ANATOMY OF THE SMALL & LARGE INTESTINES

Semester 1, 2011

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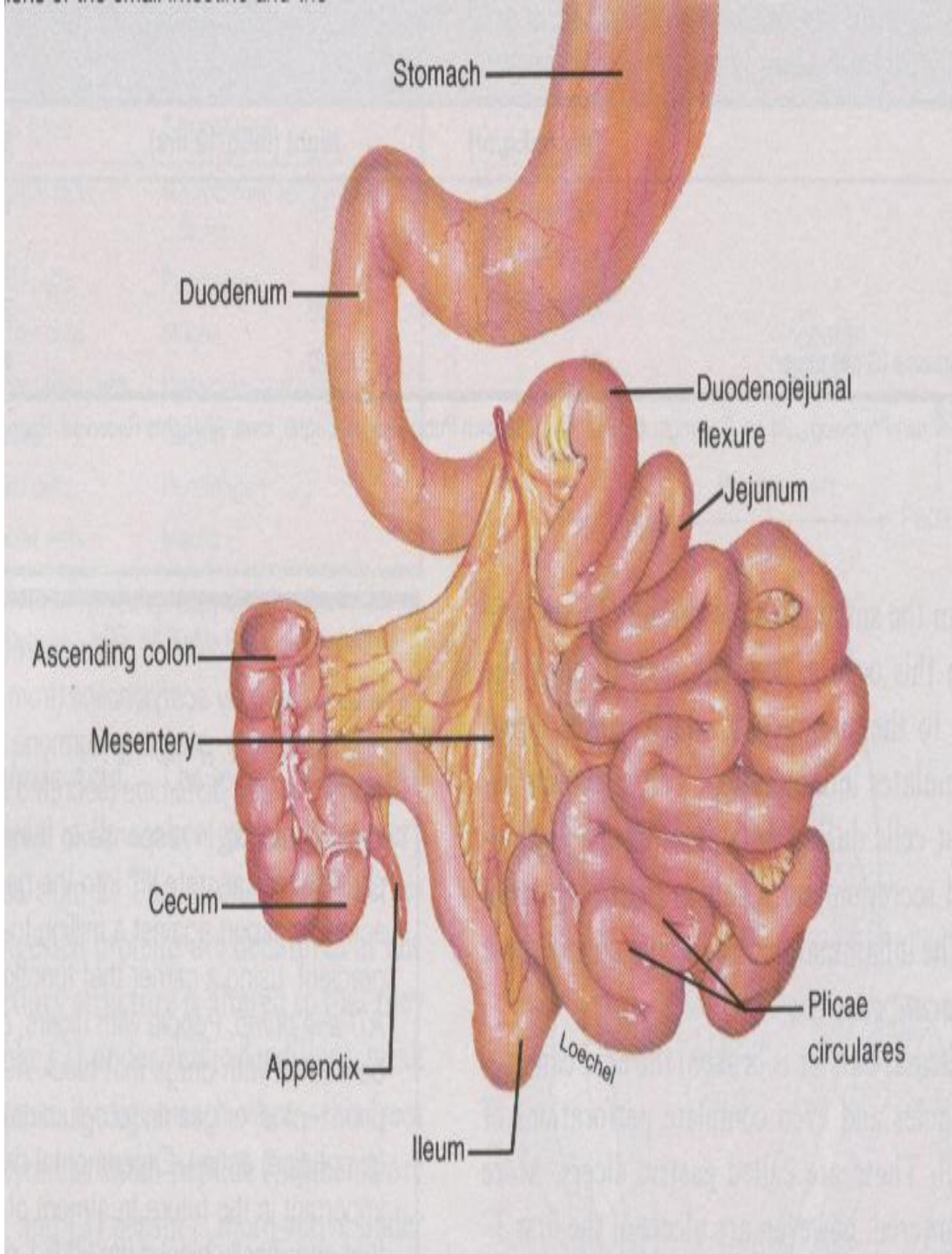
LEARNING OBJECTIVES

1. List the parts and anatomical regions of the small and large intestines
2. State anatomical relations of the small and large intestines
3. Mention the arterial supply, venous and lymphatic drainage and innervation of the small and large intestines
4. Discuss the importance of the mesenteries that are related to the small and large intestines
5. Relate the significance of McBurney's point to the anatomical position of the vermiform appendix in clinical practice
6. Describe the clinical relevance of the ligament of Treitz
7. Explain the following clinical terms: ischemia of intestines, appendicitis , hemorrhoids, rectal examination

Small intestine

- **Divided into**
  - **duodenum**
  - **jejunum**
  - **ileum**



DUODENUM

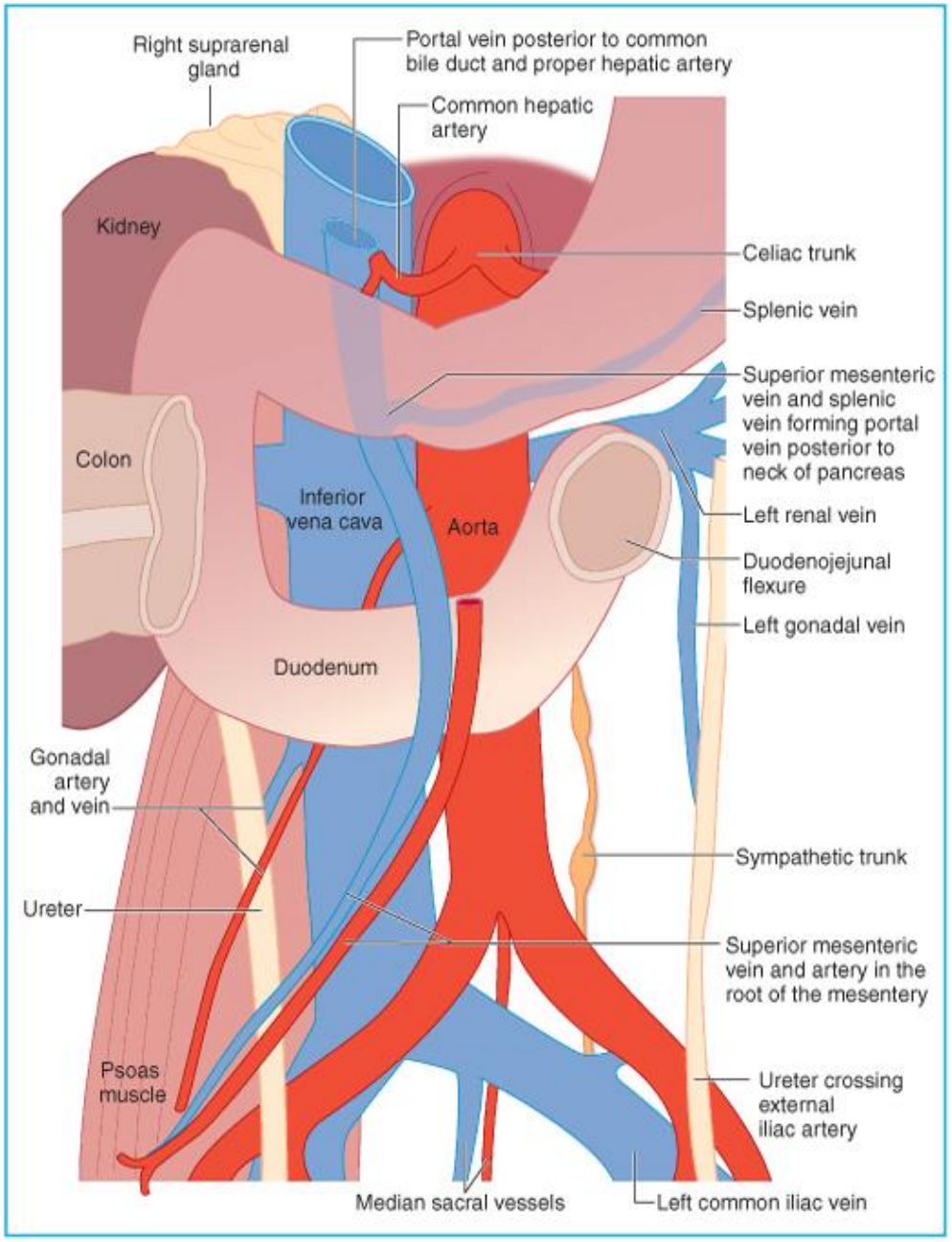
- C-shaped
- Extent : pyloric sphincter - duodenojejunal flexure
- Mostly Retroperitoneal except near stomach
- Characterized by Brunner's glands in submucosa
- These tubular glands secrete mucus
- Primary function - food digestion & absorption

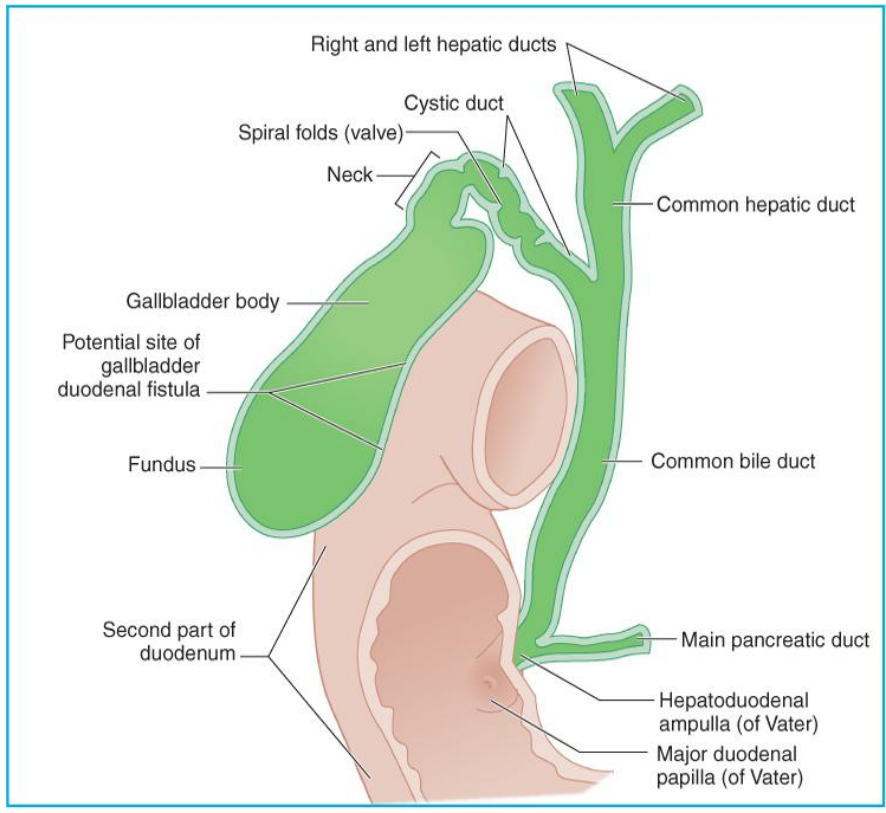
DUODENUM

- **Four anatomical parts of the duodenum**
- **Superior (first) part**
  - **Related to the pylorus**
  - **Intraperitoneal - found in the hepatoduodenal lig - freely mobile**
  - **Posteriorly - bile duct, gastrodudenal art, portal vein**

DUODENUM CONTD…

- **Descending (second) part**
  - **Retroperitoneal**
  - **Bile duct and main pancreatic duct join to form hepatopancreatic ampulla**
  - **Major duodenal papilla (of Vater) located posteromedial**
  - **Also related to the Fundus & body of gallbladder, right kidney, transverse colon, head of pancreas**





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DUODENUM CONTD…

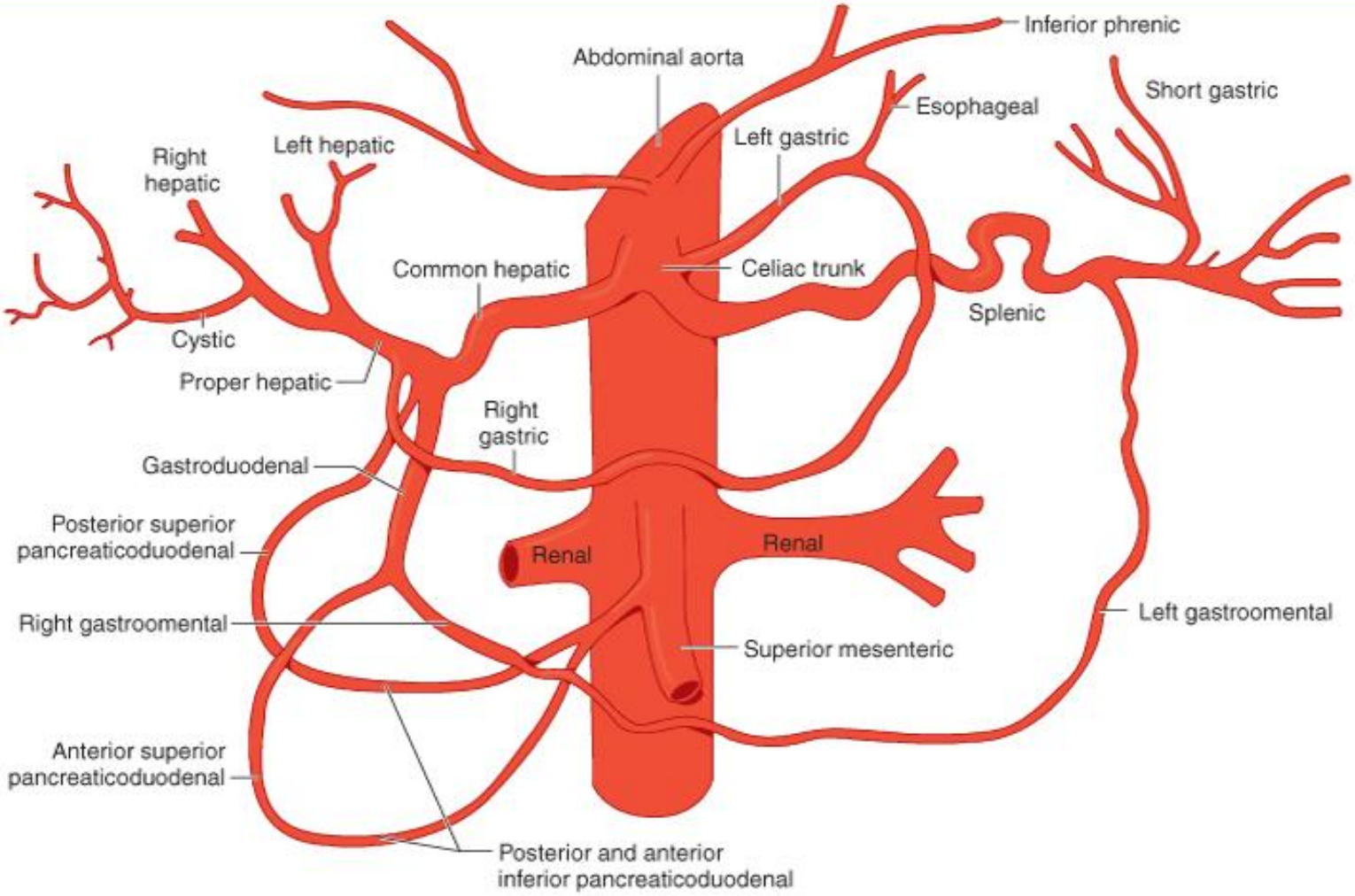
- **Horizontal (third) part**
  - **Retroperitoneal**
  - **Related to the:**
    - **Psoas major muscle**
    - **IVC & aorta**
    - **Right ureter**
    - **Gonadal vessels**
    - **Superior mesenteric art & vein**

