

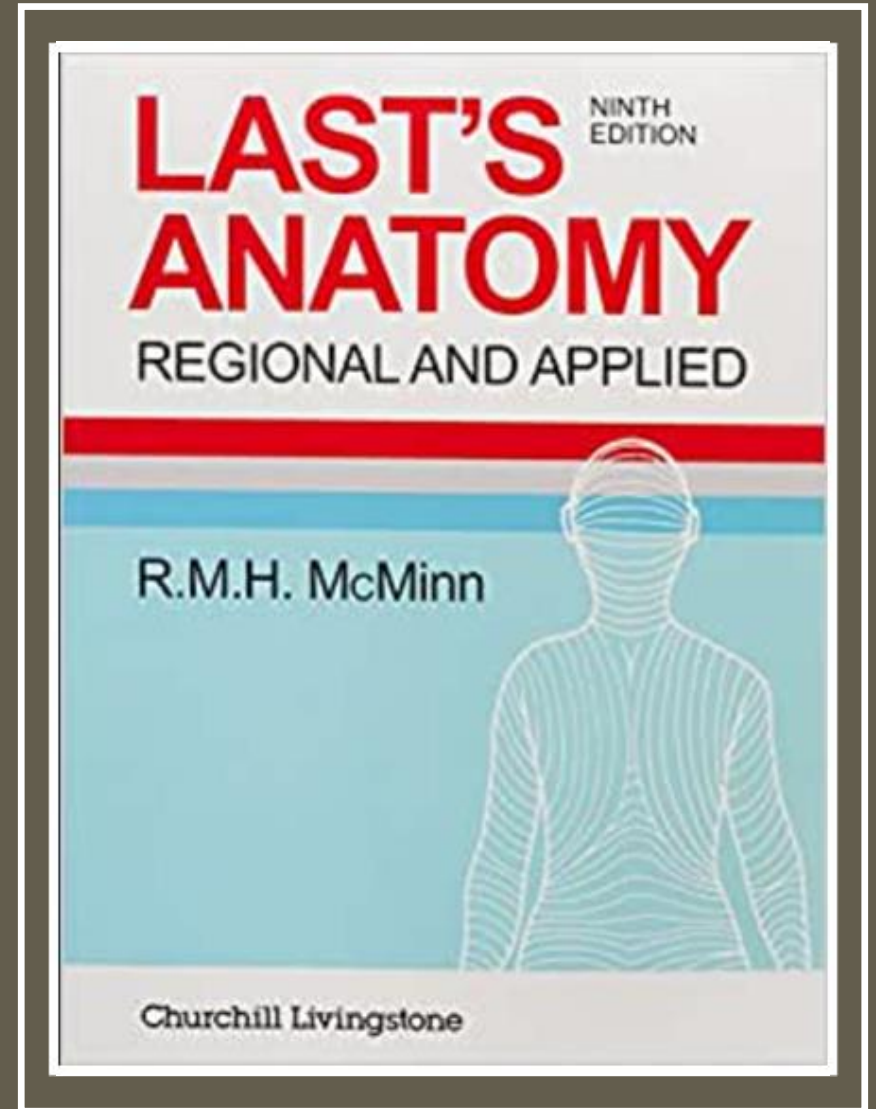
ABDOMINAL ANATOMY FOR THE GSSE

“Remember, we’re not here to learn anatomy. We’re here to learn Last’s.”

Andrew Zimmerman

0431 365 157

andrew.zimmerman@health.nsw.gov.au

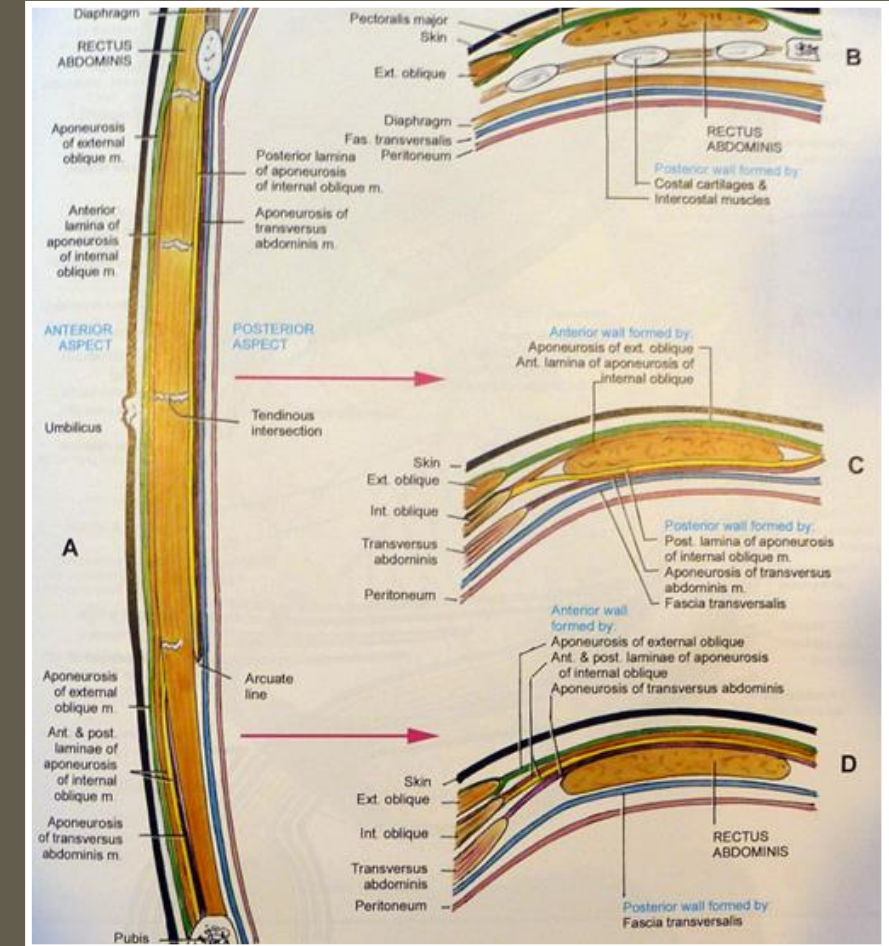
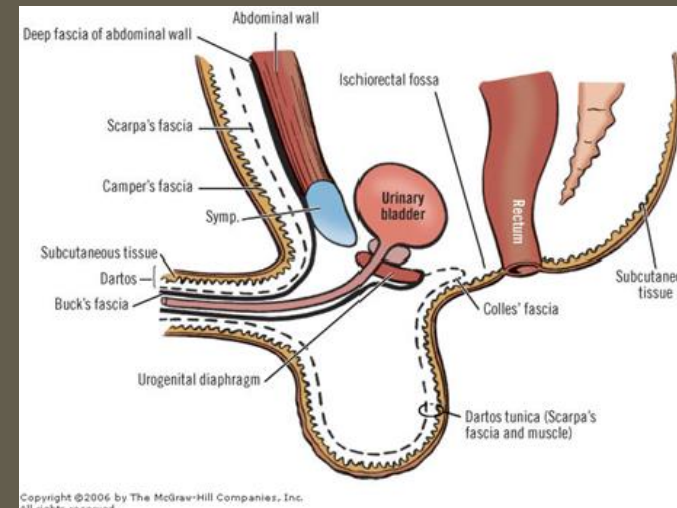
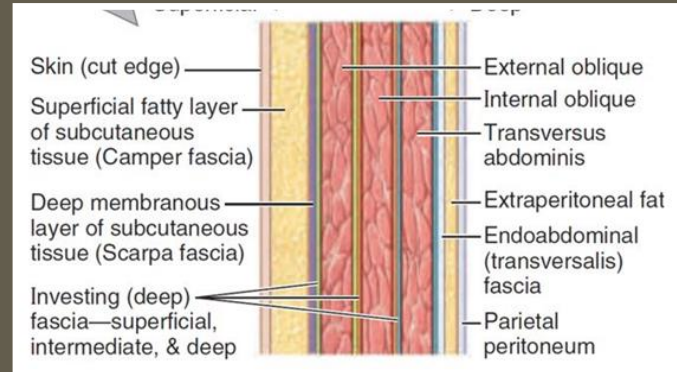


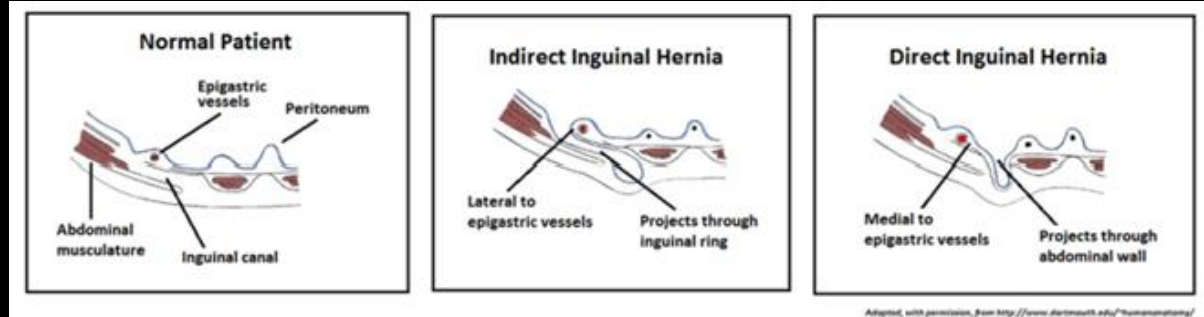
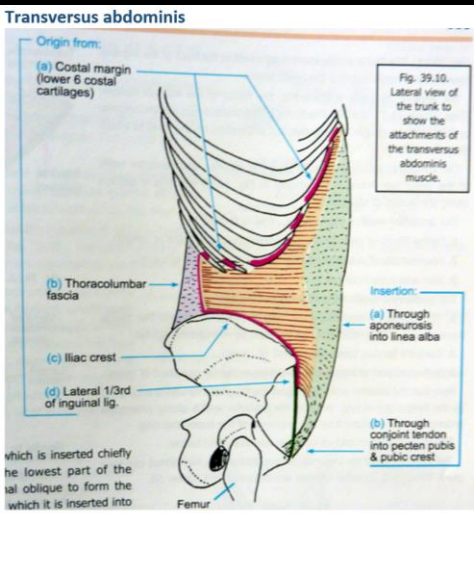
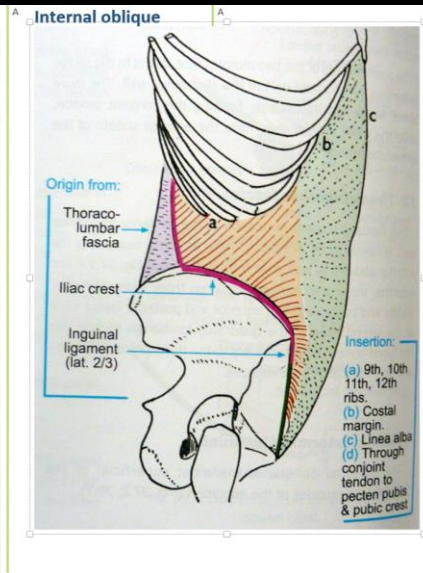
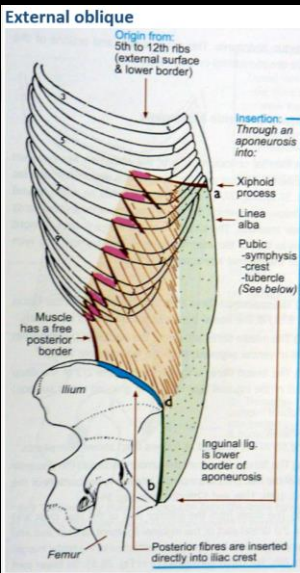
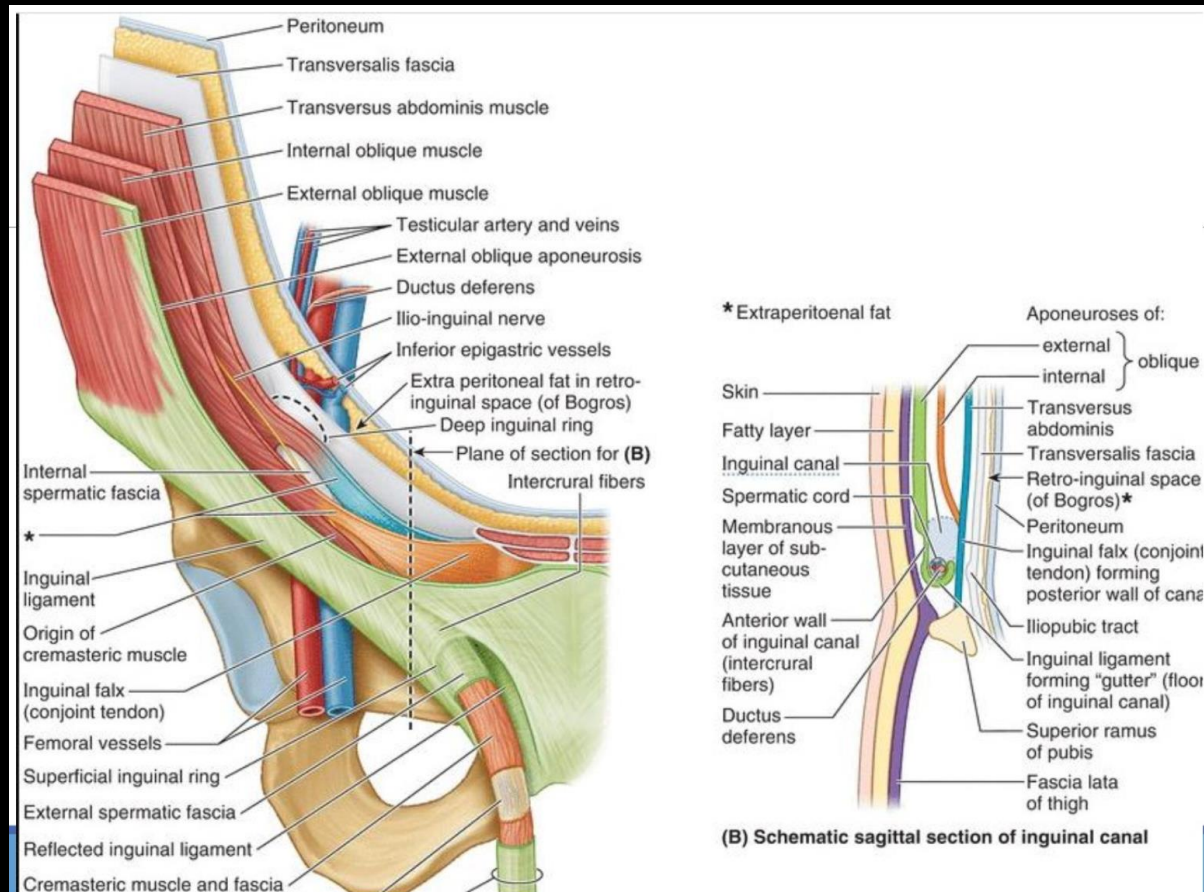
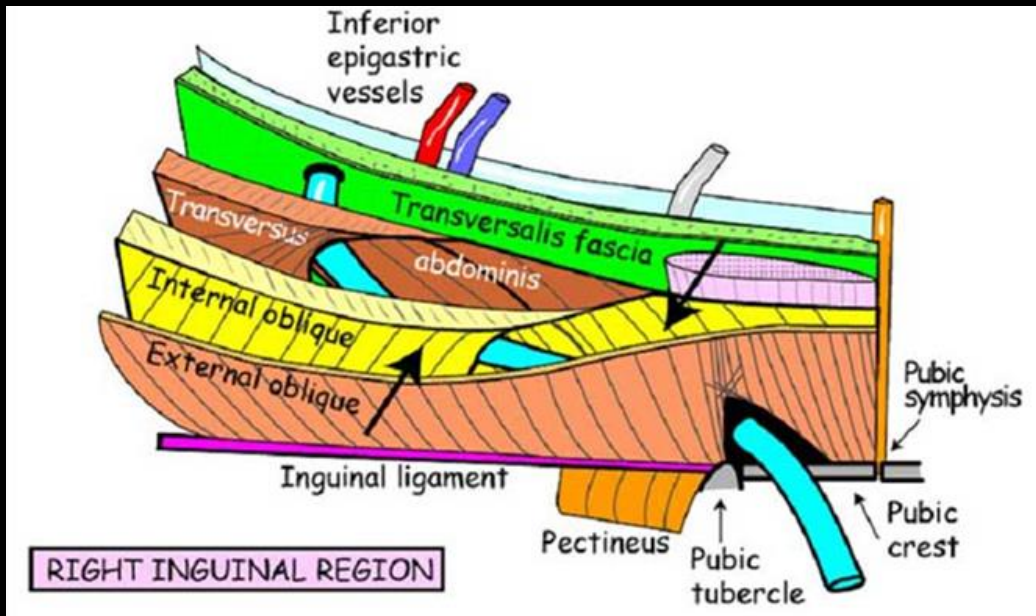
WE HAVE ONE HOUR...

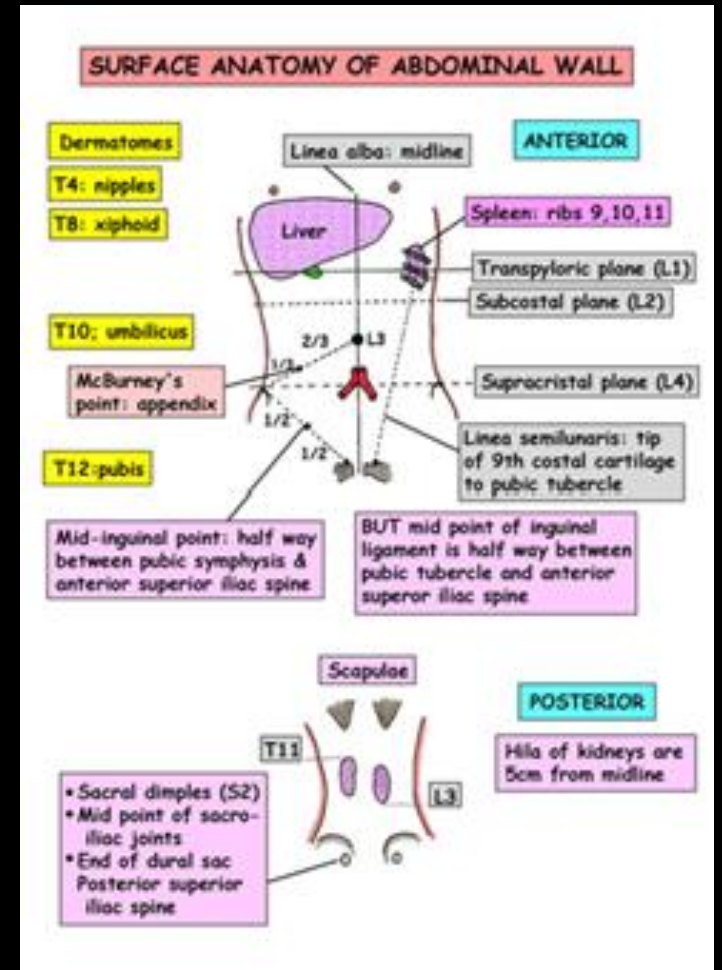
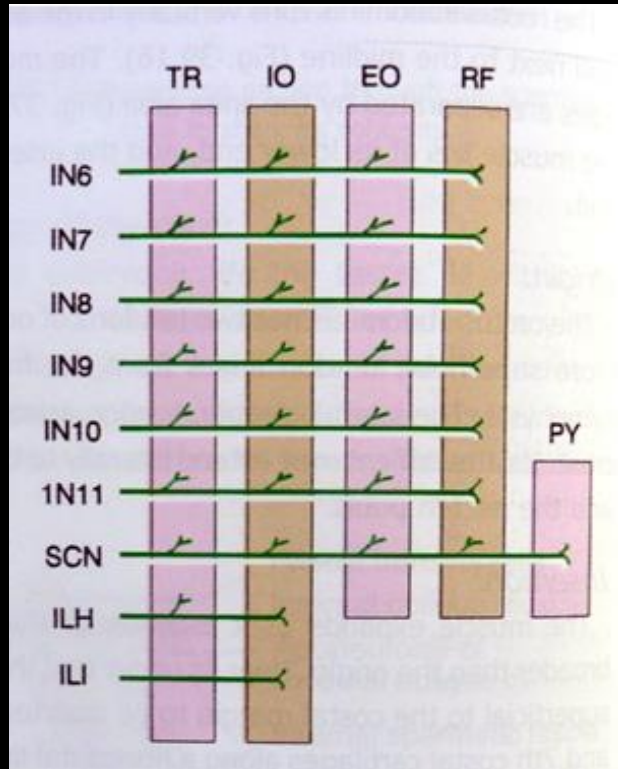
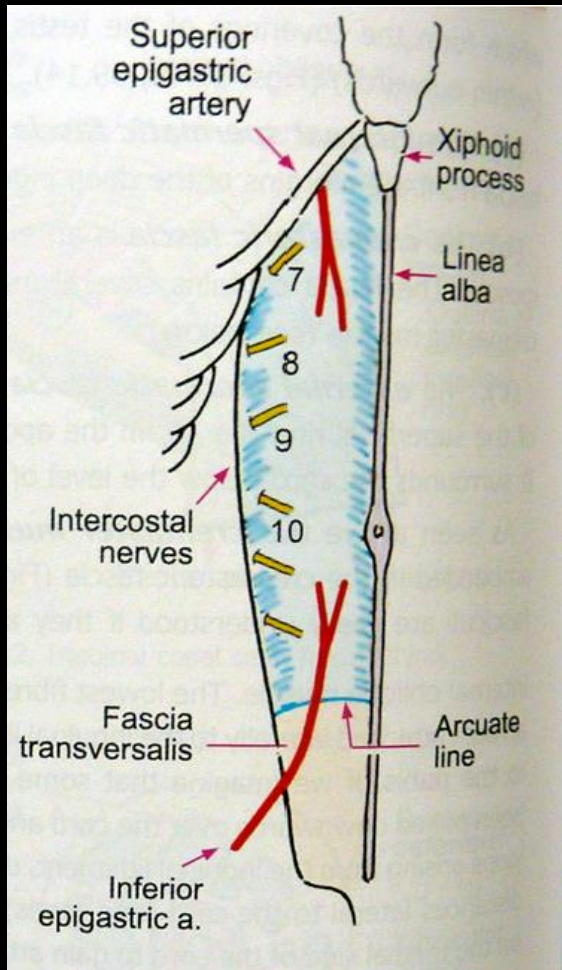
- Histological/anatomical differences across the gastrointestinal tract (e.g. jejunum vs ileum vs colon)
- Roots of the mesentery, specifically derivatives of dorsal and ventral mesogastrium; abdominal compartments
- Aspects of gastrointestinal vascular anatomy and variations in circulation
- Liver segments
- Porta hepatis, relations of the entrance to the lesser sac
- Transpyloric plane
- Relations of the duodenum
- Structures piercing the diaphragm (and passing behind the arcuate ligaments)
- Spleen/Stomach/Duodenum/Pancreas
- Other...

