



PRE-CLINICAL MEDICINE

EXAM REVISION LECTURE

SERIES: #4

GASTROENTEROLOGY

PRESENTED BY AND IN COLLABORATION WITH MUGIS
(SPECIAL THANKS TO DR. VICTOR LIN, CHERRY SHI, AND SHAUN CHEW)



MUGIS

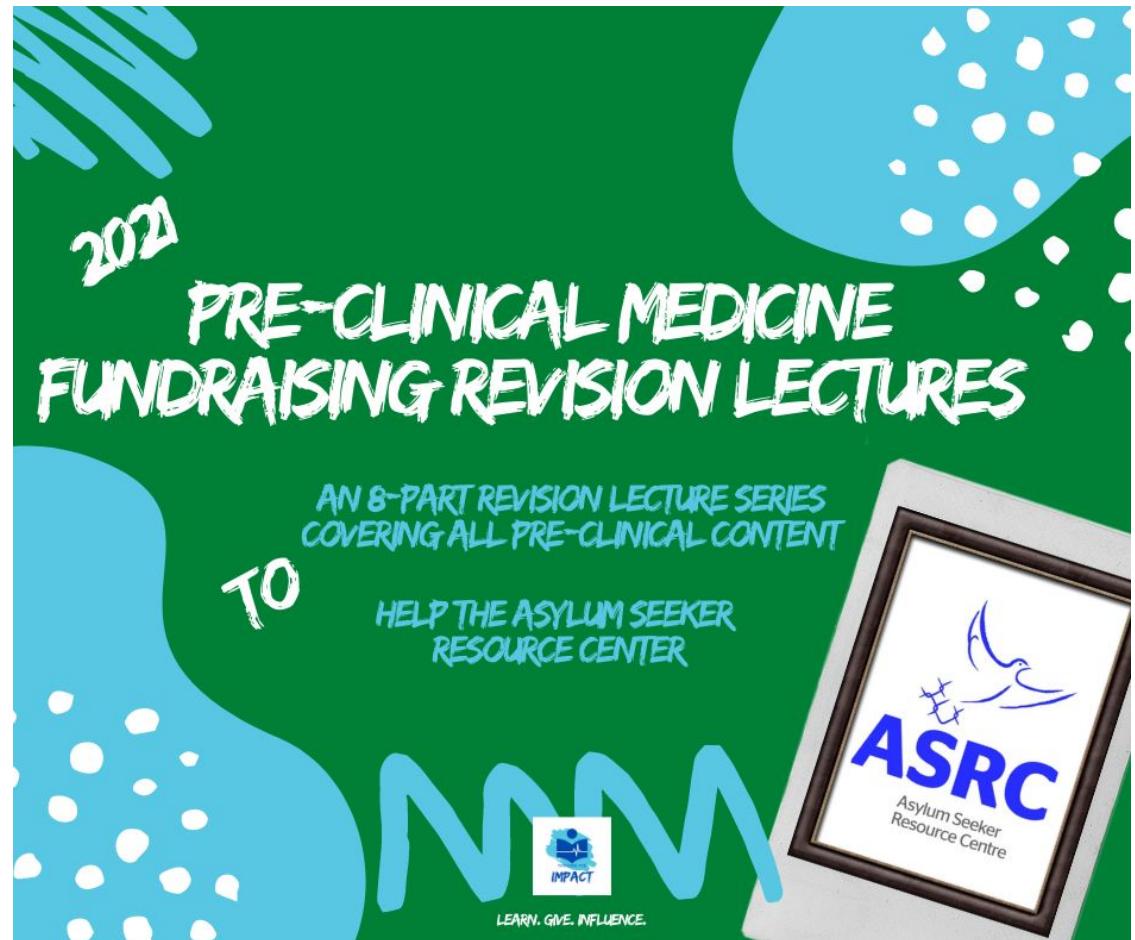
MELBOURNE UNIVERSITY GASTROINTESTINAL SOCIETY



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Teaching for Impact



Housekeeping



- Please keep your camera and microphone off throughout the entire lecture unless you are asking or answering a question to preserve bandwidth and prevent unnecessary disruptions to the flow of the lecture
- If you have a question, but do not wish to interrupt, please type your question out in the chat and we will answer them at an appropriate timepoint during the lecture.
- This lecture will be recorded and will be made available via Youtube.
- Lecture slides will be shared with everyone who registered after the lecture.

Melbourne University Gastrointestinal Society (MUGIS)

- MUGIS aims to amalgamate all forms of discipline pertaining to the gastrointestinal field from surgery to internal medicine, dietetics and research. Whether you want hands on experience with laparoscopy and simulated scopes or more information about diet and nutrition, we at MUGIS are sure there'll be something for you!
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Struggling with anatomy?





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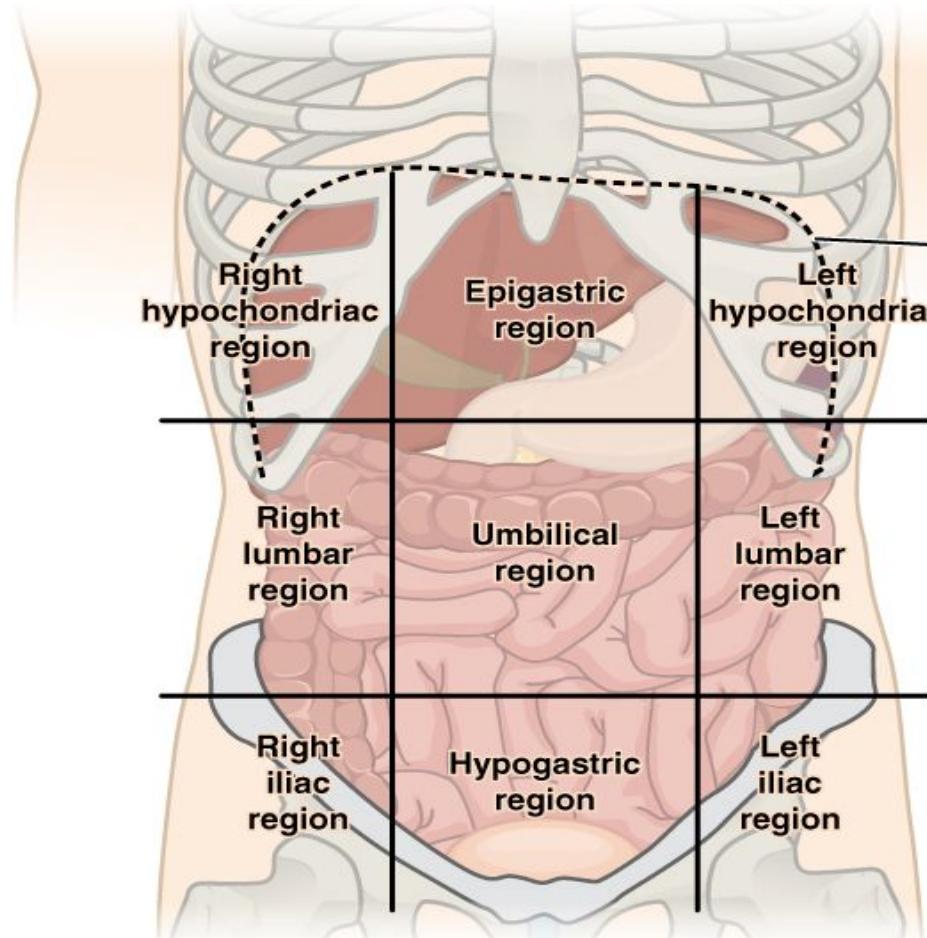
FRET NOT! WE'VE GOT YOU COVERED!



Quadrants and Regions of the Abdomen

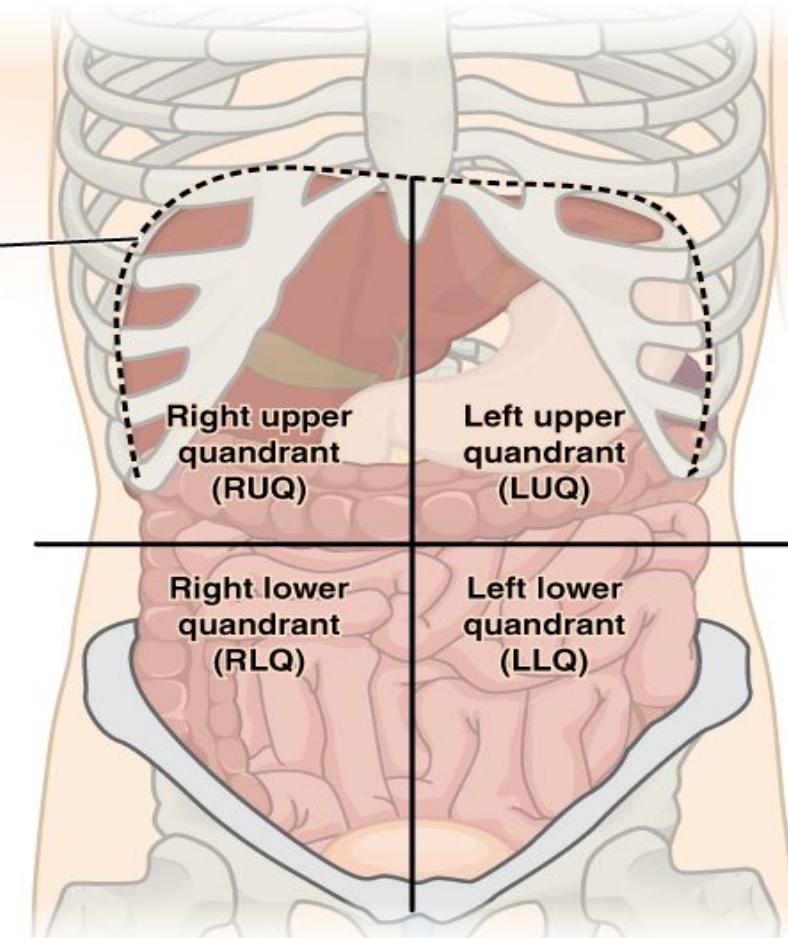


9 regions



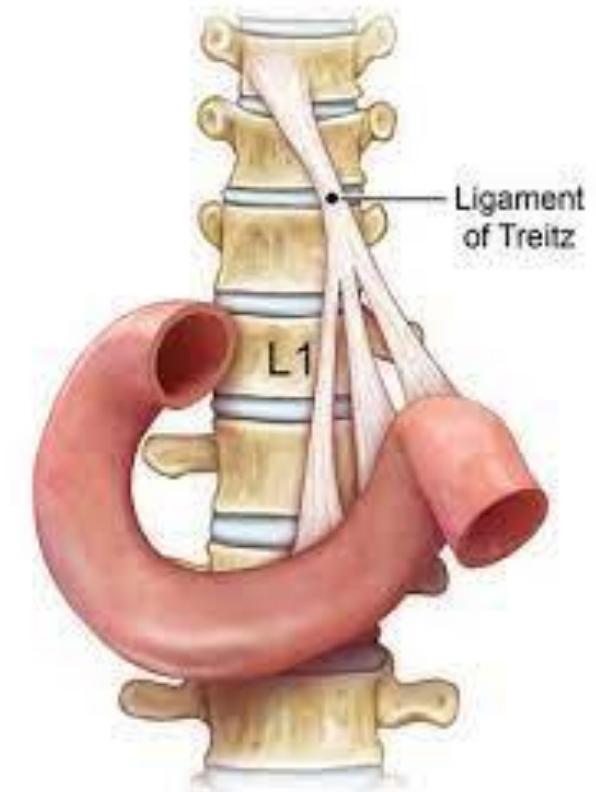
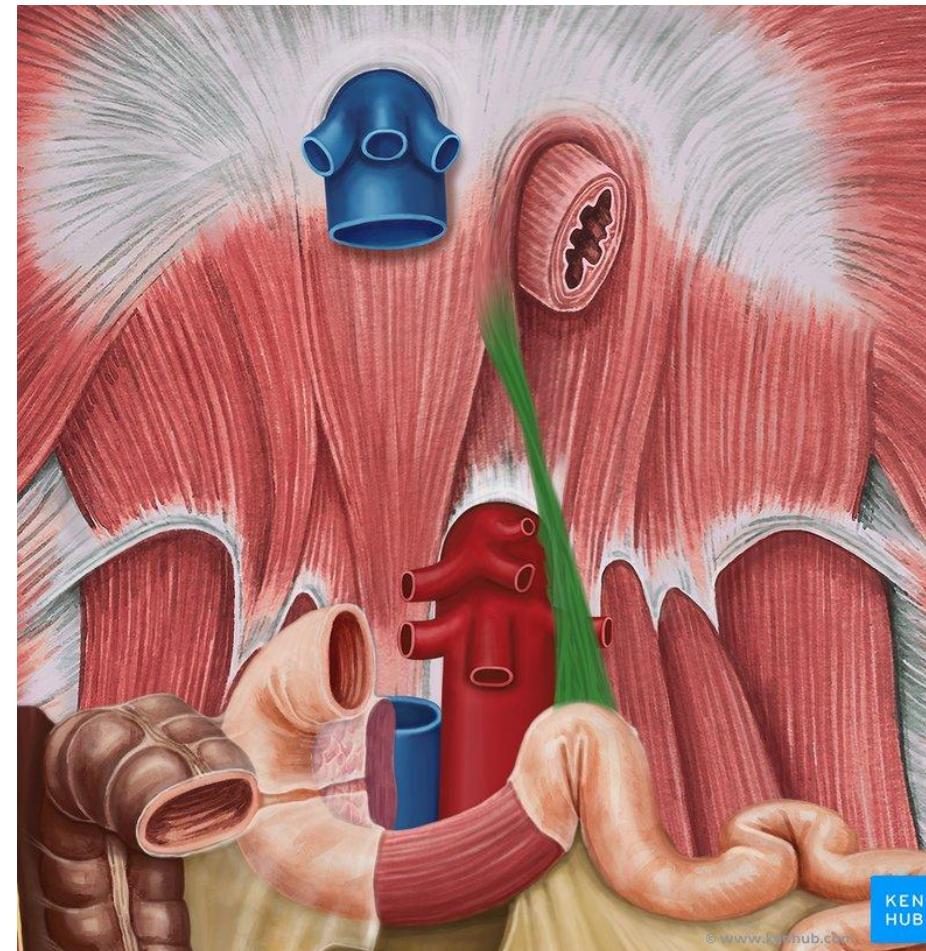
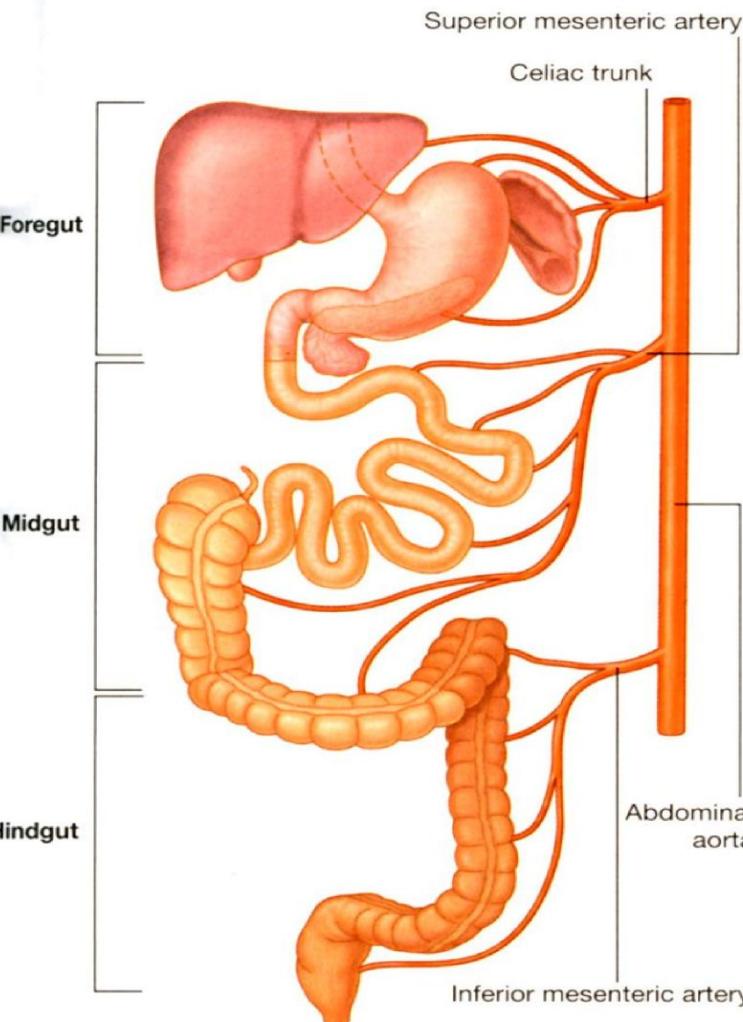
(a) Abdominopelvic regions

4 Quadrants



(b) Abdominopelvic quadrants

Structure of Gastrointestinal Tract



Gastrointestinal Bleeds



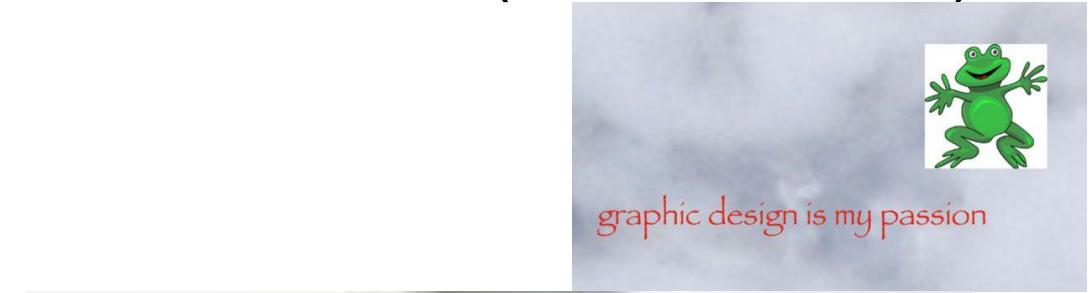
Upper GI Bleed

Haematemesis +/- Melena



Lower GI Bleed

Haematochezia (blood in stool)