DUODENUM CONTD…

- **Ascending (fourth) part**
  - ➢ **Retroperitoneal**
  - ➢ **Duodenojejunal flexure supported by suspensory ligament of duodenum (of Treitz)**
    - ❑ **Lig of Treitz used to locate duodenojejunal flexure**
    - ❑ **Clinical dividing line between upper and lowergastrointestinal tracts**
    - ❑ **Most gastrointestinal hemorrhage is above the ligament of Treitz, coming from esophagus, stomach or duodenum**
  - ✓ **Doudenal ulcers may cause peritonitis**

BLOOD & NERVE SUPPLY TO THE DUODENUM

- **Arterial Supply**
  - Supraduodenal art - can be used to identify the first part of the duodenum
  - sup & inf pancreaticoduodenal arts with their ant & post branches that form arcades
  - Right gastric art
  - Gastroduodenal art
- **Venous Drainage**
  - Duodenal veins draining into the portal vein

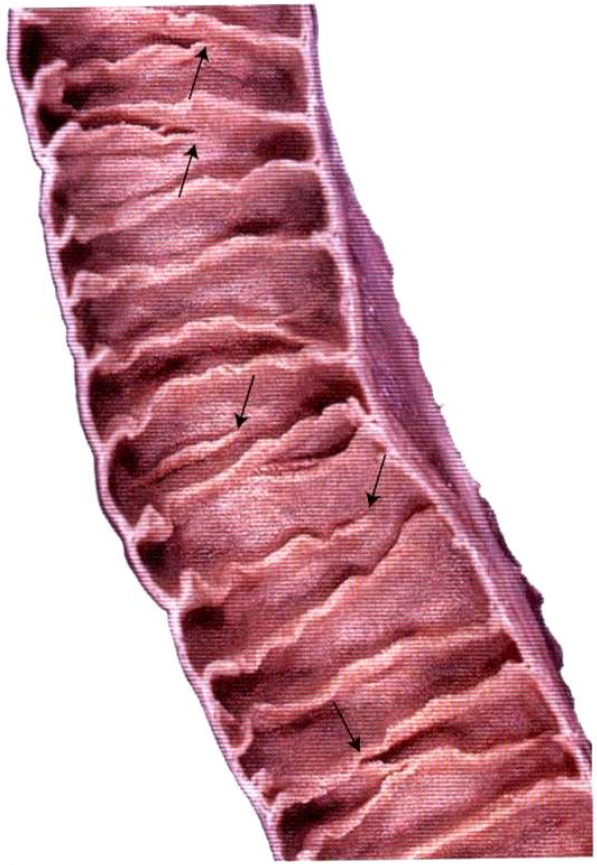


BLOOD & NERVE SUPPLY TO THE DUODENUM

- **Lymphatic Drainage**
  - **Ant lymphatic vessels drain into pancreaticoduodenal nodes, pyloric lymph nodes**
  - **Post lymphatic vessels drain into sup mesenteric lymph nodes**
  - **Celiac lymph nodes**
- **Innervation**
  - **Vagus nerve**
  - **Celiac & sup mesenteric plexuses**

JEJUNUM

- **Extent: duodenum - ileum**
- **Intraperitoneal**
- **Most of it lies in Left upper quadrant**
- **Lumen slightly larger than ileum**
- **More internal folds than ileum - plicae circulare & villi**
- **Deeper red with greater vascularity**



ILEUM

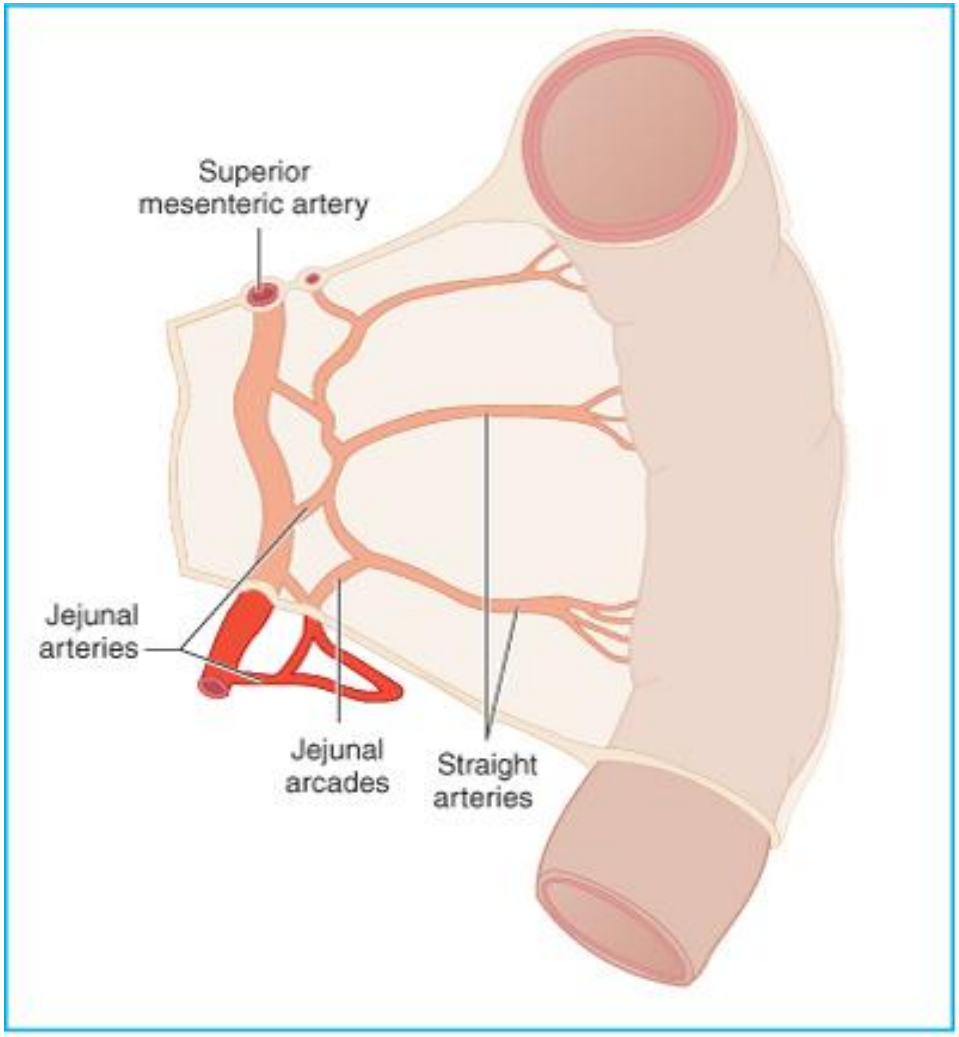
- Terminal portion
- Most of it lies in Right lower quadrant
- Ends at ileocecal junction
- Joins cecum medially through ileocecal valve
- Have shorter straight arteries than jejunum
- Has abundant lymph nodules - Peyer's patches or Mesenteric patches - GALT

MESENTERY ASSOCIATED WITH JEJUNUM & ILEUM

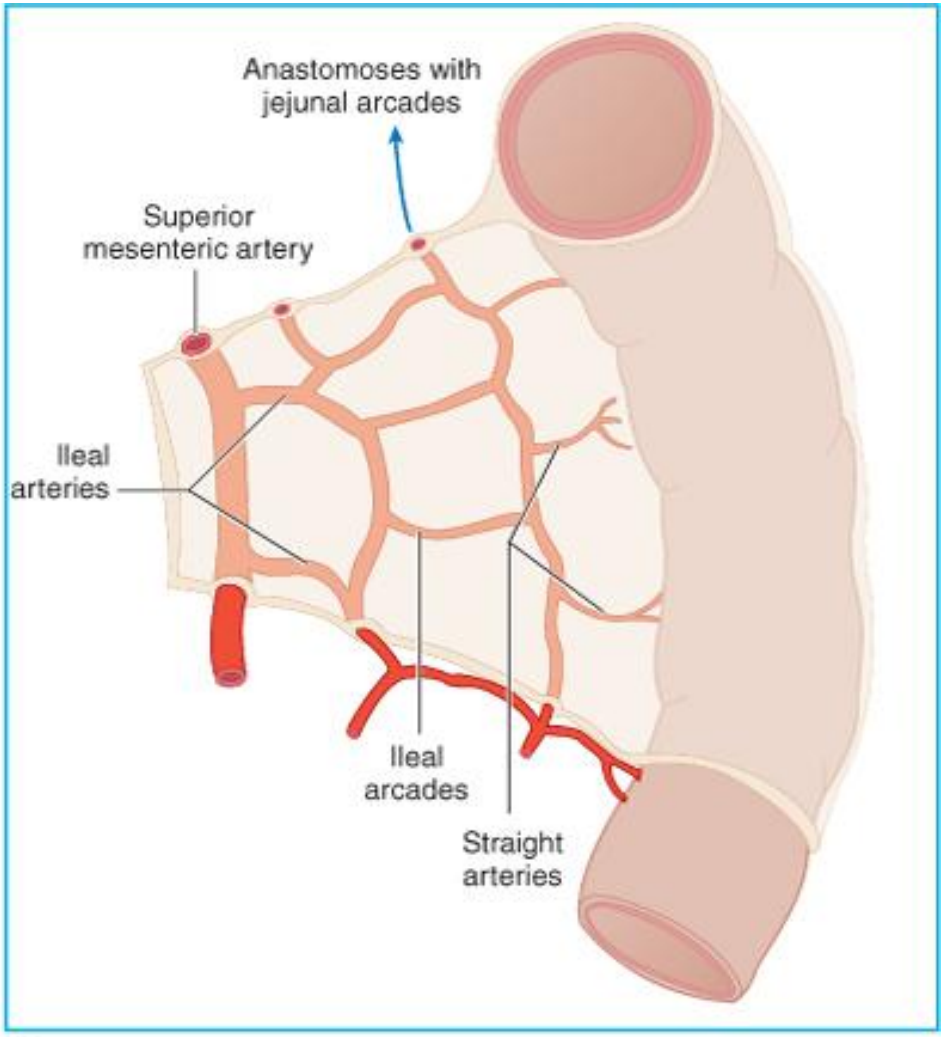
- Jejunum & ileum attached to posterior abdominal wall by mesentery
- Extent of the root (origin) of mesentery
  - duodenojejunal junction - ileocolic junction
- The root of mesentery crosses
  - Ascending & horizontal duodenum
  - Abdominal aorta & IVC
  - Right ureter, Right psoas major
  - Right testicular or ovarian vessels

BLOOD & NERVE SUPPLY TO THE JEJUNUM & ILEUM

- **Arterial supply**
  - **Sup mesenteric art - arterial arcades that give rise to vasa recta - ischemia of intestines**



A



B

BLOOD & NERVE SUPPLY TO THE JEJUNUM & ILEUM

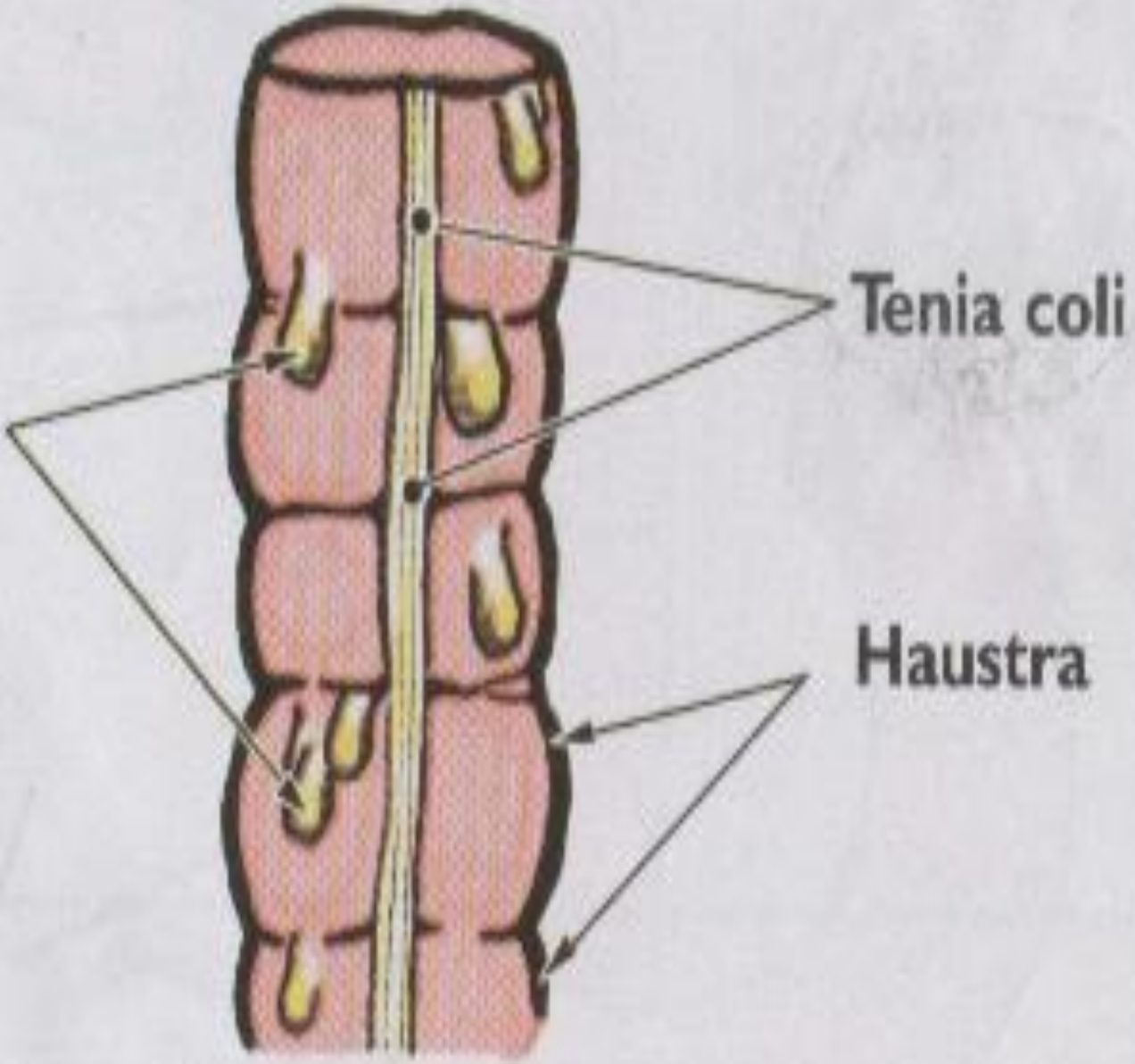
- **Venous Drainage**
  - **Sup mesenteric vein**
- **Lymphatic Drainage**
  - **Lacteals, sup mesenteric lymph nodes, ileocolic lymph nodes**
- **Innervation**
  - **Parasympathetic - Vagus nerve**
  - **Sympathetic - Lesser splanchnic nerve**
  - **Superior mesenteric plexus**