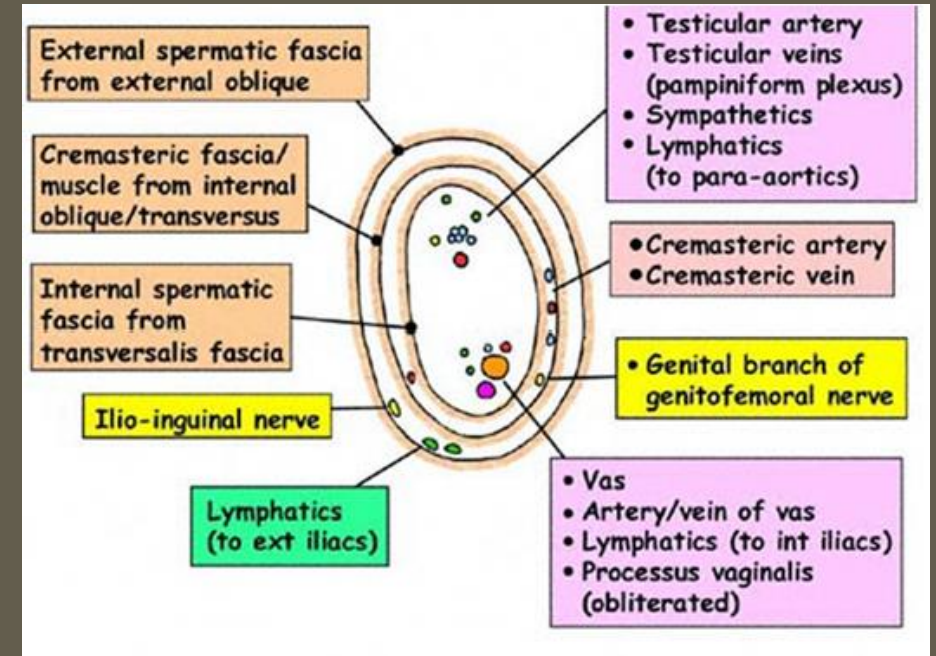
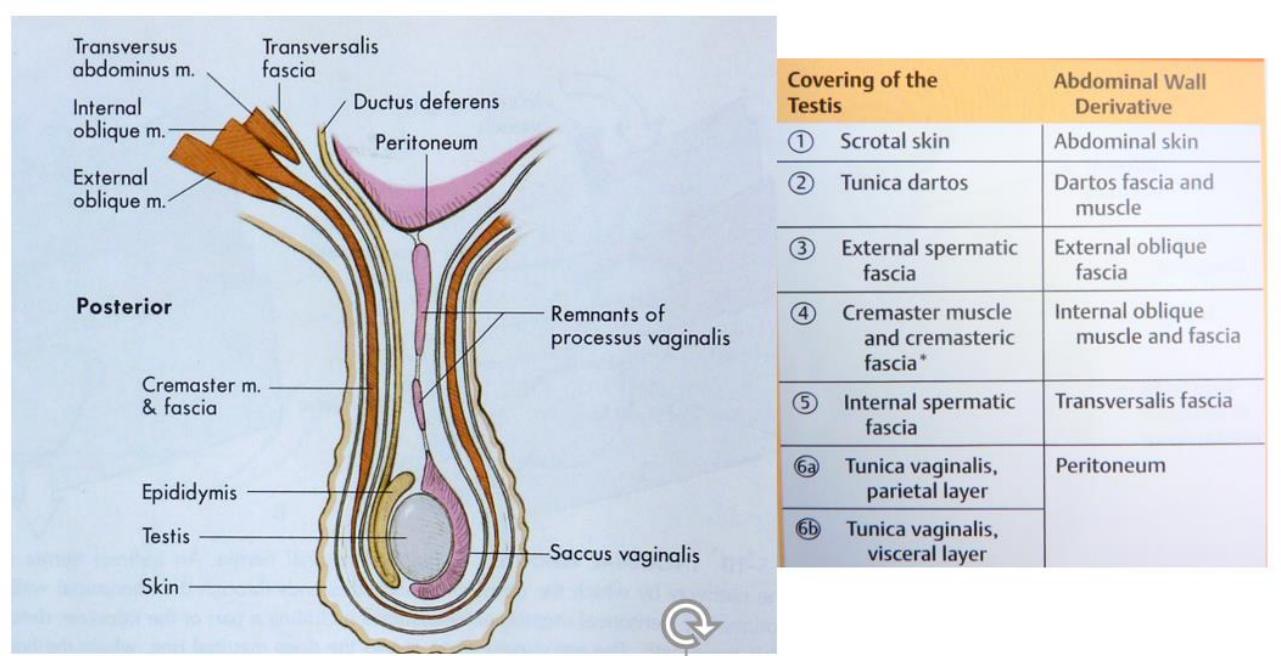
ABDOMINAL WALL, INGUINAL CANAL, FEMORAL CANAL

- Surface anatomy, landmarks
- Campers, Scarpa's (and Dartos, Buck's, Colle's) fascia – where and why dependent fluid tracks
- Muscles, layers, attachments, neurovascular plane, arcuate line
- Blood supply, venous drainage, innervation, lymphatics
- Inguinal canal, conjoint tendon, eponymous ligaments, intercrural fibres
- Spermatic cord layers, contents
- Common inguinal hernias
- Femoral canal, femoral hernias
- Know when and where things turn into other things (and/or change names)



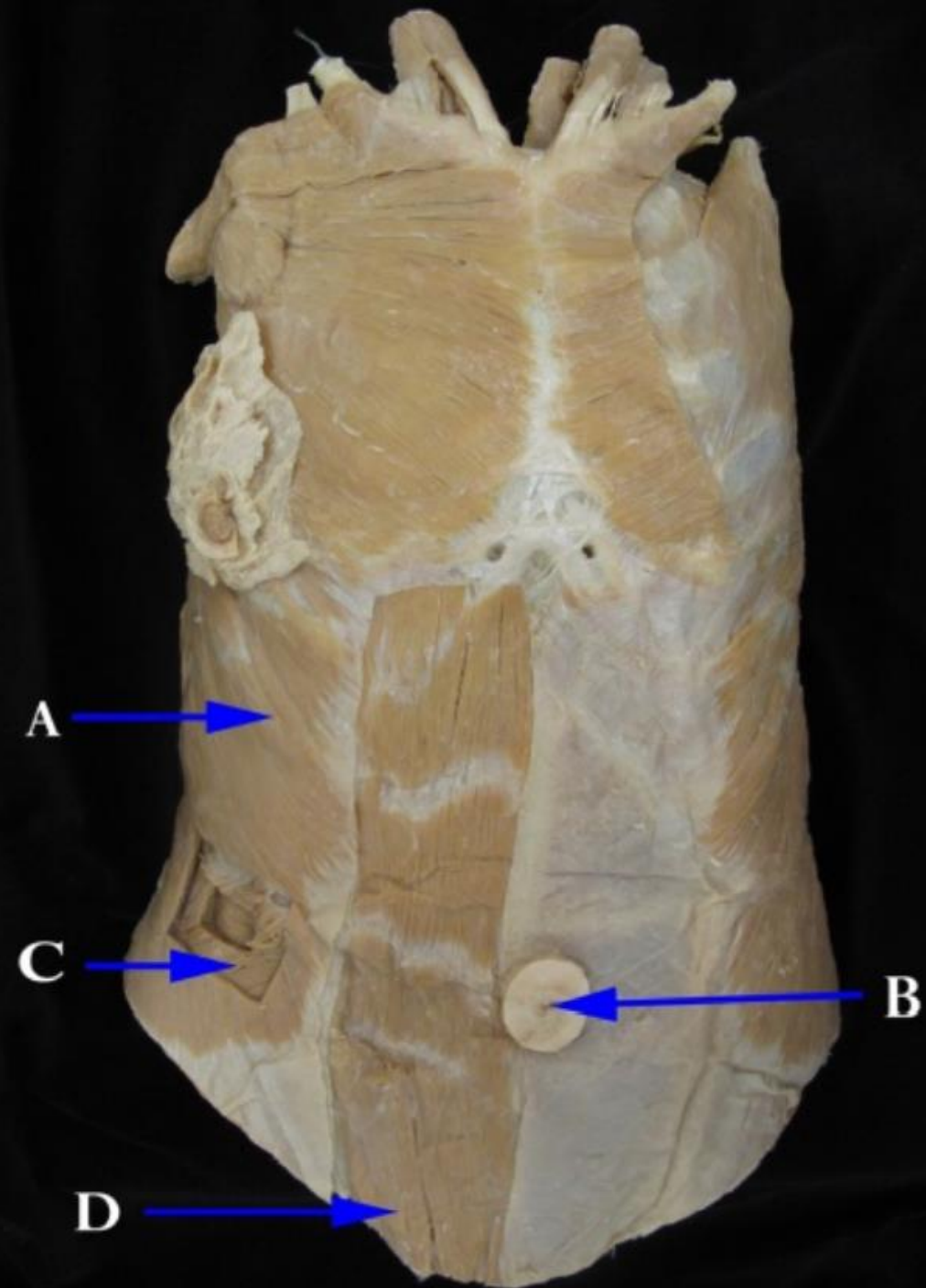






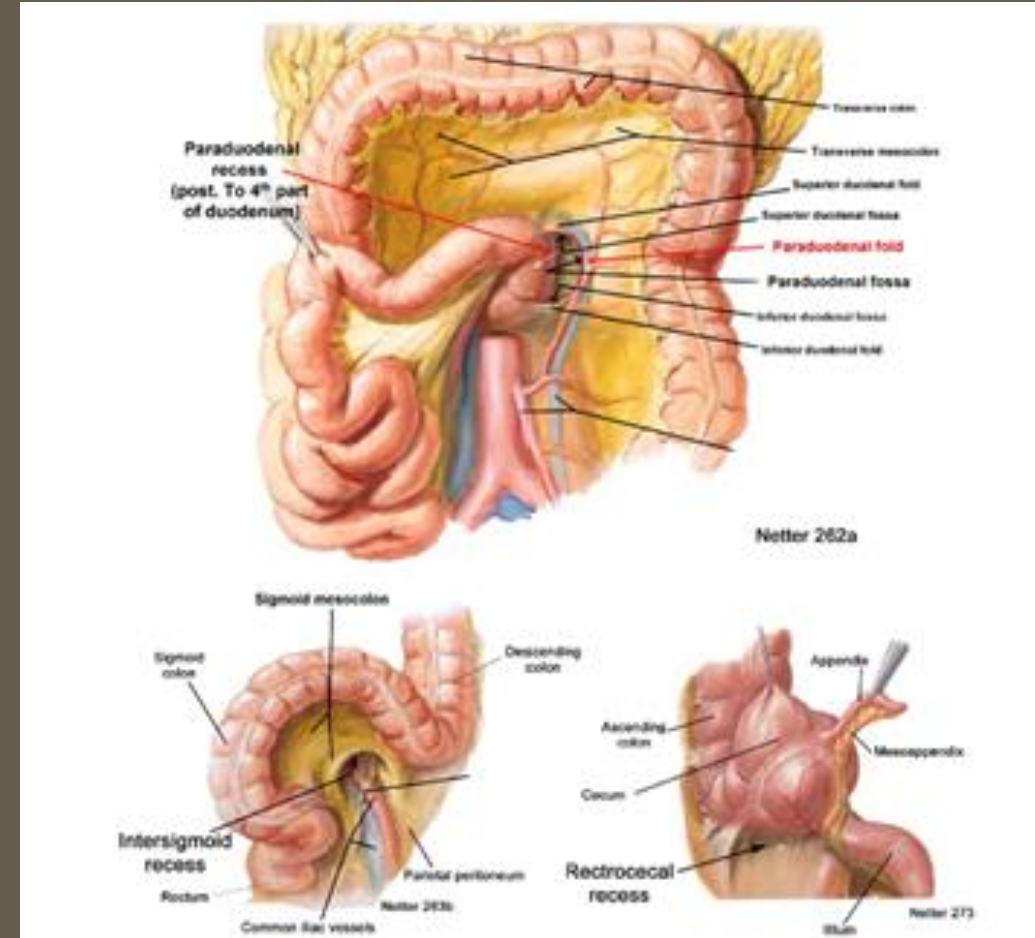
PRACTICE SPOT

- Identify A
- What dermatome supplies structure B?
- What is attachment of C to the inguinal ligament?
- What is the nerve supply (SP!) of muscle D just above the pubis?



ROOTS OF THE MESENTERY, ABDOMINAL COMPARTMENTS

- Peritoneal reflections / roots
- Abdominal compartments
- Greater and lesser omentum and layers, where they fuse, etc.
- Hepatoduodenal ligament, structures and order at the foramen of Winslow
- Ligament of Treitz
- Transverse mesocolon – separates supra and infracolic compartments
- Paraduodenal fold, fossa, recess
- Intersigmoid recess
- Retrocaecal recess
- Mesoappendix, appendiceal folds



From: Cunningham's Manual of Practical Anatomy, Vol 2, G.J Romanes, 15th Edn, Oxford Medical Publications

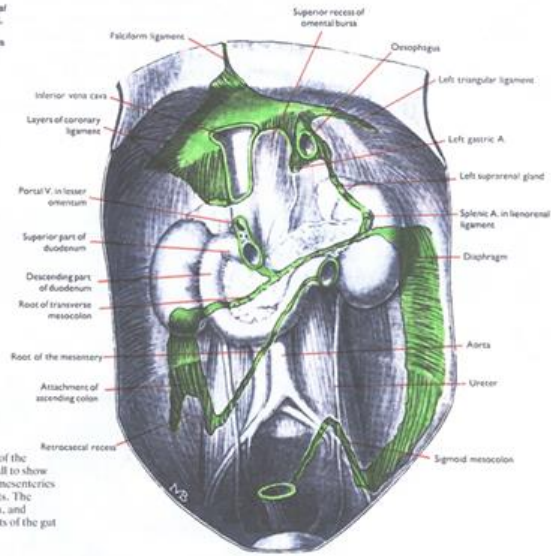
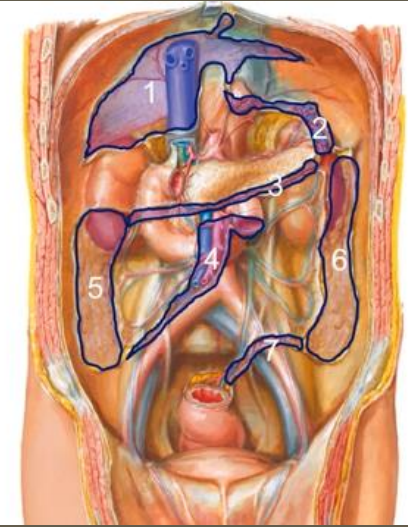


Fig. 138. A dissection of the posterior abdominal wall to show the attachments of the mesenteries and peritoneal ligaments. The oesophagus, duodenum, and rectum are the only parts of the gut tube left in situ.

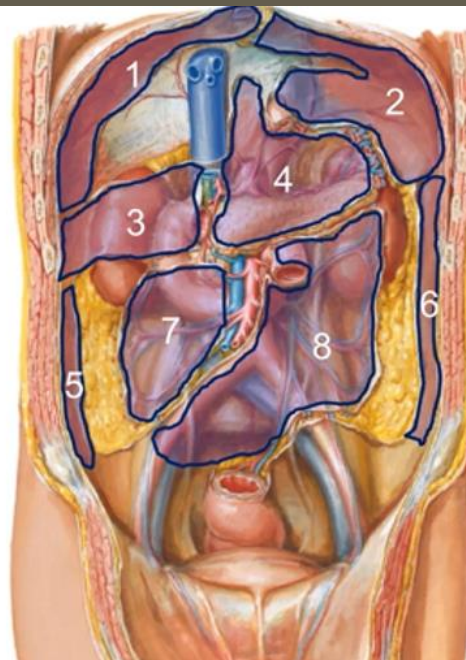
Peritoneal Reflections

1. Liver
2. Stomach and spleen
3. Transverse mesocolon
4. The mesentery
5. Ascending colon
6. Descending colon
7. Sigmoid mesocolon

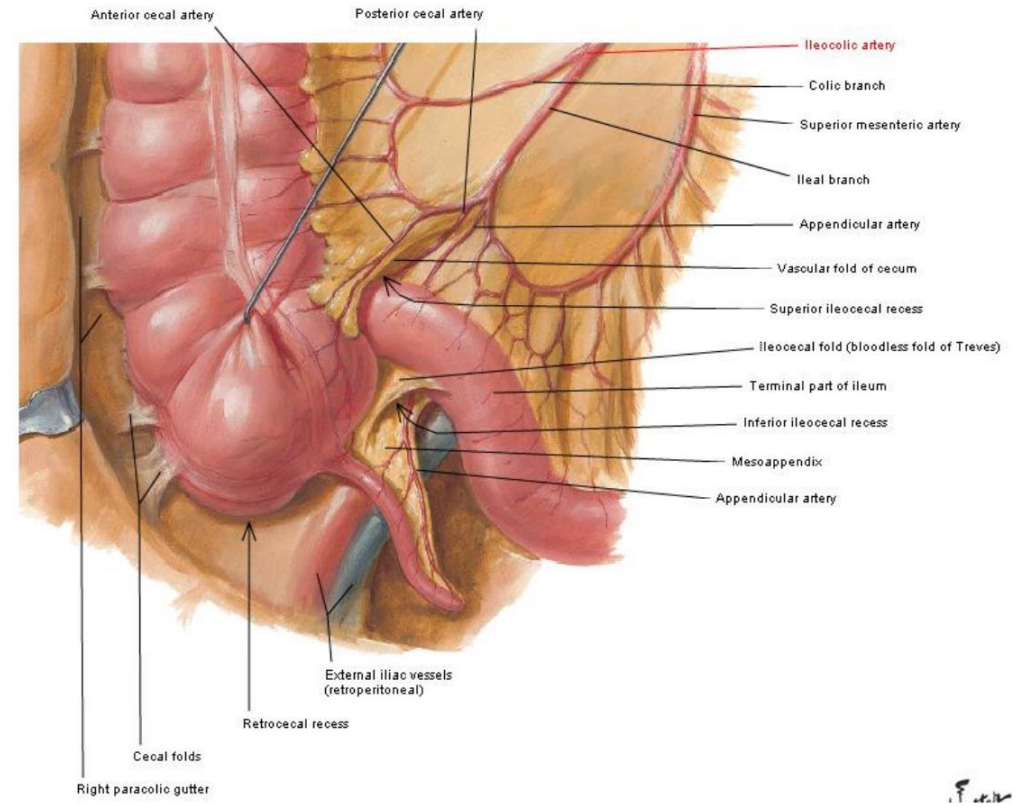
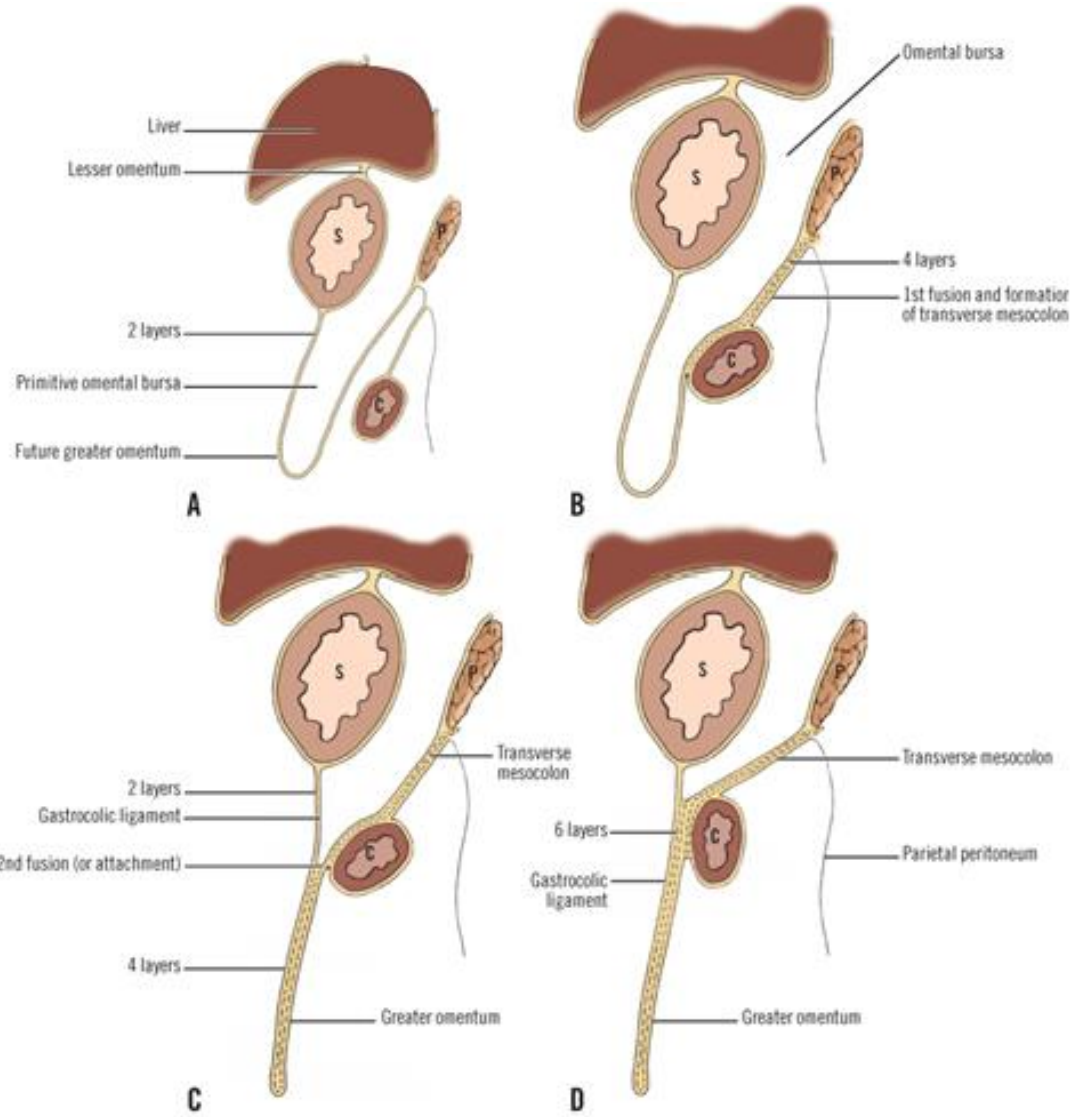


