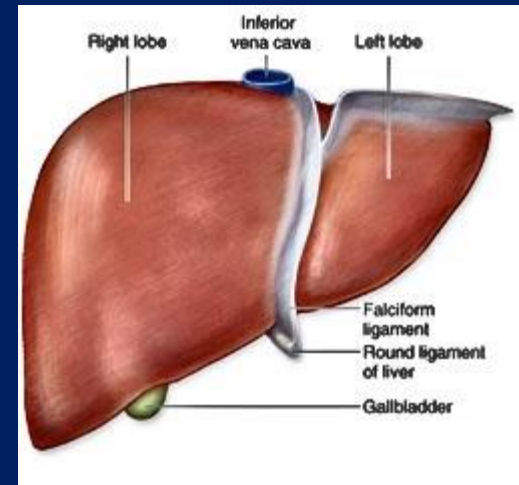
Liver



it is found in the right hypochondric region

has 2 lobes: right and left

it is entirely intraperitoneal



diaphragmatic surface

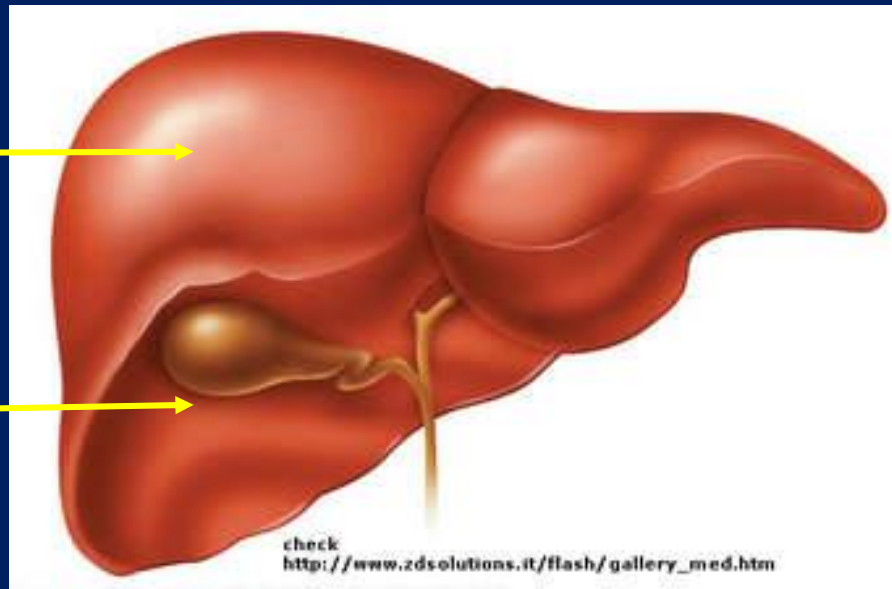
Liver

2 surfaces:

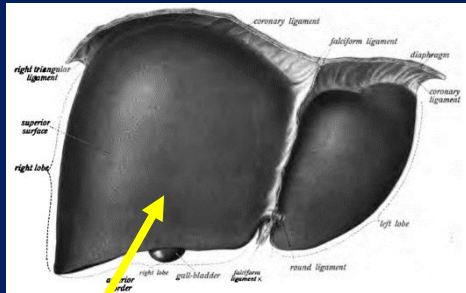
diaphragmatic



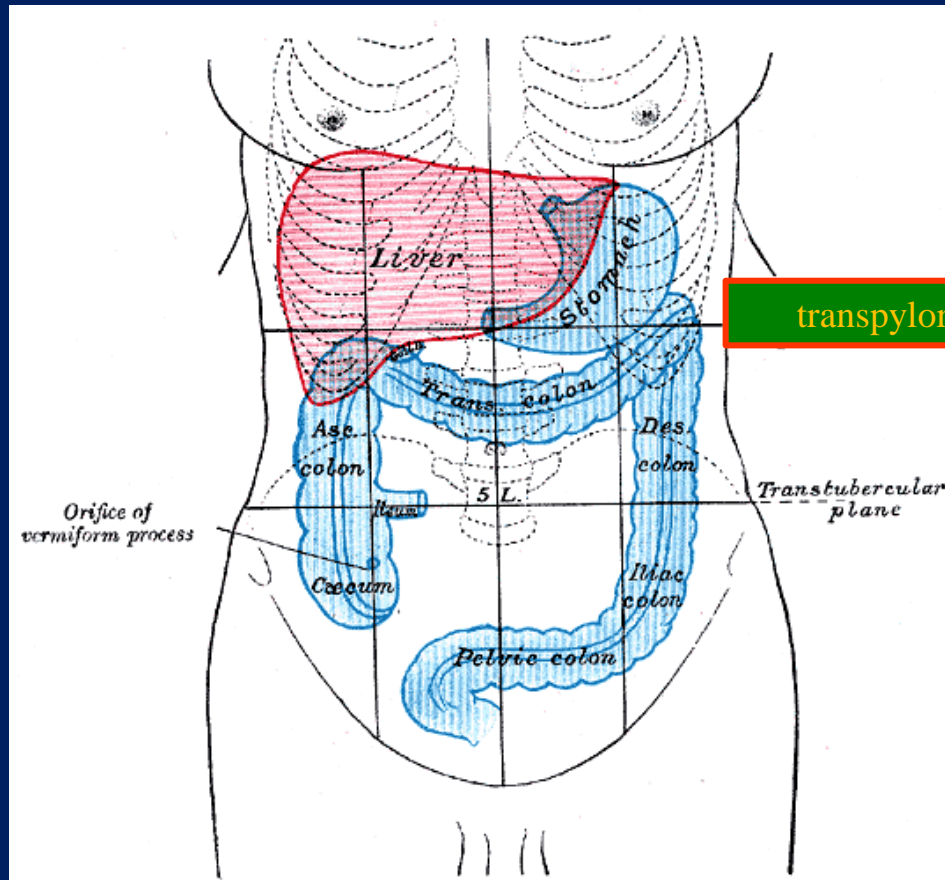
visceral



Topography of the liver

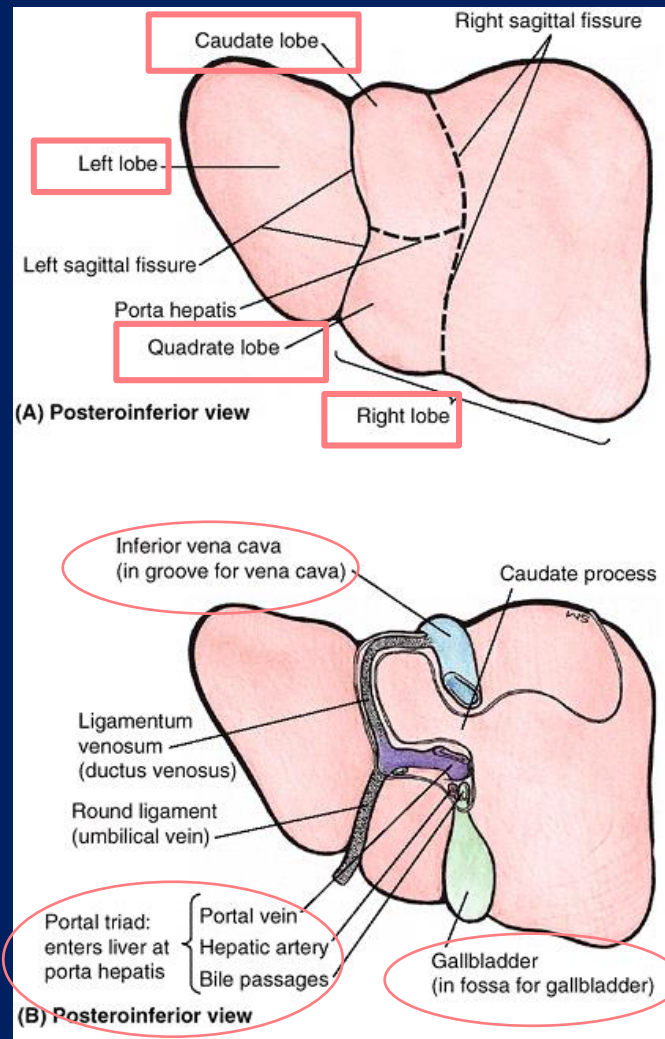


Diaphragmatic surface



transpyloric plane

Gross anatomy of the liver



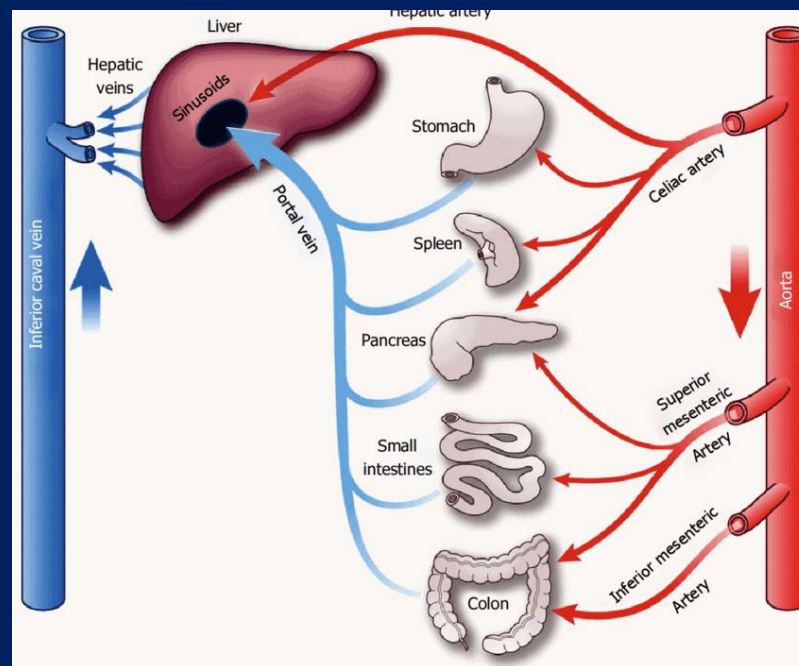
visceral surface: 2 additional lobes:

caudate
quadrate

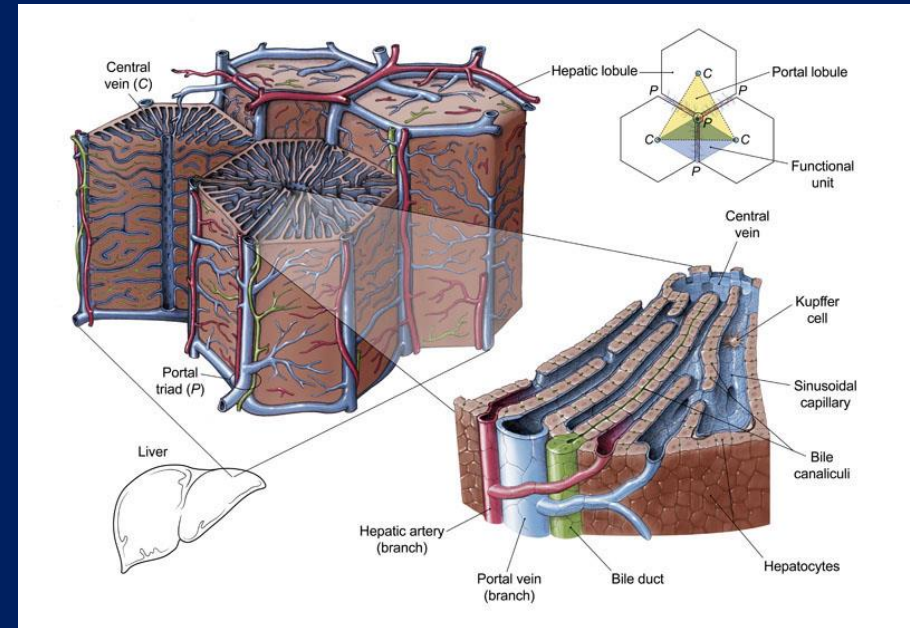
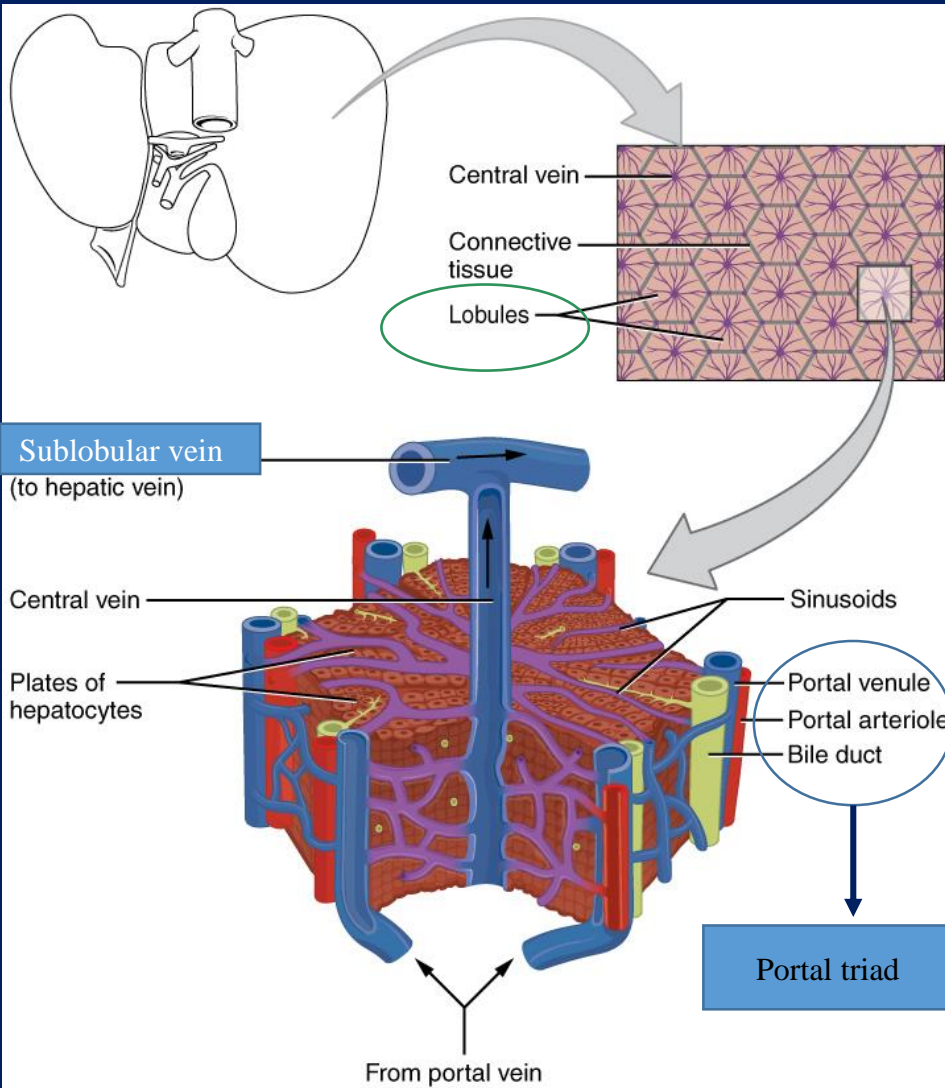
H-shaped fissure with the portal tirad