LARGE INTESTINE OR COLON

- **Extent: Ileocecal junction - anus**
- **Length: About 1.5 m**
- **Parts:**
- **Cecum with attached vermiform appendix**
- **Colon: ascending, transverse, descending, sigmoid**
- **Rectum and anal canal**

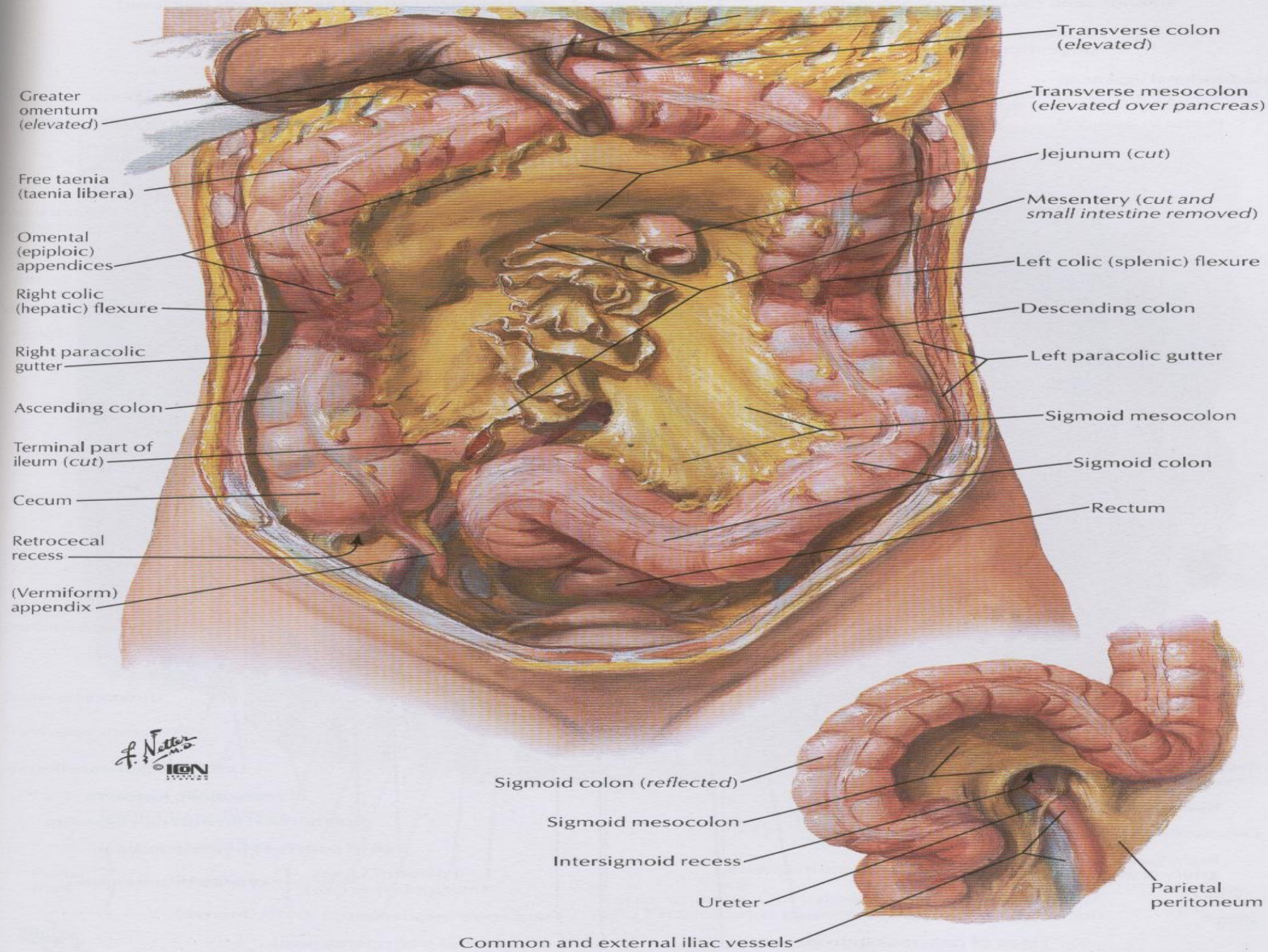
SPECIAL FEATURES

- **Teniae coli - three thickened bands of longitudinal muscle**
- **Haustra - sacculations of its wall**
- **Omental (epiploic) appendages - small pouches of omentum (peritoneum) filled with fat**
- **Villi - Mucosa has no villi but numerous mucus cells**


Tenia coli
Appendices epiploicae
(Omental tags)
Haustra

CECUM

- **Blind sac** invested in peritoneum
- 8 cm W x 8 cm L, located in RIF
- **Vermiform appendix** attached to posteromedial wall & taenia coli converge on appendix


Transverse colon (elevated)
Transverse mesocolon (elevated over pancreas)
Jejunum (cut)
Mesentery (cut and small intestine removed)
Left colic (splenic) flexure
Descending colon
Left paracolic gutter
Sigmoid mesocolon
Sigmoid colon
Rectum
Greater omentum (elevated)
Free taenia (taenia libera)
Omental (epiploic) appendices
Right colic (hepatic) flexure
Right paracolic gutter
Ascending colon
Terminal part of ileum (cut)
Cecum
Retrocecal recess
(Vermiform) appendix
F. Netter M.D.
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Sigmoid colon (reflected)
Sigmoid mesocolon
Intersigmoid recess
Ureter
Common and external iliac vessels
Parietal peritoneum

CECUM CONTD…

- Lat & med - attached by peritoneal cecal folds to iliac fossa
- This produces a small sac of peritoneal cavity called retrocecal recess
- Retrocecal recess lies post to cecum
- It may extend sup, post to inferior end of ascending colon as retrocolic recess
- In 64% of people - appendix lies in retrocolic recess

RELATIONS OF THE CECUM

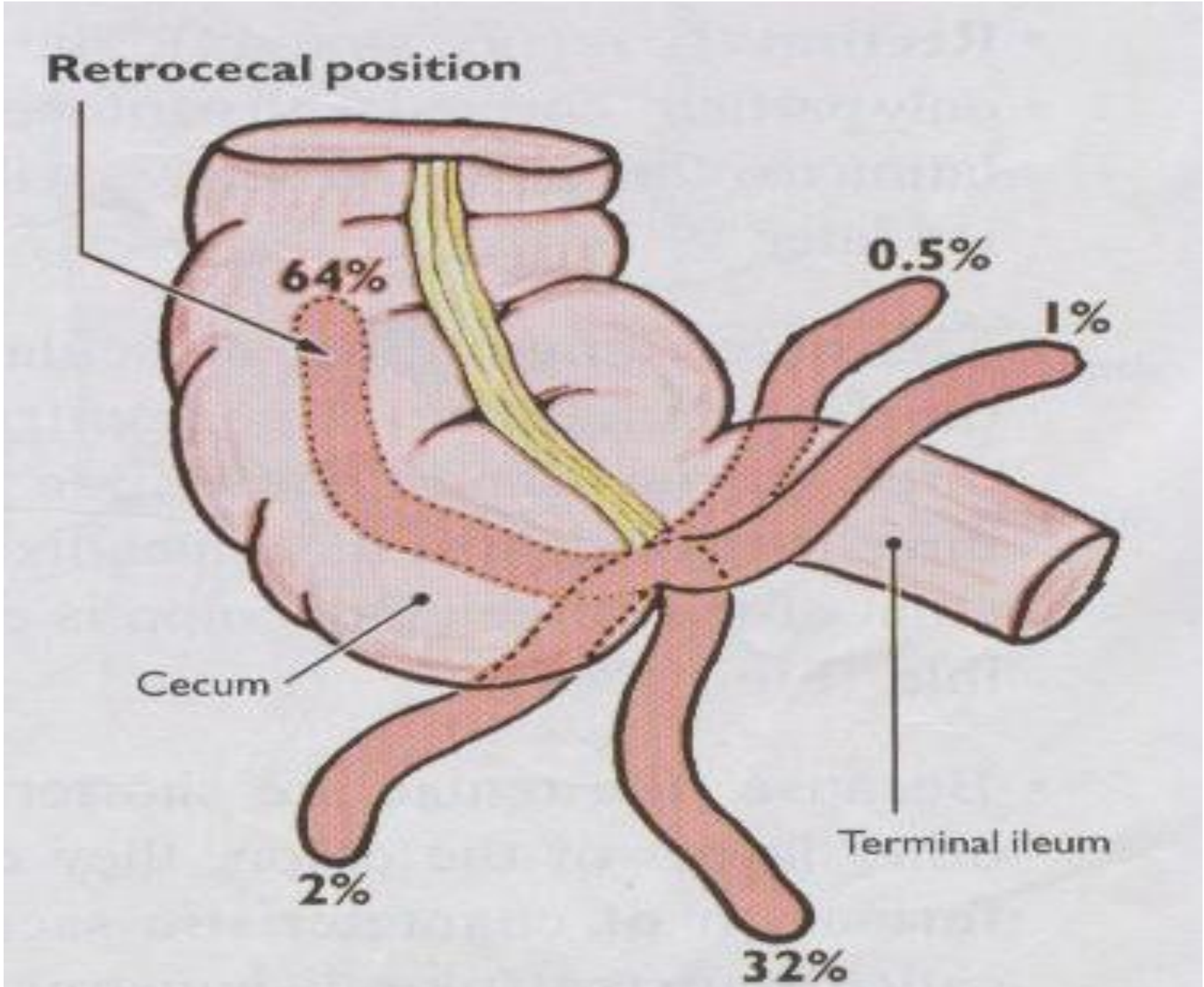
- **Post - lies on iliacus & psoas**
- **Ant - small intestines & ant abdominal wall**

VERMIFORM APPENDIX

- About 8 cm long & worm-shaped
- Joins cecum about 2.5 cm inf to ileocecal junction
- Longer in children than in adults
- Very mobile & its position is variable

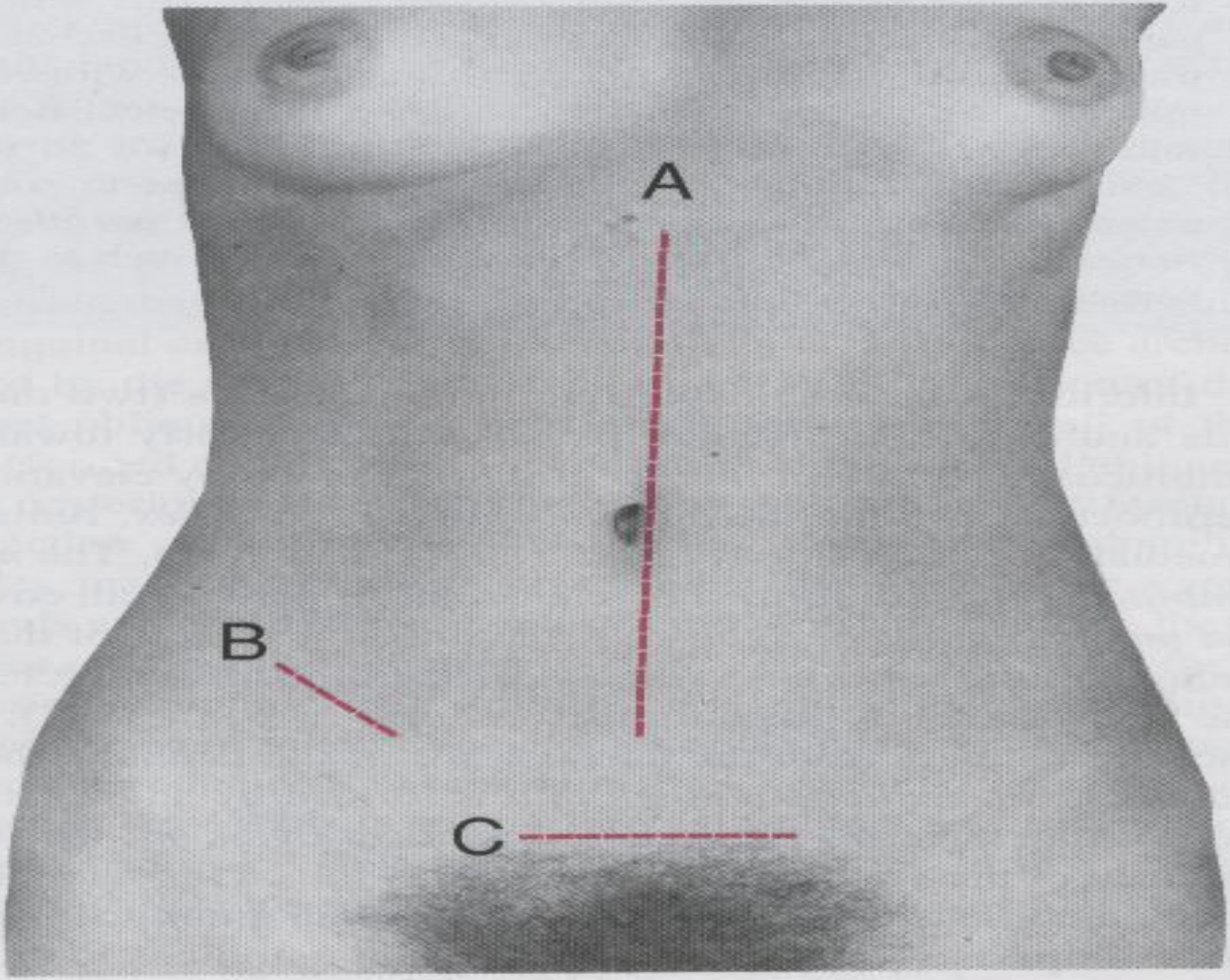
VERMIFORM APPENDIX CONTD…

- Has a mesentery called **mesoappendix** which joins it to terminal ileum
- **Appendicular artery** (an end artery) is within this fold
- Usually retrocecal - post to cecum
- The 3 teniae coli of cecum converge at base of appendix