Abdominal Compartments

1. Right subphrenic
2. Left subphrenic
3. Right subhepatic (hepatorenal pouch of Morrison)
4. Left subhepatic (lesser sac)
5. Right paracolic gutter
6. Left paracolic gutter
7. Right infracolic
8. Left infracolic



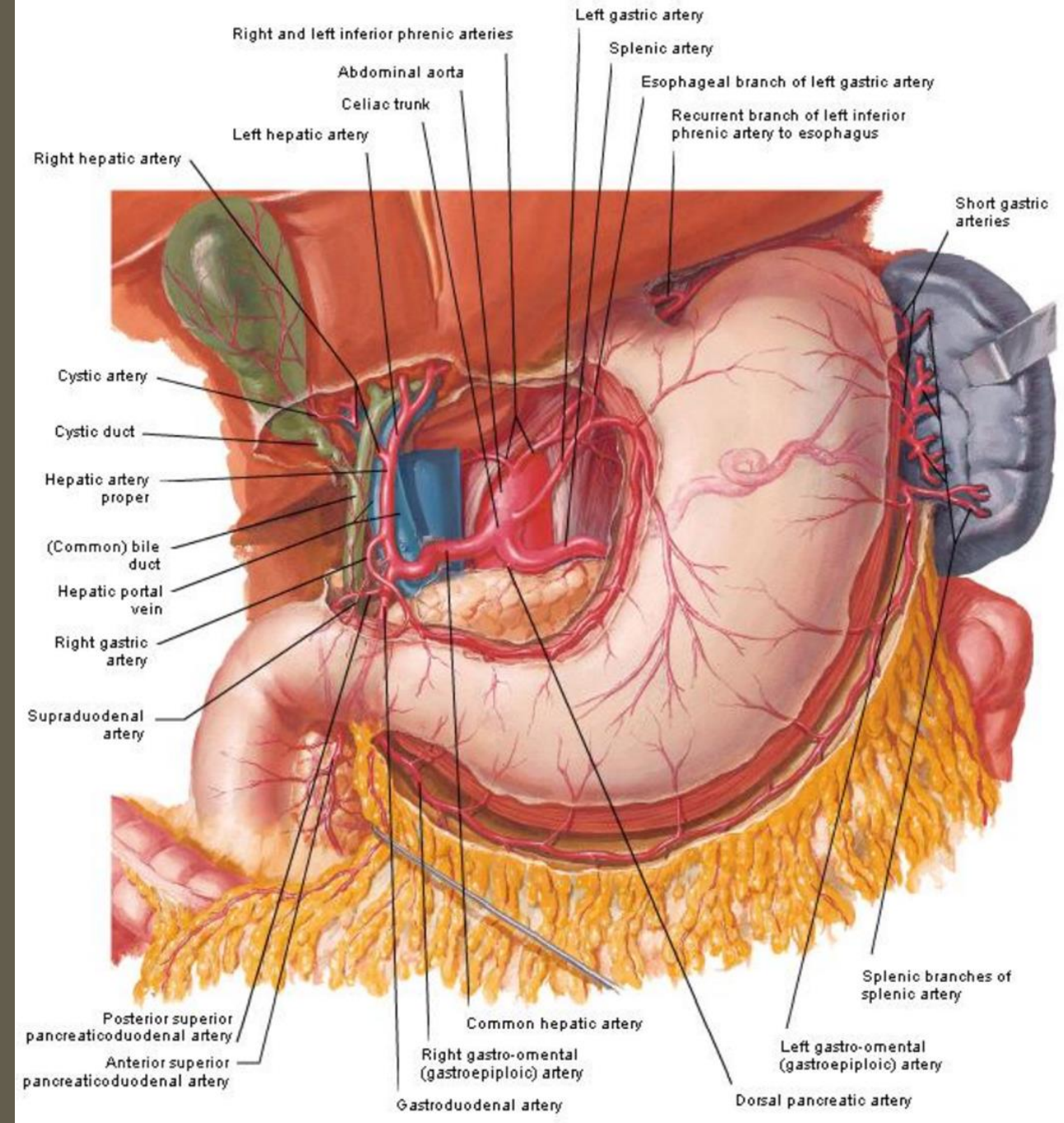
- 1-4 Supracolic compartment
 5-8 Infracolic compartment
 Demarcated by the transpyloric plane (L1)

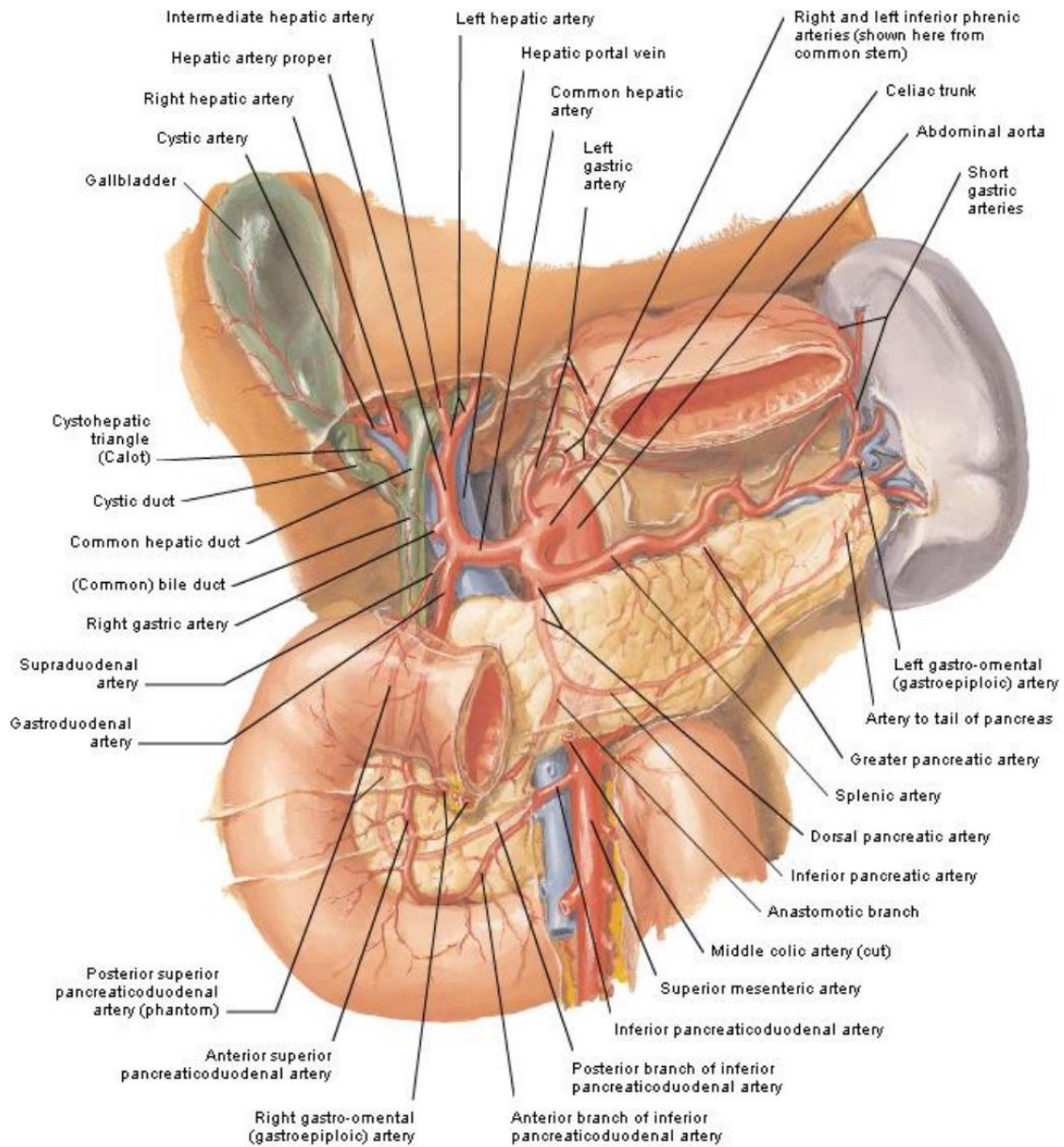


F. 10/10

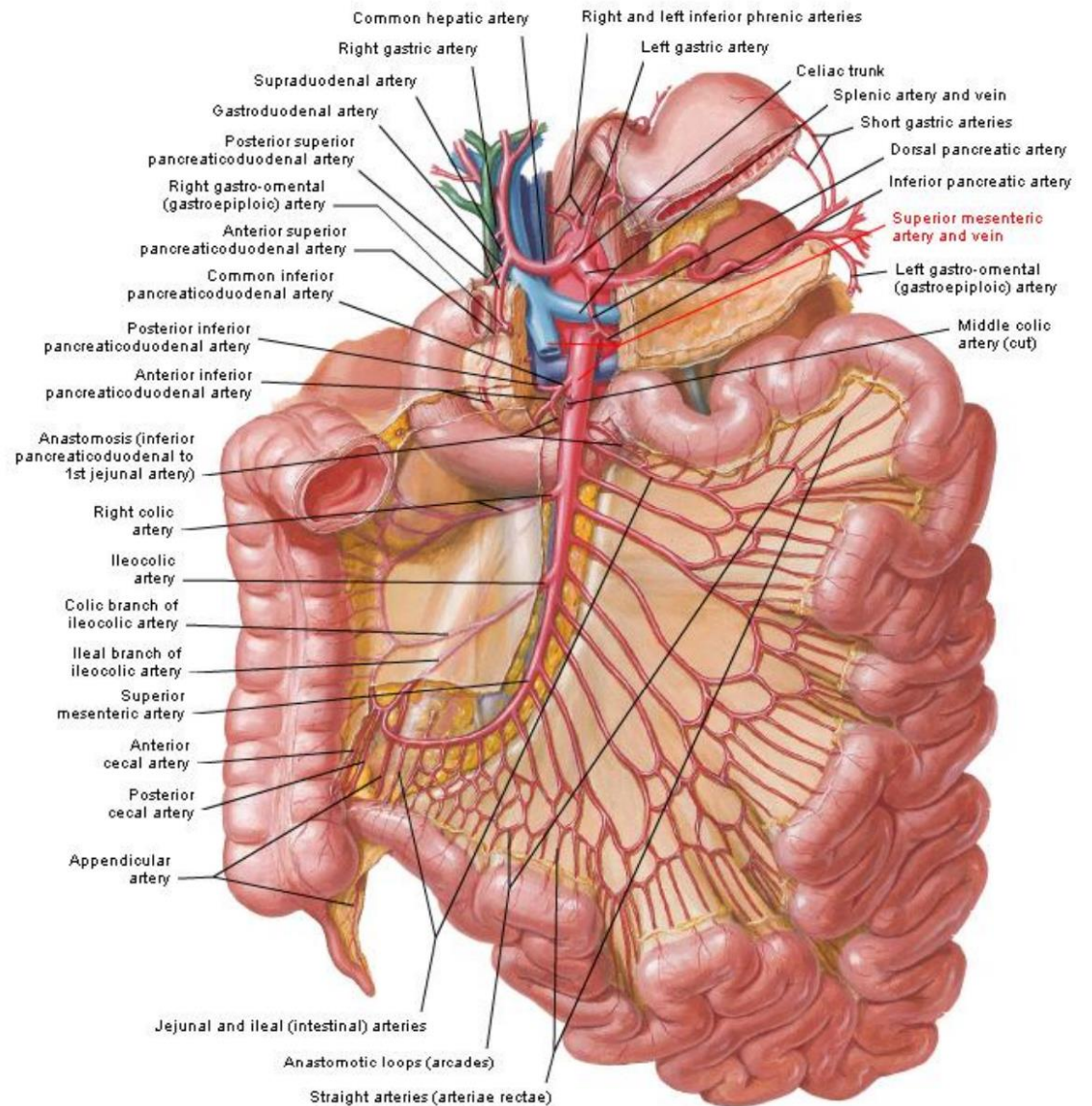
CIRCULATION

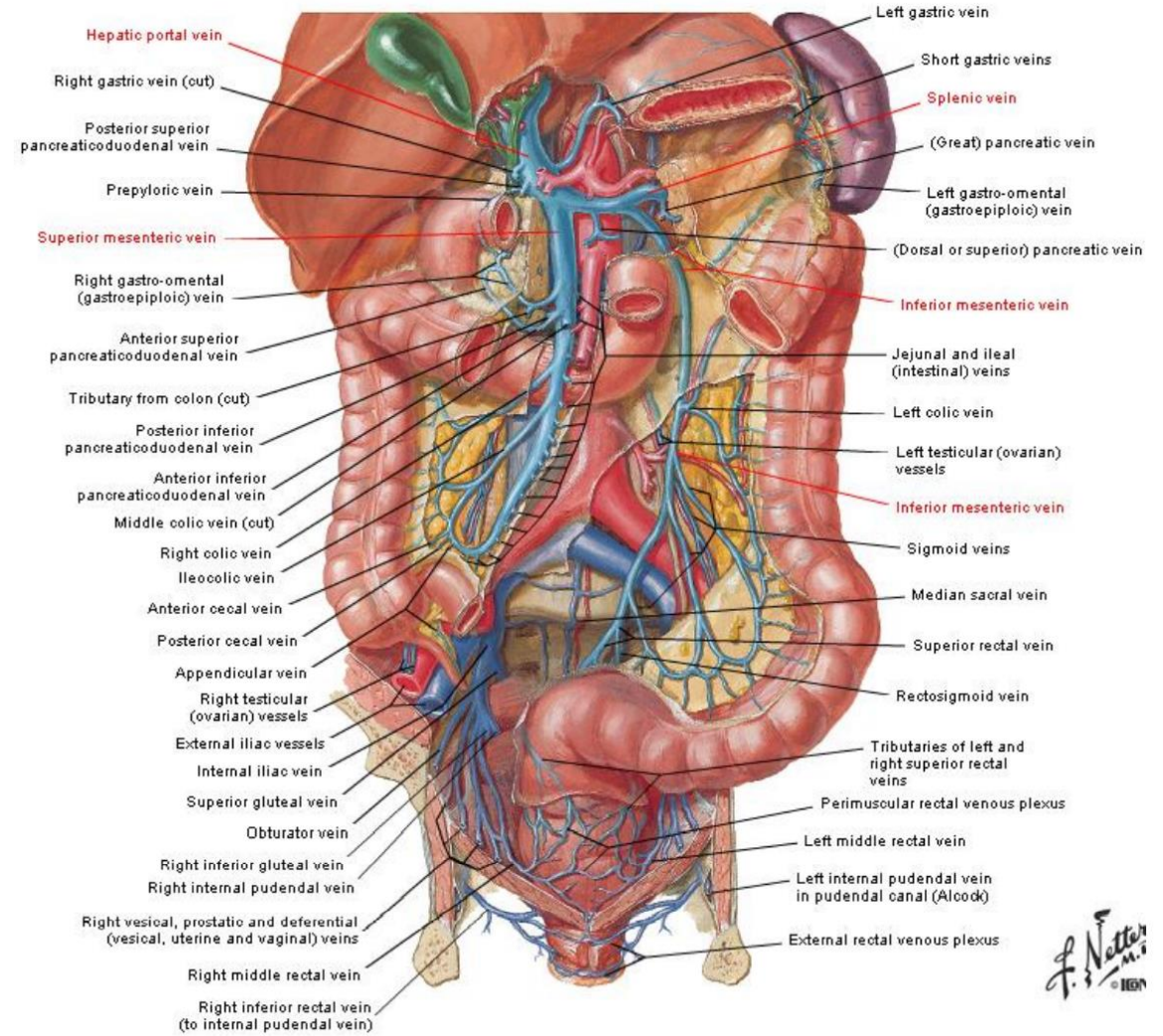
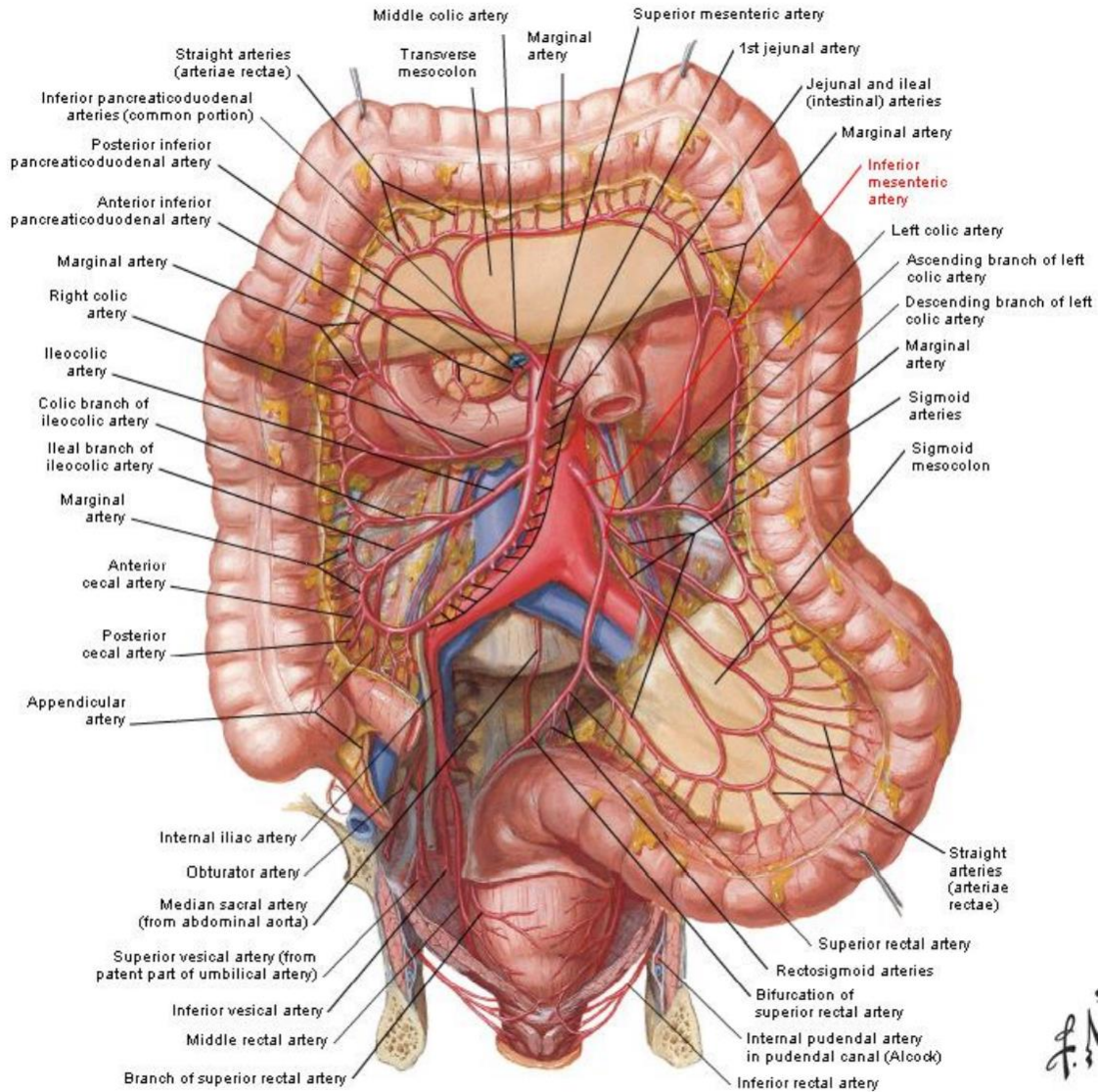
- Embryological origins = key
- Foregut, midgut, hindgut supply
- Where these zones anastomose
- Riolan's arc / anastomosis vs marginal artery of Drummond
- Portal system and portosystemic anastomoses
- Paired and unpaired branches of the abdominal aorta
- Any organ that is supplied by multiple sources, e.g. oesophagus, ureters, rectum
- Anatomical variants