Functional venous blood circulation of the liver

Portal vein → interlobular veins → sinusoids
→ central vein → sublobular vein → hepatic veins
→ v. cava inf



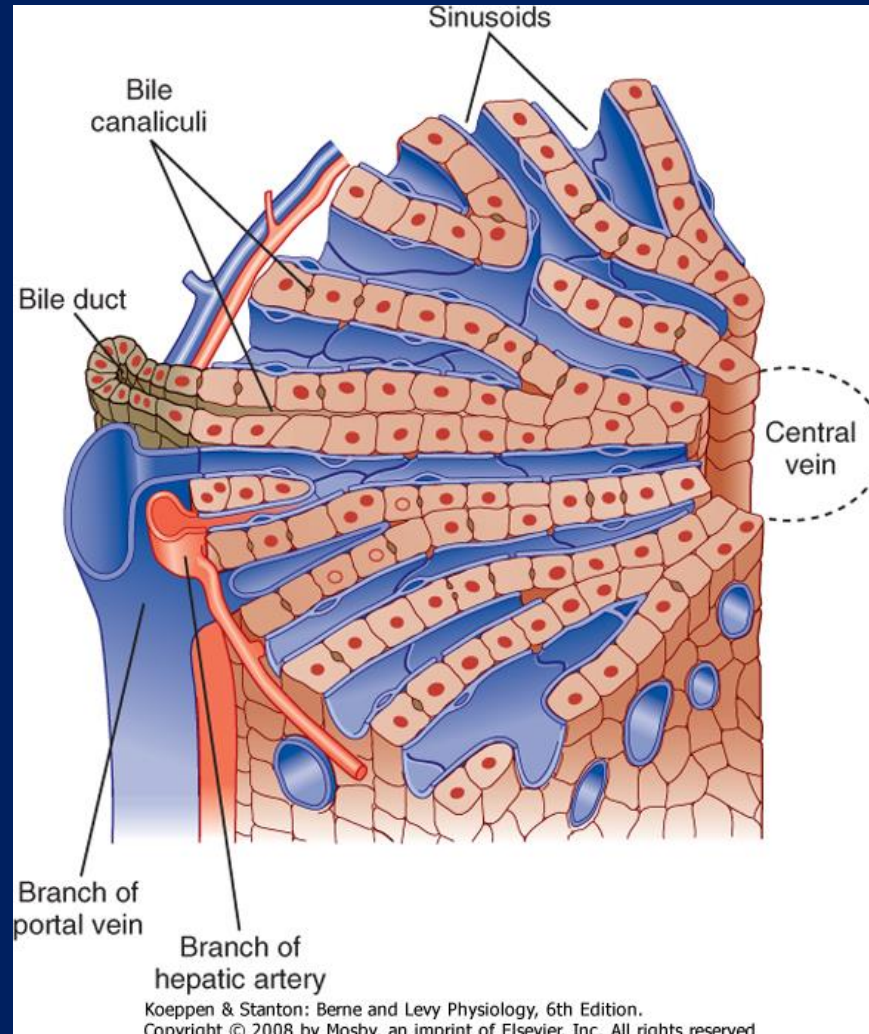
Histological unit of the liver:hepatic lobule