Retrocecal position
64%
0.5%
1%
Cecum
Terminal ileum
2%
32%

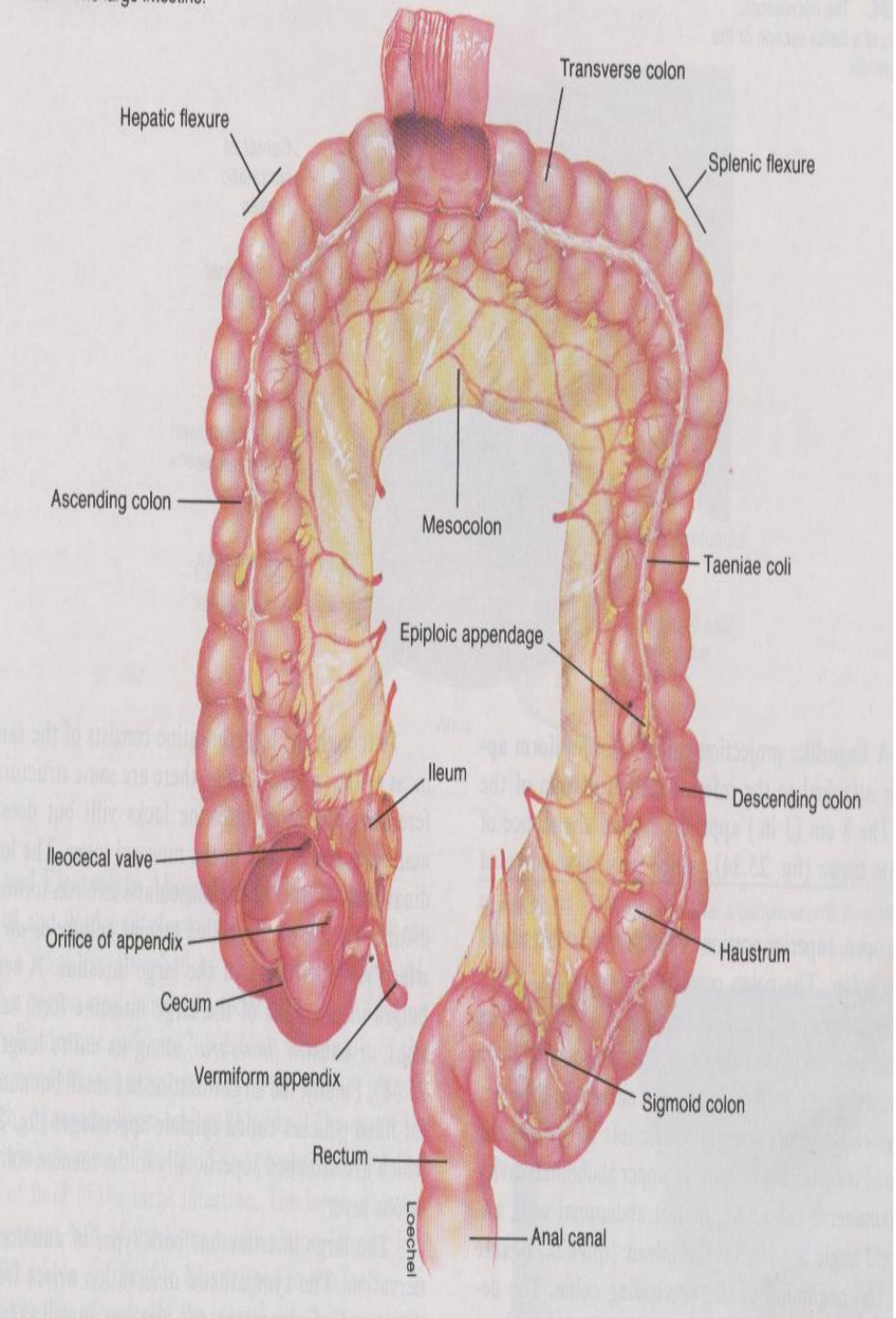
VERMIFORM APPENDIX CONTD…

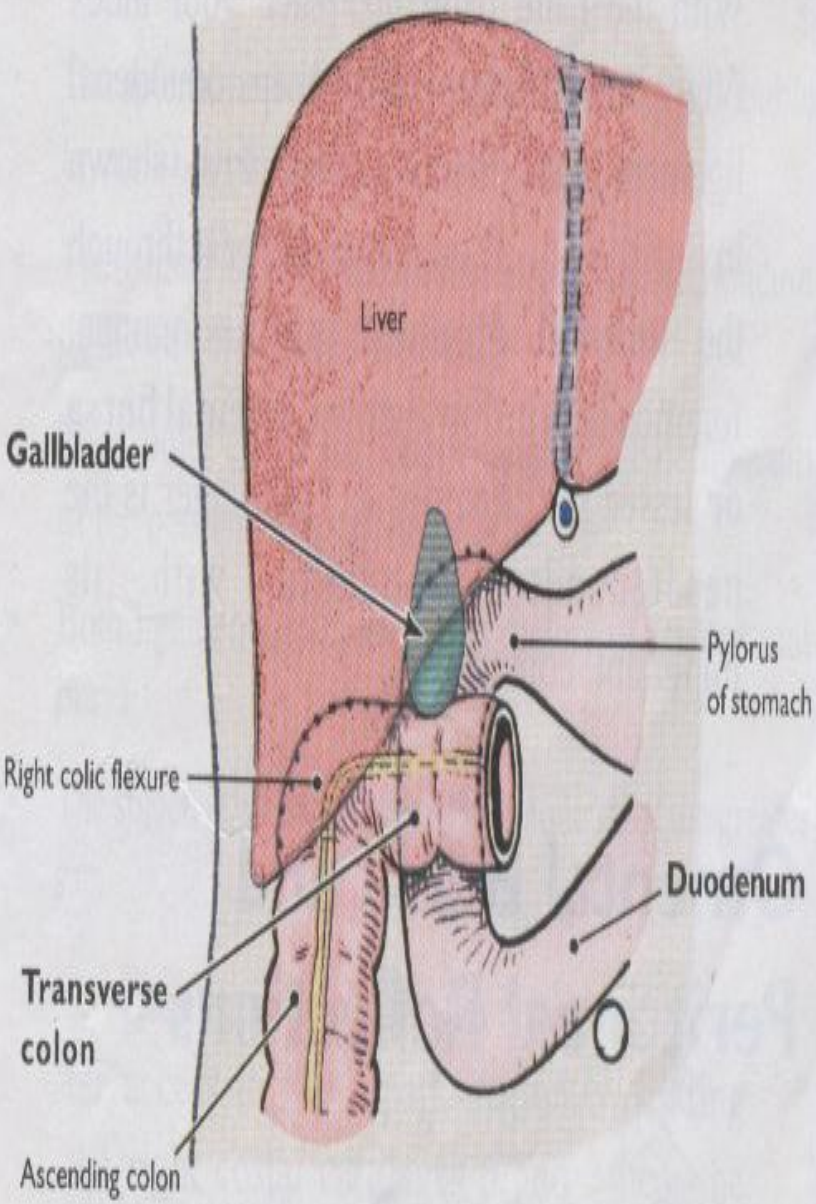
- Its base usually lies deep at Mc Burney's point - junction of lat & mid thirds of line joining ant sup iliac spine & umbilicus
- In appendectomy, incisions are made about 2.5 cm superomedial to ant. sup. iliac spine
- Appendicitis - inflammation of appendix
- Rupture of inflamed appendix causes general peritonitis - increased abdominal pain


A
B
C

ASCENDING COLON

- About 15 cm long
- Ascends on right side of abdominal cavity
- From cecum to right lobe of liver
- It turns to the left as right colic (hepatic) flexure
- It usually has no mesentery - 25% of pple have a short mesentery
- Lies retroperitoneally along right side of posterior abdominal wall

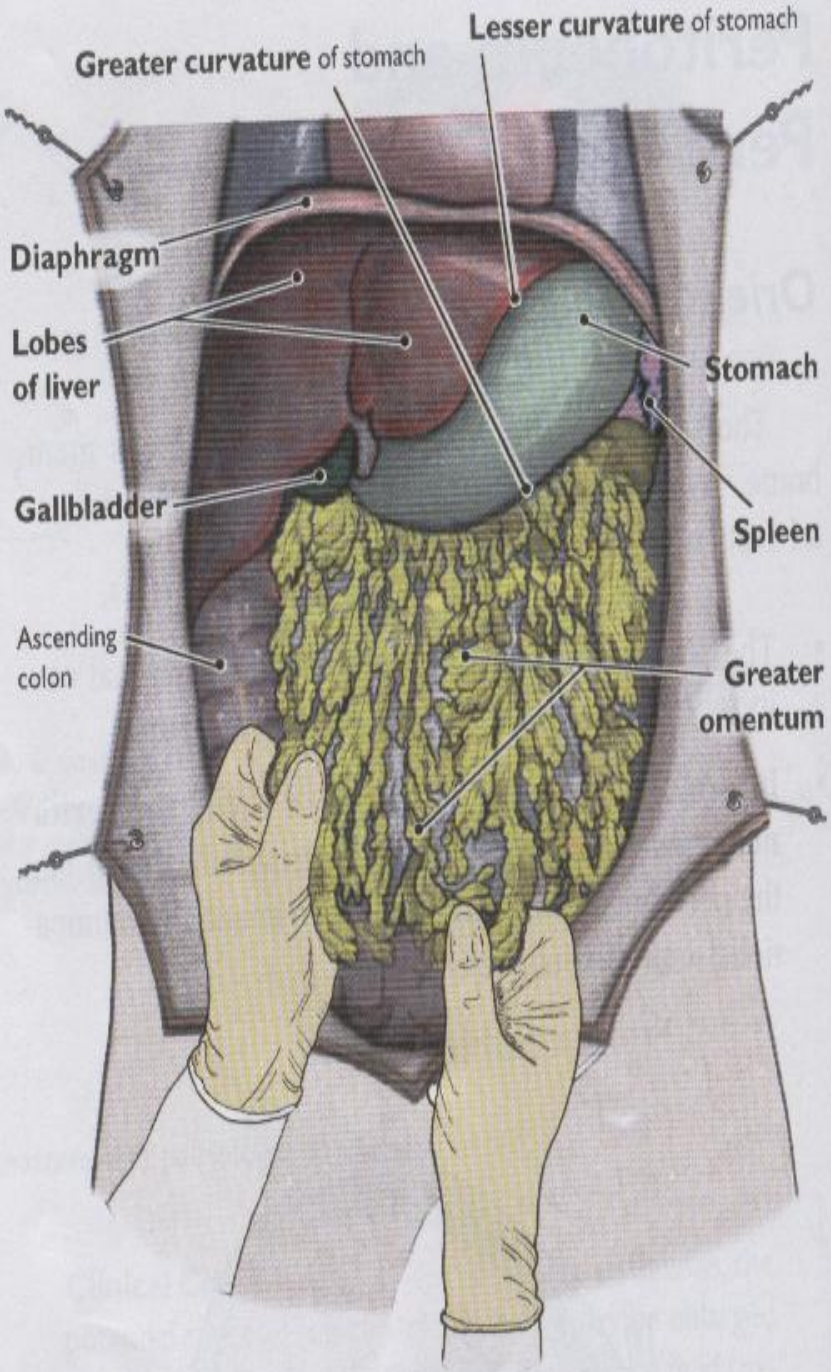

Transverse colon
Hepatic flexure
Splenic flexure
Ascending colon
Mesocolon
Taeniae coli
Epiploic appendage
Ileum
Descending colon
Ileocecal valve
Orifice of appendix
Haustrum
Cecum
Vermiform appendix
Sigmoid colon
Rectum
Anal canal
Loechel

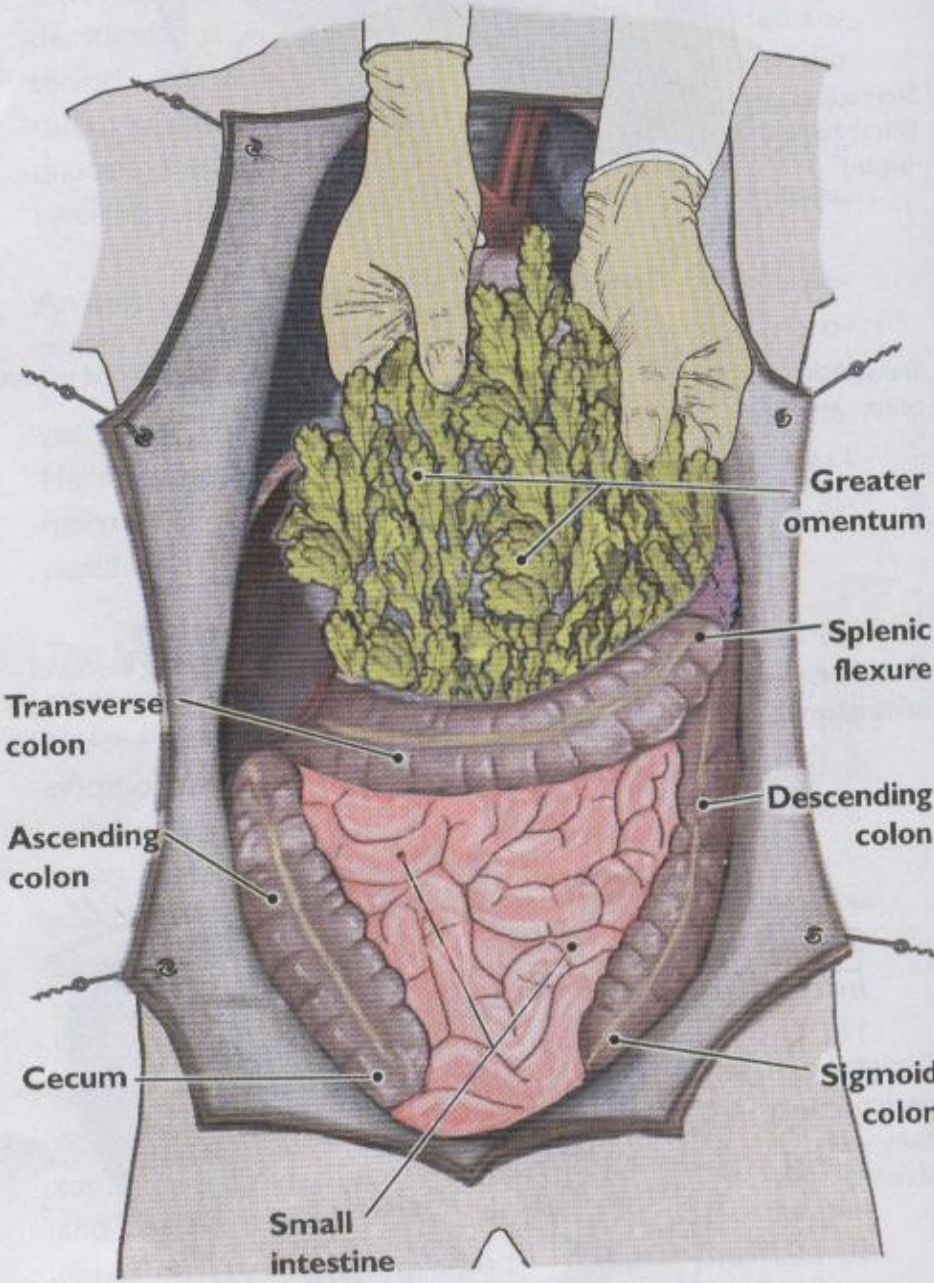

Liver
Gallbladder
Pylorus of stomach
Right colic flexure
Duodenum
Transverse colon
Ascending colon