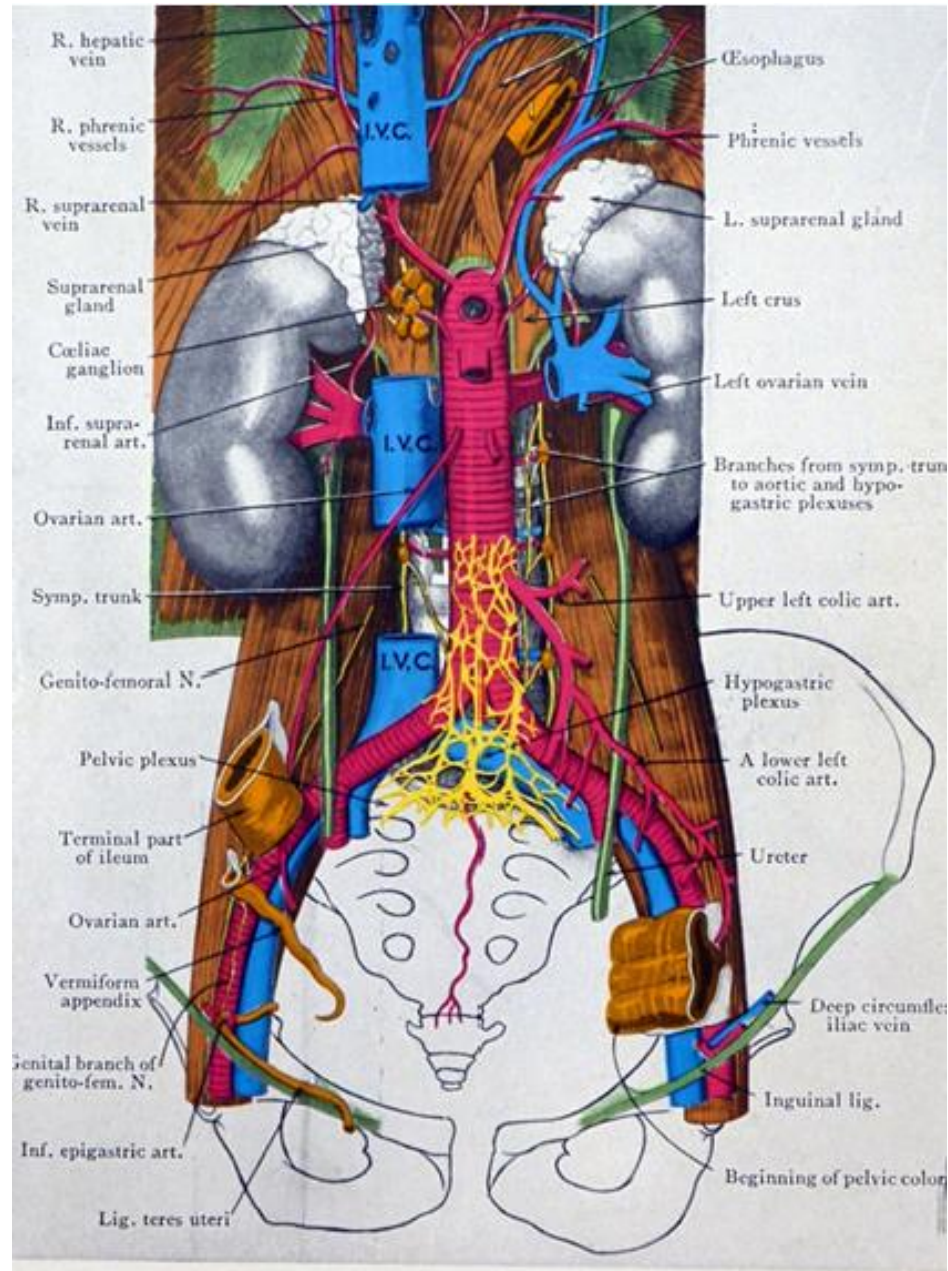


Arteries of Small Intestine



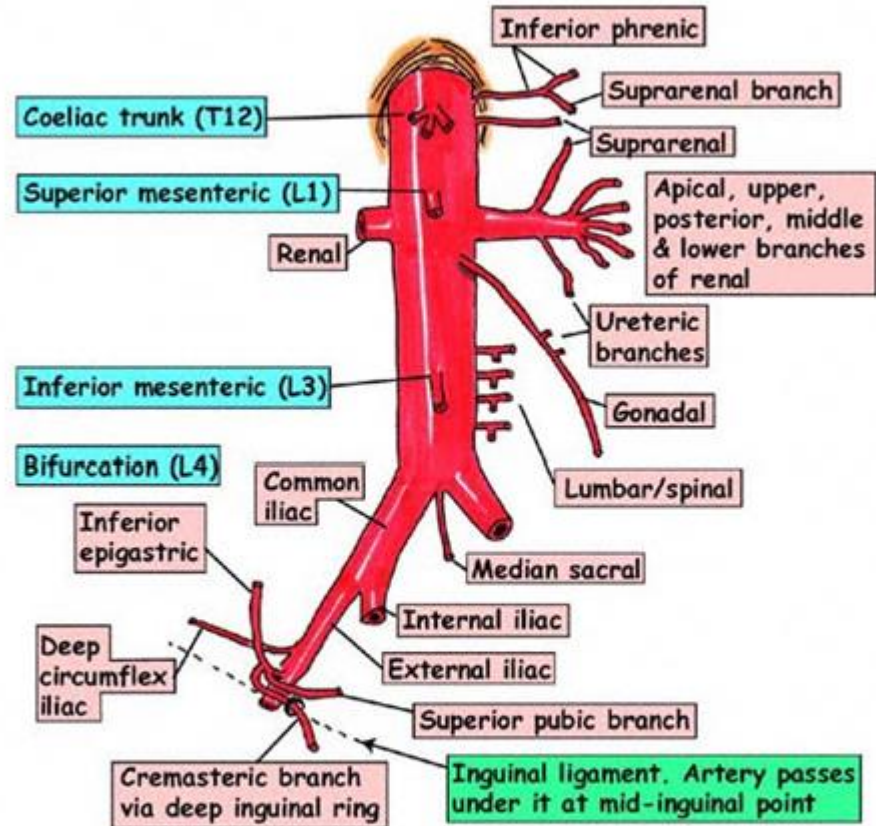


F. Netter M.D.



ABDOMINAL AORTA, INFERIOR VENA CAVA, ILIAC VESSELS AND HYPOGASTRIC PLEXUS

ABDOMINAL AORTA AND RIGHT EXTERNAL ILIAC ARTERY

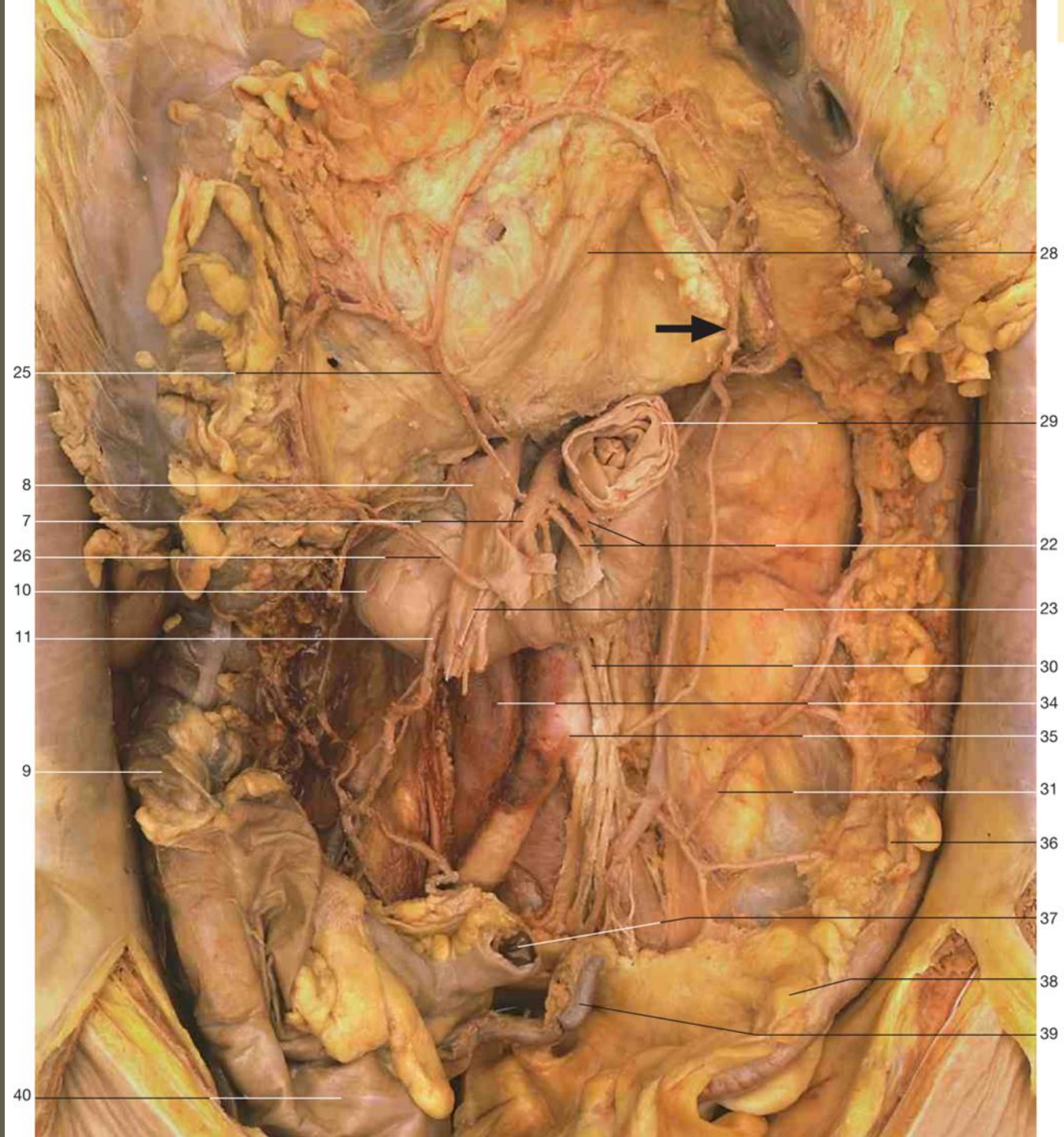


Relations of aorta

Left lateral: sympathetic chain. Right lateral: IVC, Cysterna chyli
 Both lateral: Azygos veins, para-aortic nodes, coeliac ganglia
 Anterior: Pancreas, splenic vein, left renal vein, 3rd part duodenum, mesentery, nodes, autonomic plexus, lesser sac, stomach, omentum, small bowel
 Posterior: T12-L4, left lumbar veins

PRACTICE SPOT

1. Name the structure the arrow is pointing to; what is its function?
2. Name the origin of the artery that supplies 39
3. Name 35 (precisely) and the vertebral level
4. Name 25
5. The origin of 7 lies at what vertebral level?



LIVER

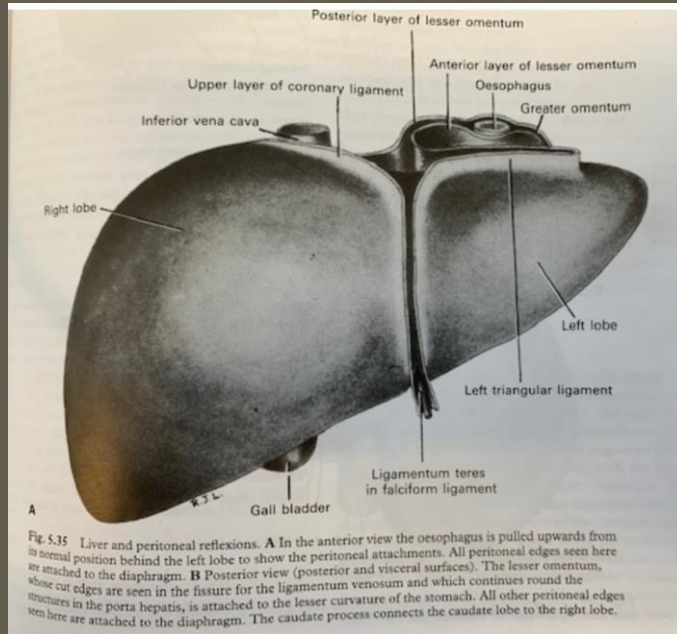


Fig. 5.35 Liver and peritoneal reflexions. **A** In the anterior view the oesophagus is pulled upwards from its normal position behind the left lobe to show the peritoneal attachments. All peritoneal edges seen here are attached to the diaphragm. **B** Posterior view (posterior and visceral surfaces). The lesser omentum, whose cut edges are seen in the fissure for the ligamentum venosum and which continues round the structures in the porta hepatis, is attached to the lesser curvature of the stomach. All other peritoneal edges seen here are attached to the diaphragm. The caudate process connects the caudate lobe to the right lobe.

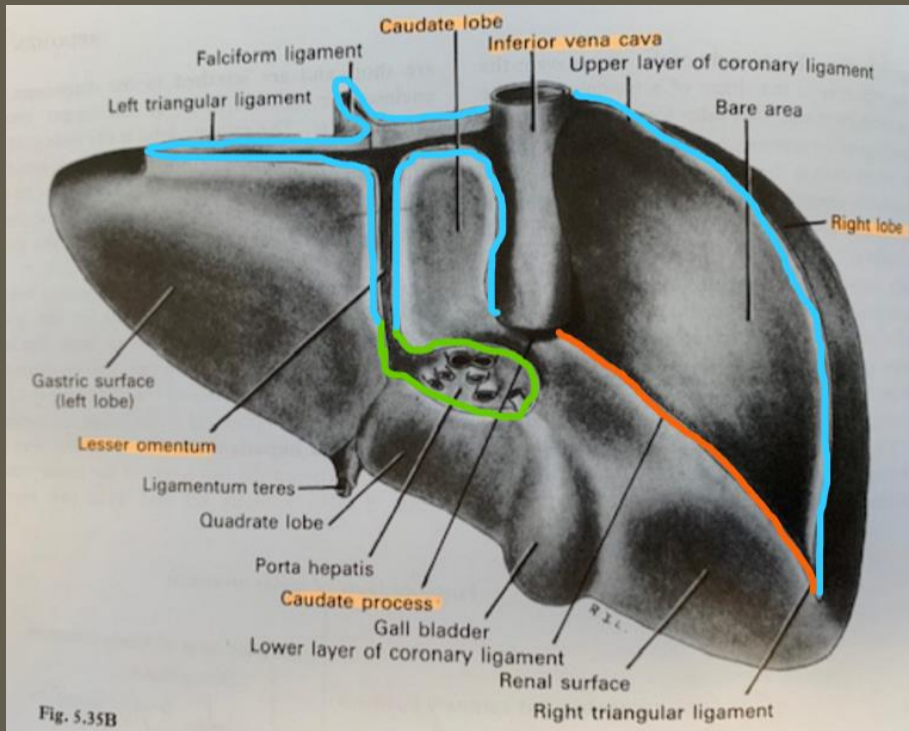


Fig. 5.35B

Dual blood supply, sites of portosystemic anastomosis

As always: innervation, lymphatics, etc.

Relations, impressions

1500g, 1500ml/min blood flow (30% cardiac output)

The “H” (posterior aspect)

Peritoneal reflexions, hepatoduodenal ligament (and structures) at the foramen of Winslow

Falciform ligament and ligamentum teres

Structure and function of the lobule

Histology

Porta hepatis – not actually a triad, T vs Y shaped bifurcation, etc.

Lobes – anatomical vs physiological

Development, foetal circulation

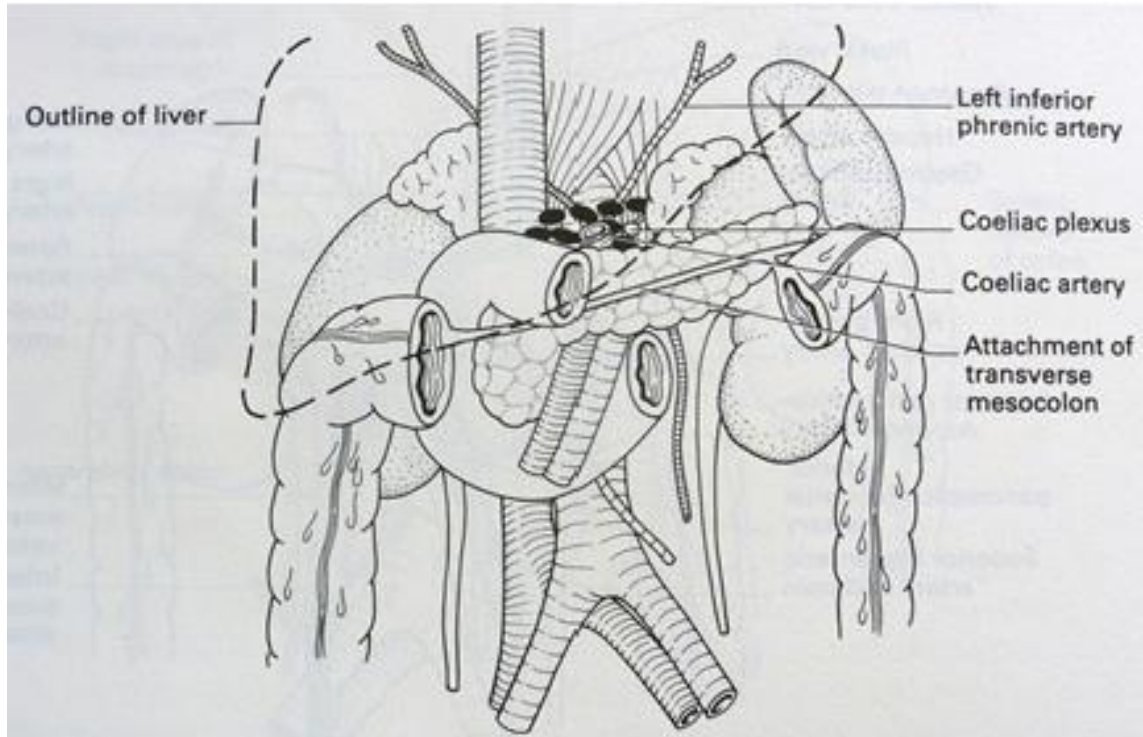


Fig. 10.10 The phrenic arteries, the coeliac plexus and the outline of the liver have been added to Fig. 10.9, but some arteries have been omitted for clarity.

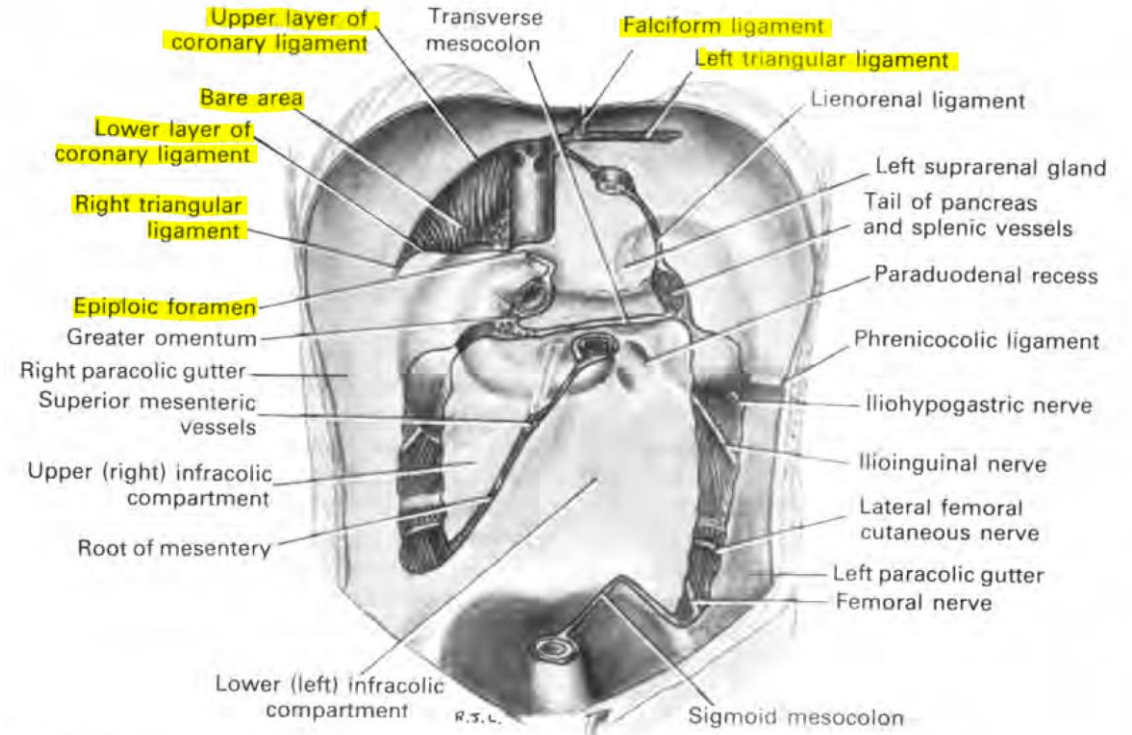
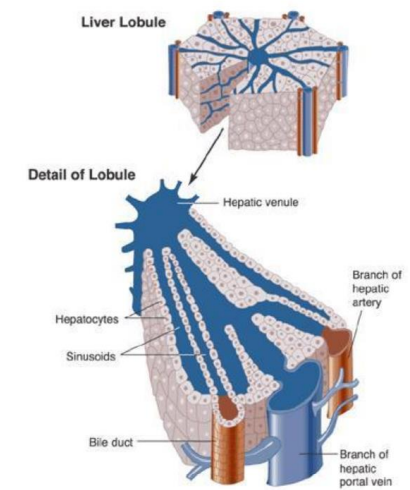
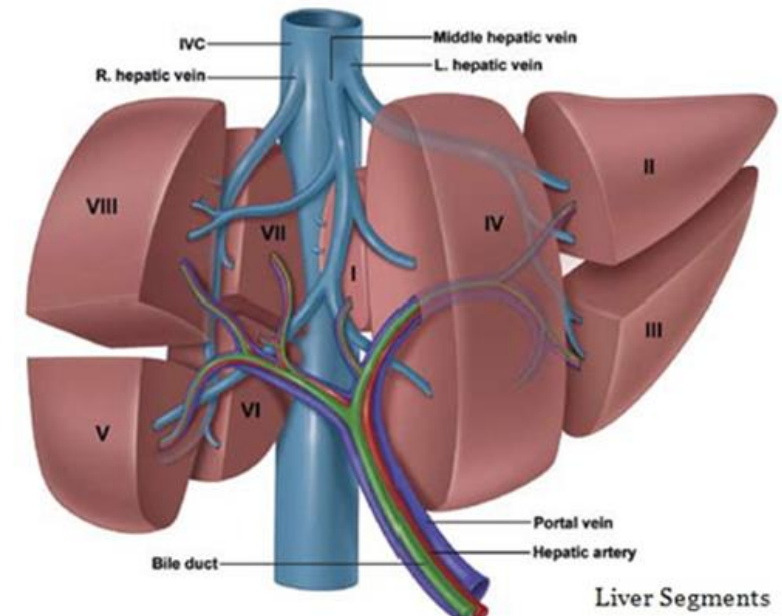
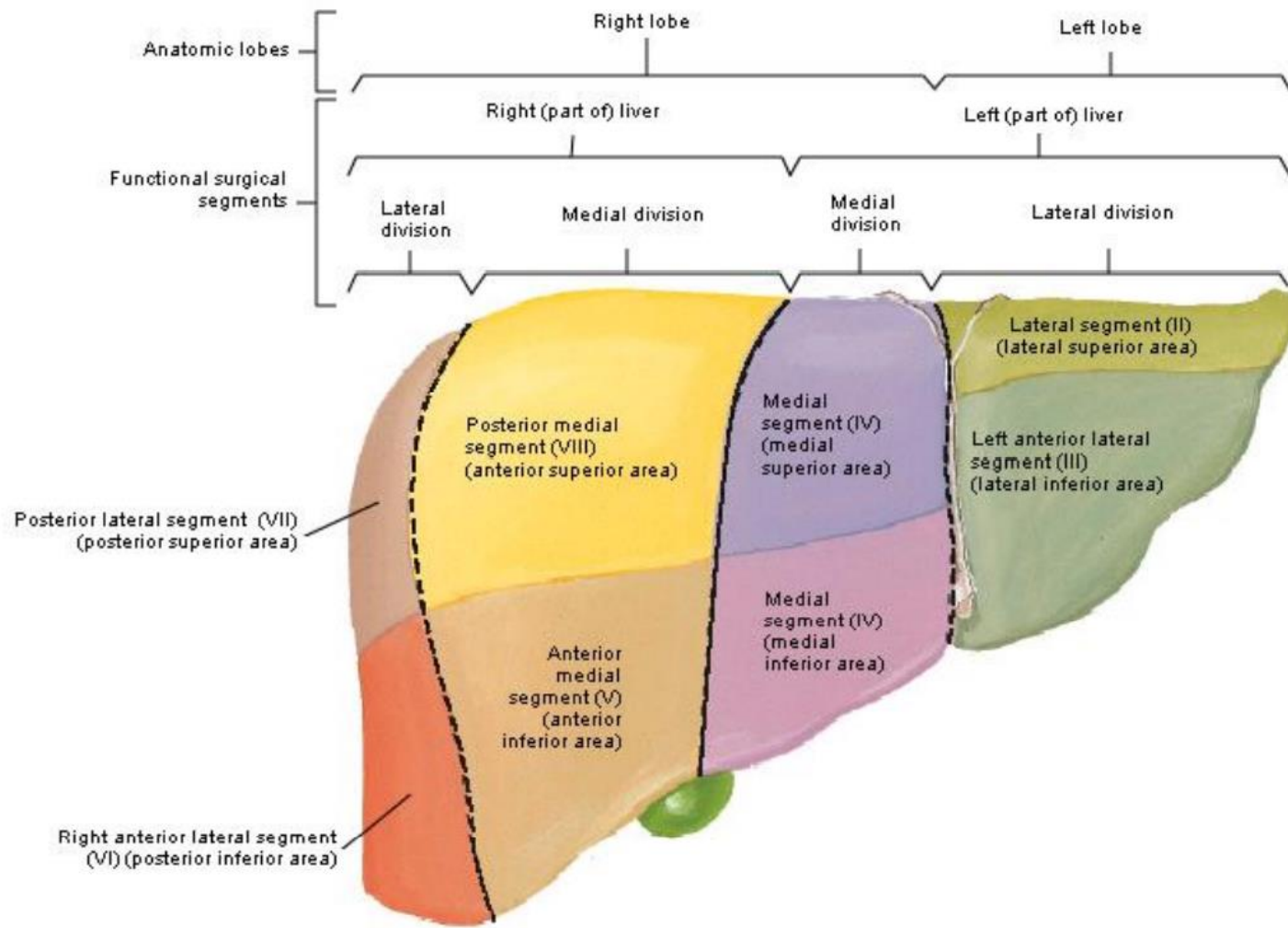
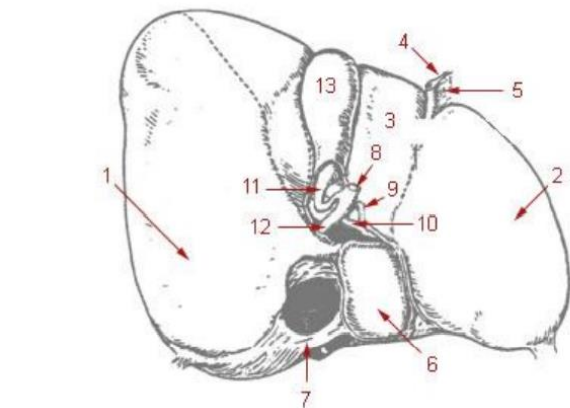
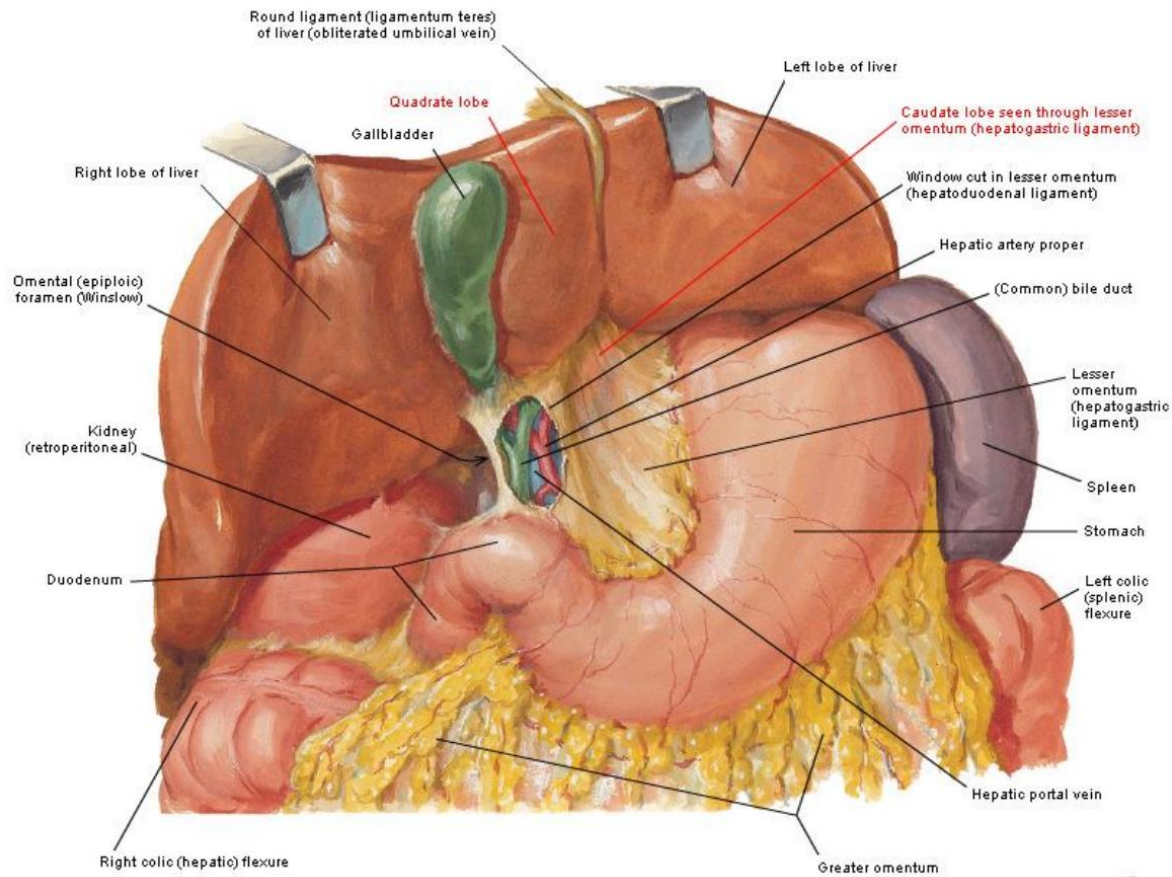