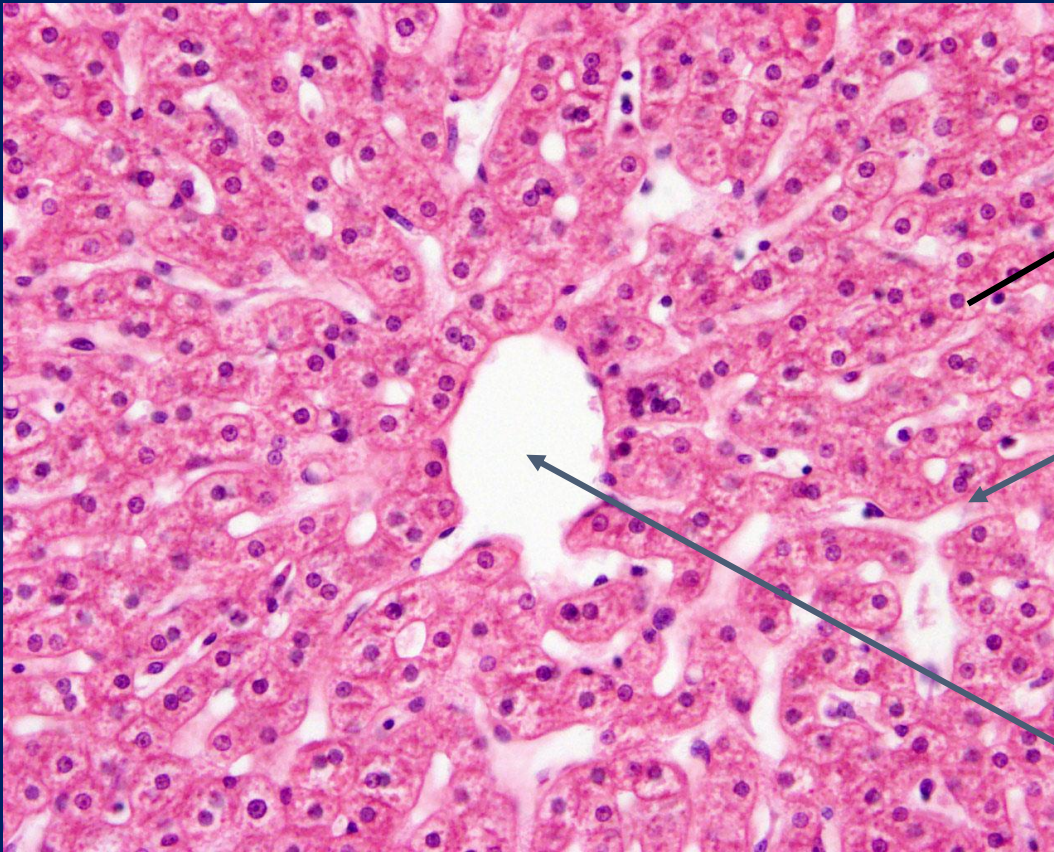
Hexagonal unit

central vein: in the middle
hepatocytes (cuboidal epithelial cells) cords
sinusoids: between the hepatocytes
interlobular veins (branches of the portal vein)+*interlobular artery*: branches of the hepatic artery proper)+ *bile duct*