Oesophagus

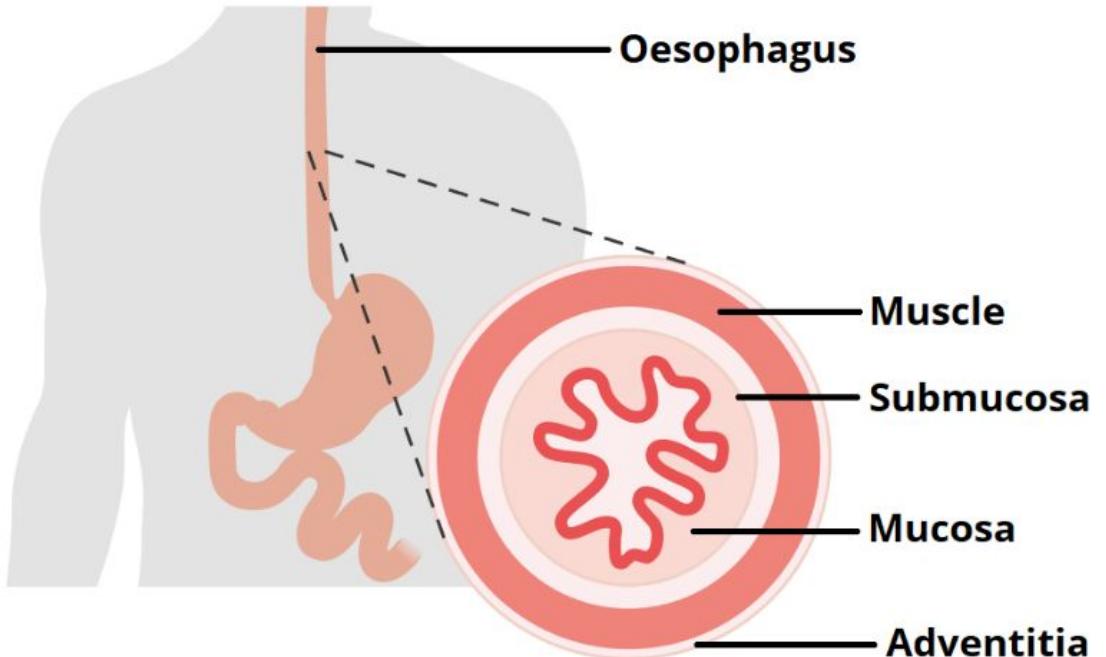
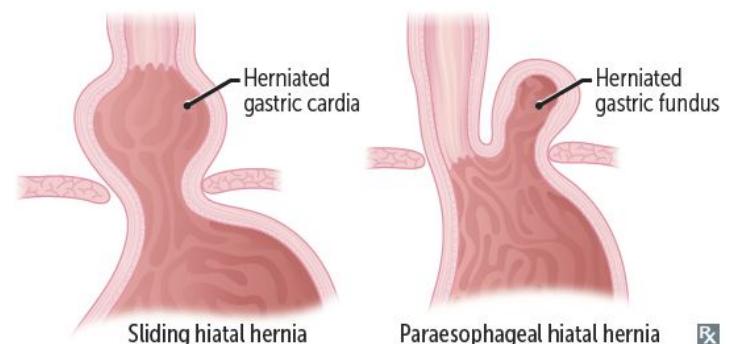
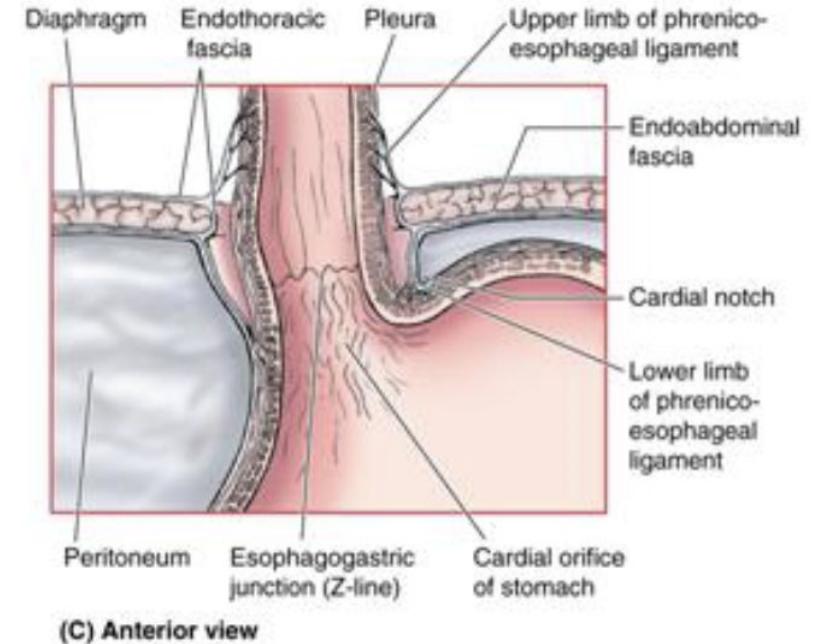


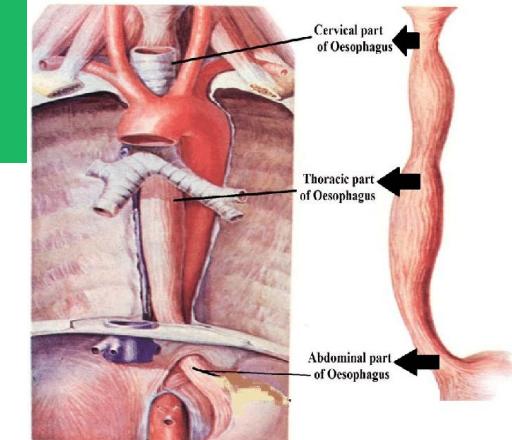
Fig 2 – The layers of the oesophagus. The muscle layer is further divided into an outer longitudinal layer and inner circular layer.



Oesophagus

3 sites of narrowing

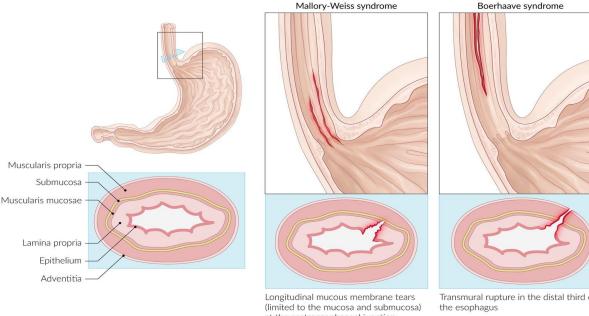
- Cervical region – **True anatomical sphincter**
- Thoracic region – Between Aortic arch and left main bronchus (*Note: **This is not a sphincter!**)
- Abdominal region – Diaphragmatic orifice (**Physiological sphincter**)



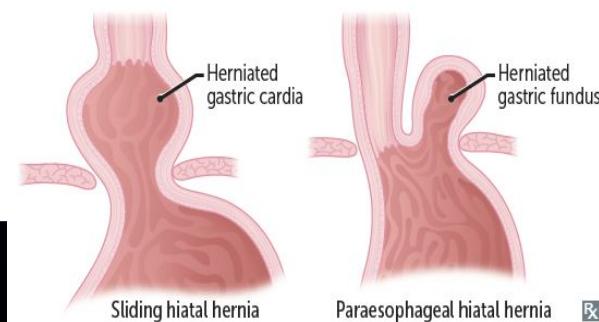
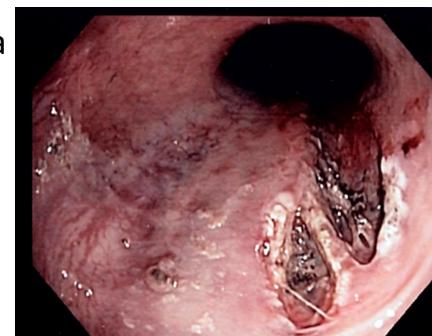
Pathologies

- **Achalasia** – Primary oesophageal motility disorder characterised by: Absence of oesophageal peristalsis + Impaired relaxation/Increased tone of LES (Lower oesophageal sphincter)
- **GORD** – Stomach contents flowing back into oesophagus causing **irritation** to the mucosa
- **Barrett oesophagus** – Intestinal metaplasia of the oesophageal mucosa induced by chronic reflux
- **Oesophageal Ca – Squamous cell carcinoma** (Upper 2/3rd of oesophagus) vs **Adenocarcinoma** (Lower 1/3rd of oesophagus)
- **Diaphragmatic hernia** – Abdominal structures herniating upwards through diaphragm
 Sliding hiatal hernia (95%) vs **Paraoesophageal hiatal hernia** (5%)
- **Mallory-Weiss syndrome** – Acute upper GI bleed caused by mucous membrane lacerations
- **Boerhaave syndrome** – Transmural rupture of distal oesophagus due to violent retching

Mackler's triad – Vo



↑ + Subcutaneous emphysema



Rx

**Feeling overwhelmed already? Don't you worry,
we've only just covered the Oesophagus :O**

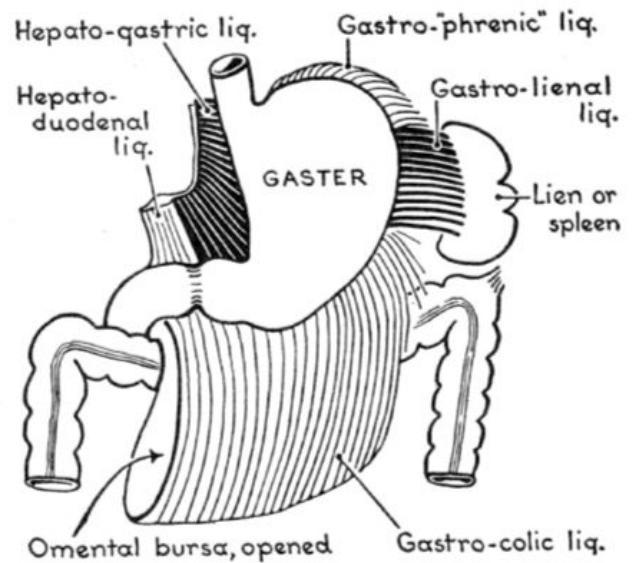
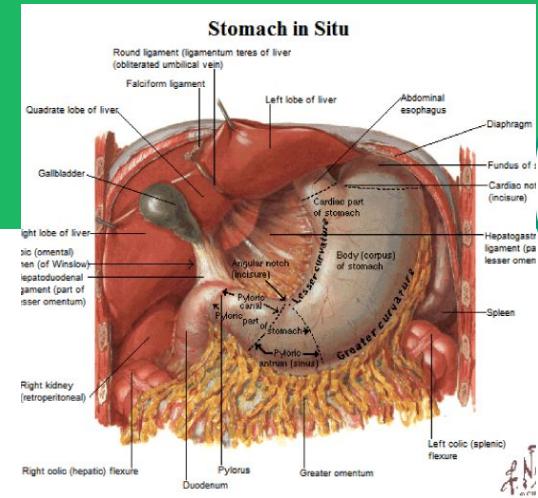
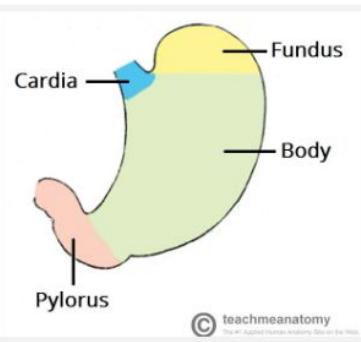


Stomach

- Intraperitoneal viscus
- J-shaped, features of lesser and greater curvature
- Situated at LUQ
- Parts of stomach:
 - Cardiac orifice: Oesophagus enters
 - Pyloric orifice: Terminal part draining into duodenum
 - Fundus: Dome-shaped, lateral to cardiac orifice
 - Body (Corpus): Large central portion inferior to fundus
- Pylorus: Narrowing/Converging funnel (Pyloric antrum) into Pyloric canal
- Angular notch: Demarcates the junction of **Body and Pylorus**

- **Lesser omentum:** Tethers lesser curvature to visceral surface of Liver
 - **Hepato-gastric ligament** – from lesser curvature to visceral surface of liver
 - **Hepato-duodenal ligament** – 1st inch of duodenum to visceral surface of liver

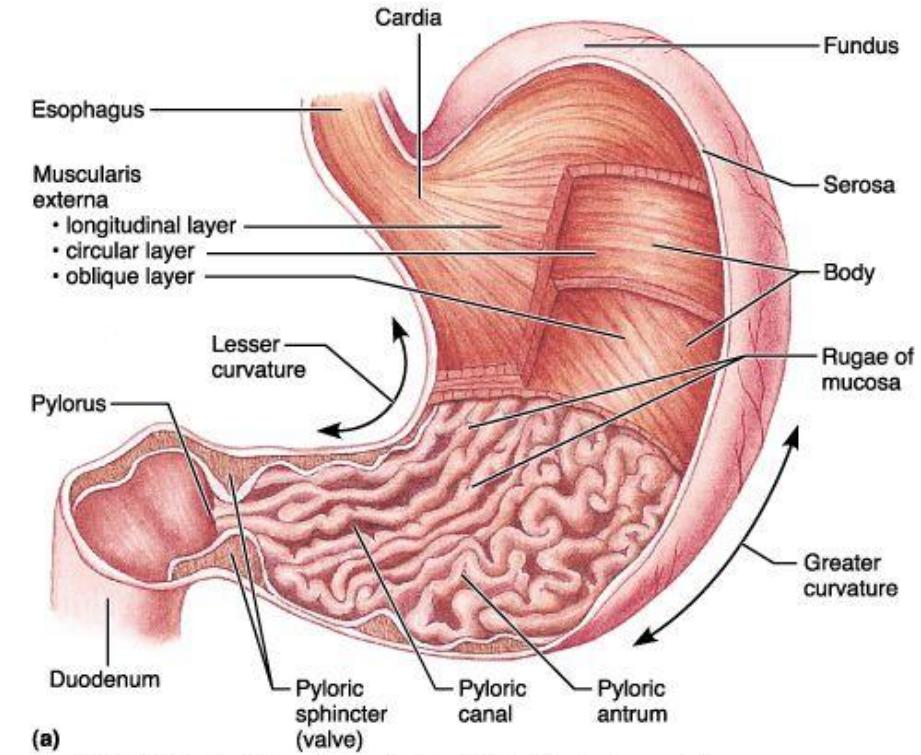
- **Greater omentum:** Tethers greater curvature to posterior abdominal wall
 - **Gastro-phrenic ligament** – Connects most **proximal** part of greater curvature (Fundus) to under surface of Diaphragm
 - **Gastro-lienal/Gastro-splenic ligament** – Middle part of greater curv ->Surrounds spleen ->Posterior wall overlying the **Left kidney**
 - **Fatty apron** – Travels down and back up over the top of transverse colon and onto the posterior abdominal wall



Stomach



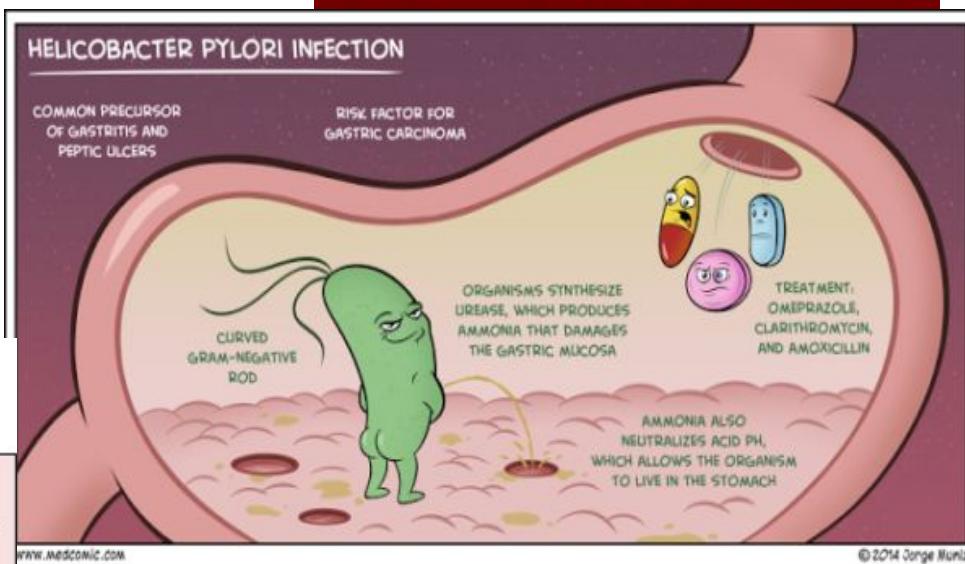
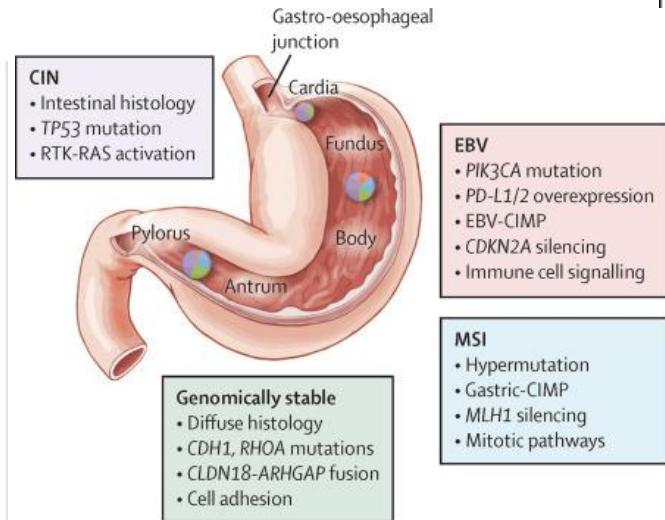
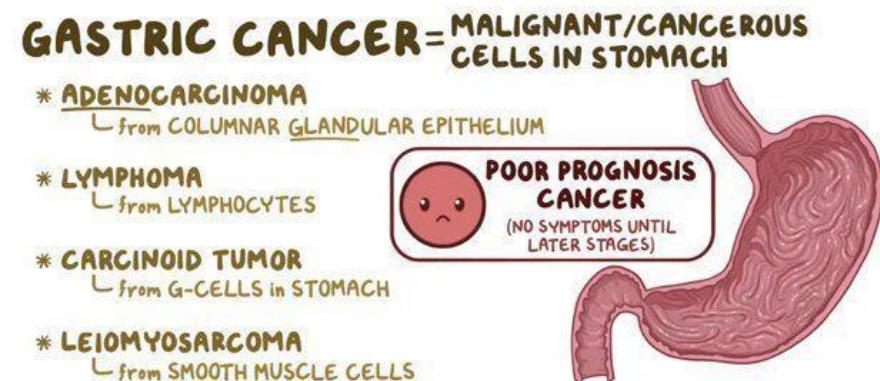
- **Rugae:**
 - Longitudinal mucosal folds (more prominent towards the pylorus)
 - Functions to allow for expansion of the stomach following consumption of food and liquids
- **3 layers of muscles:**
 - Longitudinal layer
 - Circular layer
 - Oblique layer