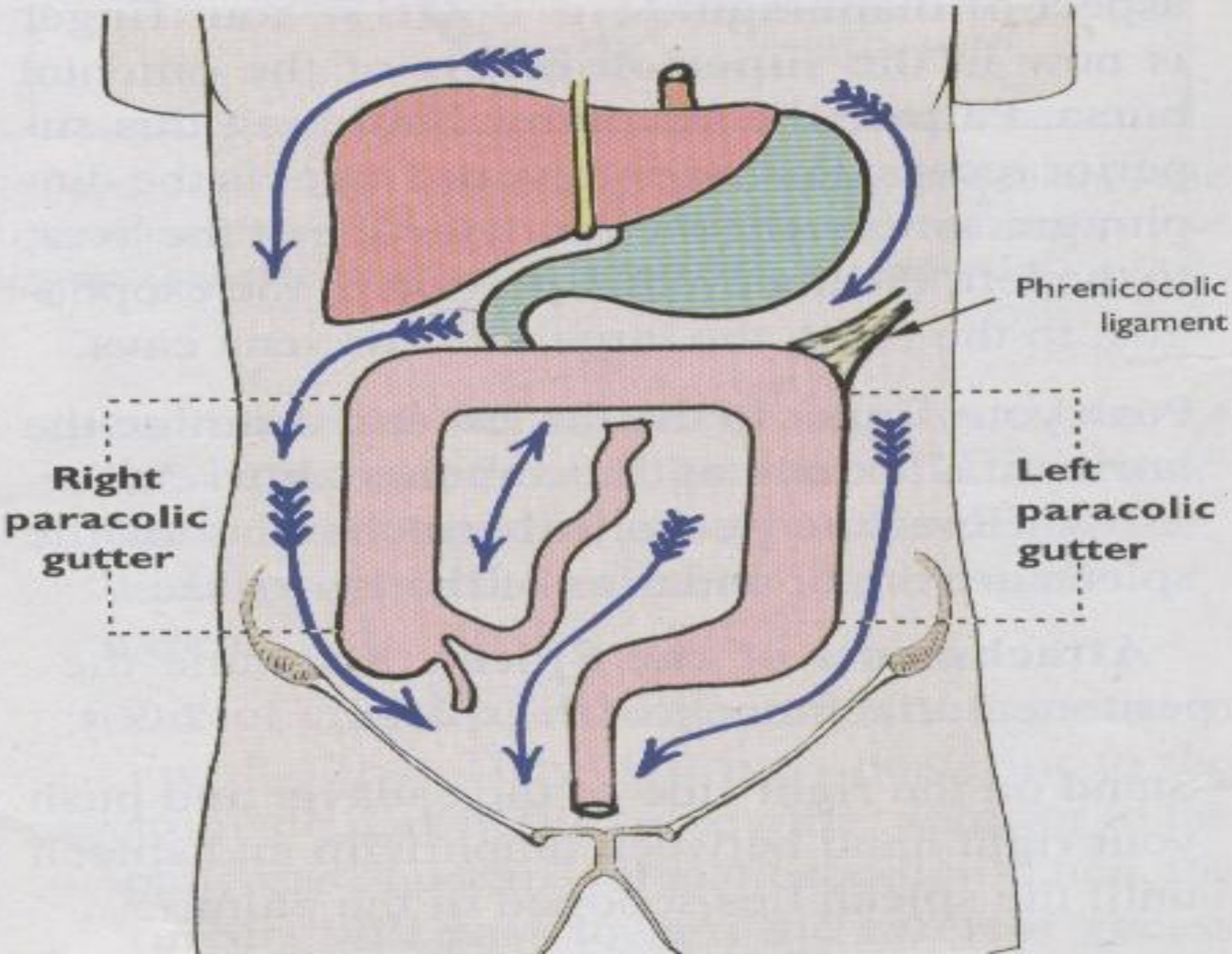
ASCENDING COLON - CONTD…

- **Posterior relations**
  - **Back muscles: iliacus & quadratus lumborum; right kidney**
  - **Nerves of posterior abdominal wall: ilioinguinal & iliohypogastric**
- **Anterior relations - small intestines & greater omentum**
- **Laterally - covered by peritonium, which attaches it to posterior abdominal wall**
- **Its peritonium forms a trench or groove called right paracolic gutter**

its size and its relations to abdominal organs.





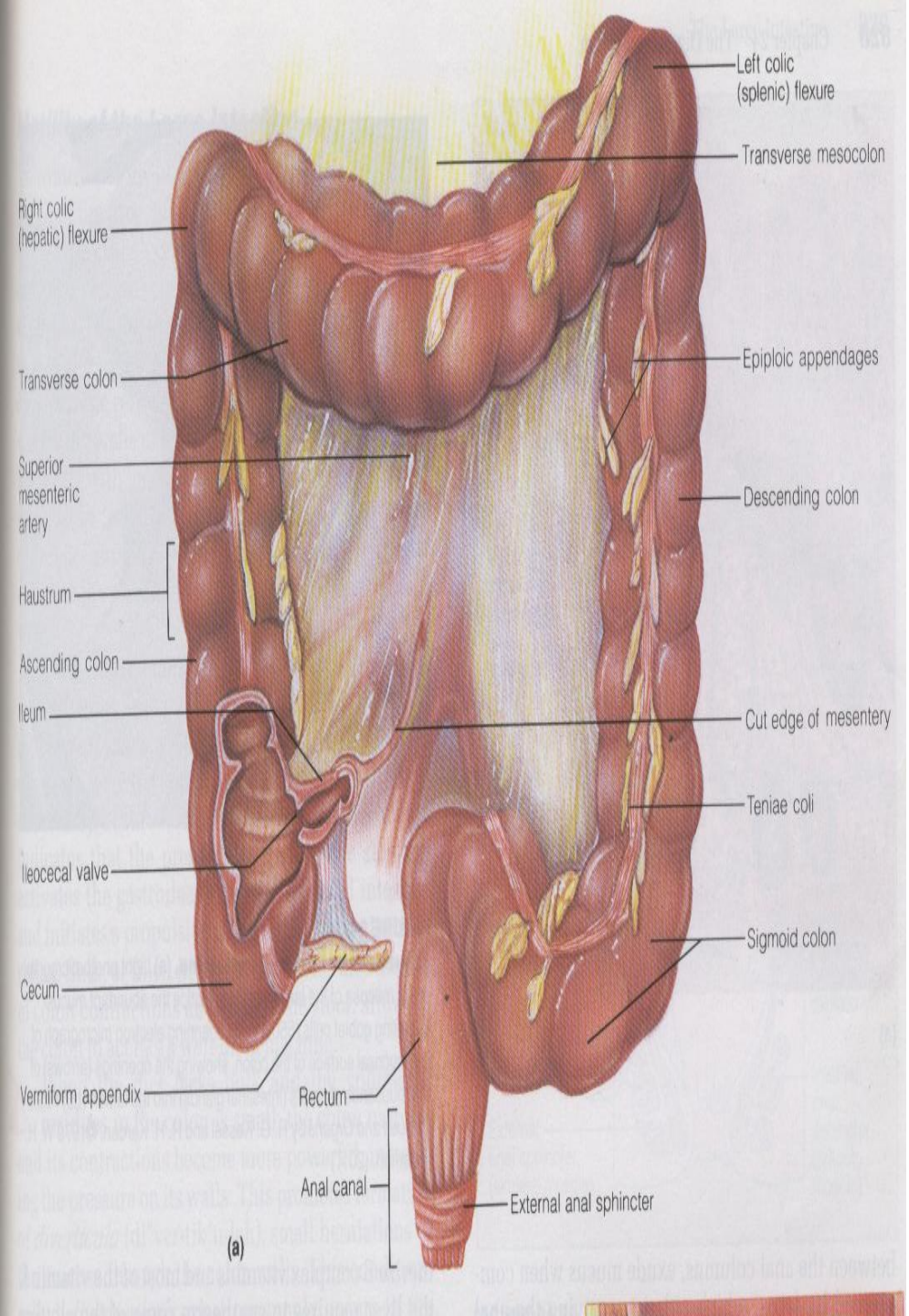

Phrenicocolic ligament
Right paracolic gutter
Left paracolic gutter

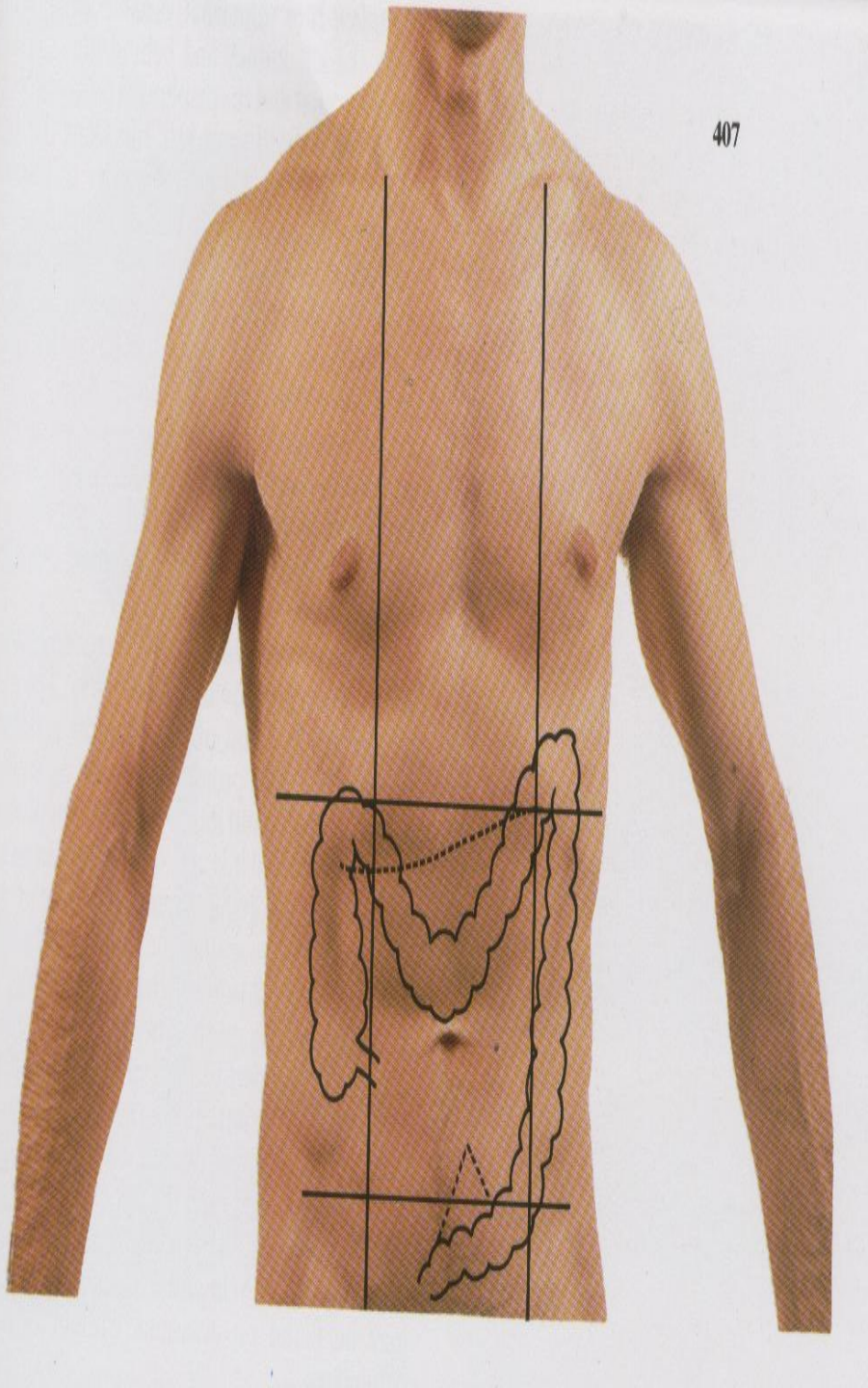
ASCENDING COLON - CONTD…

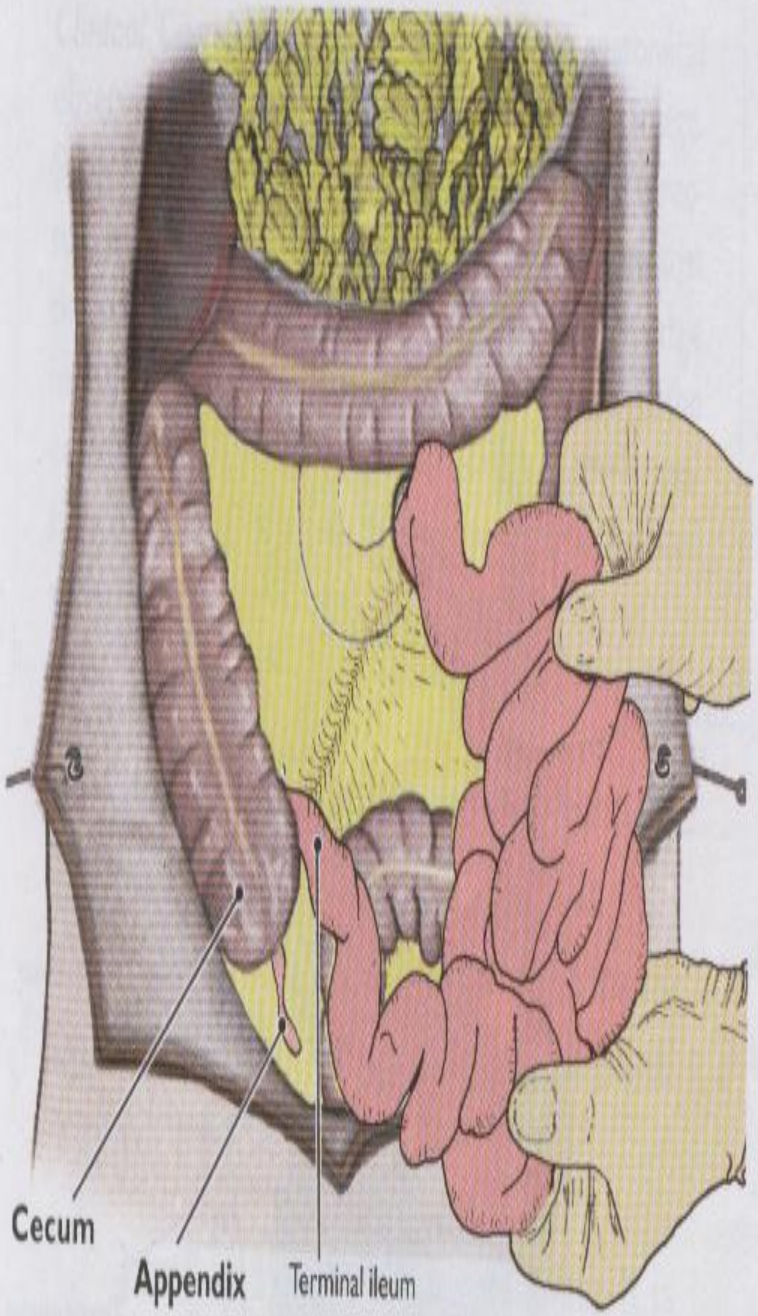
- **VOLVULUS**
  - **Abnormal mobility of cecum & proximal part of ascending colon because inferior part of ascending colon has a mesentery**
  - **It may cause obstruction of intestines resulting from twisting**
- **CECOPEXY - Anchoring procedure where tenia colia of cecum & ascending colon are sutured to abdominal wall to avoid volvulus**