Histological unit of the liver:hepatic lobule



Histology of the liver



hepatocytes

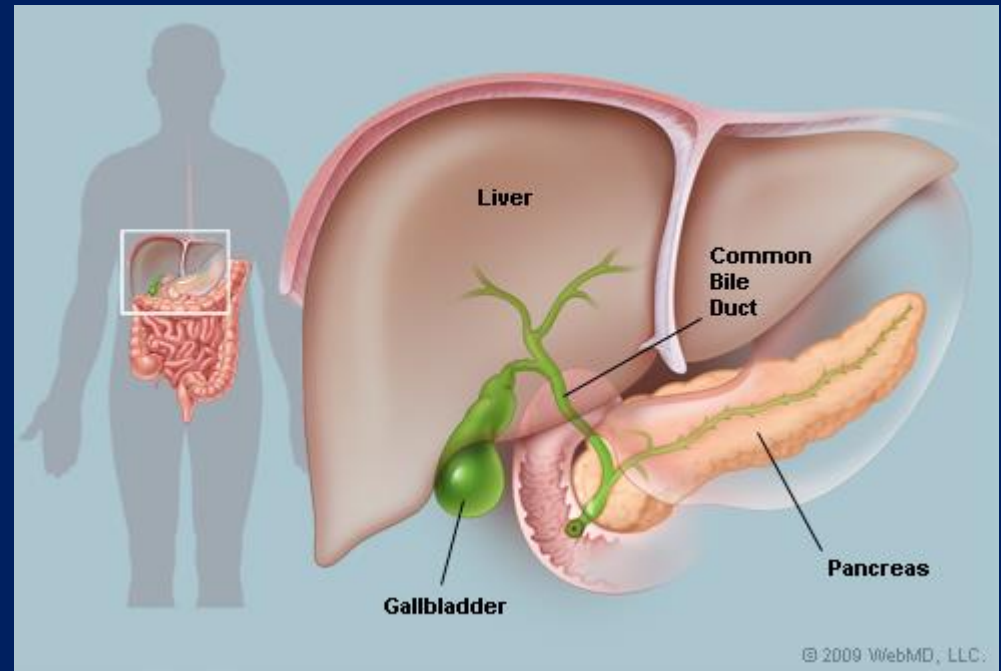
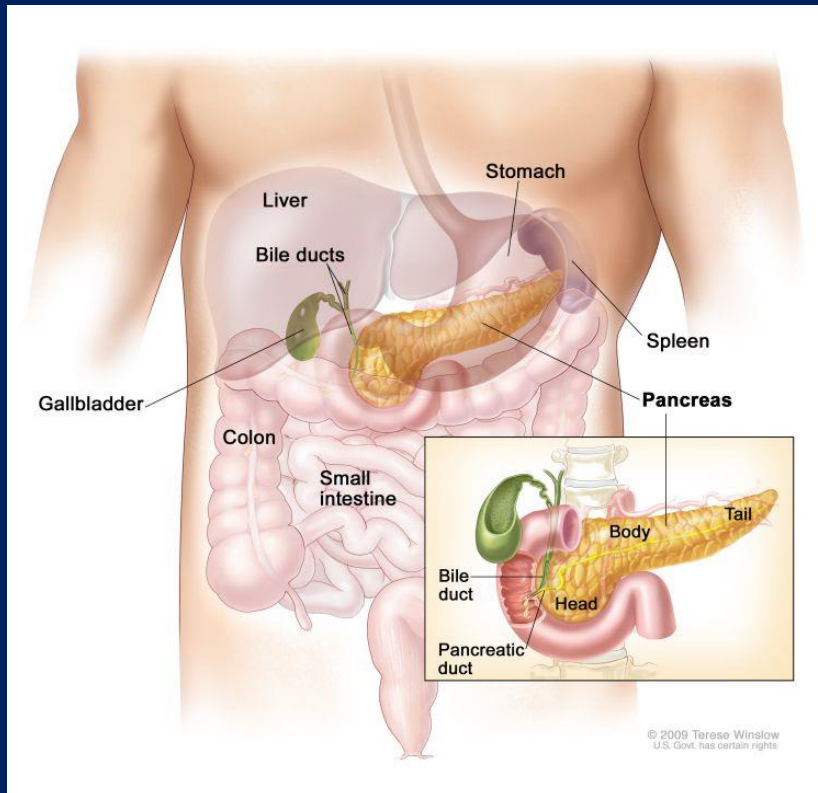
sinusoids