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Pathologies of Stomach

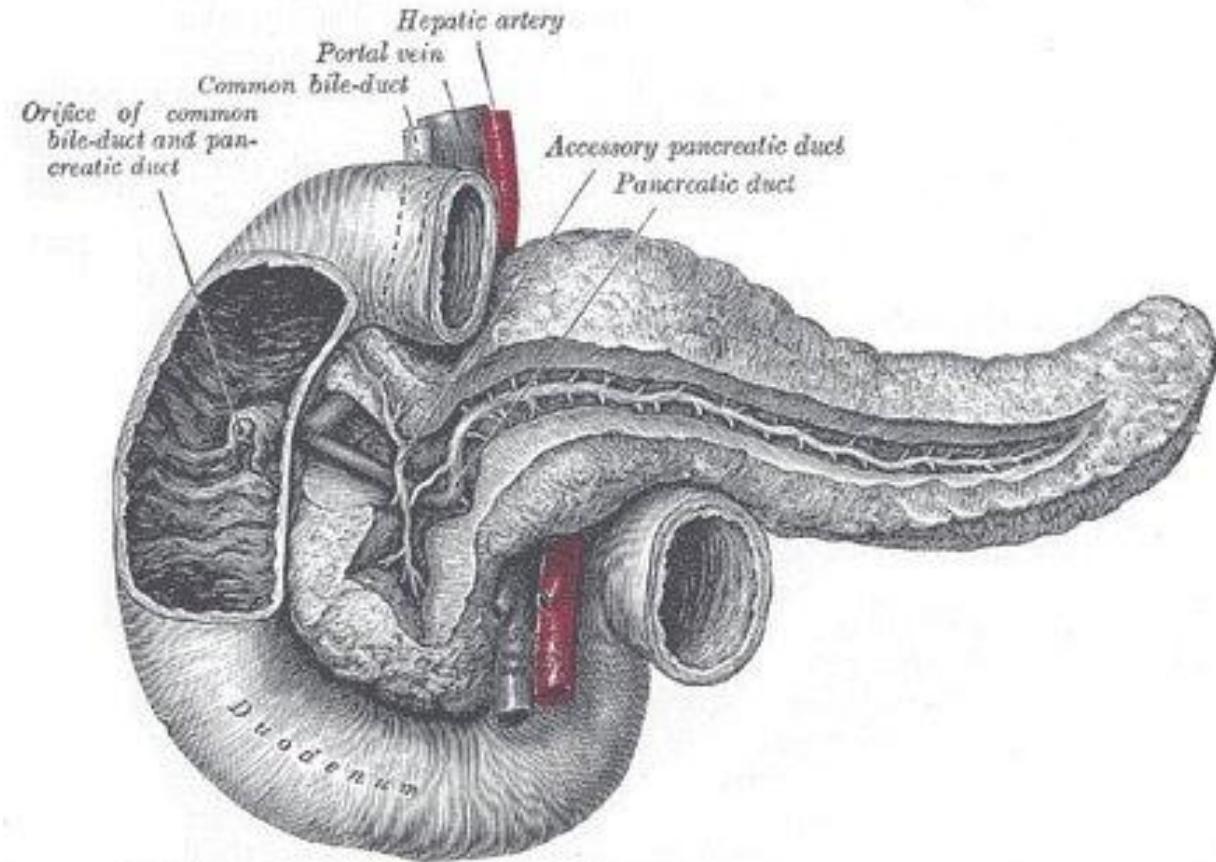
- Acute gastritis – Gastric erosion due to acute inflammation of stomach
- Chronic gastritis – 2 main causes:
 - 1) H. Pylori
 - 2) Autoimmune gastritis
- Peptic ulcer disease (PUD) – Can occur in both stomach (gastric ulcer) and duodenum (duodenal ulcer)
- Gastric cancer – Gastric adenocarcinoma (commonest)



Duodenum

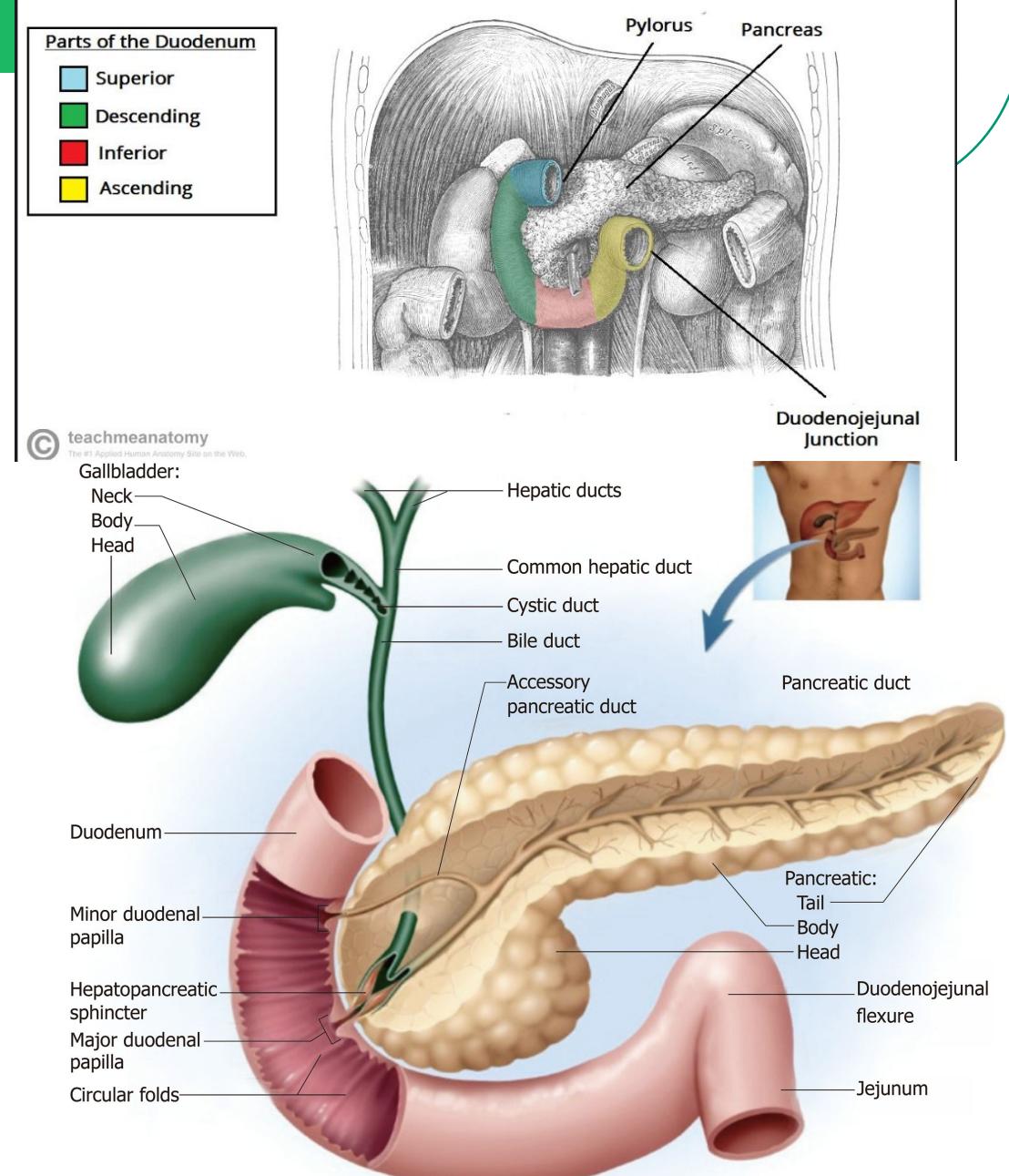


- 10 inches long
- C-shaped that sits around head of pancreas
- All but 1st inch is **retroperitoneal**
- Sits on **right psoas m.** -> Goes across IVC and Abdominal Aorta -> Ends up n the **left psoas m.**



4 parts of the duodenum

- 1st part – (Duodenal cap)
 - 2 inches (5cm long)
 - Travels upwards and backwards towards post. Abdominal wall
 - Lies on R. psoas m.
 - **1st inch is Intraperitoneal**
 - Most of the peptic ulcers occurs here
- 2nd part
 - 3 inches
 - Descends vertically down between head of pancreas and R. kidney
 - Major and minor duodenal papilla – opening for **common bile duct and pancreatic duct**
- 3rd part
 - 4 inches
 - Runs horizontally (Right psoas -> IVC & Abdominal aorta -> Left psoas) at **L3**
 - Is the root of “**The mesentery**” of the Jejunum and Ileum
- 4th part
 - 1 inch
 - Goes away from the L. psoas -> Curve anteriorly into abdominal cavity -> Forms **DJ flexure** (Duodenal-Jejunal flexure)



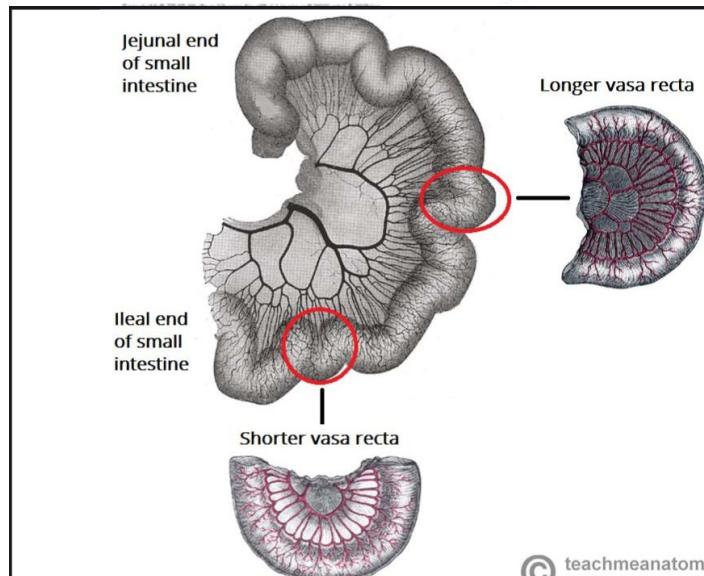
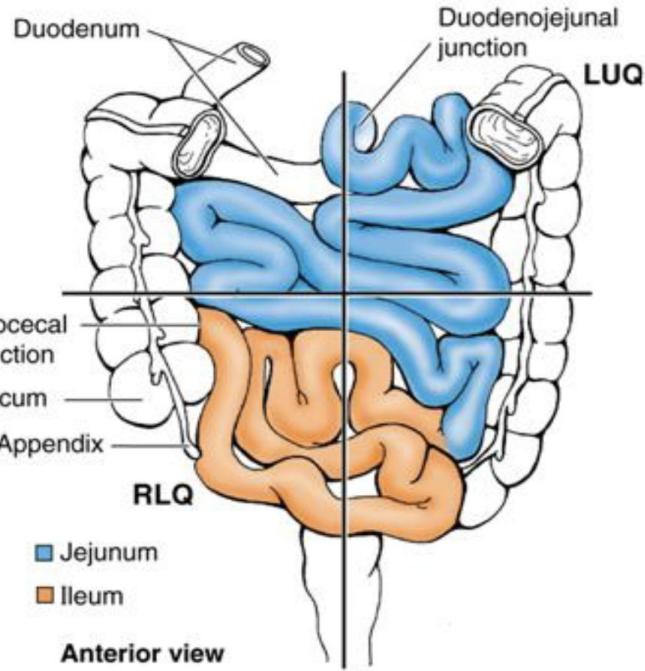
Jejunum vs Ileum

Jejunum

- Left Upper Quadrant
- Thick intestinal wall and large in diameter
- Higher and numerous mucosal folds
- The mesentery
 - Longer vasa recta (Straight arteries)
 - Less arcades (Arterial loops)
 - Less fat (vessels more visible)
- Absorption: Sugars, amino acids, fatty acids

Ileum

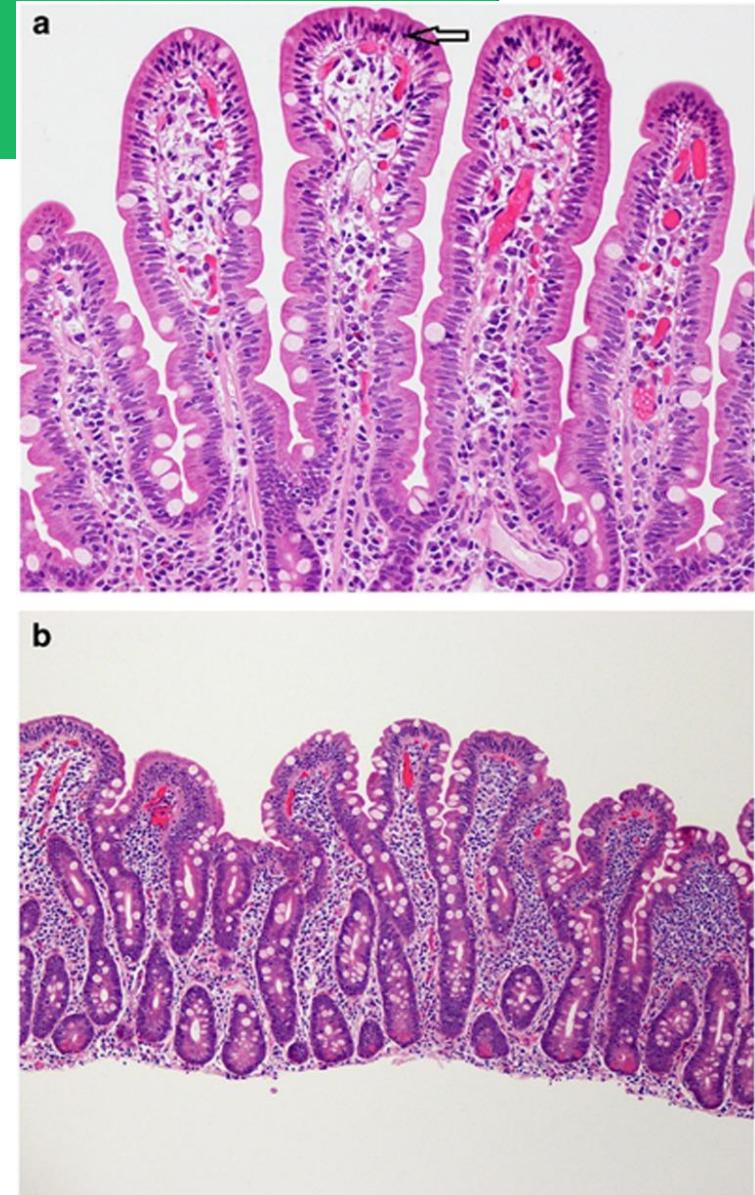
- Right lower quadrant
- Thin intestinal wall
- The mesentery
 - Shorter Vasa Recta
 - More arcades
 - More fat
- Absorption: Vit. B12 & Bile acids