Fig. 5.17 Attachments of the parietal peritoneum to the posterior abdominal wall.

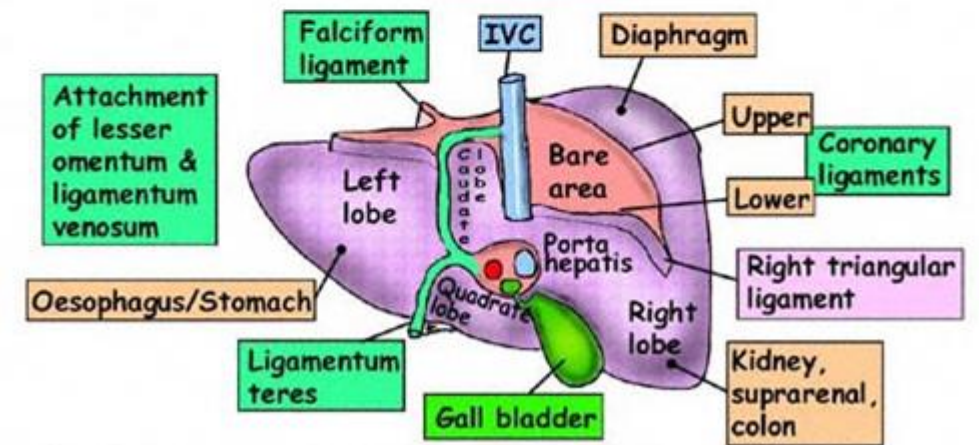
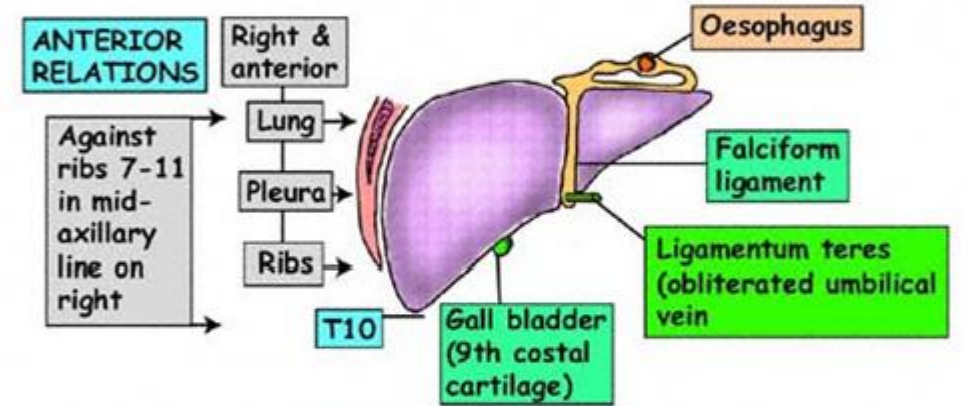




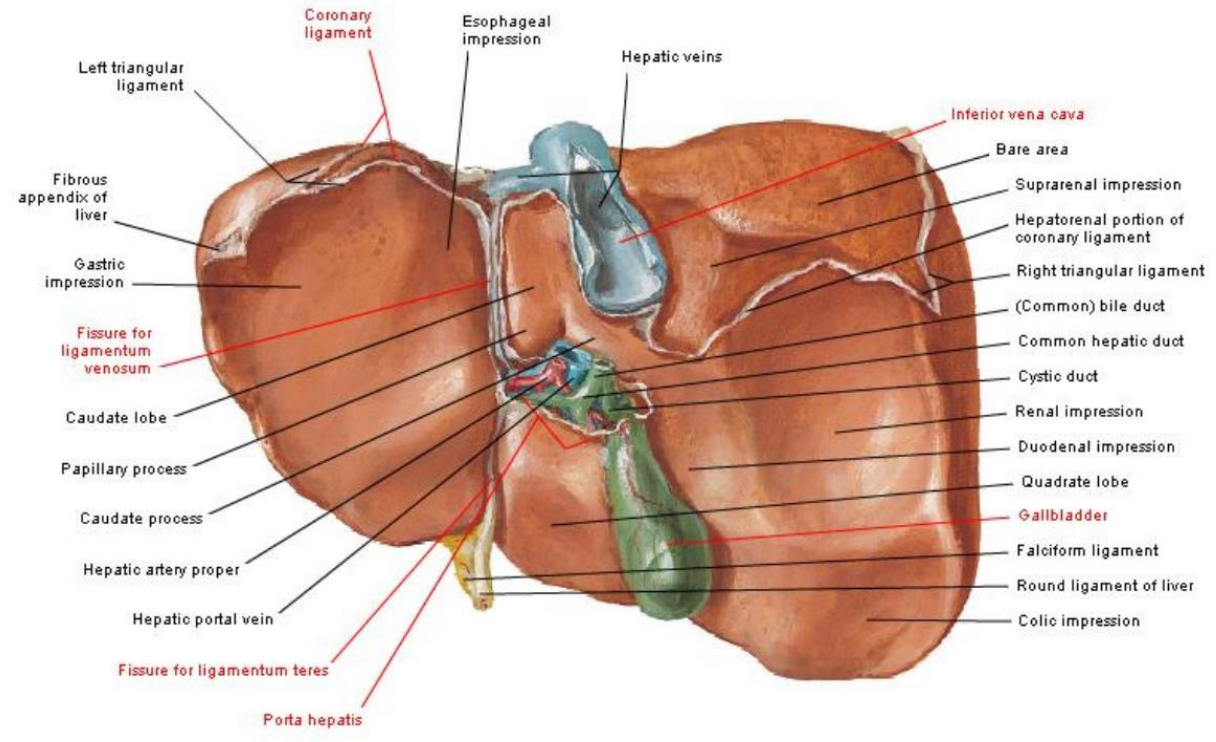
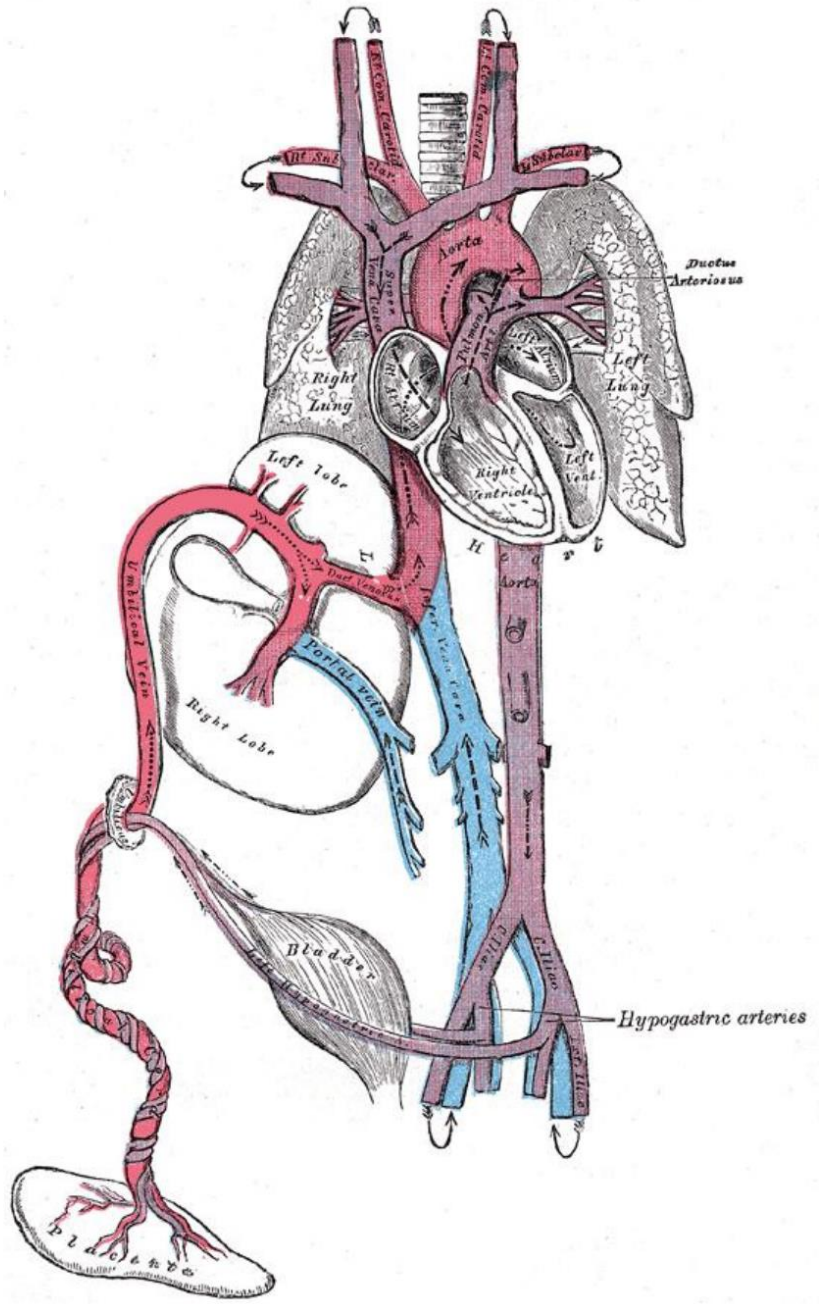
- 1: [Right lobe of liver](#)
- 2: [Left lobe of liver](#)
- 3: [Quadrato lobe of liver](#)
- 4: [Round ligament of liver](#)
- 5: [Falciform ligament](#)
- 6: [Caudate lobe of liver](#)
- 7: [Inferior vena cava](#)
- 8: [Common bile duct](#)
- 9: [Hepatic artery](#)
- 10: [Portal vein](#)
- 11: [Cystic duct](#)
- 12: [Hepatic duct](#)
- 13: [Gallbladder](#)

LIVER - GENERAL DESCRIPTION

- Wedge shaped
- largest organ in body
- Weight 1500g
- 1500 blood flow per minute (30% of cardiac output)
- Lies: Right-6-10 ribs/costal cartilages; Left-6-7 costal cartilages
- Surfaces: anterior, superior, posterior, right - all smooth/convex
Postero-inferior (visceral) concave & features ++
- Supports: IVC & hepatic veins (+ ligamentum teres & peritoneum)
- Nerve supply: Right vagus via coeliac ganglia, left directly to porta hepatis. Sympathetics on vessels
- Reaches: T5 vertebra, nipples (5th intercostal space), xiphisternal joint



INFERIOR SURFACE SEEN FROM ABOVE

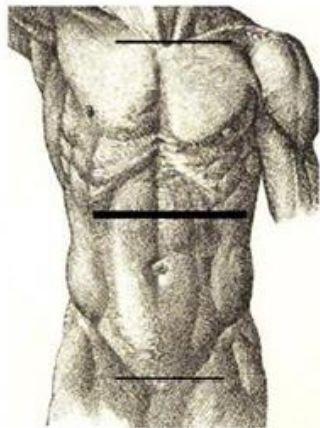


PRACTICE

- The portal vein divides into right and left branches in a “Y” shaped bifurcation in the porta hepatis
- The portal vein lies behind the common bile duct and hepatic artery in the hepatoduodenal ligament
- The common hepatic artery may arise from the superior mesenteric artery, in which case it runs behind the portal vein
- The falciform ligament provides structural support to the liver
- Phrenic vessels crossing the bare area provide oxygenated blood to the liver

L1: THE TRANSPYLORIC PLANE

TRANSPYLORIC PLANE



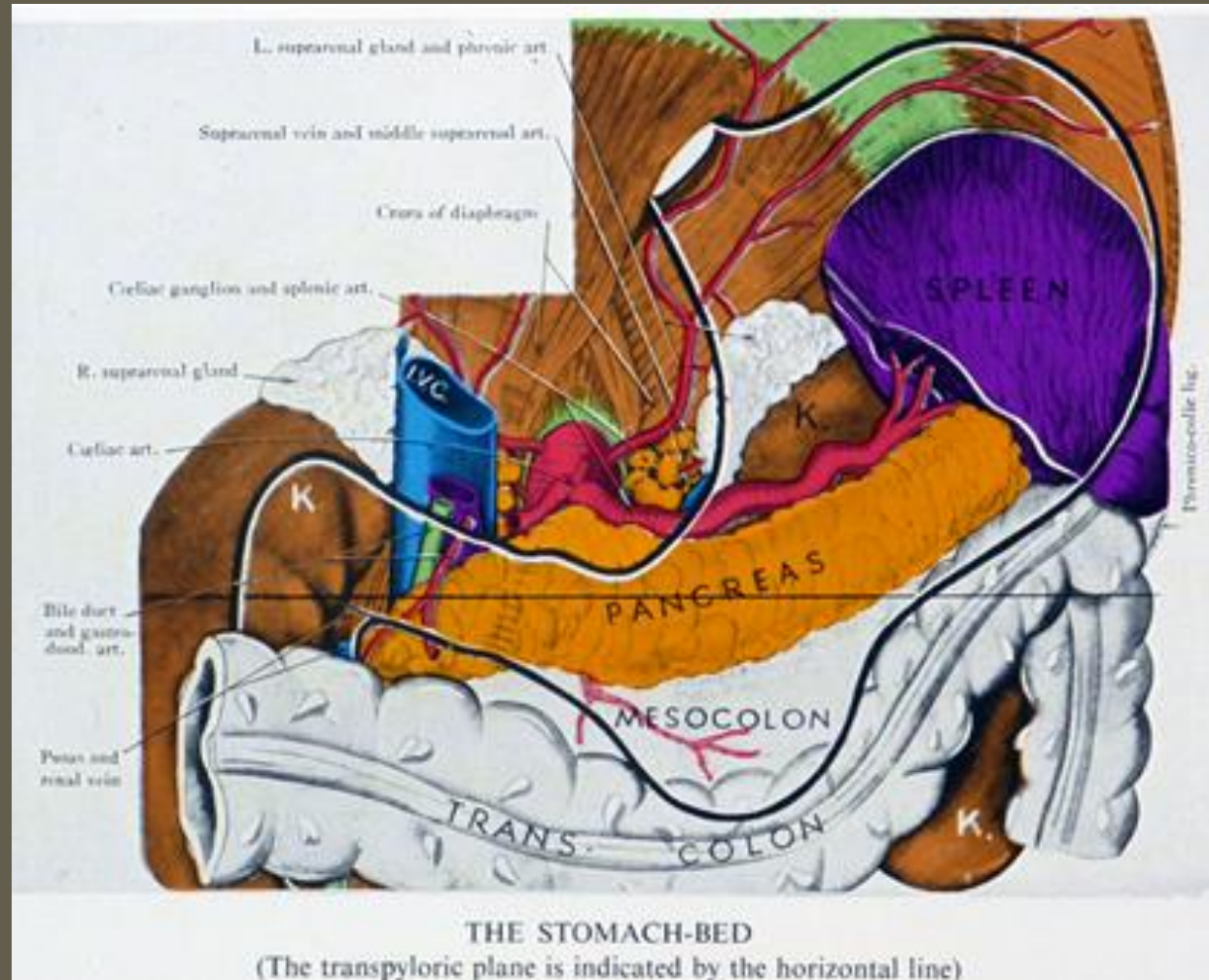
Suprasternal notch (T2/3)

Transpyloric plane (L1)
(1/2 way between)

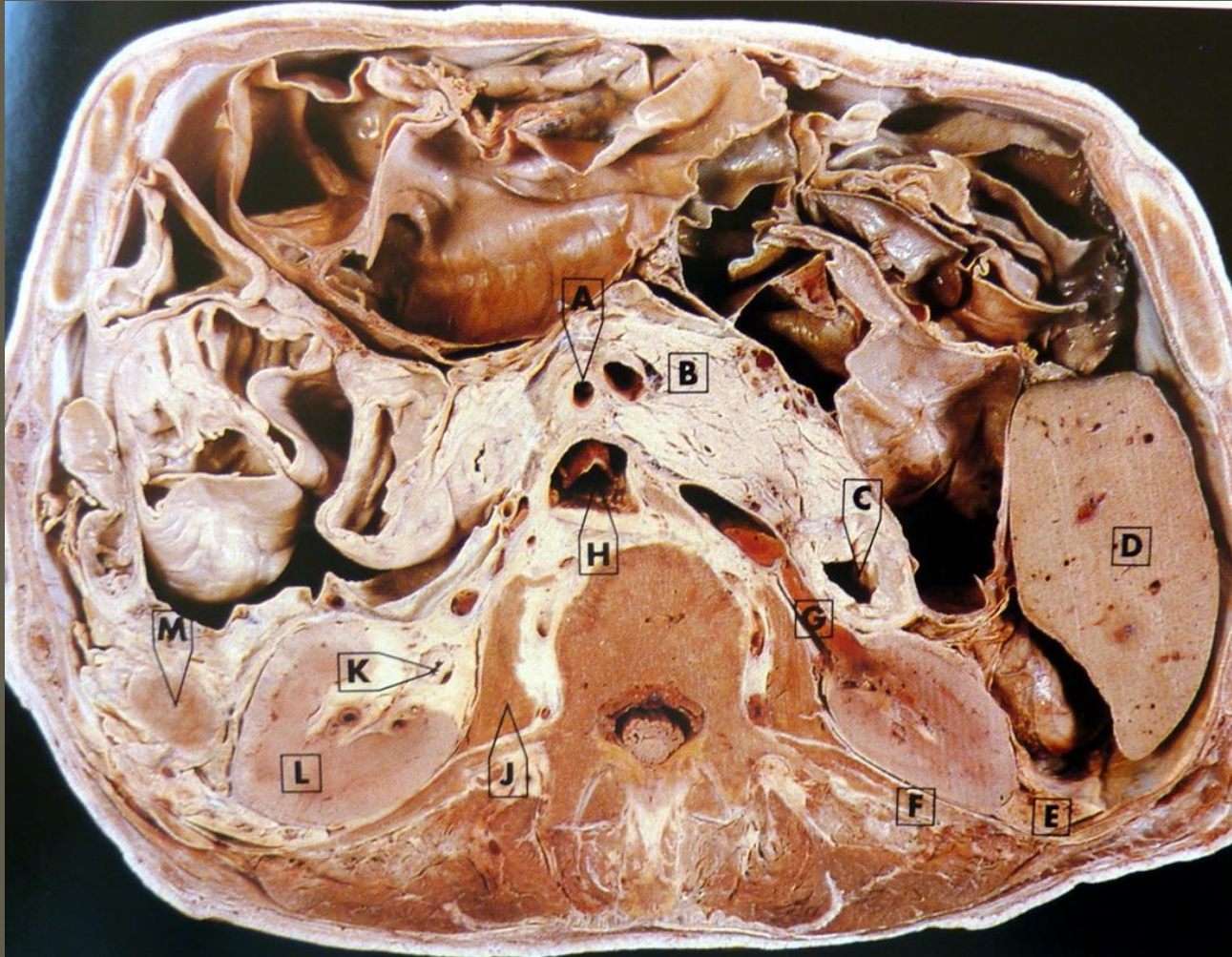
Pubic symphysis

On transpyloric plane

- L1 vertebra
- Pylorus
- Hila of kidneys
- Duodenojejunal flexure
- Fundus of gall bladder
- Neck of pancreas
- Origin of portal vein
- Transverse mesocolon
- 2nd part of duodenum
- Origin of superior mesenteric artery
- Hilum of spleen
- 9th costal cartilage
- End of spinal cord (just below)



PRACTICE SPOT



1. What is the origin of A?
2. Name the tissue that surrounds L
3. What is the fascia surrounding L continuous with?
4. What is the termination of K?