central vein

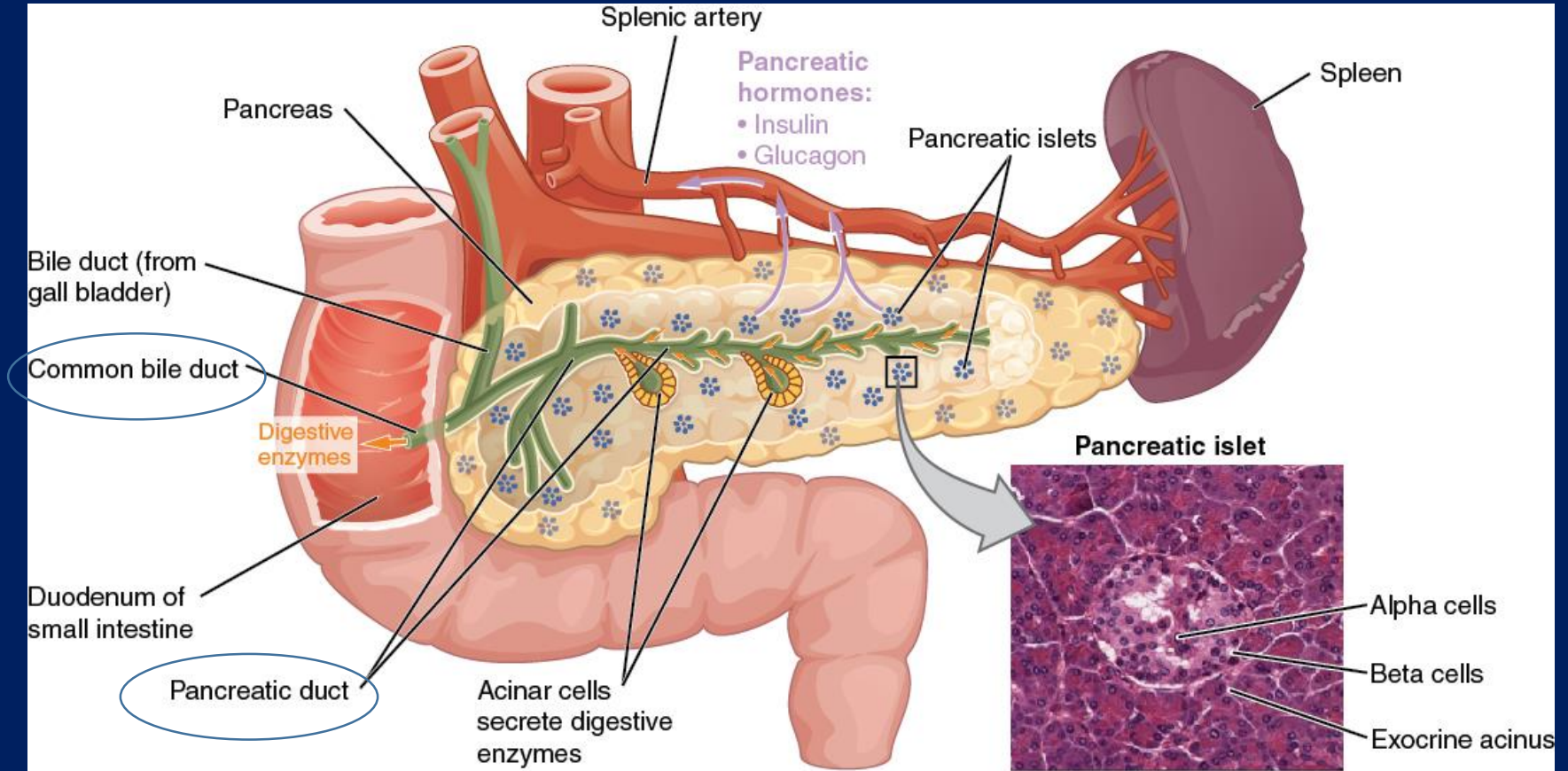
Pancreas: the main salivary gland

Exocrine and endocrine gland; entirely retroperitoneal
Serous exocrine acini:

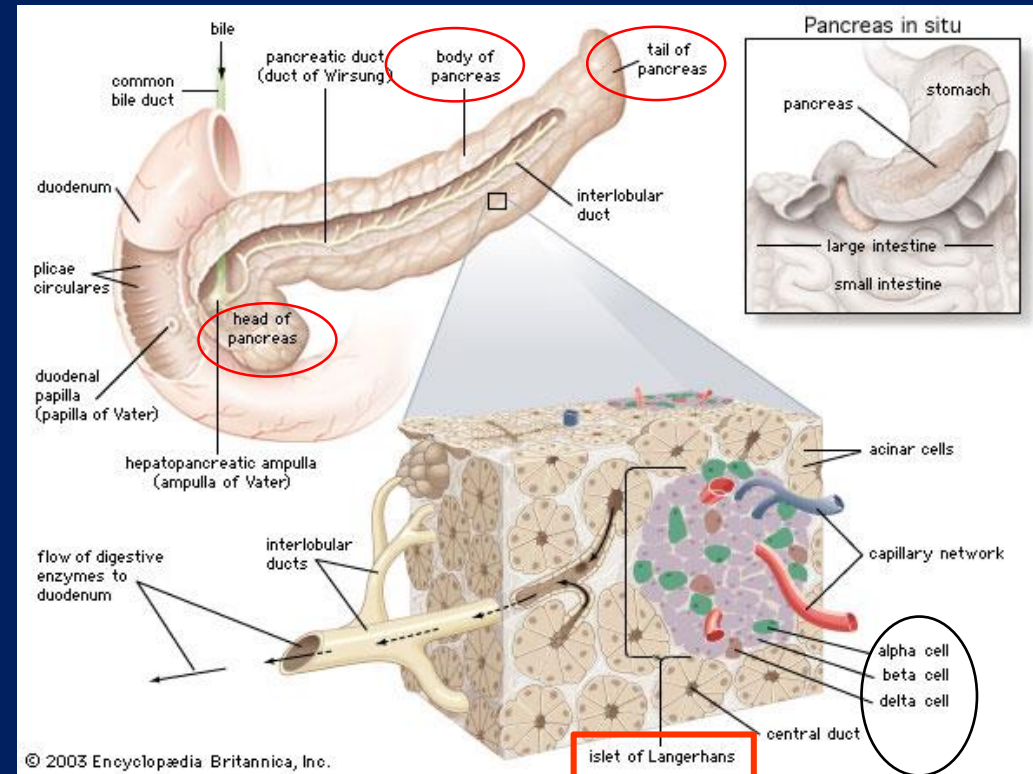
- produce digestive enzymes
- ducts open to the duodenum