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Coeliac Disease

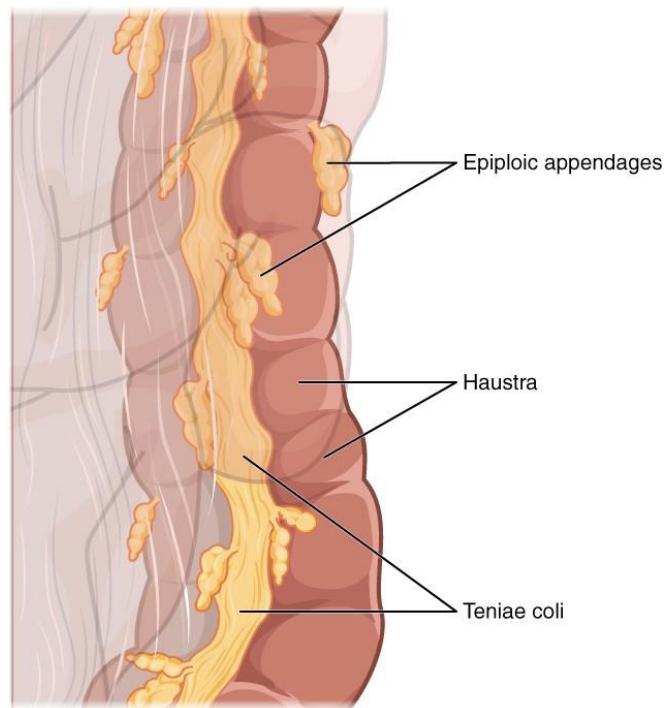
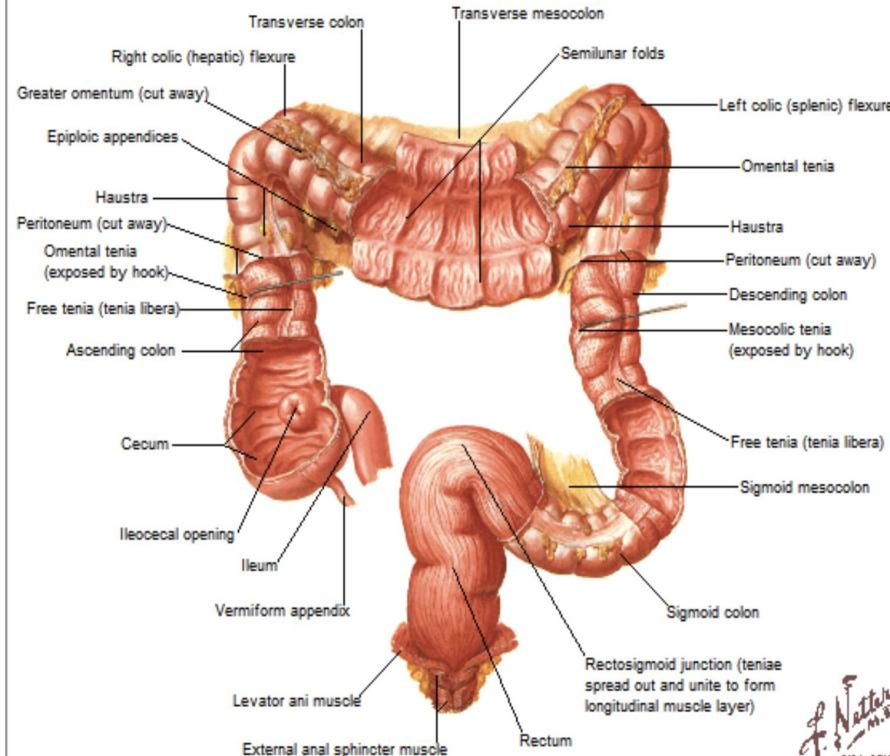
- Autoimmune-mediated intolerance of gliadin
- Clinical features: Malabsorption, Steatorrhea, Flatulence, Abdominal bloating and Pain
- Associated with HLA-DQ2/8 alleles
- Histological findings:
 - >Villous atrophy
 - >Crypt hyperplasia
 - >Intraepithelial lymphocytosis
- Blood tests: IgA tTG, IgG deamidated gliadin peptide
- Tx: Gluten-free diet



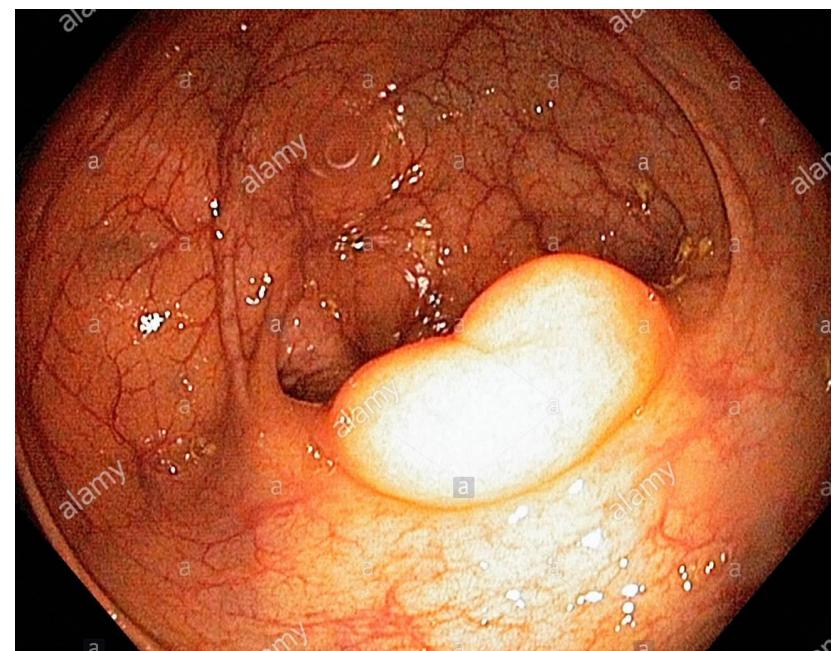
Large Intestine



Mucosa and Musculature of Large Intestine



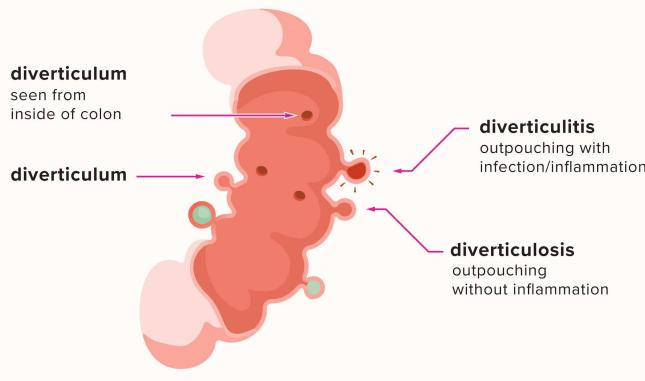
Healthy Ileocaecal valve



a alamy stock photo

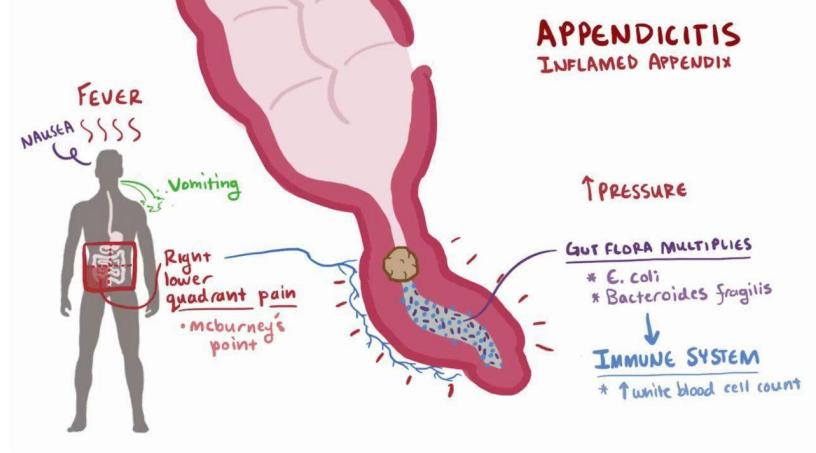
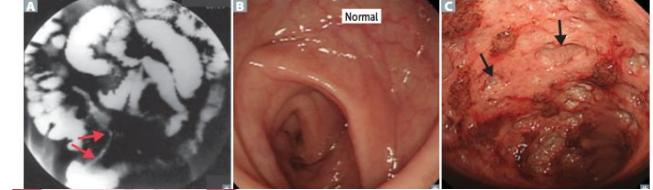
Pathology of Large Intestine

- Inflammatory bowel disease:** Crohn's disease vs Ulcerative Colitis
- Appendicitis:** Acute inflammation of appendix
- Diverticular disease:**
 - >Diverticulum: small bulging pouches
 - >Diverticulosis: formation of abnormal pouches in bowel wall
 - >Diverticulitis: inflammation of diverticula



Inflammatory bowel disease	
Crohn disease	Ulcerative colitis
LOCATION	Any portion of the GI tract, usually the terminal ileum and colon. Skip lesions, rectal sparing .
GROSS MORPHOLOGY	Transmural inflammation → fistulas. Cobblestone mucosa, creeping fat , bowel wall thickening ("string sign" on barium swallow x-ray A), linear ulcers, fissures.
MICROSCOPIC MORPHOLOGY	Noncaseating granulomas and lymphoid aggregates. Th1 mediated.
COMPLICATIONS	Crypt abscesses and ulcers, bleeding, no granulomas. Th2 mediated. Malabsorption/malnutrition, colorectal cancer (↑ risk with pancolitis).
INTESTINAL MANIFESTATION	Diarrhea that may or may not be bloody. Bloody diarrhea .
EXTRAINTESTINAL MANIFESTATIONS	Rash (pyoderma gangrenosum, erythema nodosum), eye inflammation (episcleritis, uveitis), oral ulcerations (aphthous stomatitis), arthritis (peripheral, spondylitis). Kidney stones (usually calcium oxalate), gallstones. May be ⊕ for anti- <i>Saccharomyces cerevisiae</i> antibodies (ASCA).
TREATMENT	Corticosteroids, azathioprine, antibiotics (eg, ciprofloxacin, metronidazole), infliximab, adalimumab. For Crohn , think of a fat granny and an old crone skipping down a cobblestone road away from the wreck (rectal sparing).

Ulcerative colitis causes **ULCCERS**:
Ulcers
Large intestine
Continuous, **Colorectal carcinoma**, **Crypt abscesses**
Extends proximally
Red diarrhea
Sclerosing cholangitis

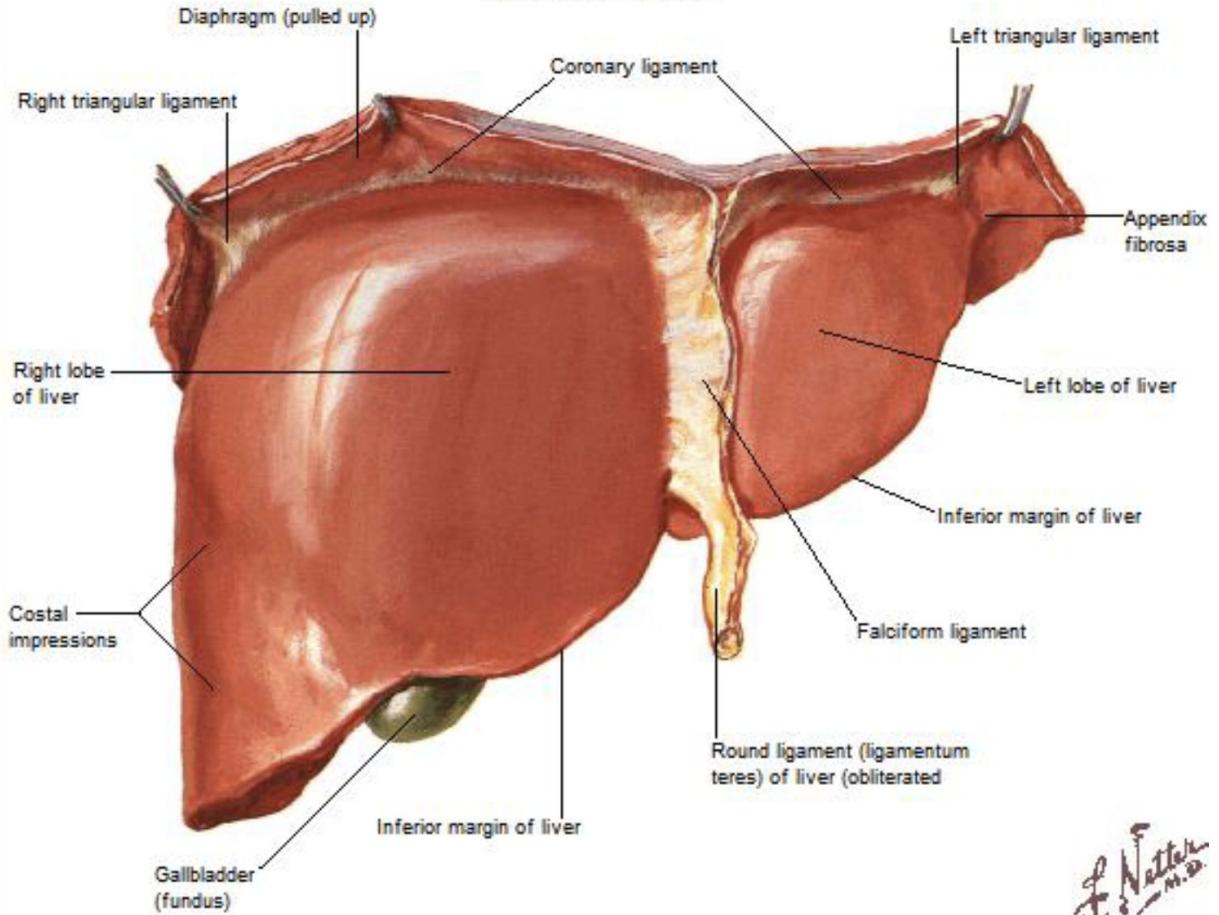


Liver



Surfaces and Bed of Liver

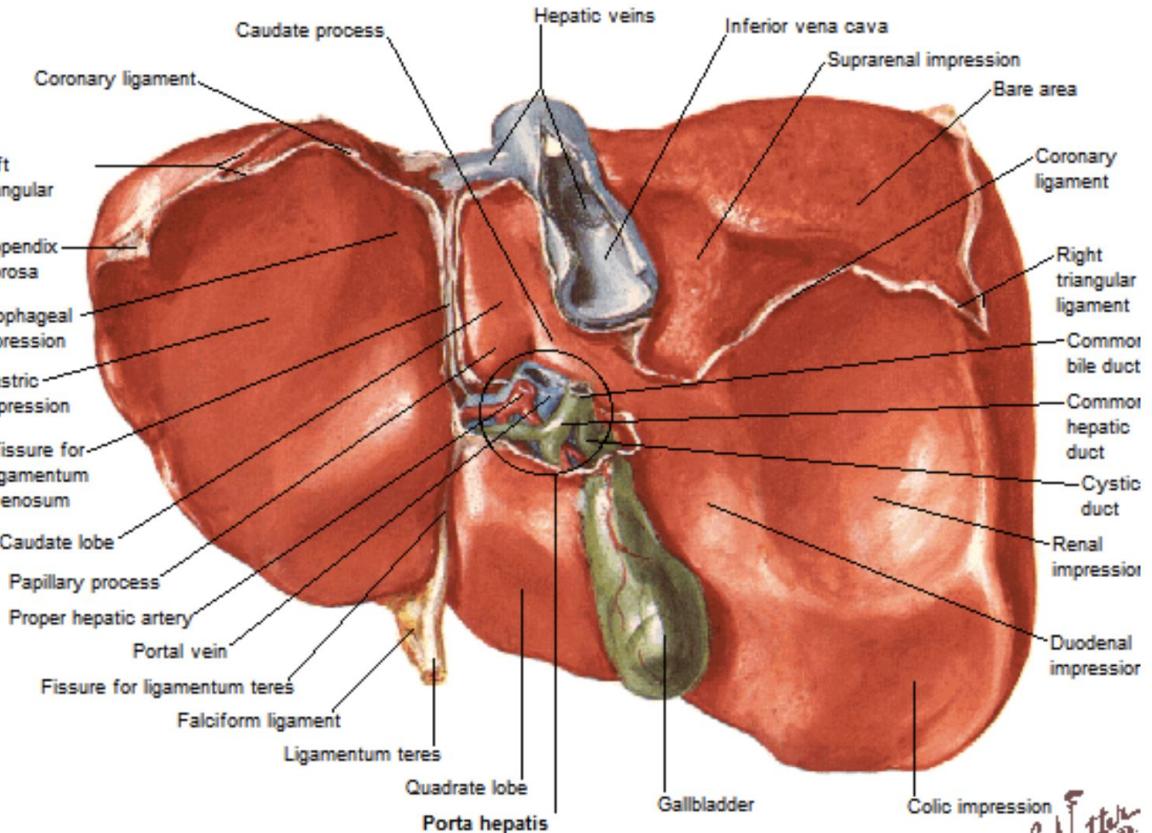
Anterior View



*J. Netter M.D.
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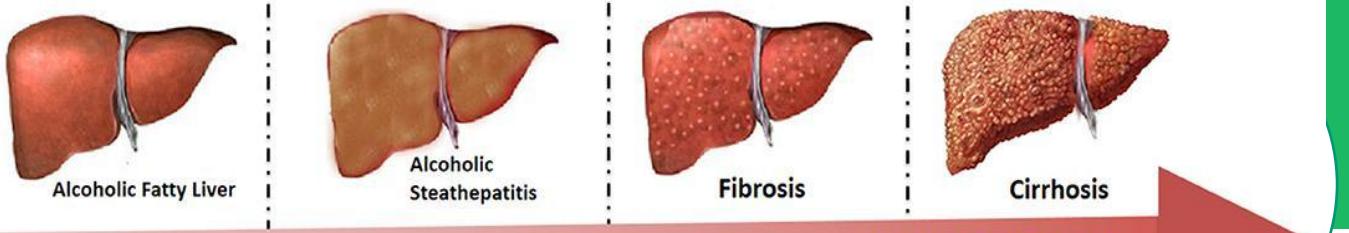
Surfaces and Bed of Liver