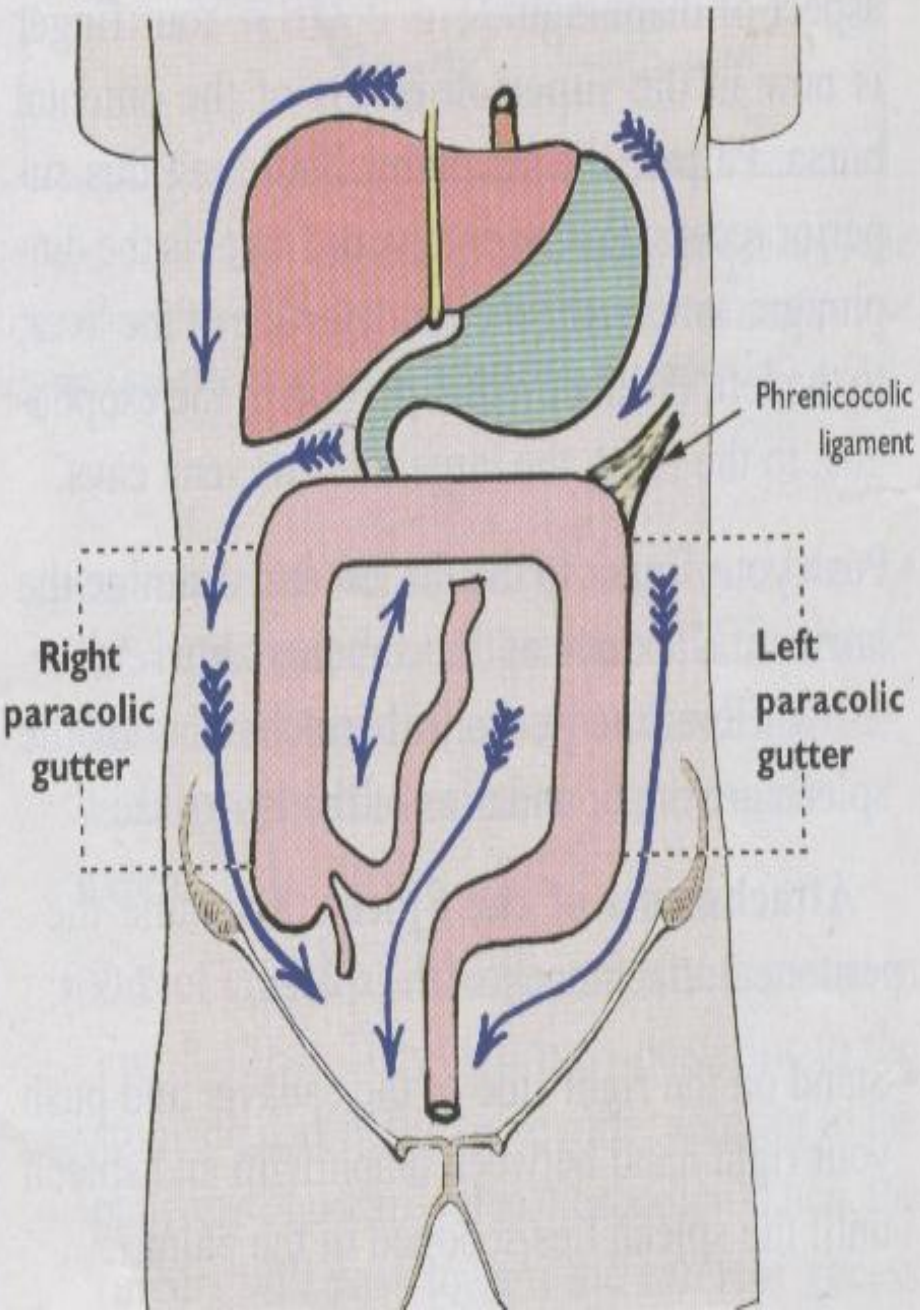
TRANSVERSE COLON

- **Length: About 50 cm**
- **Extent: Right colic to left colic flexures**
- **Largest & most mobile part of L intestine**
- **Splenic flexure:**
  - **lies ant. to the inferior part of left kidney & is attached to the diaphragm by phrenicocolic ligament - shelf to support spleen**
  - **is more sup. & post. to right colic flexure &**
  - **more acute & less mobile than hepatic flexure**
- **It has a mesentery called transverse mesocolon**
- **Mesocolon suspends transverse colon from posterior abdominal wall**
- **T. colon is variable in position**


Left colic (splenic) flexure
Transverse mesocolon
Right colic (hepatic) flexure
Epiploic appendages
Transverse colon
Superior mesenteric artery
Descending colon
Haustrum
Ascending colon
Ileum
Cut edge of mesentery
Teniae coli
Ileocecal valve
Sigmoid colon
Cecum
Vermiform appendix
Rectum
Anal canal
External anal sphincter
(a)




Cecum
Appendix
Terminal ileum

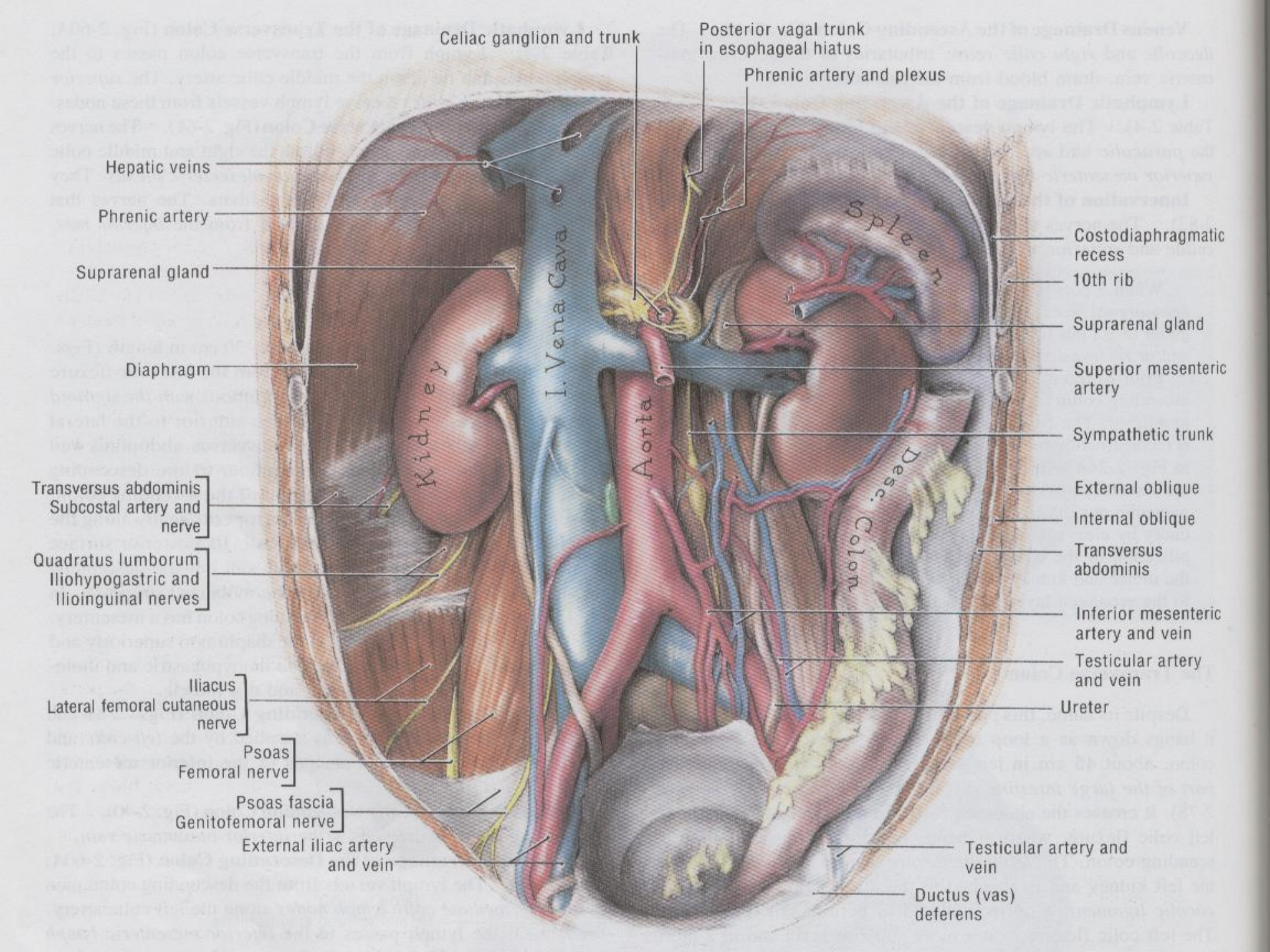

Phrenicocolic ligament
Right paracolic gutter
Left paracolic gutter

DESCENDING COLON

- **Length: About 30 cm**
- **Extent: Left colic (splenic) flexure into left iliac fossa where it is continuous with sigmoid colon**
- **Caliber - smaller than ascending colon**
- **Relations:**
  - **Sup - related to diaphragm & quadratus lumborum muscles**
  - **Passes ant. to lat. border of left kidney, transversus abdominis & quadratus lumborum muscles**

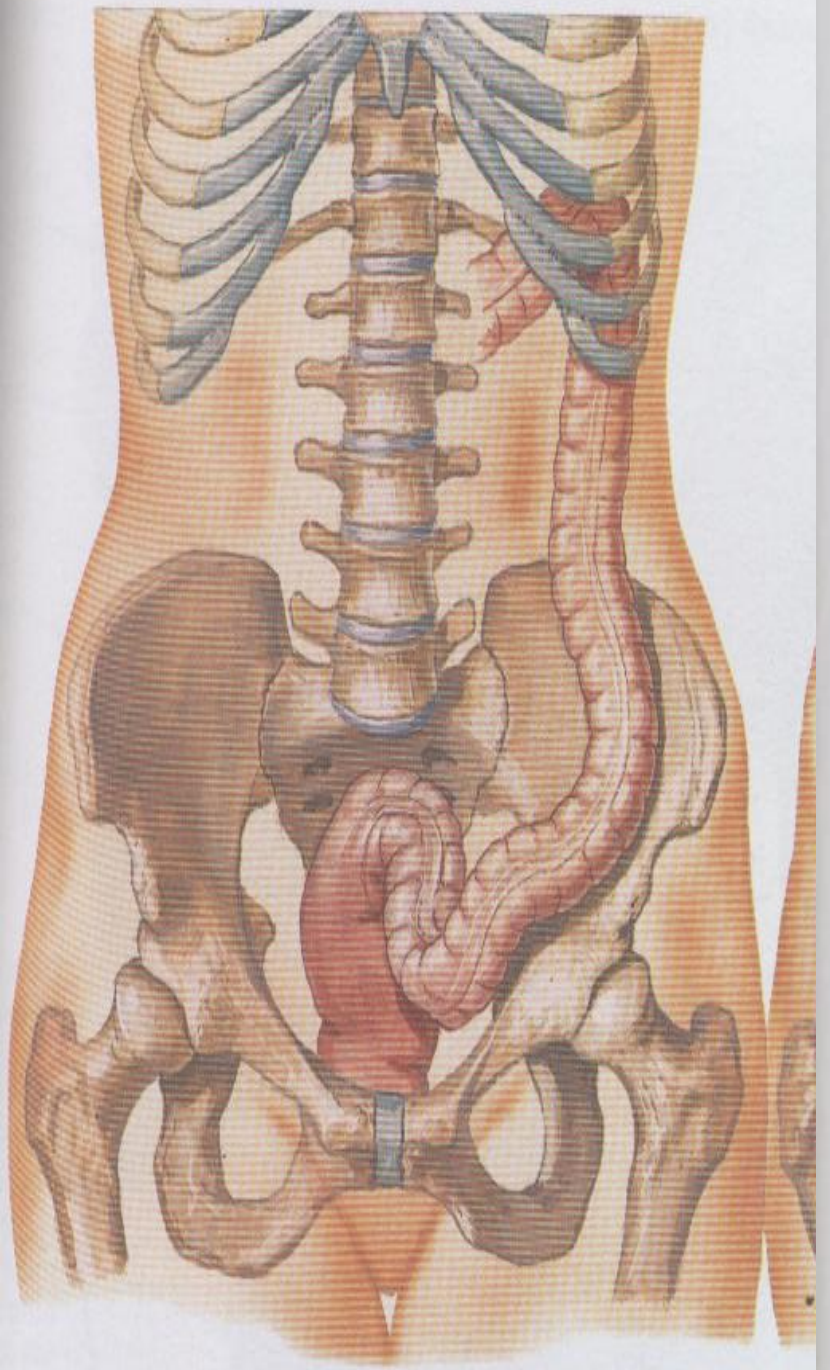
DESCENDING COLON CONTD…

- **It usually has no mesentery (33% of pple have)**
- **Has left paracolic gutter on lat aspect**