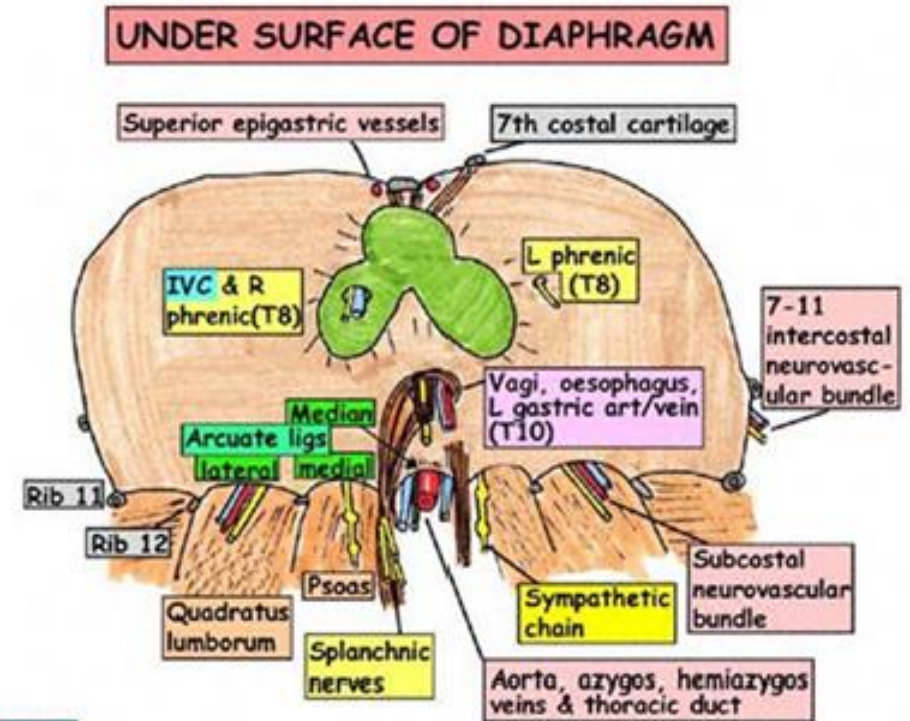
STRUCTURES LEAVING / ENTERING VIA THE DIAPHRAGM

5 arcuate ligaments – structures going under each

Spinal levels – T8, T10, T12

Right crus passing around oesophagus (part of sphincter mechanism)

Almost everything you need to know is in this Instant Anatomy schematic ->



Origin:

Vertebral - Right crus (L1,2,3), left crus (L1,2), 5 arcuate ligaments
Sternal - Xiphoid Costal - Rib & costal cartilages 7-12

Insertion:

Central tendon (trefoil-1 ant, 2 post, fused with pericardium)

Action:

Inspiration - 70% at rest (5cm of movement)

Less % on exertion (10cm movement)

Straining - Outlet of chest is fixed to raise intra-abdominal pressure

Nerve supply:

Phrenic nerves - C3,4,5. 1/3 sensory, 2/3 motor. Diaphragm has no other motor supply

Blood:

Outer - lower 5 intercostals & subcostal arteries

Inner - Inferior phrenic (aorta), musculophrenic/pericardiophrenic (internal thoracic)

STOMACH

Parts and their features (overlap)

Relations, stomach bed

Blood supply and venous drainage,
innervation, lymphatics

Landmarks e.g. prepyloric vein

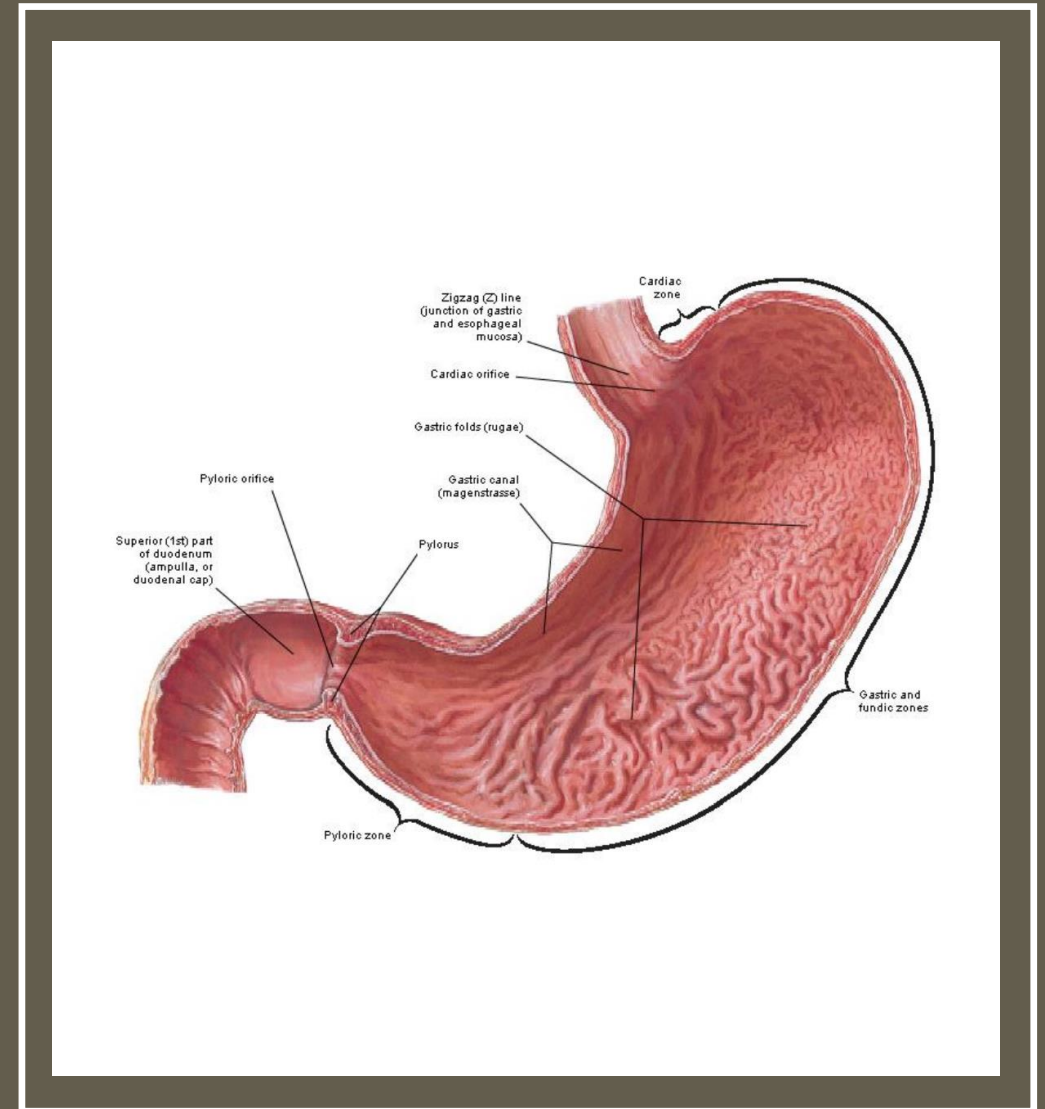
Internal features, incl histological

Muscular layers

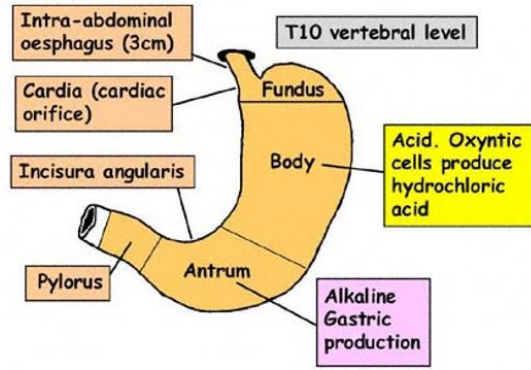
Embryology, rotation for orientation (e.g.
anterior and posterior vagal trunks)

Oesophagogastric junction – why it's an
effective sphincter

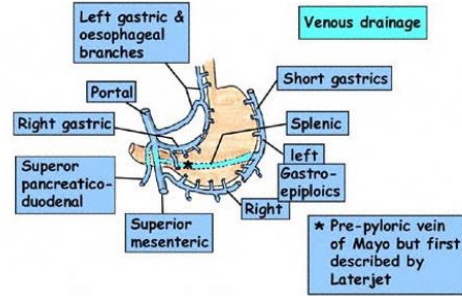
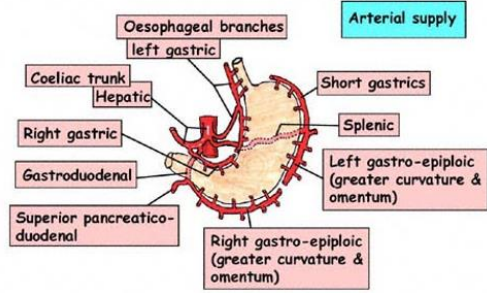
Greater and lesser curvatures and their
connection to the greater and lesser
omentum



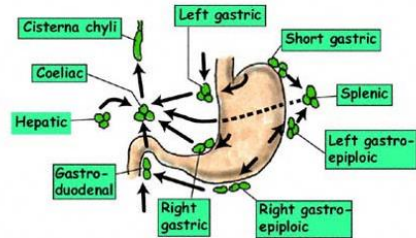
STOMACH - TOPOGRAPHY & OESOPHAGOGASTRIC JUNCTION



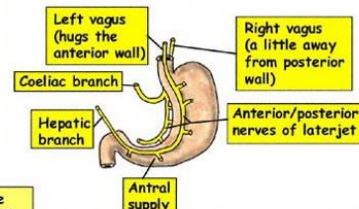
STOMACH - BLOOD SUPPLY & VENOUS DRAINAGE



STOMACH - LYMPHATIC DRAINAGE & NERVE SUPPLY



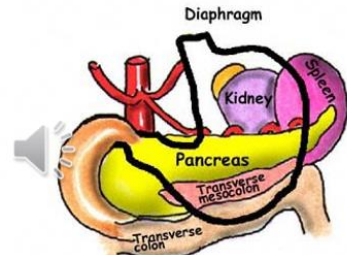
Sympathetics
Greater splanchnic nerves (T5-9) for decreasing motility, vaso-constriction, closing pylorus & sensation



Vagus nerves are 80% sensory, 20% motor for increasing motility, opening pylorus & initiating secretions

Note: Highly selective vagotomy destroys vagus to fundus & body but preserves nerve to antral pump

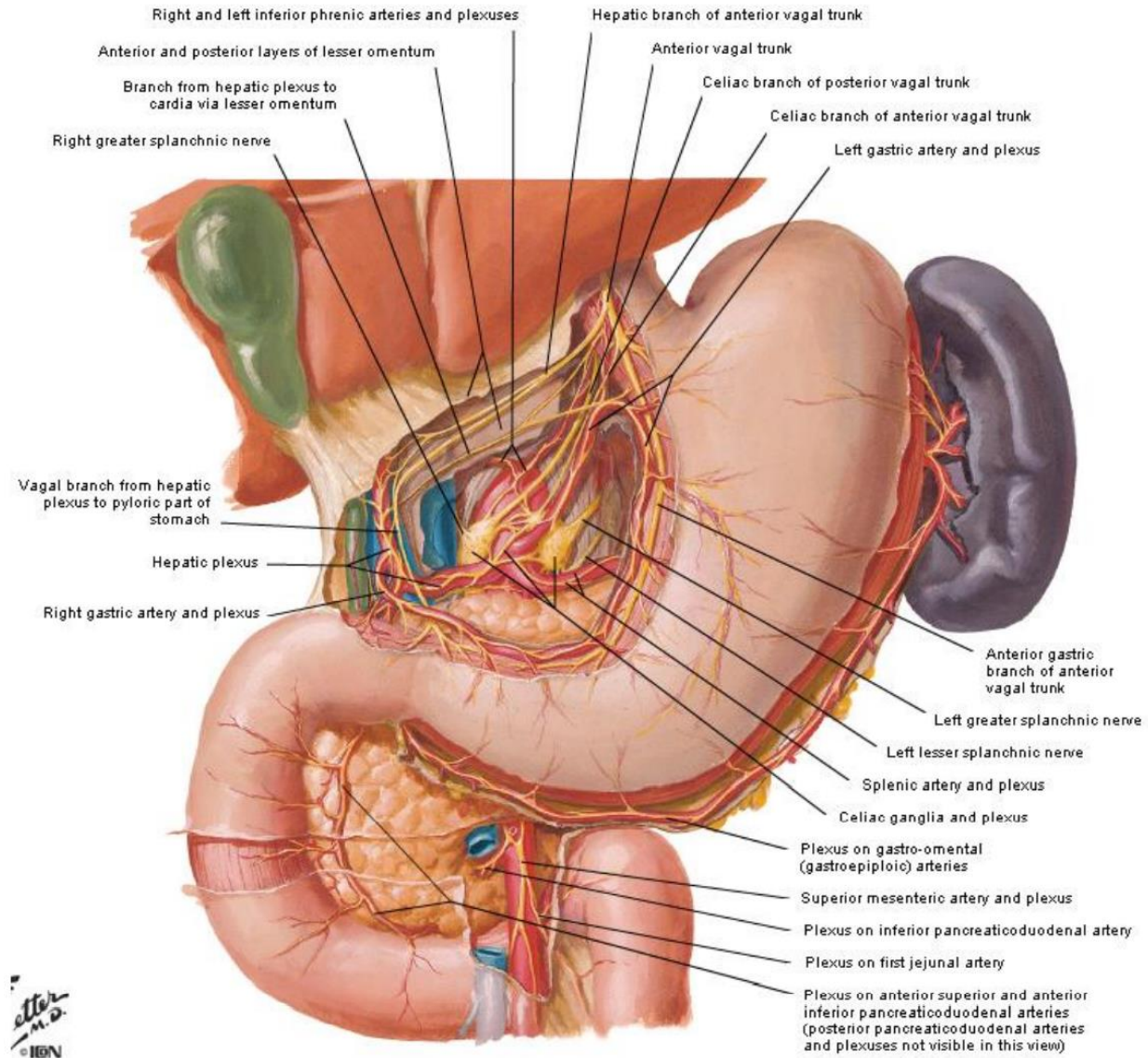
STOMACH - RELATIONS



ANTERIOR
Abdominal wall
Left costal margin
Diaphragm
Left lobe of liver

POSTERIOR
Lesser sac
Pancreas
Transverse mesocolon
Transverse colon
Left kidney/suprarenal gland
Spleen/splenic artery

SUPERIOR
Left dome of diaphragm

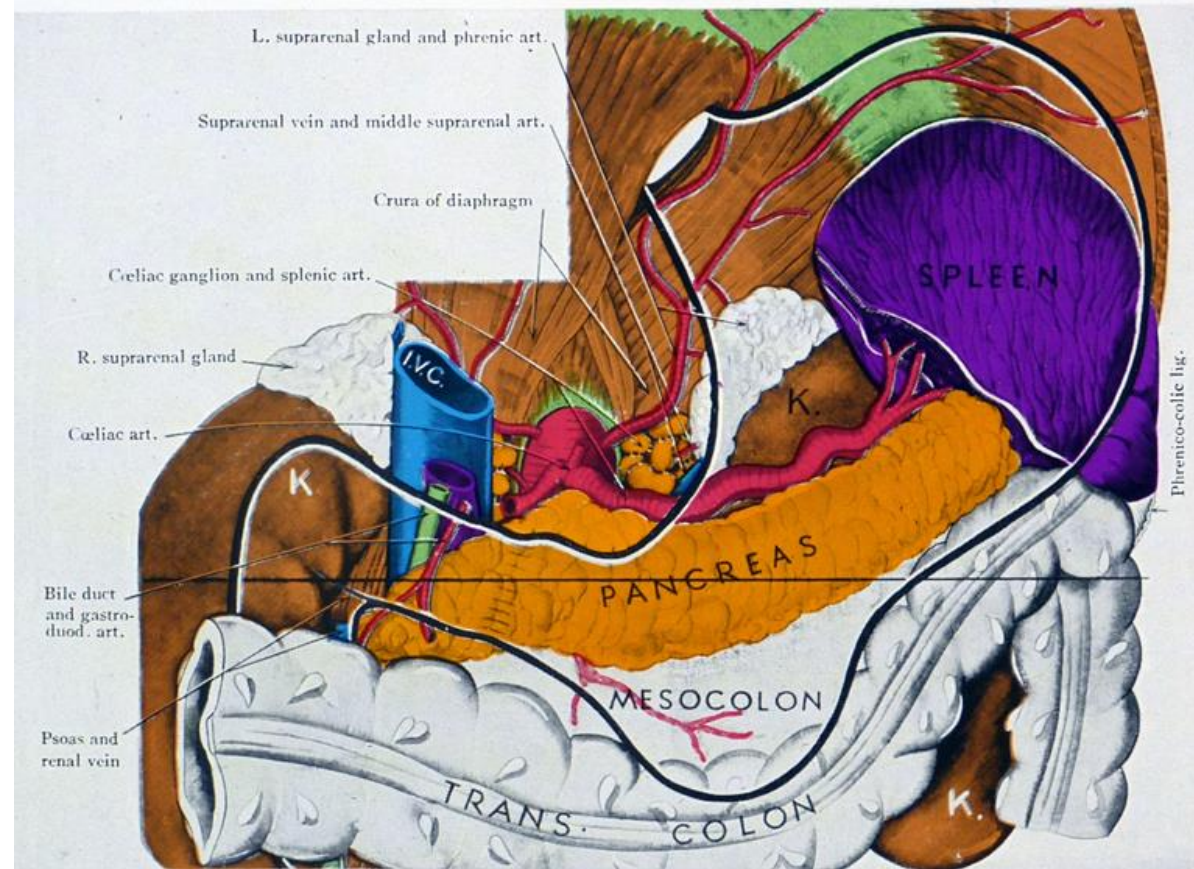


etter
M.D.
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STOMACH BED

Bed is covered by the peritoneum of the posterior wall of the lesser sac

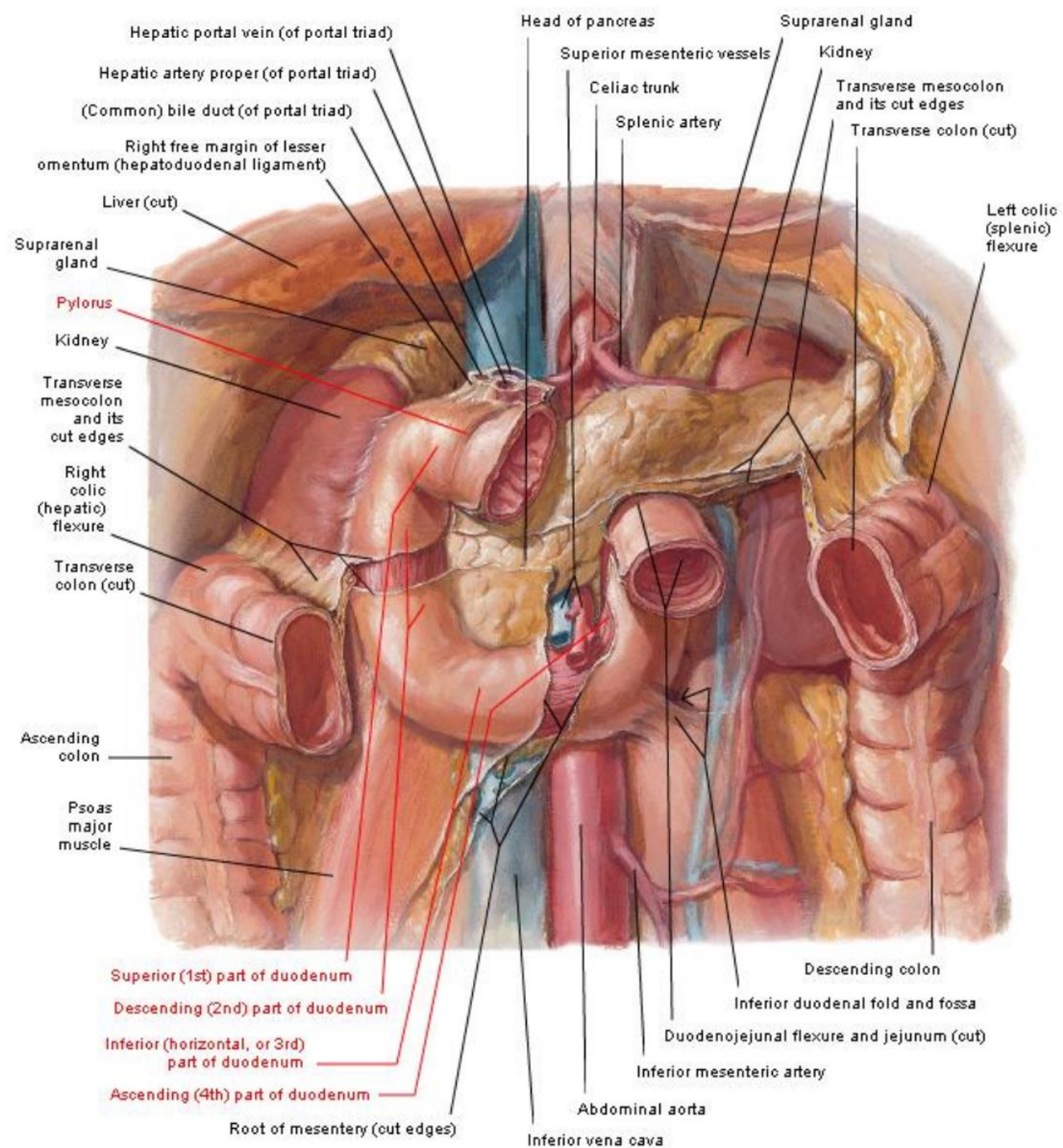
- Left crus
- Left dome of the diaphragm
- Upper part of the left kidney
- Left adrenal gland
- Pancreas
- Splenic artery
- Spleen laterally
- Transverse mesocolon
- Aorta and coeliac trunk just to the right of the lesser curvature (with coeliac ganglia and lymph nodes)