Visceral Surface

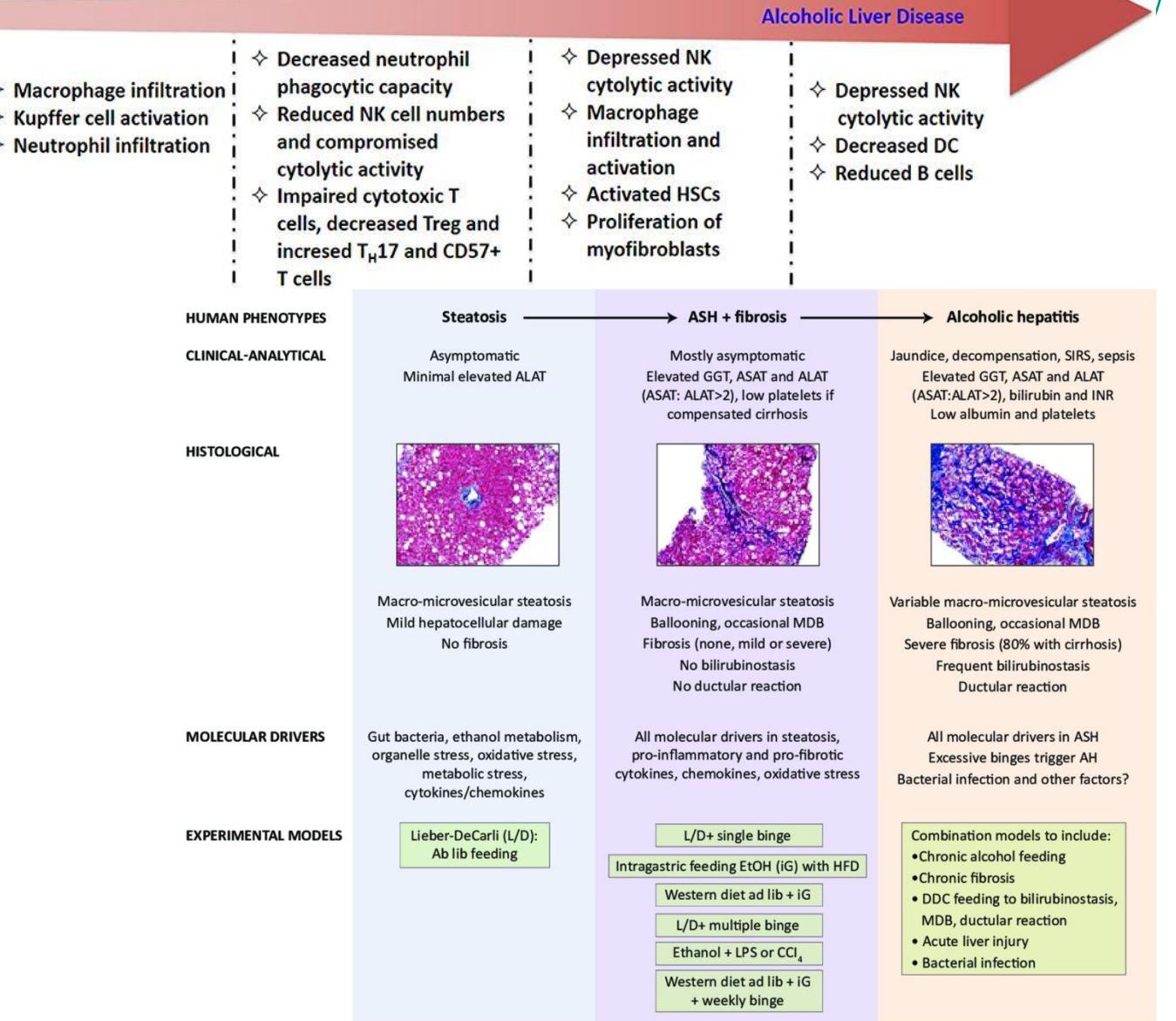


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Pathologies of the Liver

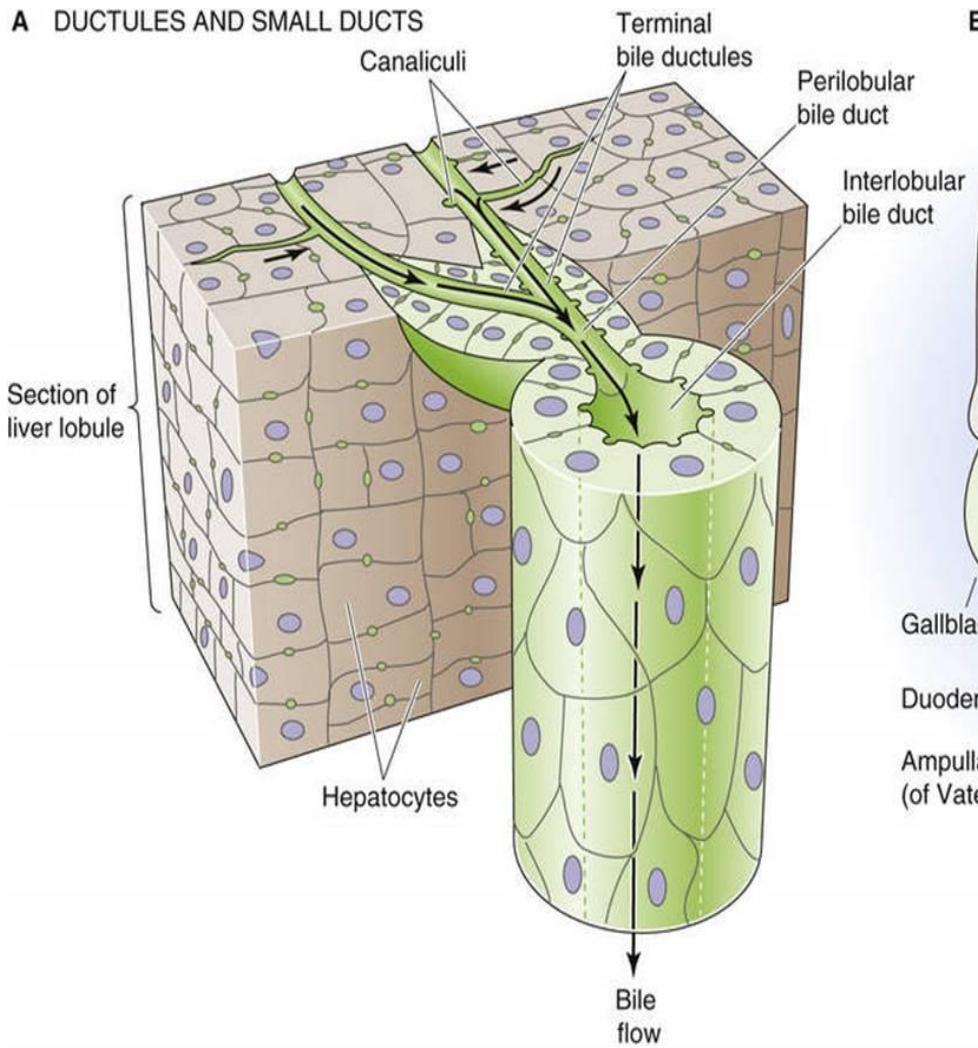


- **Alcoholic liver disease**
 - Ratio of AST to ALT **2:1**
- **Non-alcoholic fatty liver disease (NAFLD)**
- **Hepatocellular carcinoma (HCC)**

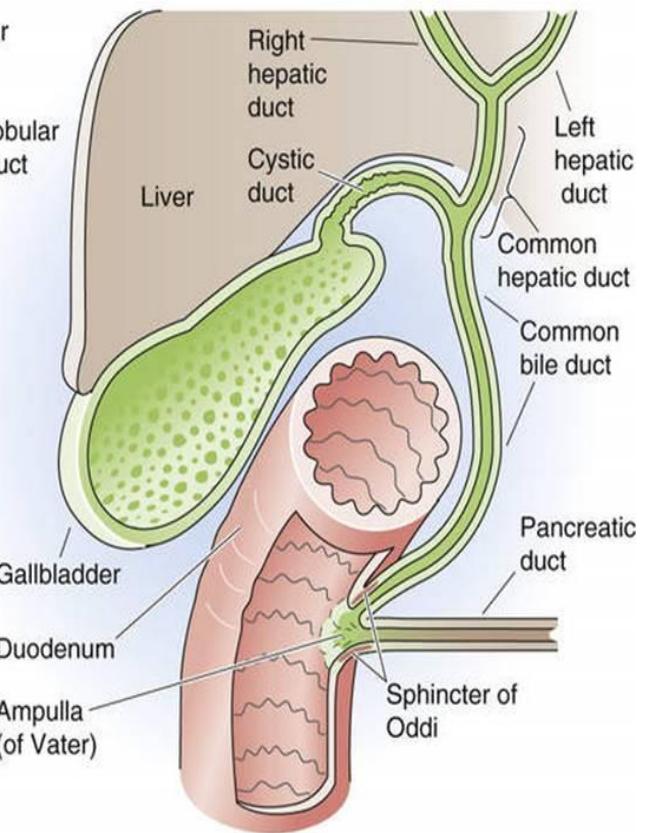


Gallbladder and Biliary Tract

A DUCTULES AND SMALL DUCTS

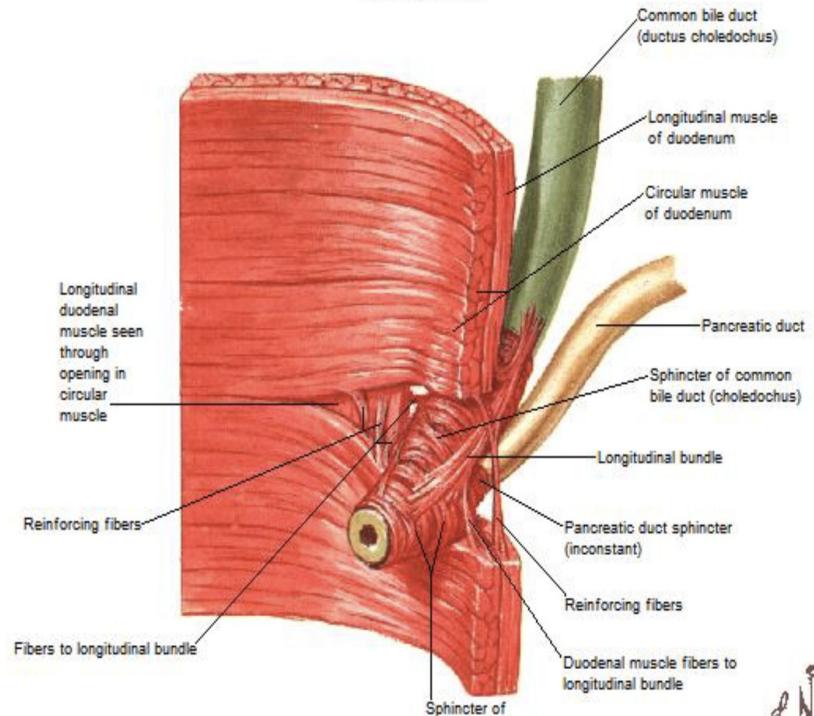


B LARGE DUCTS AND GALLBLADDER

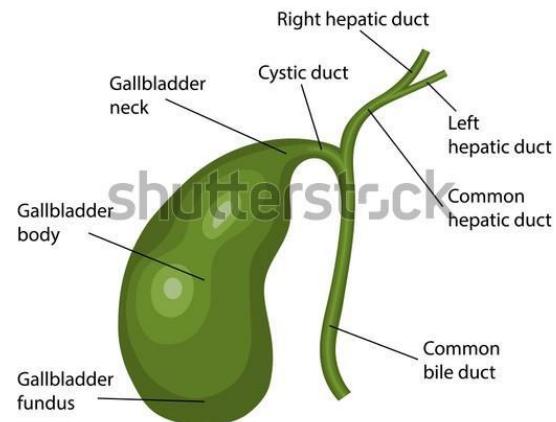


Choledochoduodenal Junction

Dissection



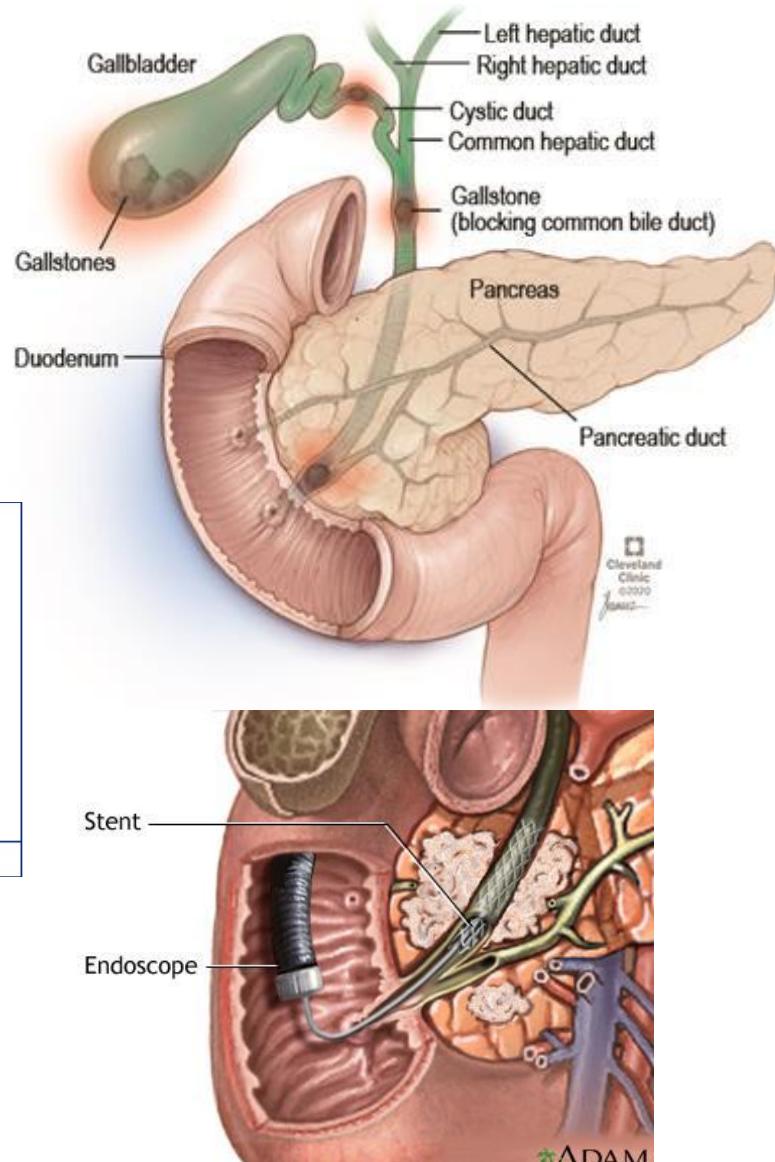
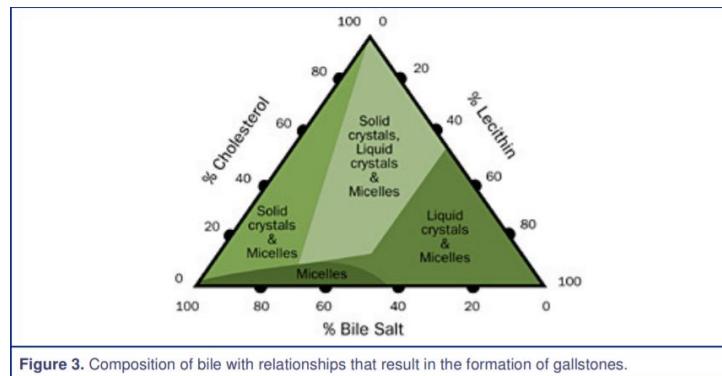
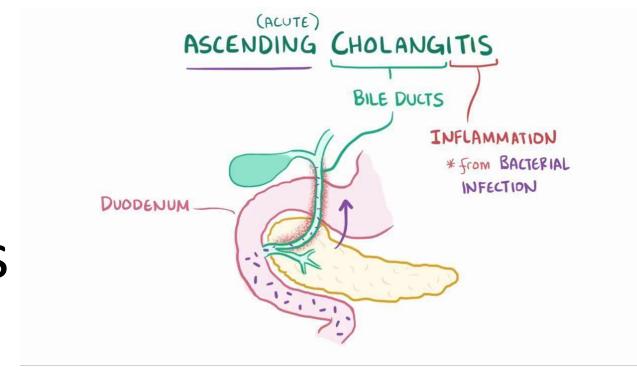
Gallbladder anatomy



Pathology of Gall Bladder & Biliary Tract



- **Cholelithiasis** – stones in gallbladder
- **Cholecystitis** – Cx of cholelithiasis resulting in inflammation of gallbladder
- **Choledocholithiasis** –stones in common bile duct
- **Ascending cholangitis** – Cx of choledocholithiasis



Pancreas

- Head of pancreas wedge-shaped coming off the **Uncinate process**
- Neck of pancreas – deep to pyloric canal of stomach
- Body of pancreas – extends from Right to Left above the DJ flexure
- Tail of pancreas – head towards hilum of spleen
- Retroperitoneal**