Celiac ganglion and trunk
Posterior vagal trunk in esophageal hiatus
Phrenic artery and plexus
Hepatic veins
Phrenic artery
Suprarenal gland
Diaphragm
Transversus abdominis
Subcostal artery and nerve
Quadratus lumborum
Iliohypogastric and Ilioinguinal nerves
Iliacus
Lateral femoral cutaneous nerve
Psoas
Femoral nerve
Psoas fascia
Genitofemoral nerve
External iliac artery and vein
Kidney
I. Vena Cava
Aorta
Spleen
Desc. Colon
Costodiaphragmatic recess
10th rib
Suprarenal gland
Superior mesenteric artery
Sympathetic trunk
External oblique
Internal oblique
Transversus abdominis
Inferior mesenteric artery and vein
Testicular artery and vein
Ureter
Testicular artery and vein
Ductus (vas) deferens

SIGMOID COLON

- **Length: About 40 cm**
- **Extent: Btwn descending colon & rectum**
- **Forms S-shaped loop - Greek letter sigma (S)**
- **It is also called pelvic colon**
- **Termination of teniae coli indicates beginning of rectum**
- **Has a long mesentery - sigmoid mesocolon whose root has an inverted V - shaped attachment sup**



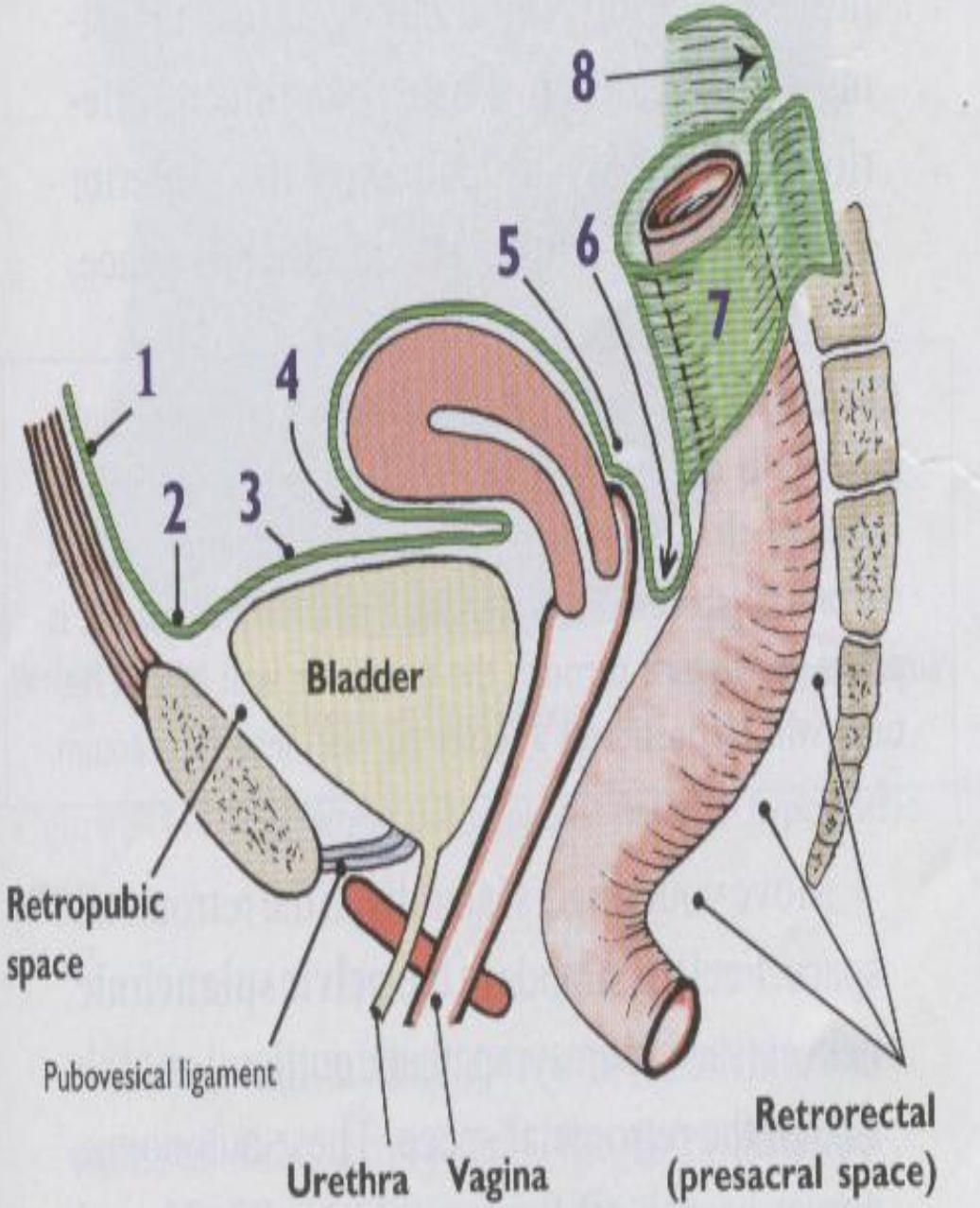
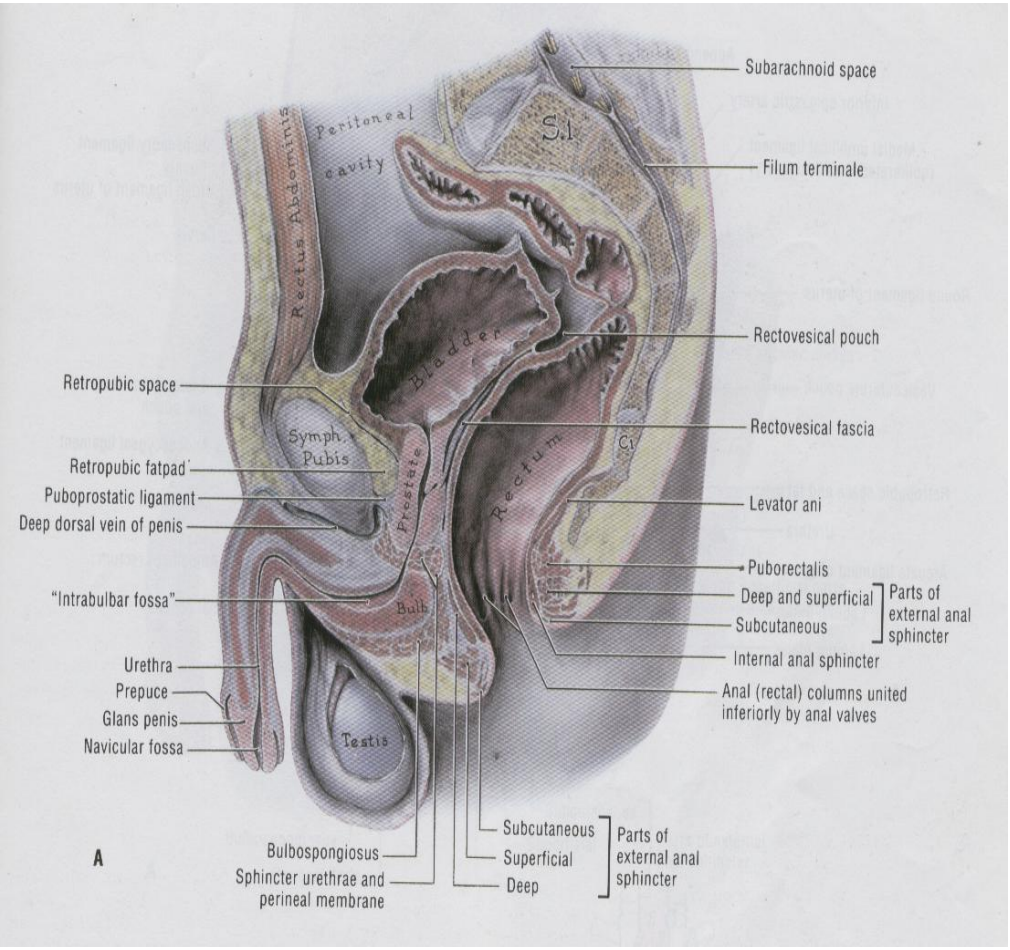


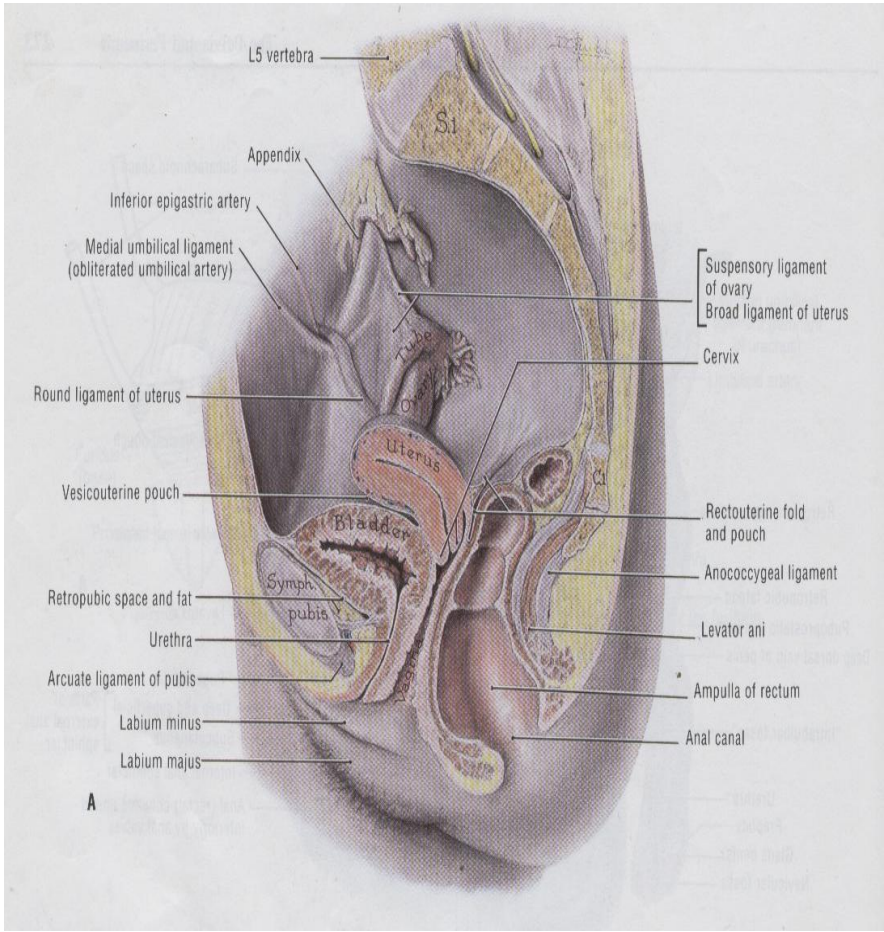
Figure 3.38 Peritoneum (green) in the female pelvis. The