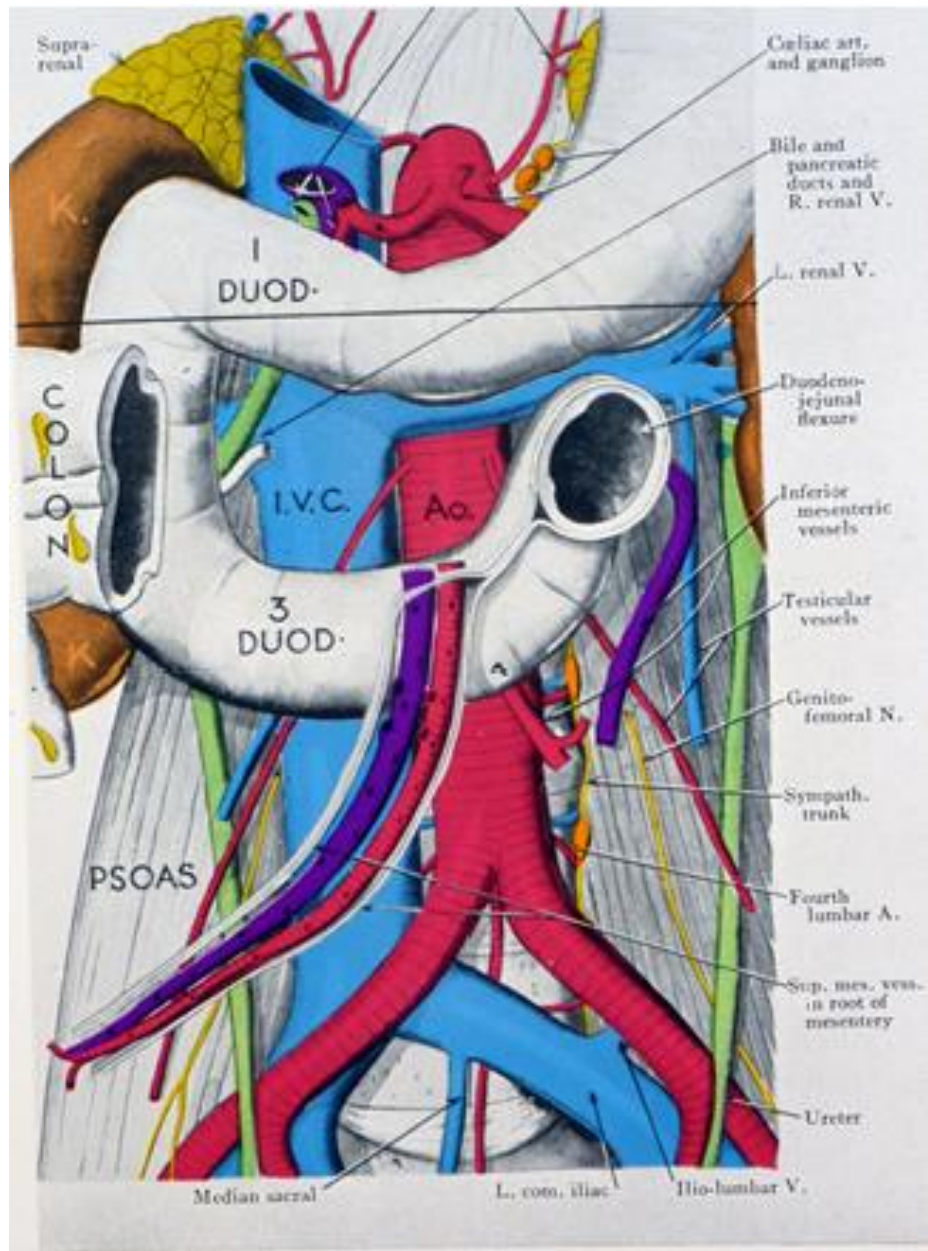


THE STOMACH-BED
(The transpyloric plane is indicated by the horizontal line)

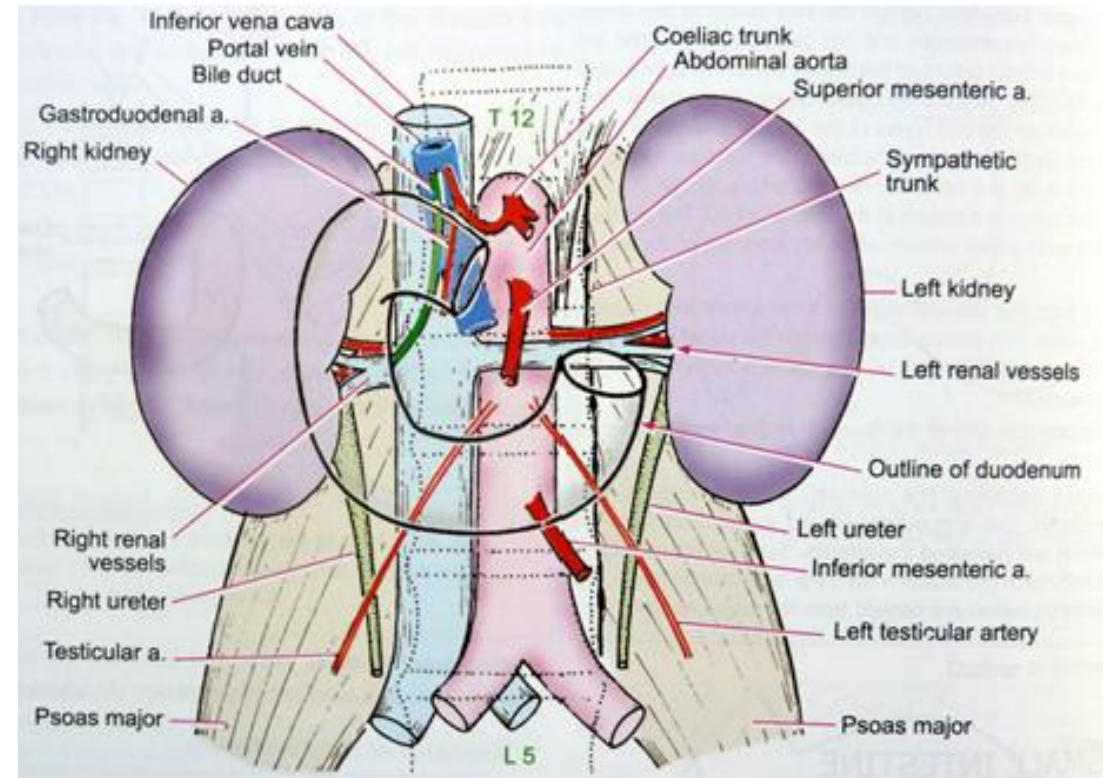
DUODENUM

- Four parts – 5, 7.5, 10, 2.5cm in length
- First 2.5cm is intraperitoneal
- Relations – head of pancreas, SMA, SMV, etc.
- Landmarks, spinal levels
- Ligament of Treitz
- Connections with the biliary system, ampulla of Vater
- Internal features, histology
- Superior, inferior, paraduodenal recesses





ROOT OF MESENTERY; AND POSTERIOR RELATIONS OF DUODENUM AND HEAD OF PANCREAS



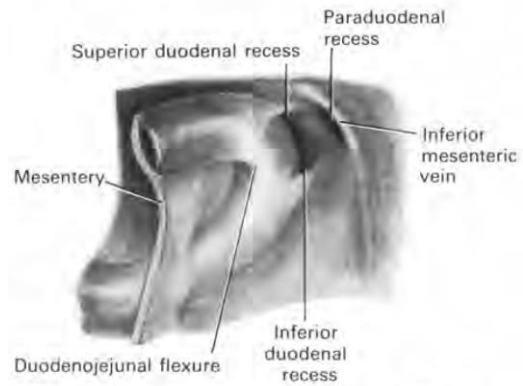
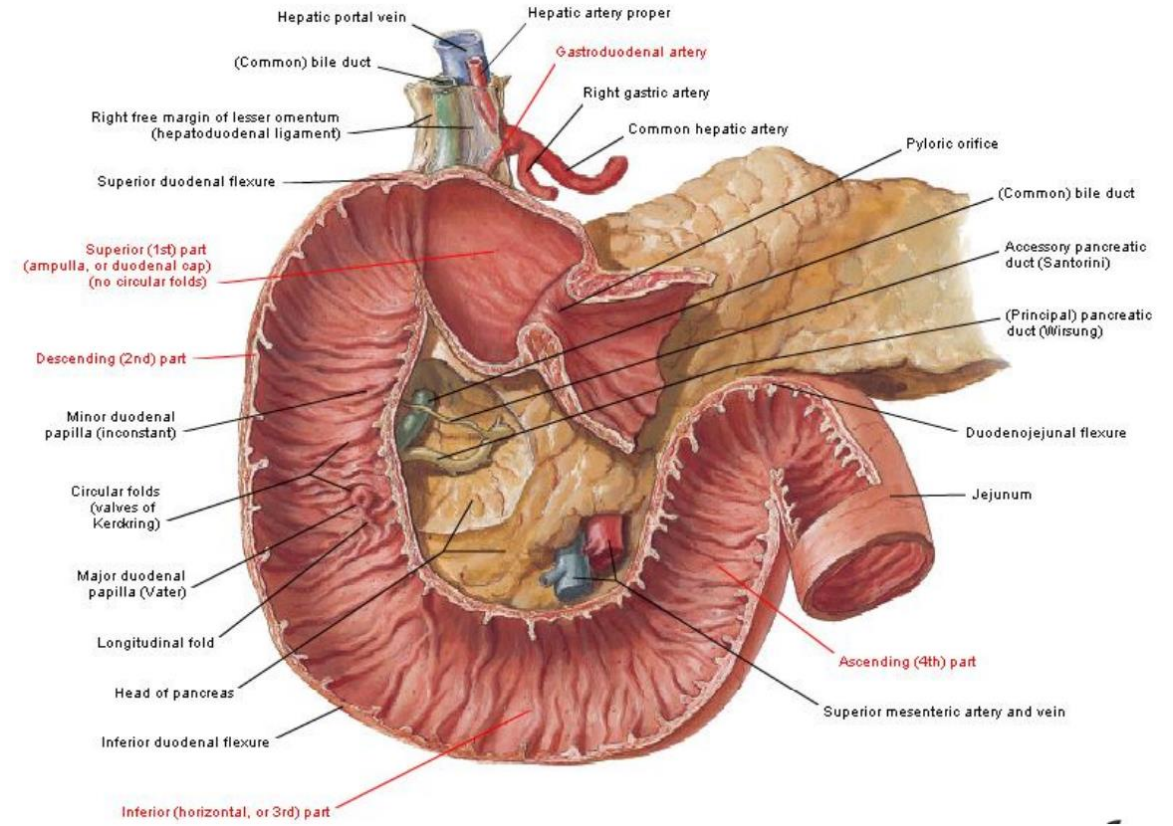
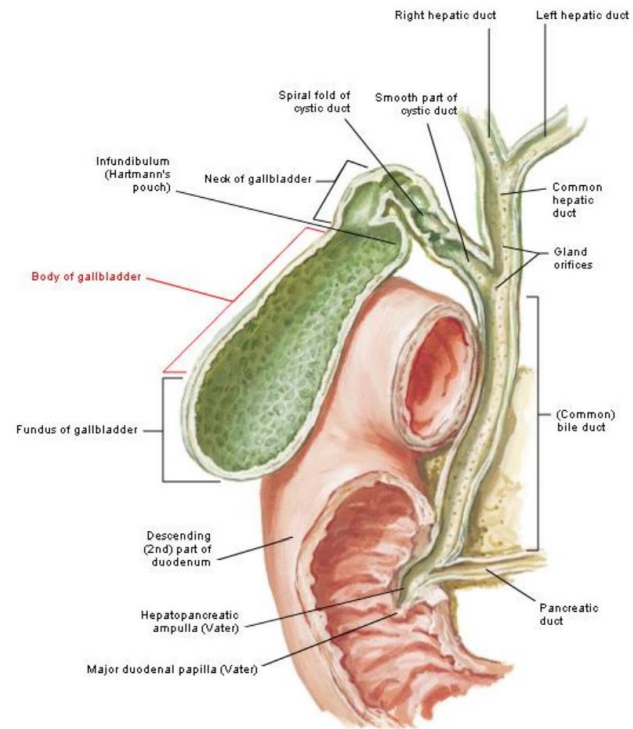


Fig. 5.31 Peritoneal recesses of the duodenum. They are only occasionally present. **The paraduodenal recess has the inferior mesenteric vein at the front of its opening.**







JEJUNUM AND ILEUM

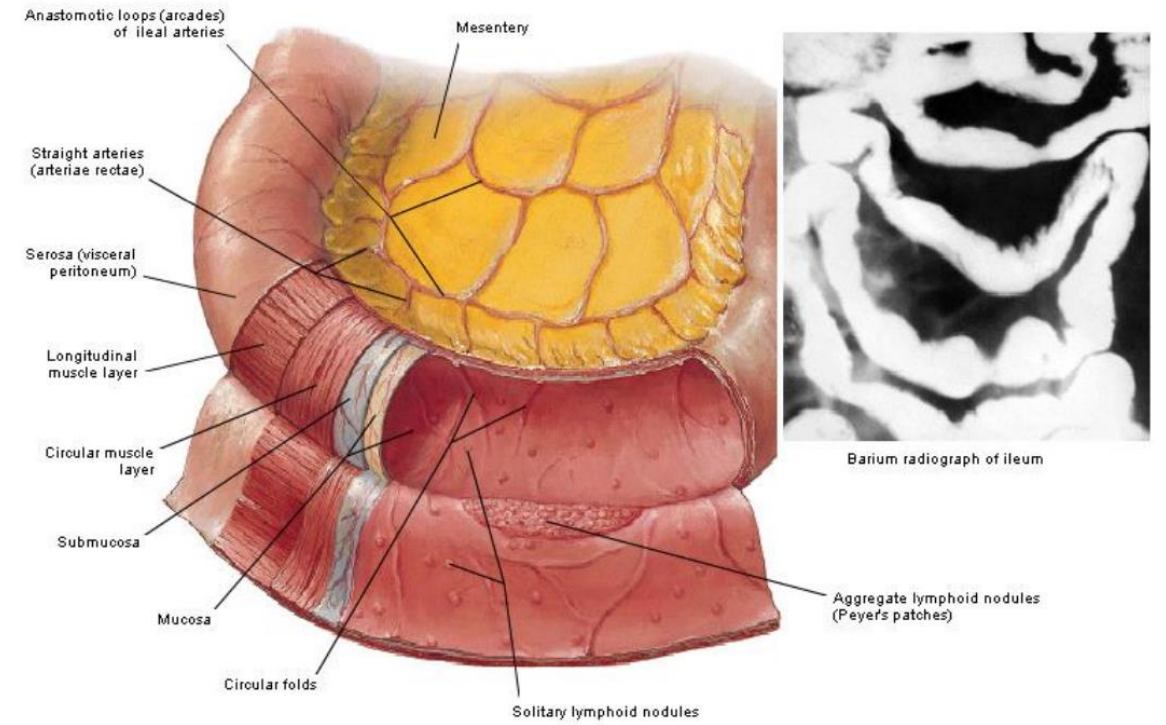
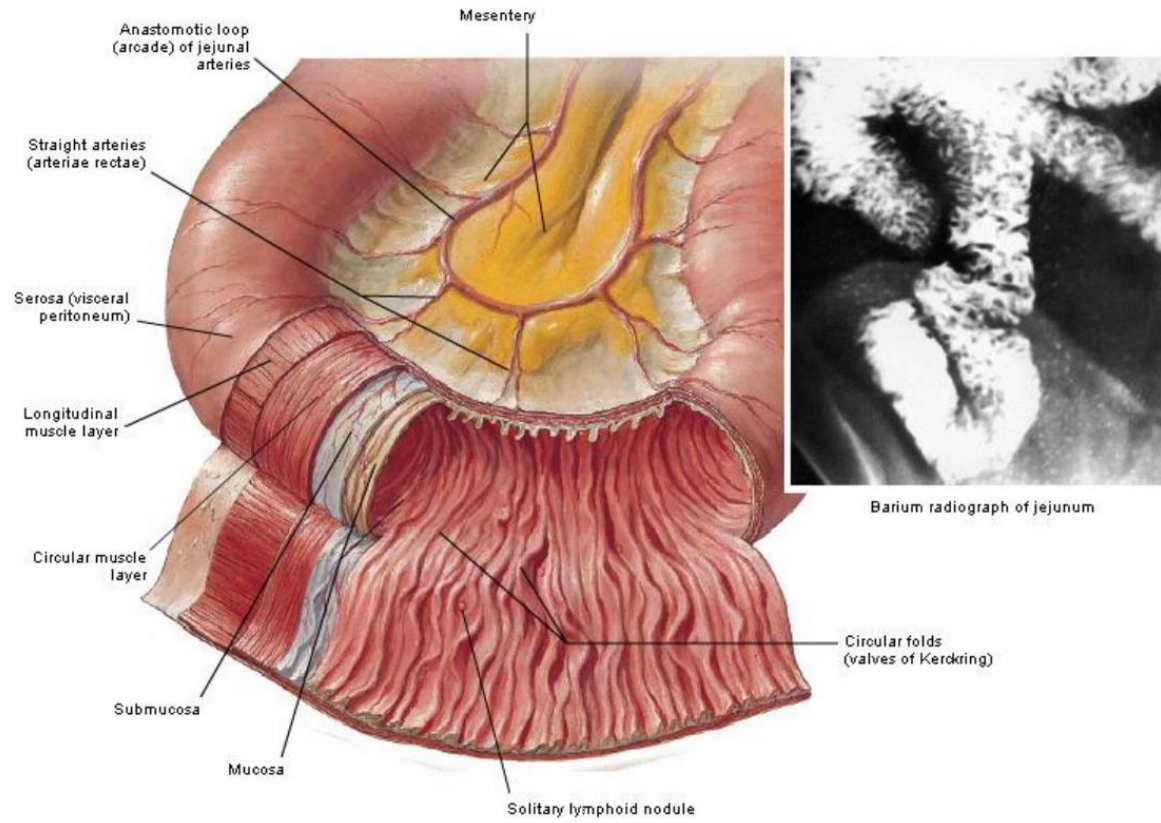
- As always, blood supply, venous drainage, innervation, lymphatics
- Differences in features of the jejunum and ileum
- Histological features and zones of transition
- Muscular layers
- Myenteric plexus
- Meckel's diverticulum – rule of 2s

SMALL INTESTINE

- Average length 6 metres (24 feet)
- Range 3-10 metres (10-33 feet)
- Patients can survive with 2/3 removed. Little if any effect by removing 1/3