- Exocrine:**

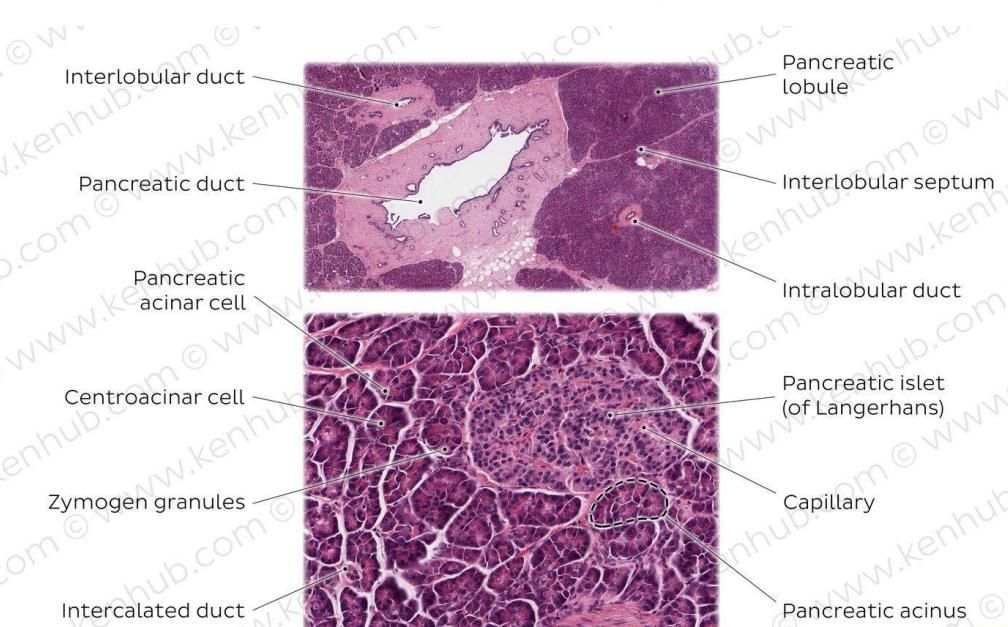
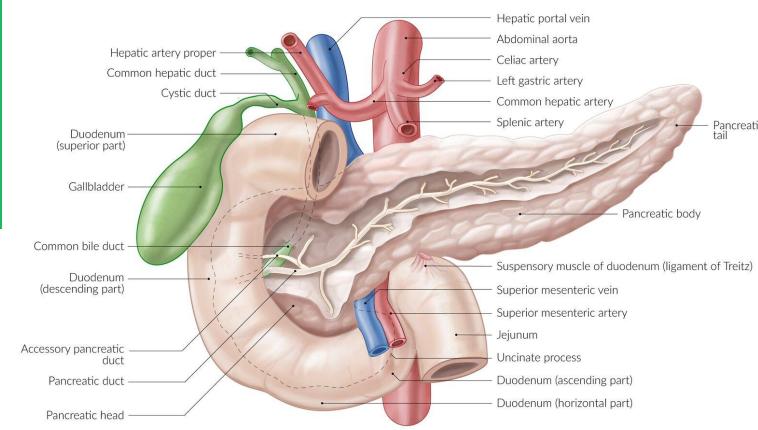
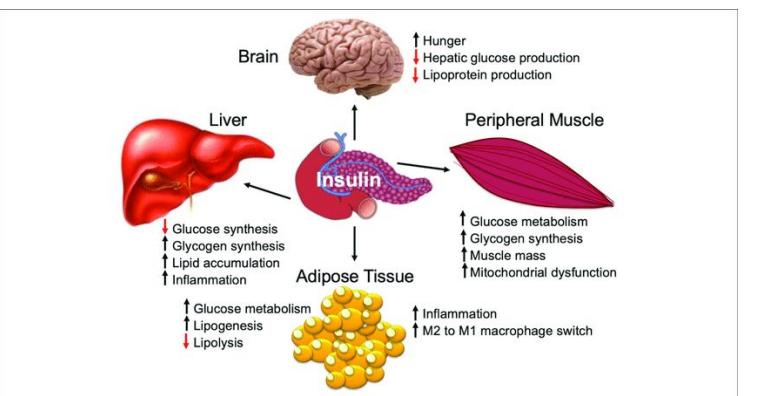
- Ductal cells – HCO_3^- \rightarrow neutralise acidic chyme
- Acinar cells – pancreatic enzymes \rightarrow breaks down proteins, FA, CHO

Bicarb and Pancreatic enzymes enter pancreatic duct released

Into the **Major duodenal papilla**

- Endocrine**

- Alpha cells (20%) – Glucagon \rightarrow Glycolysis + Gluconeogenesis
- Beta cells (75%) – Insulin
- Delta cells – Somatostatin



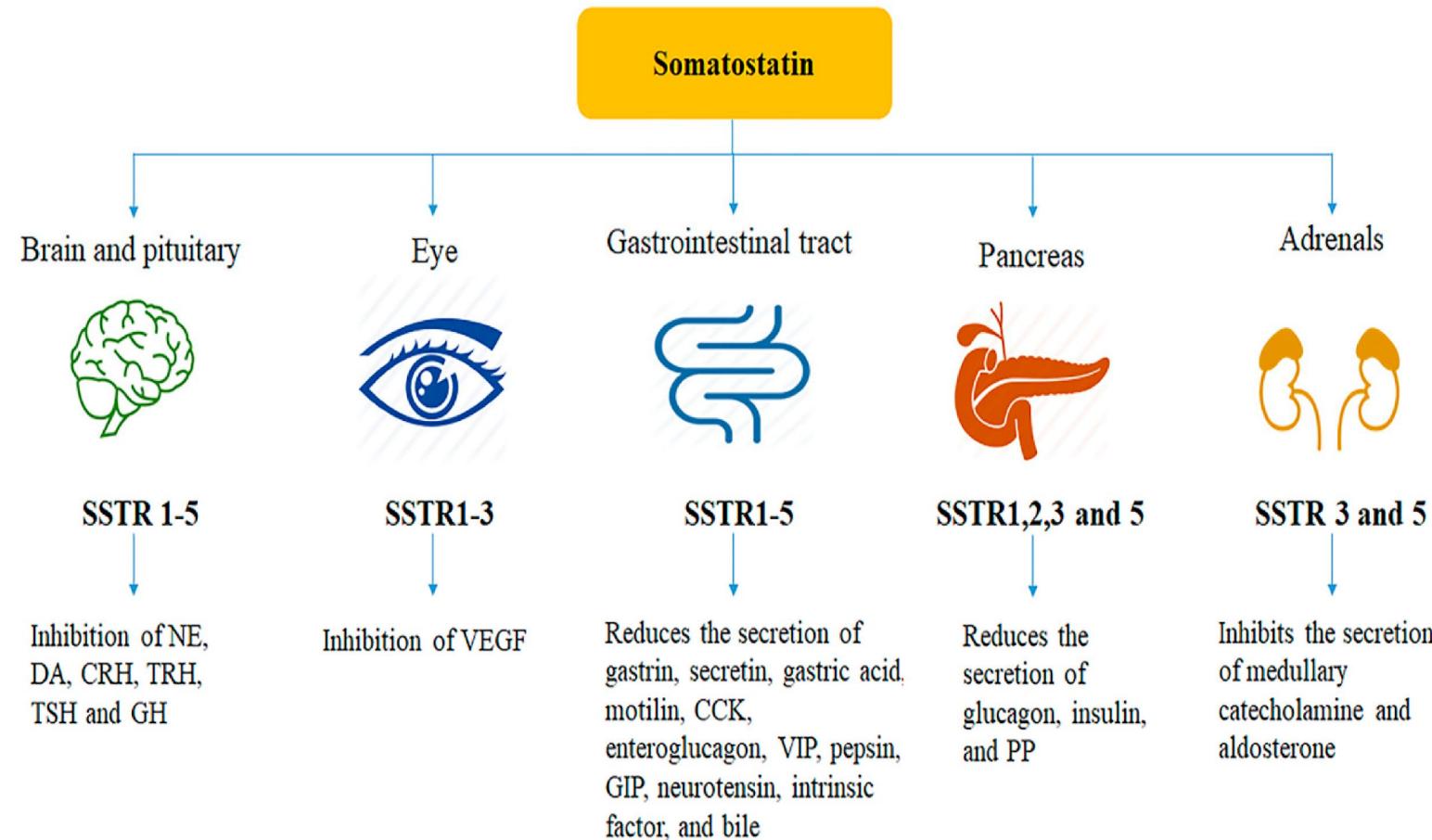


Somatostatin

Digestive hormones in the GI tract

powered by
Screencastify Lite

HORMONE	LOCALIZATION	MAIN PHYSIOLOGIC ACTIONS
Gastrin	Gastric antrum, duodenum (G cells)	-stimulate secretion of gastric acid and intrinsic factor from parietal cells -stimulates secretion of pepsinogen from chief cells -promotes gastric and intestinal motility, mucosal growth
Cholecystokinin (CCK)	Duodenum, jejunum (I cells)	-stimulates gallbladder contraction -stimulates release of pancreatic enzymes -relaxes sphincter of Oddi for release of bile and enzymes -role in inducing satiety
Secretin	Duodenum, jejunum (S cells)	-stimulates secretion of HCO ₃ from pancreas -inhibits gastrin and gastric acid secretion
Vasoactive intestinal peptide (VIP)	Enteric nerves	-increases water and electrolyte secretion from pancreas and gut -relaxes smooth muscles (via nitric oxide) of the gut
Gastric inhibitory polypeptide (GIP)	Duodenum, jejunum (K cells)	-reduces gastric acid secretion and intestinal motility -stimulates insulin release
Motilin	Throughout the gut (Mo cells and ECL cells)	-increases small bowel motility (MMC during fasting) and gastric emptying
Somatostatin	Stomach, small intestine, and pancreas (D cells)	-inhibits secretion and action of many hormones, including all of the above



Pathology of Pancreas

- Pancreatitis – Inflammation of pancreas

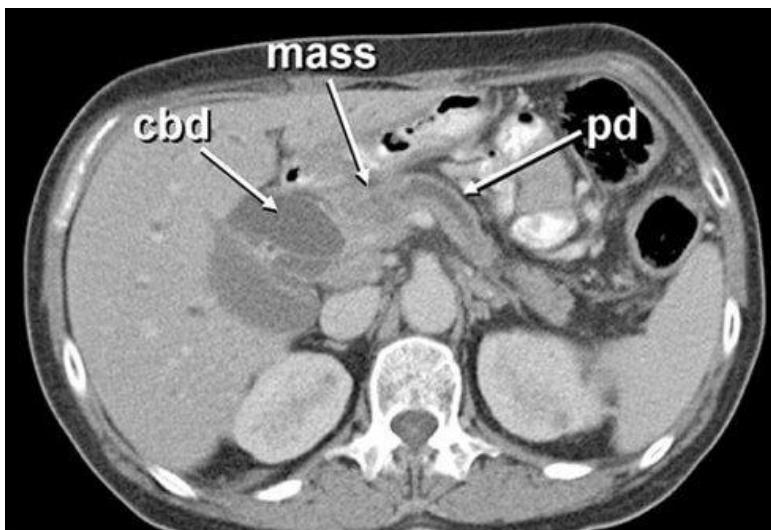
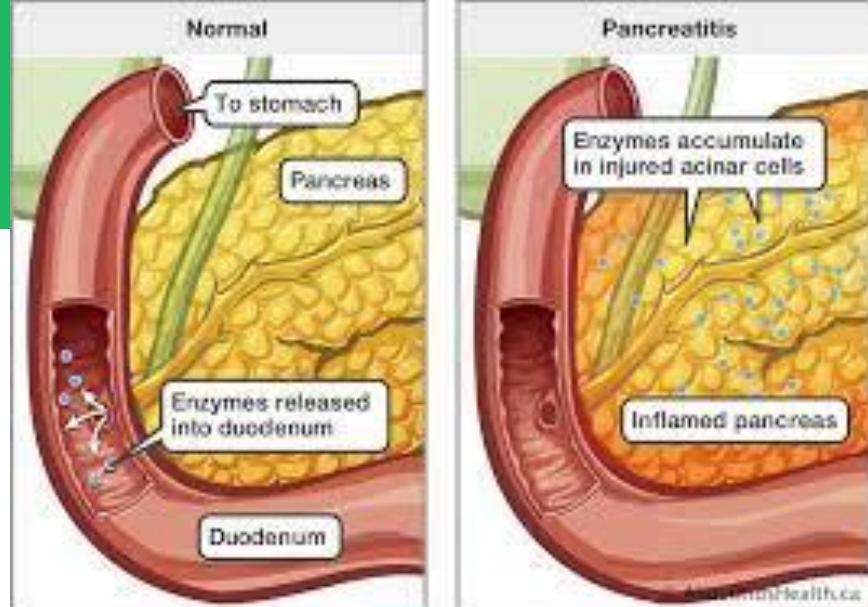
I GET SMASHED

- Pancreatic cancer

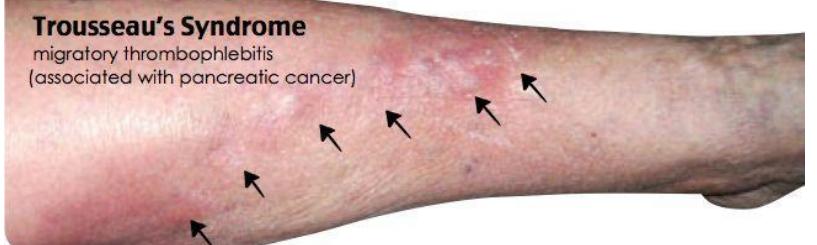
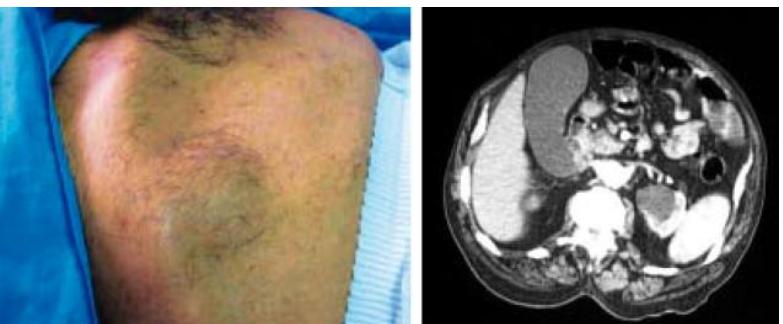
Often metastatic at presentation

Poor prognosis

Associated with CA 19-9



Enlarged gall bladder due to bile build-up





BRACE YOURSELVES

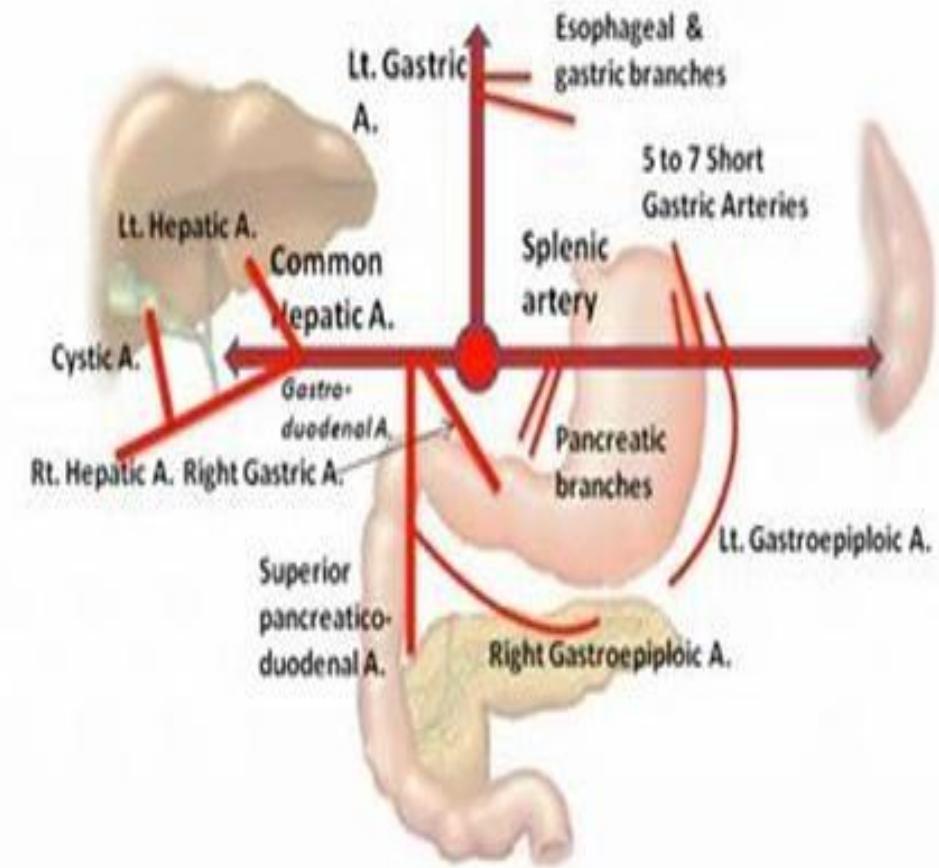


FOR THE ARTERIAL SUPPLY OF GIT

Coeliac Trunk



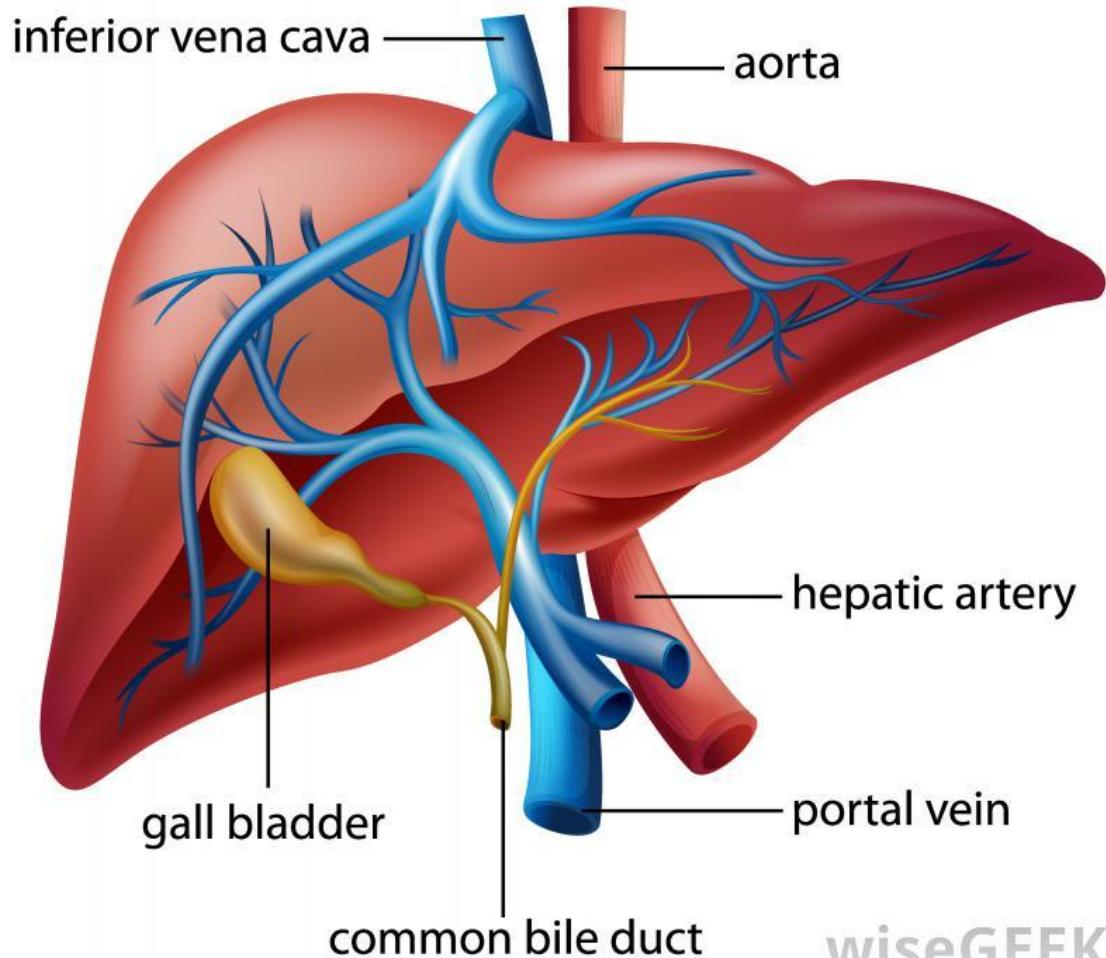
- Branches off immediately as the abdominal aorta begins
- **1st branch:** **Left Gastric Artery** heads up and to the left towards the **Lesser curvature**
 - > Oesophageal branches to supply **Abdominal oesophagus**
 - > LGA turns and runs between Lesser curvature to anastomose with R. Gastric artery
- **2nd branch:** **Splenic artery** -> Tortuous course of pancreas towards hilum to spleen
 - > Pancreatic branches to supply pancreas
 - > Short gastric artery to supply fundus
 - > Left gastroepiploic artery that runs along Greater curvature to anastomose with **R. Gastroepiploic artery**
- **3rd branch:** **Common hepatic artery**. Branches in **Proper hepatic Artery & Gastroduodenal artery**
 - > Proper hepatic artery gives off **Right gastric artery** -> runs along Lesser curvature -> Anastomose with L. Gastric artery
 - > **Proper hepatic artery** then runs in the free edge of lesser omentum with common bile duct (right) & portal vein (posteriorly) towards the Hilum of the liver!
 - Splits into Left, Right hepatic artery, and Cystic artery!
 - > Gastroduodenal artery branches into:
 - **Right gastroepiploic artery** -> runs along greater curvature -> anastomose with L. Gastroepiploic artery
 - **Superpancreaticoduodenal artery** -> Supplies superior part of duodenum to major duodenal papilla & head of pancreas