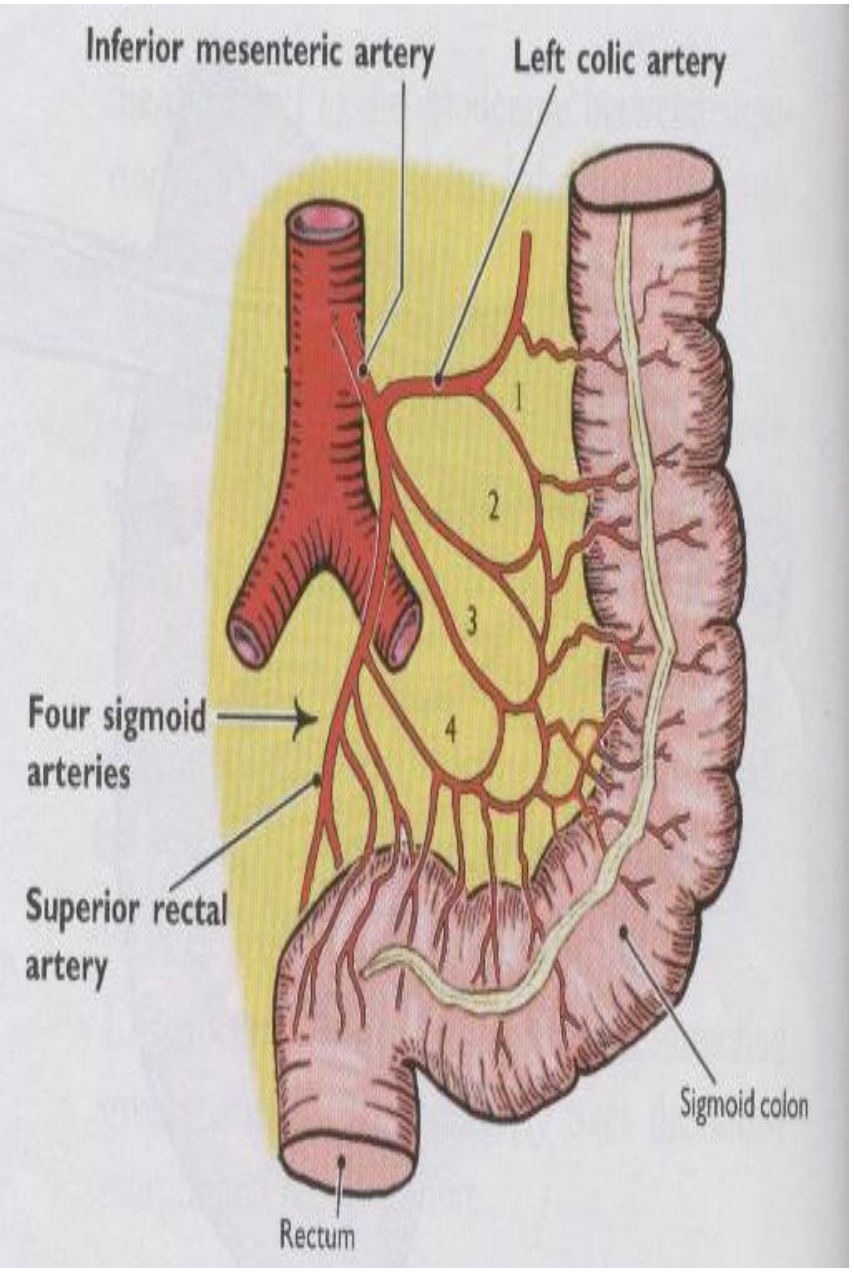
SIGMOID COLON CONTD…

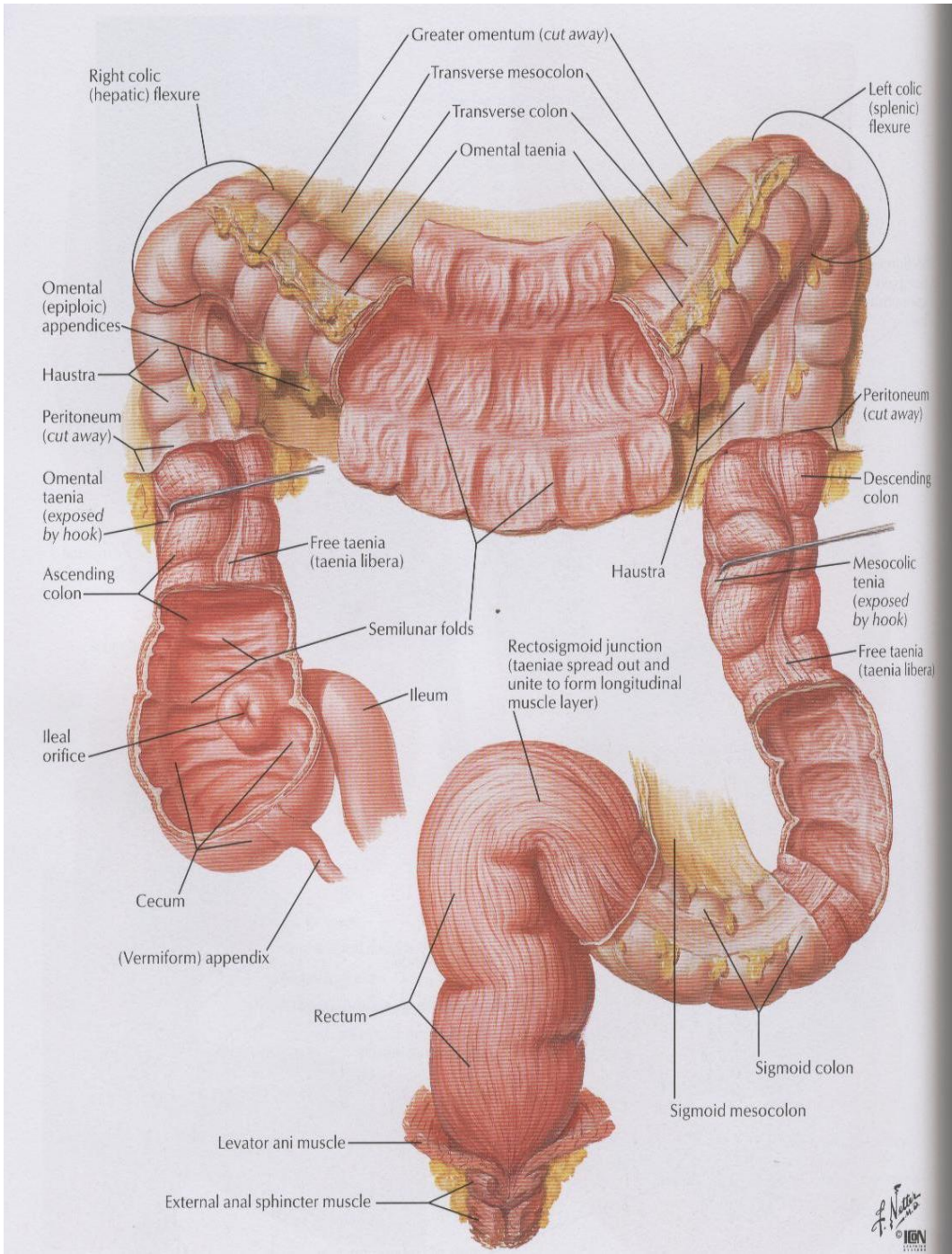
- Left ureter & a division of left common iliac artery are post to the apex of the mesentery
- It occupies rectovesicle pouch in males & rectouterine pouch in females
- Has long omental appendages
- Rectosigmoid junction is about 15 cm from anus
- Post - Left external iliac vessels & piriformis muscle

SIGMOID COLON CONTD…






Inferior mesenteric artery
Left colic artery
1
2
3
4
Four sigmoid arteries
Superior rectal artery
Sigmoid colon
Rectum

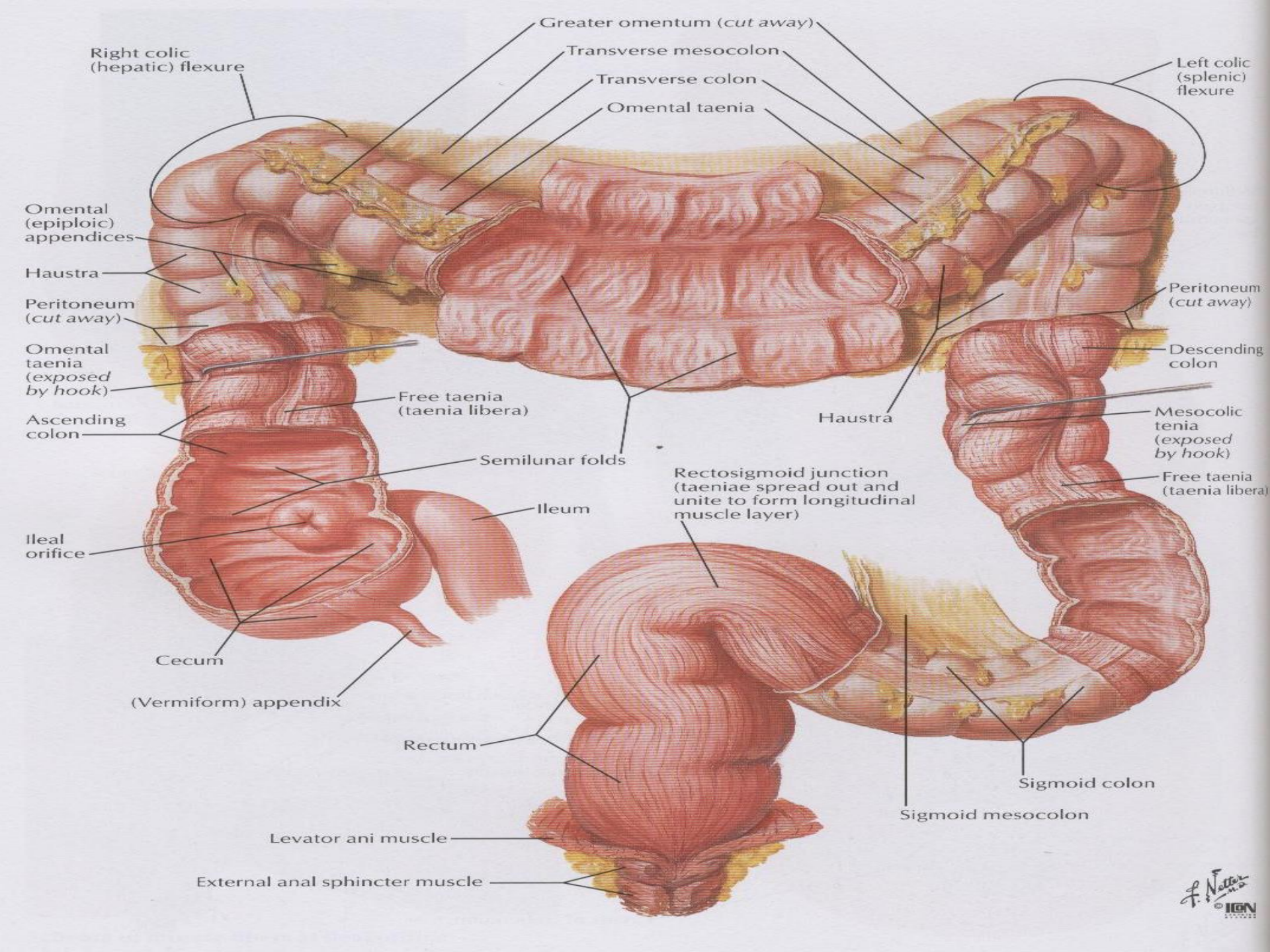

Greater omentum (cut away)
Transverse mesocolon
Transverse colon
Omental taenia
Right colic (hepatic) flexure
Left colic (splenic) flexure
Omental (epiploic) appendices
Haustra
Peritoneum (cut away)
Omental taenia (exposed by hook)
Ascending colon
Free taenia (taenia libera)
Semilunar folds
Ileum
Ileal orifice
Cecum
(Vermiform) appendix
Haustra
Peritoneum (cut away)
Descending colon
Mesocolic tenia (exposed by hook)
Free taenia (taenia libera)
Rectosigmoid junction (taeniae spread out and unite to form longitudinal muscle layer)
Rectum
Sigmoid colon
Sigmoid mesocolon
Levator ani muscle
External anal sphincter muscle

RECTUM

- 12 cm long
- Sup - continuous with sigmoid colon at the level of S3 - rectosigmoid junction
- Inf - continuous with anal canal

PERITONEAL RELATIONS

- **Sup 1/3 ant & lat peritoneal cover**
- **Mid 1/3 ant peritoneal cover**
- **Inf 1/3 no peritoneal cover**
- **Rectal examination - prostate gland**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Ascending colon
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Peritoneum (cut away)
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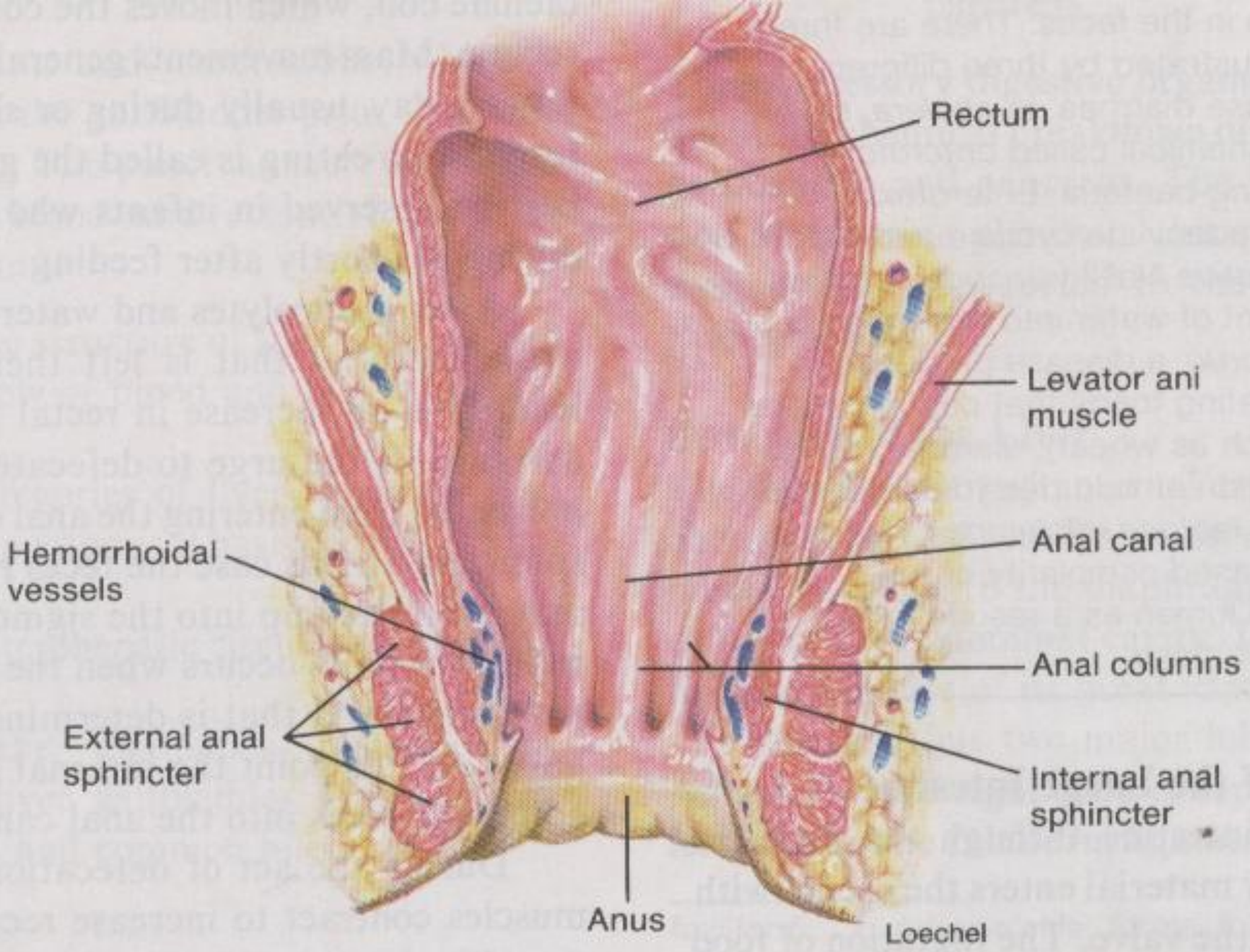
Free taenia (taenia libera)
Rectosigmoid junction (taeniae spread out and unite to form longitudinal muscle layer)
Rectum
Sigmoid colon
Sigmoid mesocolon
Levator ani muscle
External anal sphincter muscle

ANAL CANAL

- Terminal part of GI tract - 4 cm long
- Anus - external opening of anal canal
- Two sphincters guard the anus
- External anal sphincter - composed of skeletal muscle
- Internal anal sphincter - composed of smooth muscle fibers
- Has anal columns & anal valves with anastomoses; anal sinuses
- Hemorrhoids - veins in anal area


Rectum
Levator ani muscle
Anal canal
Hemorrhoidal vessels
Anal columns
External anal sphincter
Internal anal sphincter
Anus
Loechel

BLOOD & NERVE SUPPLY TO THE LARGE INTESTINE

- **Arterial supply**
- **Branches of SMA**
  - **Middle colic art with its branches - R & L**
  - **Right colic with its branches - ascending & descending**
  - **Ileocolic with its branches - colic and ileal**
- **Branches of IMA**
  - **Left colic art**
  - **Sigmoid art**

BLOOD & NERVE SUPPLY TO THE LARGE INTESTINE

- **Venous Drainage**
  - Superior mesenteric vein
  - Inferior mesenteric vein
  - Splenic vein
  - Portal vein
- **Lymphatic Drainage**
  - Follow arteries
  - Preaortic lymph nodes

BLOOD & NERVE SUPPLY TO THE LARGE INTESTINE

- **Innervation**
- **Parasympathetic**
  - **Vagus nerve**
  - **Pelvic splanchnic nerves**
- **Sympathetic**
  - **Superior mesenteric & aorticorenal ganglia**
  - **Lesser splanchnic nerves**
  - **Inferior mesenteric ganglia**
  - **Lumbar splanchnic nerves**