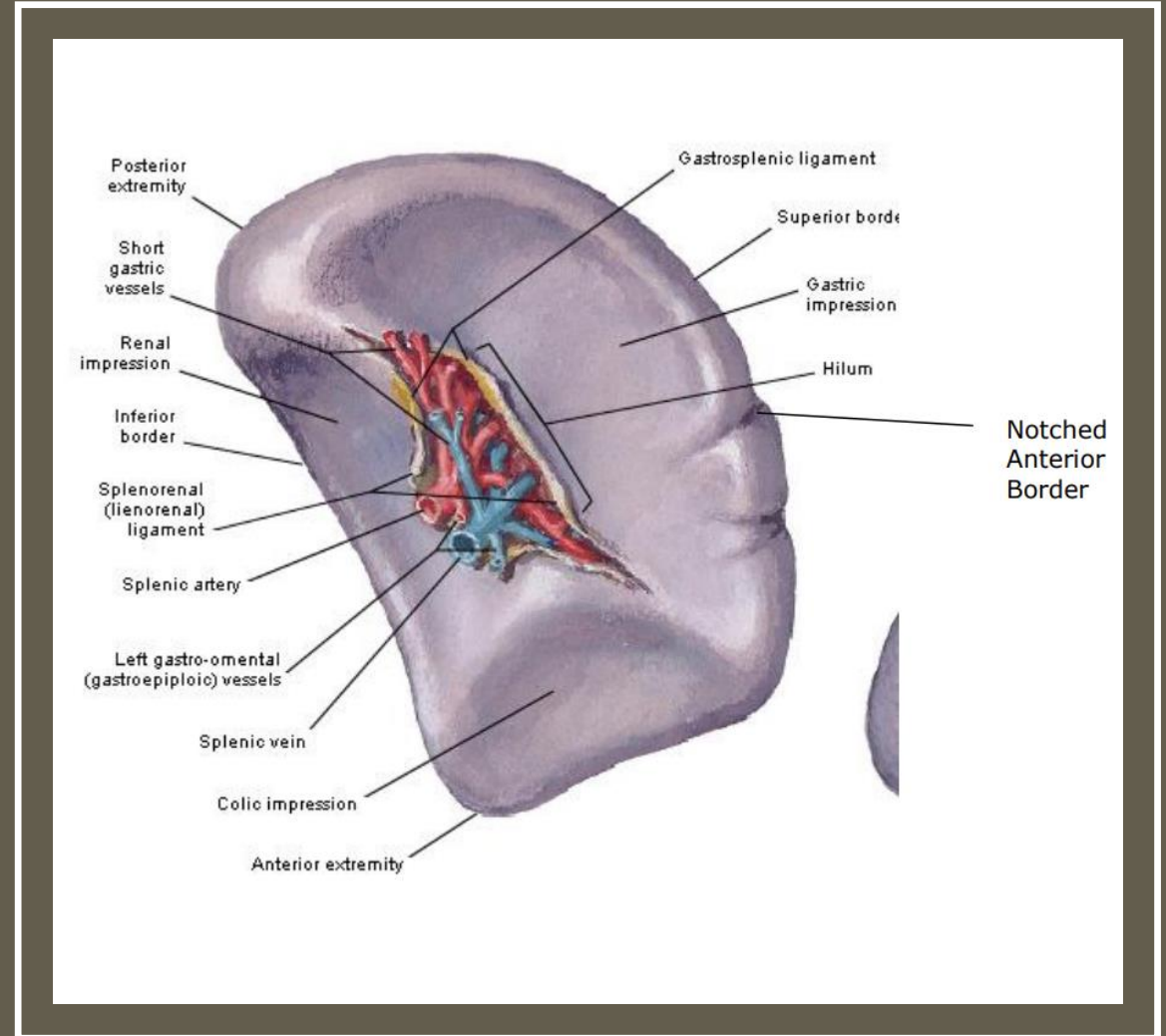
	JEJUNUM	ILEUM
General	2/5, red, wide bore, thick wall	3/5, pink, narrow bore, thin wall,
Macroscopic	Valvulae conniventes, plicae circulares ++, sparse arcades 	Smooth wall, Peyer's patches, multiple arcades 
Mesentery	Lies superiorly, attached to left of aorta, less fat	Lies inferiorly, attached to right of aorta, fatty mesentery
Histology	Tall villi Long crypts 	Short villi Short crypts 

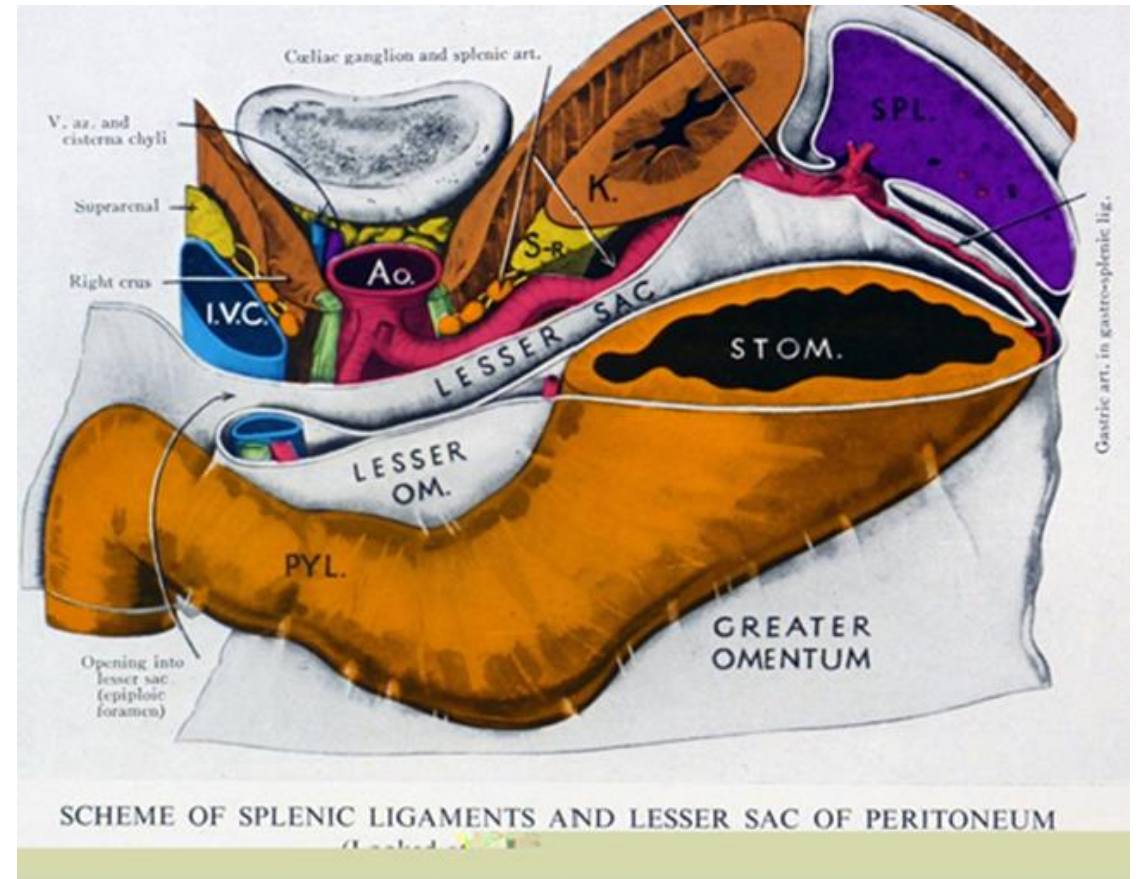
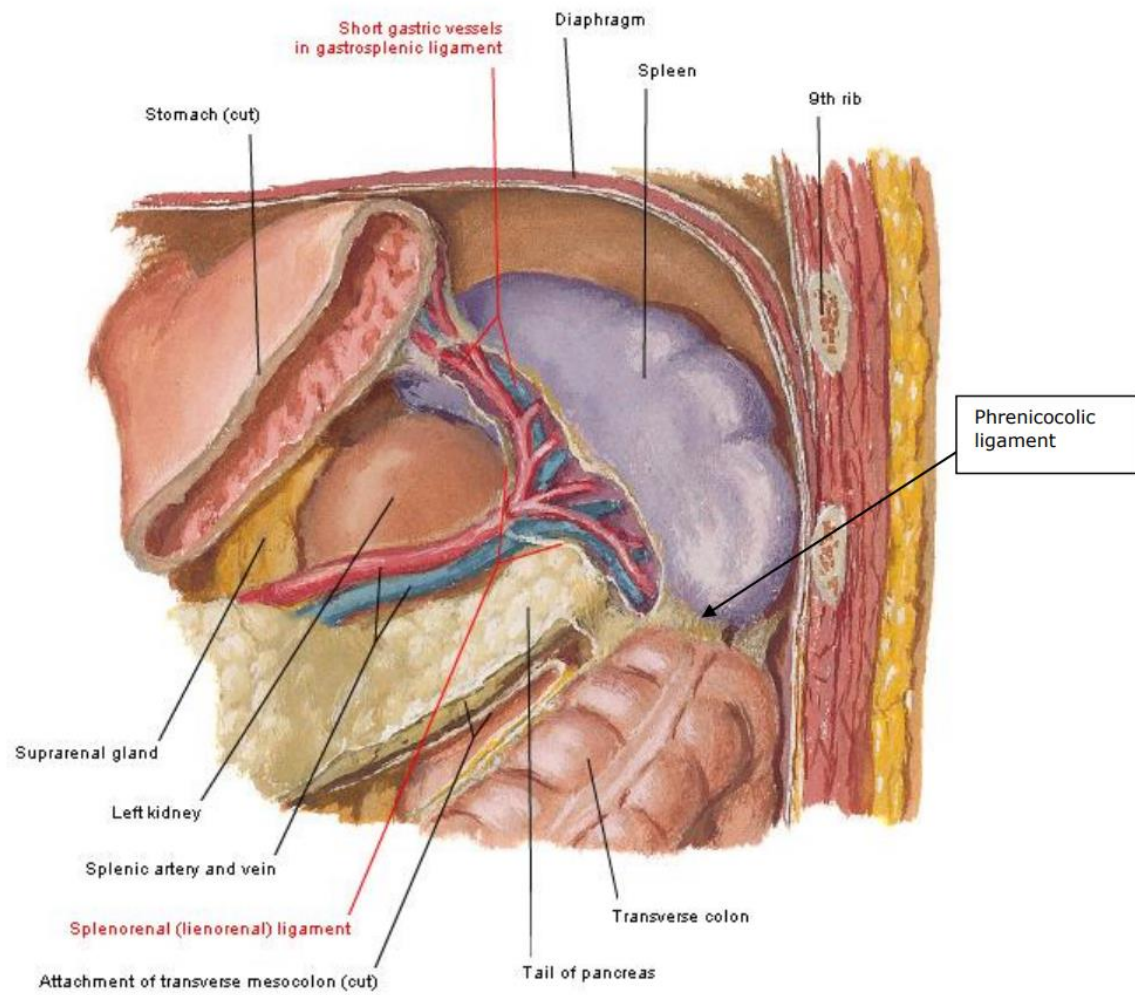
Note: At base of crypts are Paneth cells that produce lysozyme



SPLEEN

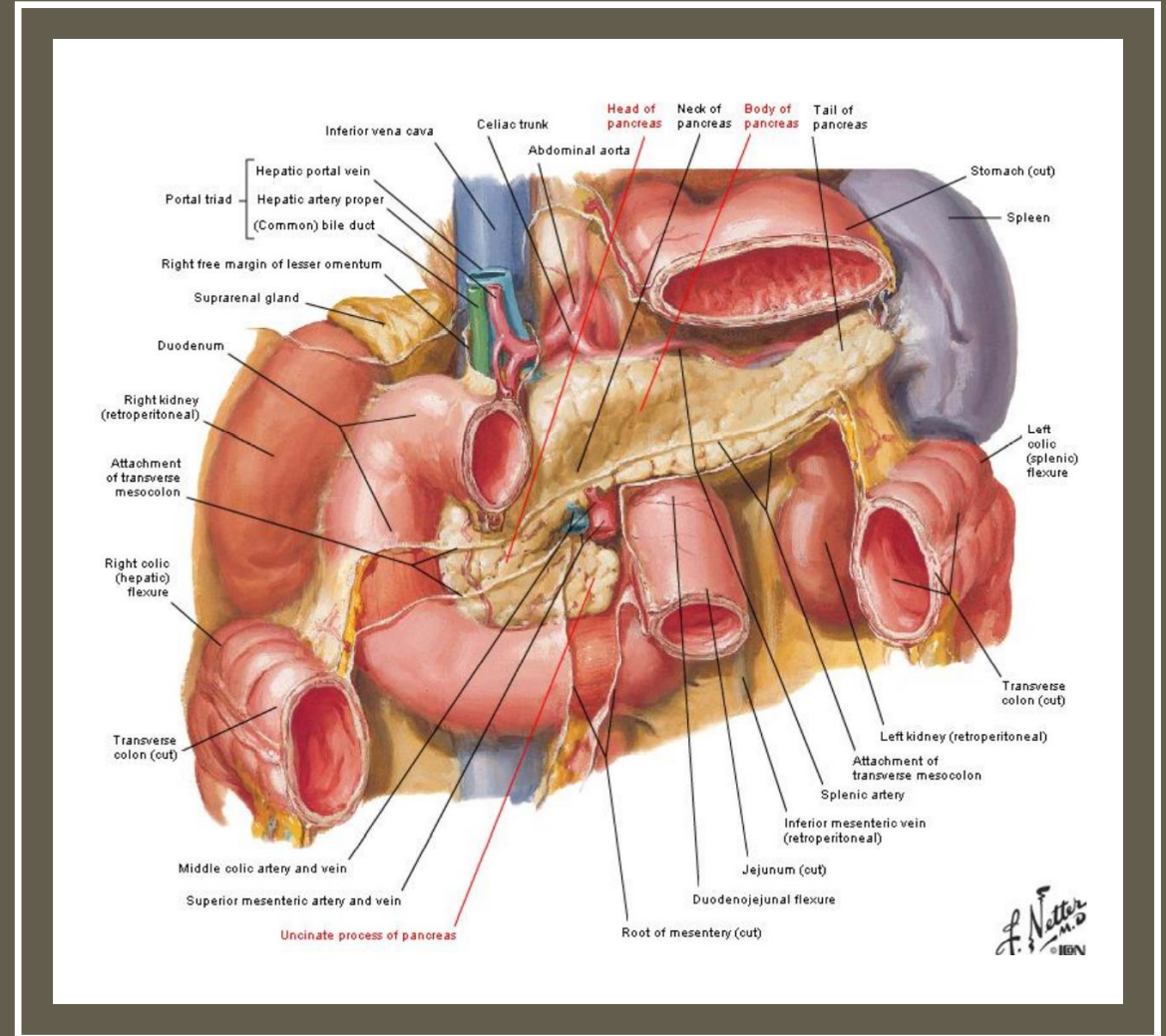
- Surface anatomy, impressions, notch, landmarks
- “1, 3, 5, 7, 9, 11”
 - 1x3x5 inches
 - 7 oz
 - Ribs 9-11
- Relations
- Blood supply, venous drainage, innervation, lymphatics
- Reticuloendothelial system, histology
- Capsule
- Lienorenal and gastrosplenic ligaments, contents





PANCREAS

- Composite gland – endocrine, exocrine
- 15cm
- Uncinate process, head, neck, body, tail – relations to each
- Peritoneum covering it is the posterior wall of the lesser sac
- Spinal levels – neck and body in TPP
- Blood supply, venous drainage, innervation (incl pain fibres), lymphatics
- Pancreatic duct ofWirsung and accessory duct of Santorini, ampulla of Vater, major and minor duodenal papillae
- Development – two separate buds, rotation and fusion



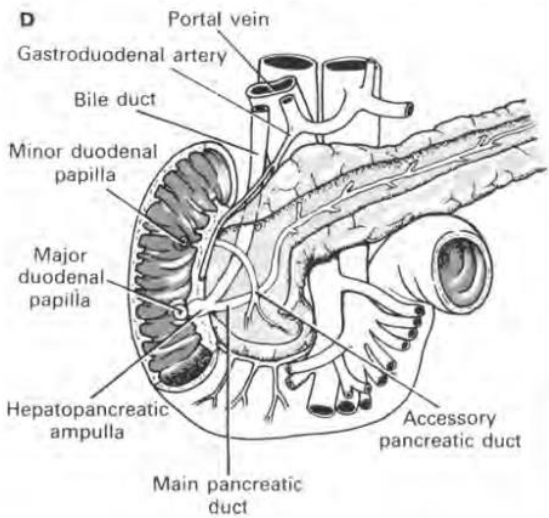
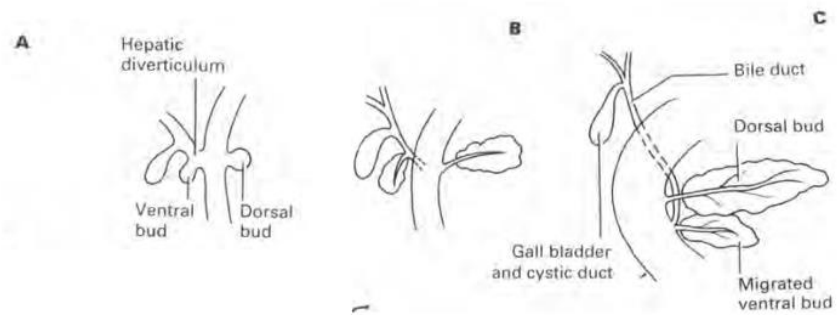
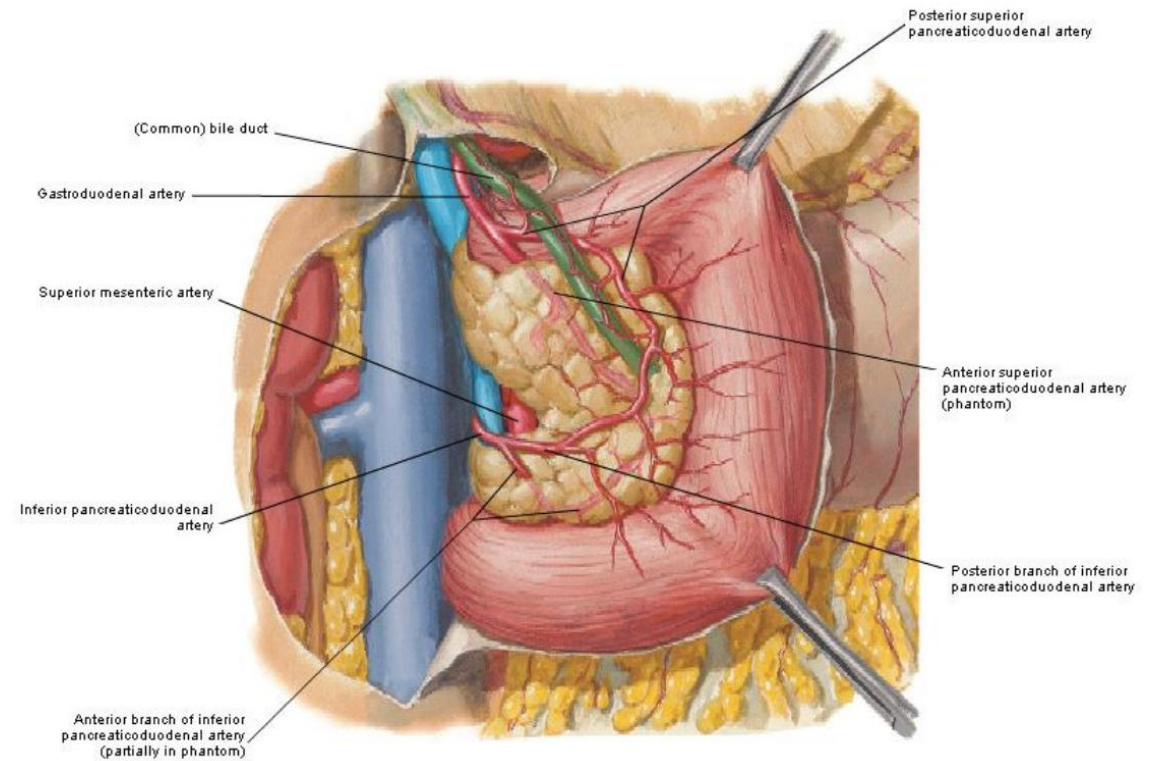


Fig. 5.41 Development of liver and pancreas. **A** The hepatic diverticulum and ventral and dorsal pancreatic buds. **B** The site of the original hepatic diverticulum and ventral pancreatic bud migrates dorsally, so that in **C** it comes to lie below the opening of the dorsal pancreatic bud. **D** The pancreatic duct systems anastomose and eventually the main pancreatic duct comes to be formed from the ventral bud duct and the distal part of the dorsal bud duct, and the proximal part of the dorsal duct becomes the accessory pancreatic duct.

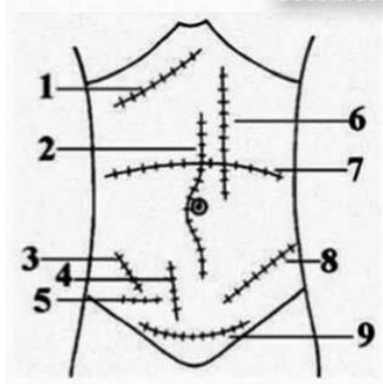


PRACTICE T/F

Regarding the relations of the pancreas:

- The tail lies within the lienorenal ligament, in contact with the splenic hilum
- The head lies in the concavity of the duodenum at L1
- The body is related to the left renal vein, aorta, left crus of the diaphragm and left psoas major
- It lies in both the supracolic and infracolic compartments
- The tail passes forward and to the left from the anterior surface of the left kidney
- The splenic vein and superior mesenteric vein coalesce behind the head of the pancreas to form the portal vein

...AND THERE'S MORE



- Innervation – splanchnics, sympathetics, parasympathetics, major ganglia, plexuses, patterns, etc.
- Caecum and appendix, large intestine, differences between small and large bowel (haustrations, taenia coli, histological, etc.)
- Gallbladder, biliary tree, Calot's triangle
- Kidneys, adrenals – blood supply, innervation, etc.
- Ureters – course, landmarks, imaging, blood supply
- Posterior wall and other retroperitoneal structures
- Common incisions: Kocher, midline, McBurney, Battle, Lanz, paramedian, transverse, Rutherford Morrison, Pfannenstiel
- Surgical approaches (less yieldy)



- Look at the RACS Anatomy syllabus (!)
- Last's, Last's, Last's (+/- Winter's notes)
- Netter, Rohen, Instant Anatomy, Langman's
- Dr Mundy's resources and practice exams – email her ASAP at julie.mundy@health.qld.gov.au
- Doing the bank is not enough (but do the bank!)
- Do questions first even though it hurts
- Basic embryology knowledge pays
- Cramming doesn't work – start early
- Reading is not studying (but do the reading)
- Dissection > USyd GSSE anatomy > Anatomy X, etc. > nothing
- Accept that there will be some weird questions
- Standard exam strategy – look at the weighting and apportion your time accordingly
- Make a study plan and stick to it
- Monitor your progress – be brutally honest with yourself
- Ignore the noise, do your own thing

MY TWO CENTS, FOR WHAT IT'S WORTH...

Physiology Self-assessment form – GSSE February 2021
Andrew Zimmerman

Topic	Self-assessment			Comments
	Poor	Moderate	Good	
Cell physiology				
Total body water		X		Ganong, Bank, Prakash Qs 1/3 is ECF, 2/3 is intracellular 60% of body weight in young male - Intracellular accounts for about 40% - ECF accounts for about 20% About 25% of the ECF is in the vascular compartment Exam Q: how many litres of NS would you have to administer to increase the plasma volume by 1L? A: 4L – NS is isotonic and will not go into the intracellular compartment, only the ECF. Plasma is in the vascular compartment, and only 25% of ECF is in that compartment. Therefore, if you transfuse 4L, 1L will stay in the vascular compartment (i.e. plasma) and 3L will diffuse into the interstitial fluid.
Cell membranes		X		Ganong, Bank, Prakash Qs
Gibbs Donnan effect			X	Ganong, Guyton, YouTube, Bank, Prakash Qs
Intra and extracellular ions			X	Ganong, Bank, Prakash Qs
Cell junctions		X		Ganong, Bank, Prakash Qs CAMs (cellular adhesion molecules) – four broad families: 1. Integrins: heterodimers that bind various receptors

THANK YOU

Good luck!