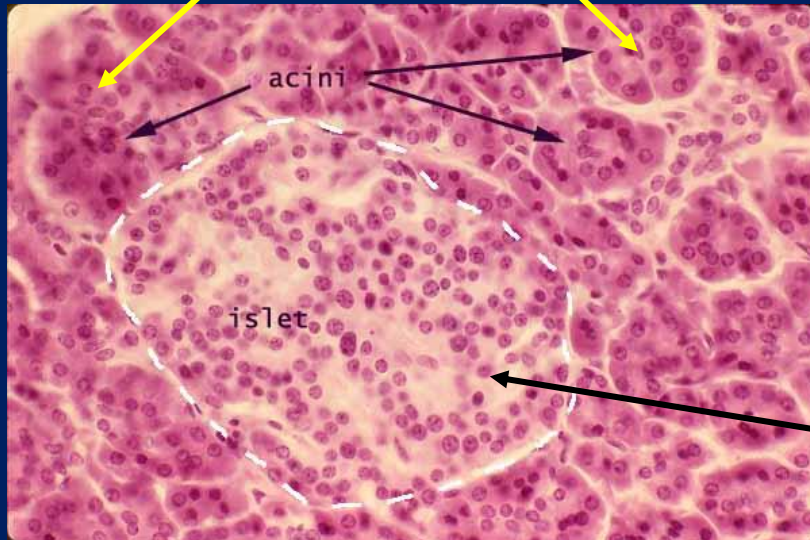
Pancreas



Pancreas

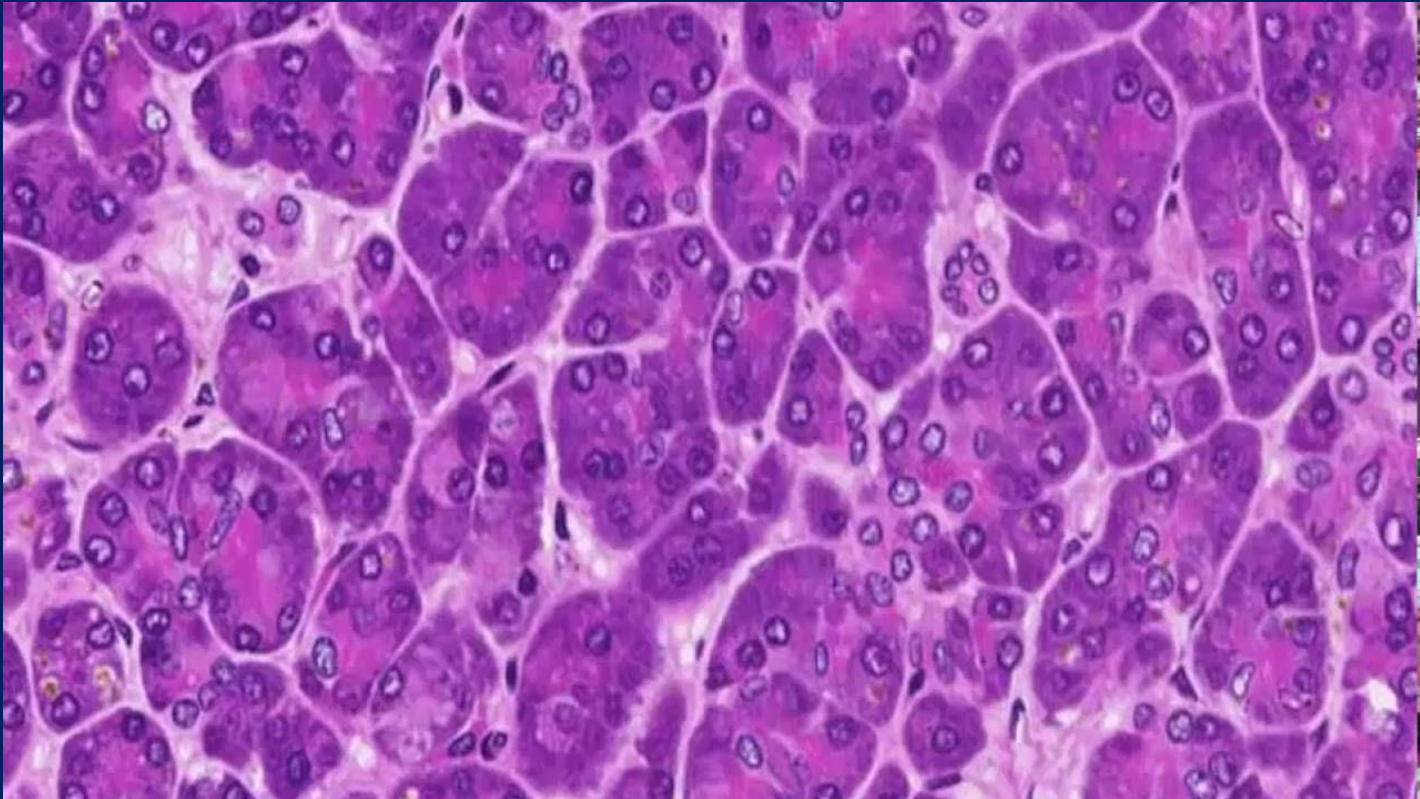


serous acini



Endocrine pancreas: insulin, glucagon
Langerhans islet

Histology of the exocrine pancreas: typical serous gland



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