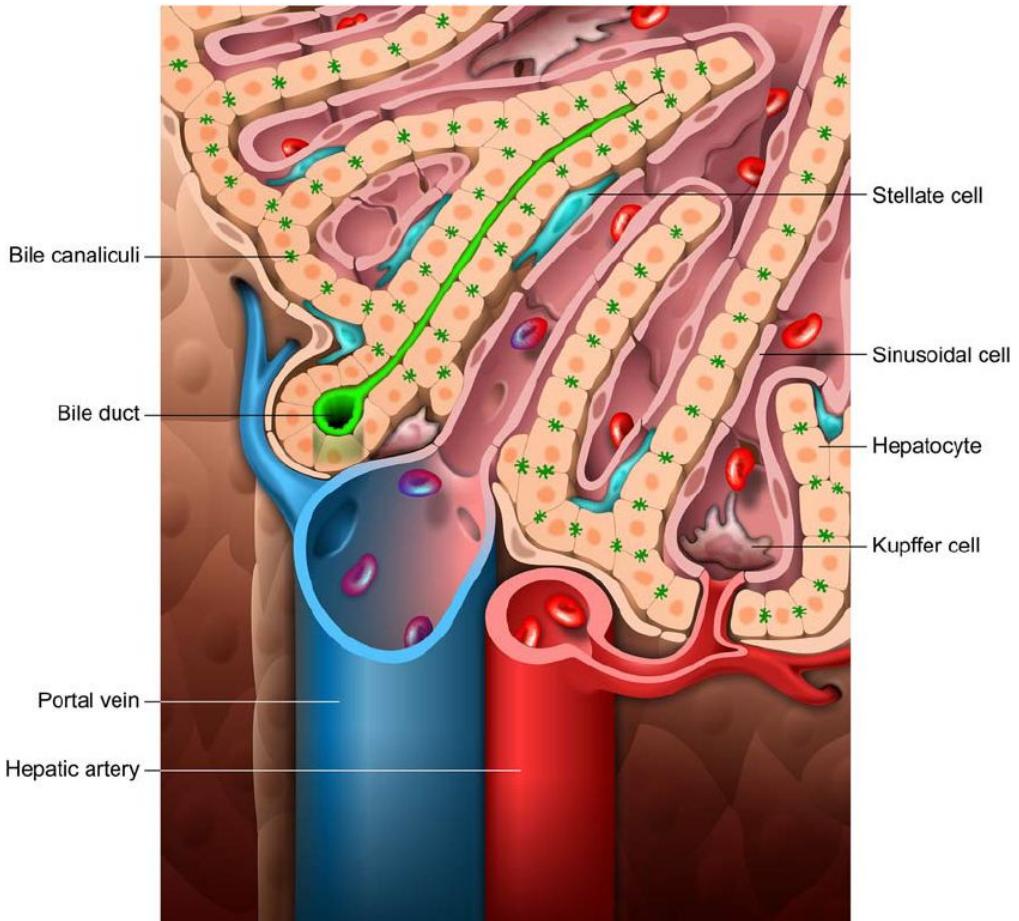
Portal triad



Human Liver Anatomy

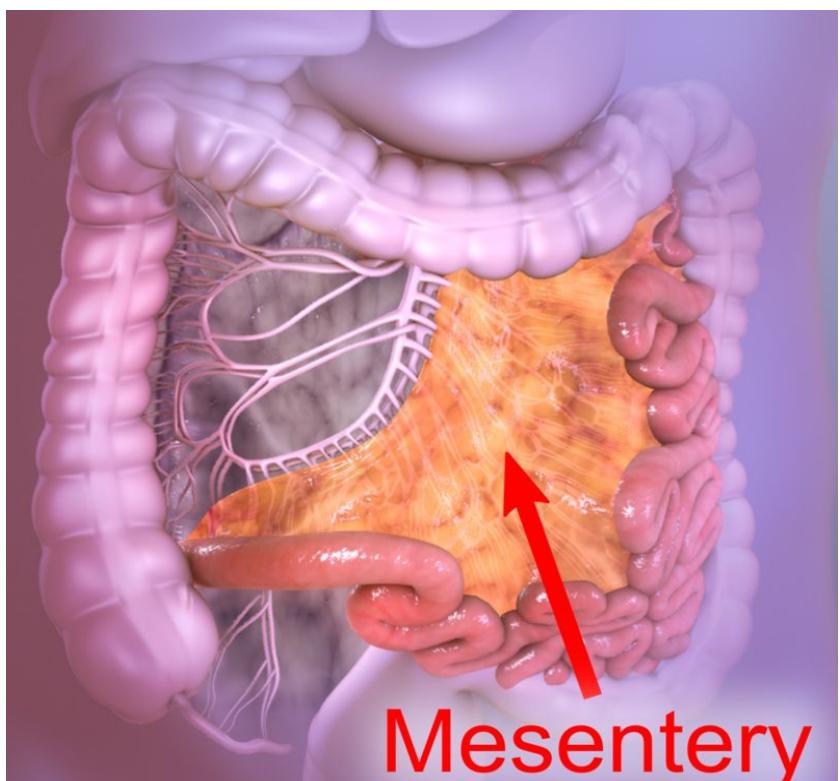
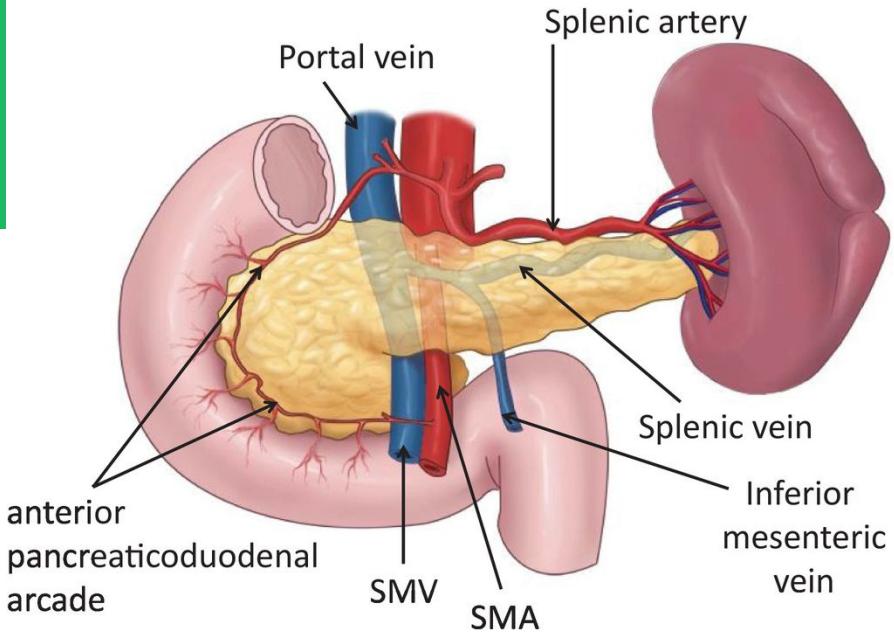


wiseGEEK



Superior Mesenteric Artery

- Comes off front of abdominal aorta at L1
- Appears beneath **Inferior border of pancreas** & goes over top of **3rd part of duodenum**
- Runs along **THE MESENTERY**
 - >DJ Flexure ->Across 3rd part Duodenum ->Over abdominal aorta & IVC -> Right psoas muscle -> Right iliac fossa
- Supplies **Major duodenal papilla** to **2/3rd of Transverse Colon**



SMA (cont.)

Branches

- Inferior pancreaticoduodenal artery

Supplies: Rest of pancreas and duodenum

- Jejunal and ileal branches to the left into **The Mesentery**.

Supplies: Jejunum and Ileum

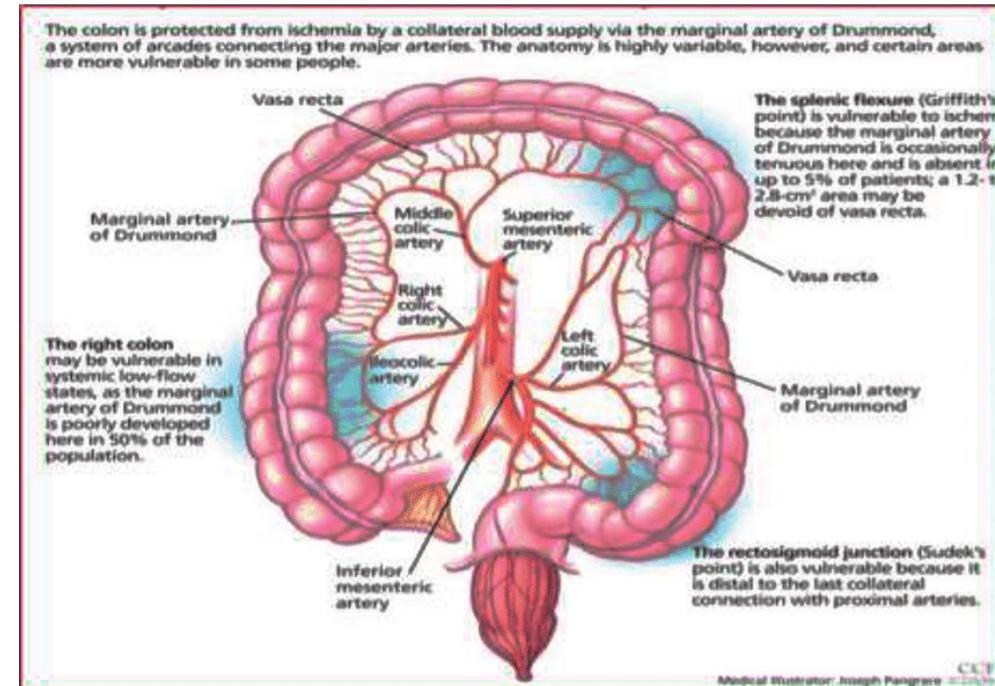
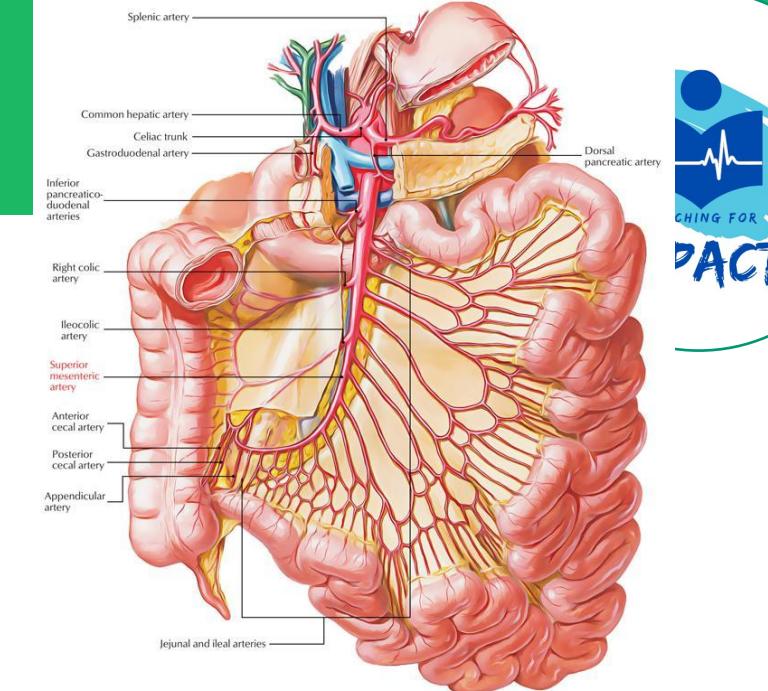
- Colic branches

>**Ileocolic** artery supplies: Terminal ileum, caecum, appendix, ascending colon

>**Right colic** artery supplies: Ascending colon

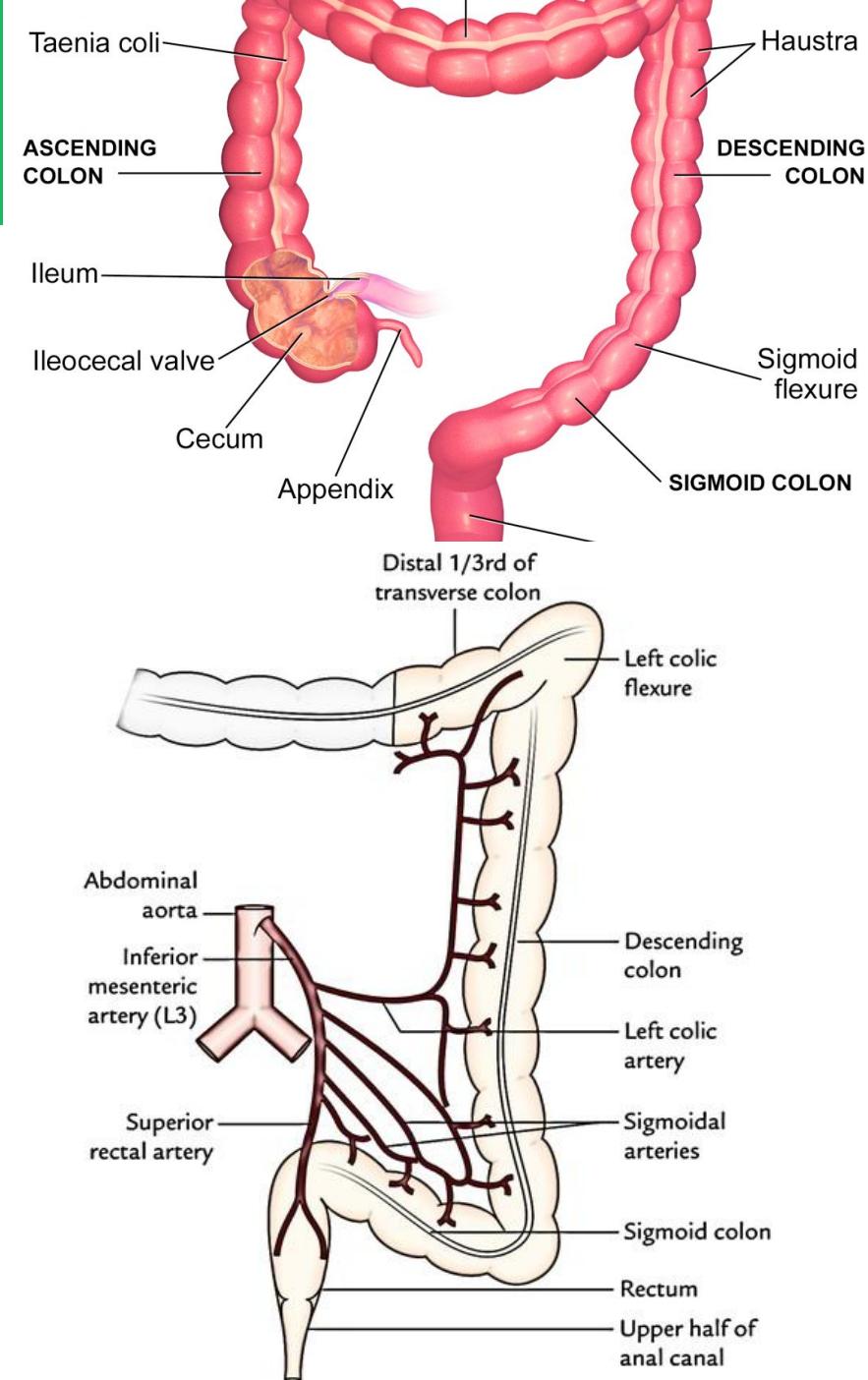
>**Middle colic** artery supplies: Proximal 2/3rd Transverse colon

*Note: Ileocolic + Right colic + Middle colic contribute to development of the Marginal artery

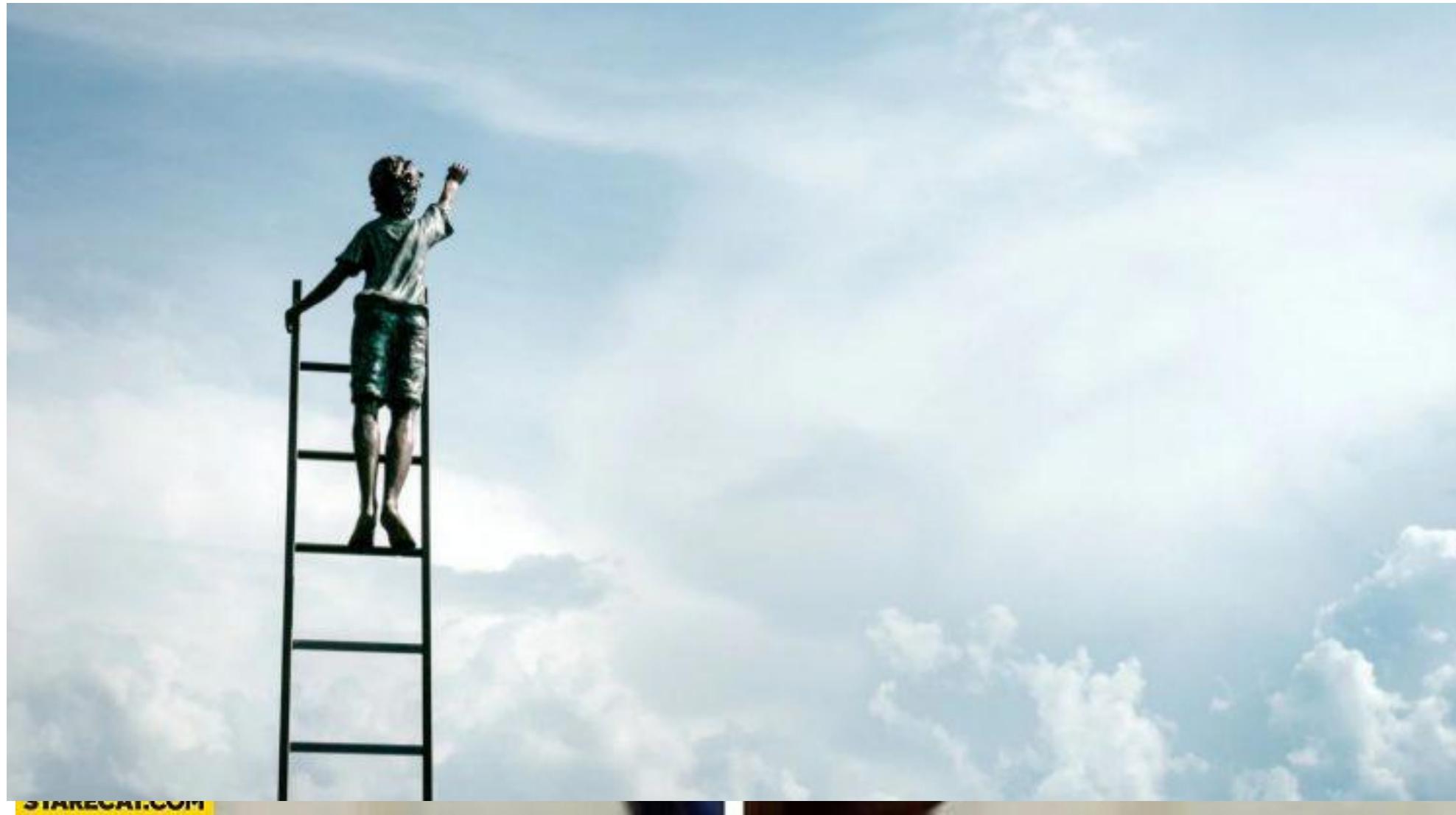


Inferior Mesenteric Artery

- Last branch of the abdominal aorta at **L3**
- Comes off inferior to **3rd part of duodenum**
- Supplies: Distal 1/3rd transverse colon to anal canal!
- Branches:
 - >**Left colic artery** – Feeds into the marginal artery
Supplies: Distal 1/3rd transverse colon + Descending colon
 - >**Sigmoid artery** – Feeds into sigmoid mesocolon
Supplies: Sigmoid colon
- Becomes the **Superior rectal artery** at the end
Supplies: Rectum and Anal canal



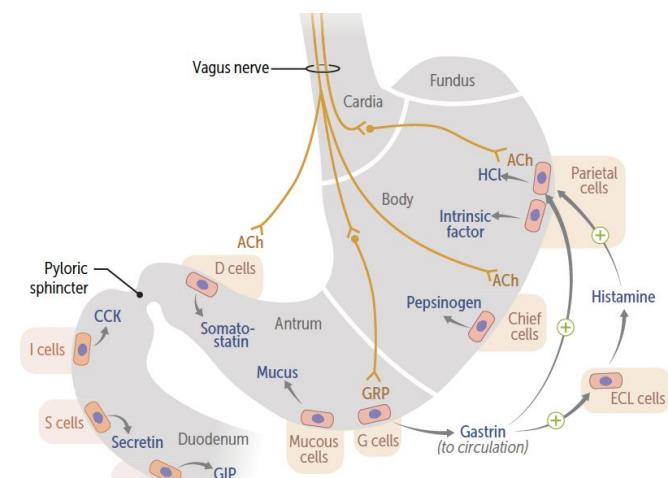
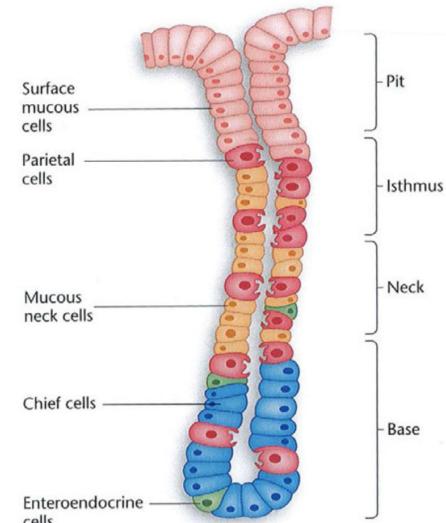
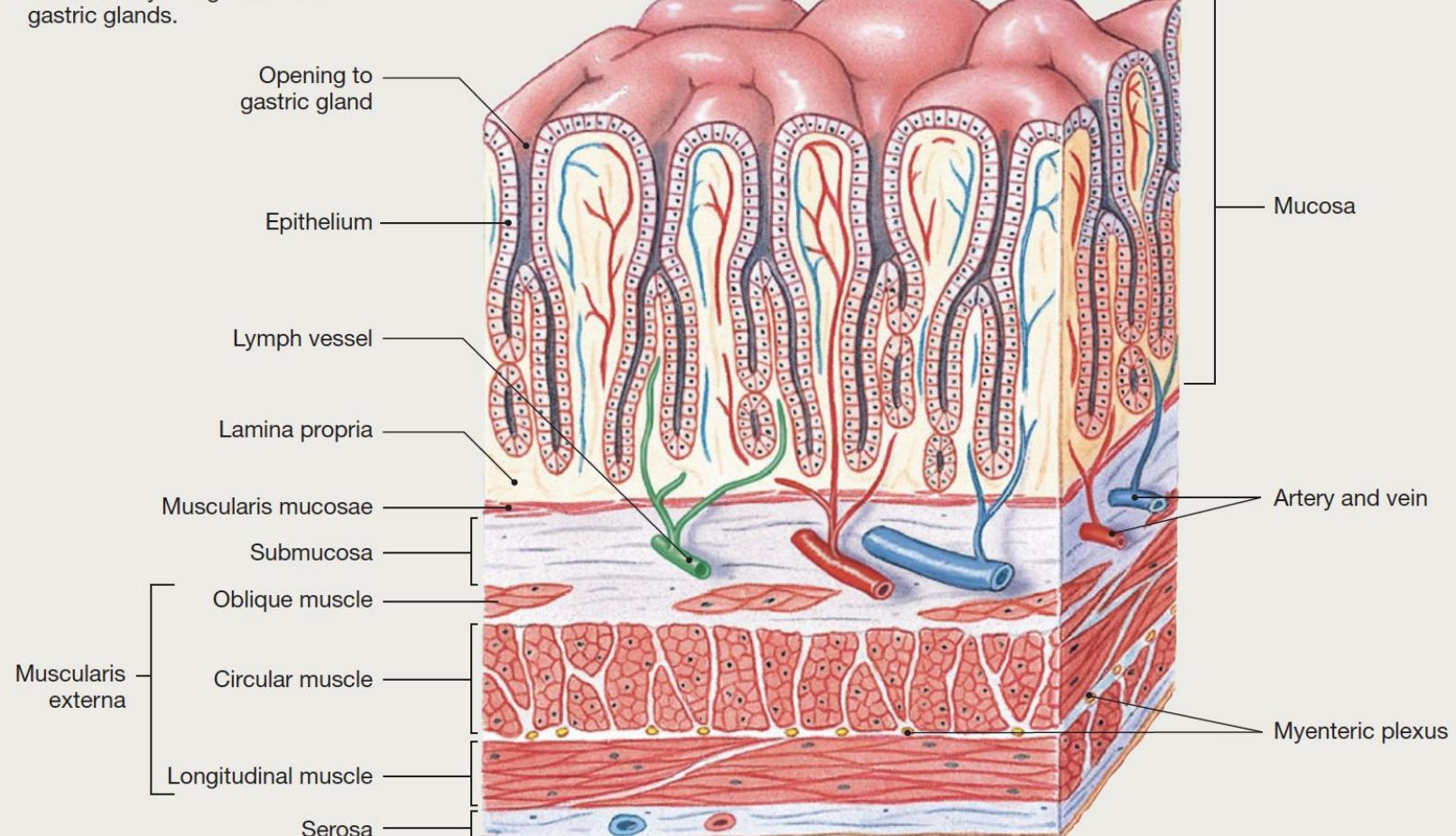
PERSERVERE WE'RE ALMOST THERE !!!



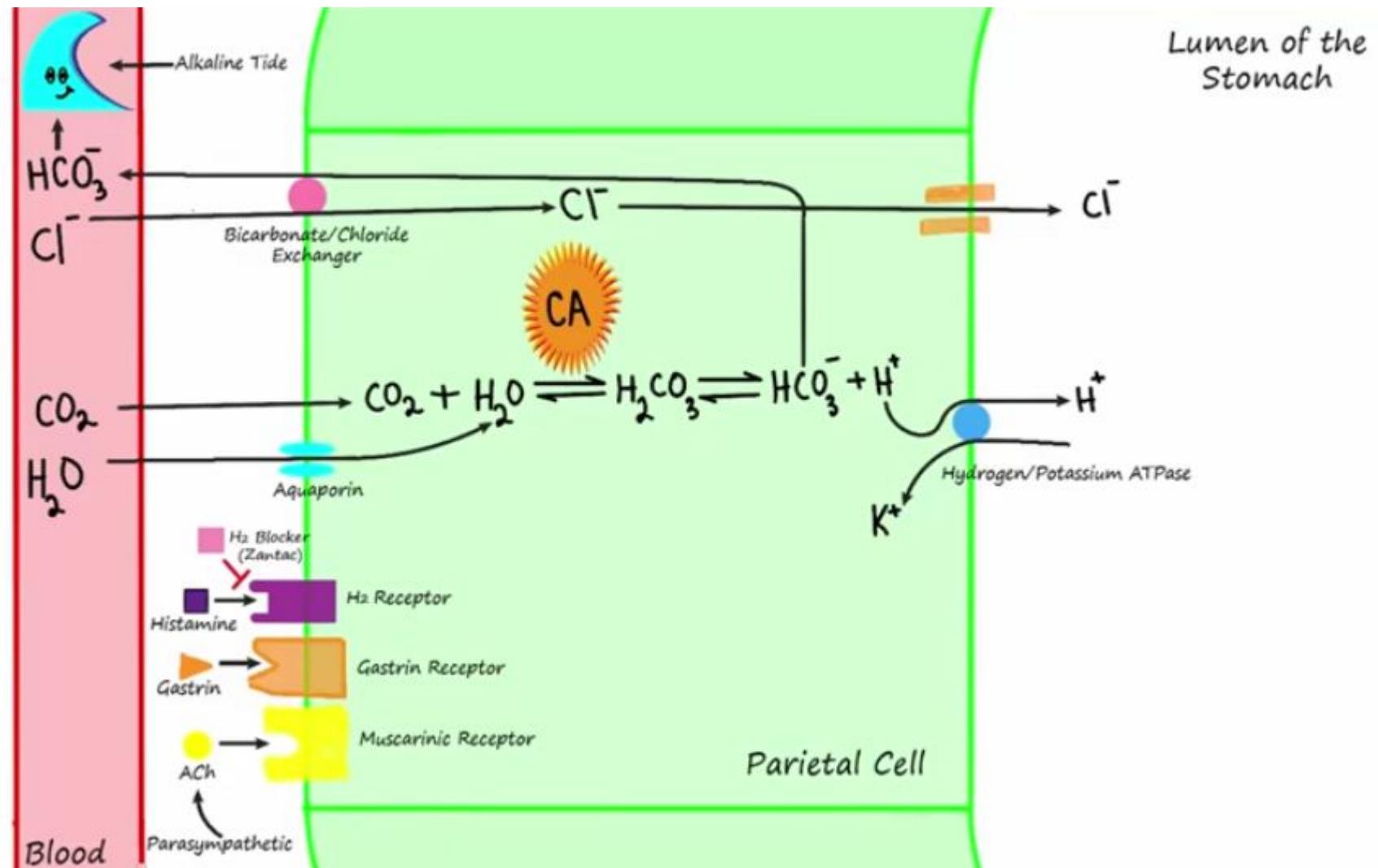
Gastric Glands

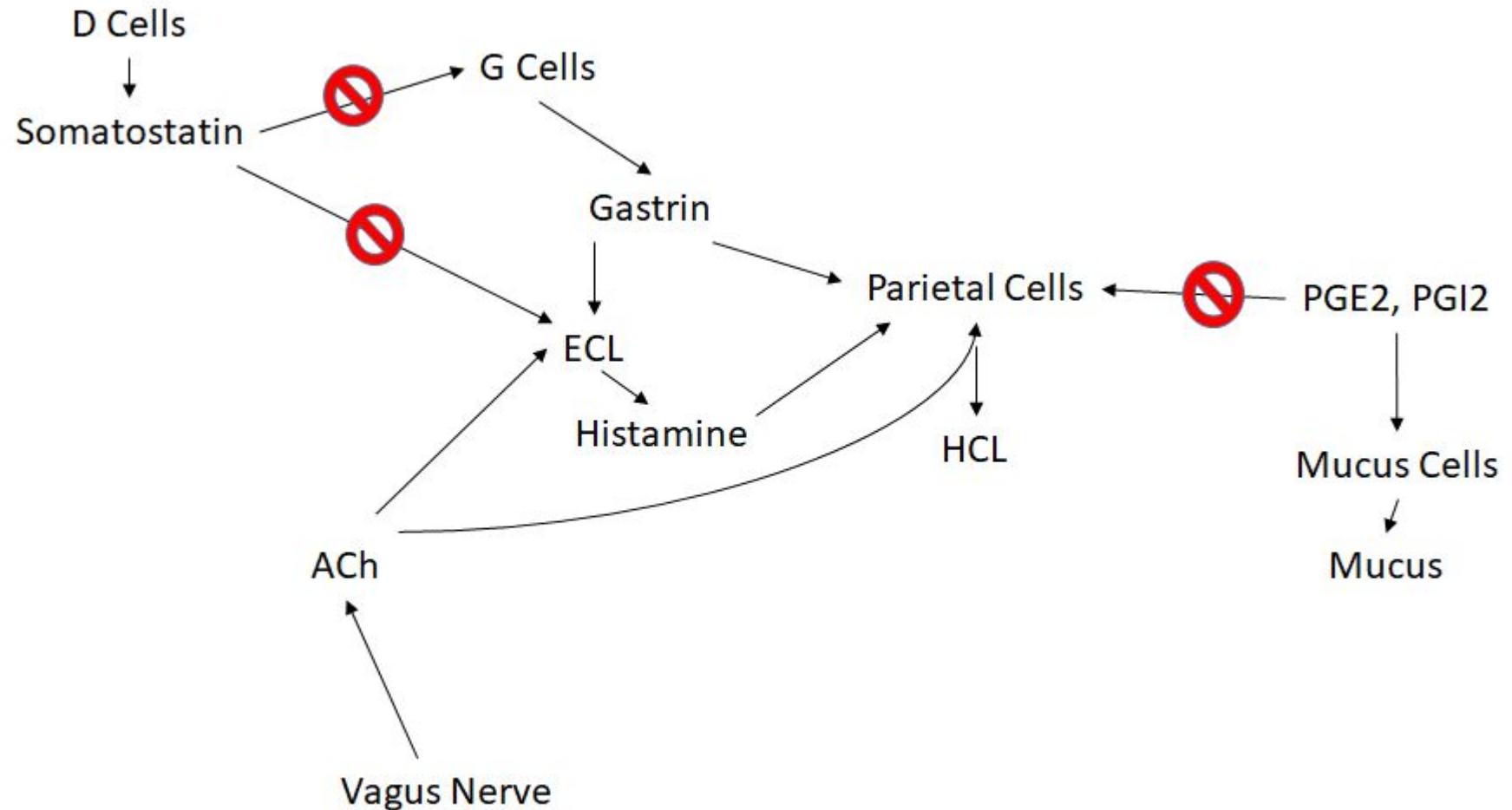


In the stomach, surface area is increased by invaginations called gastric glands.

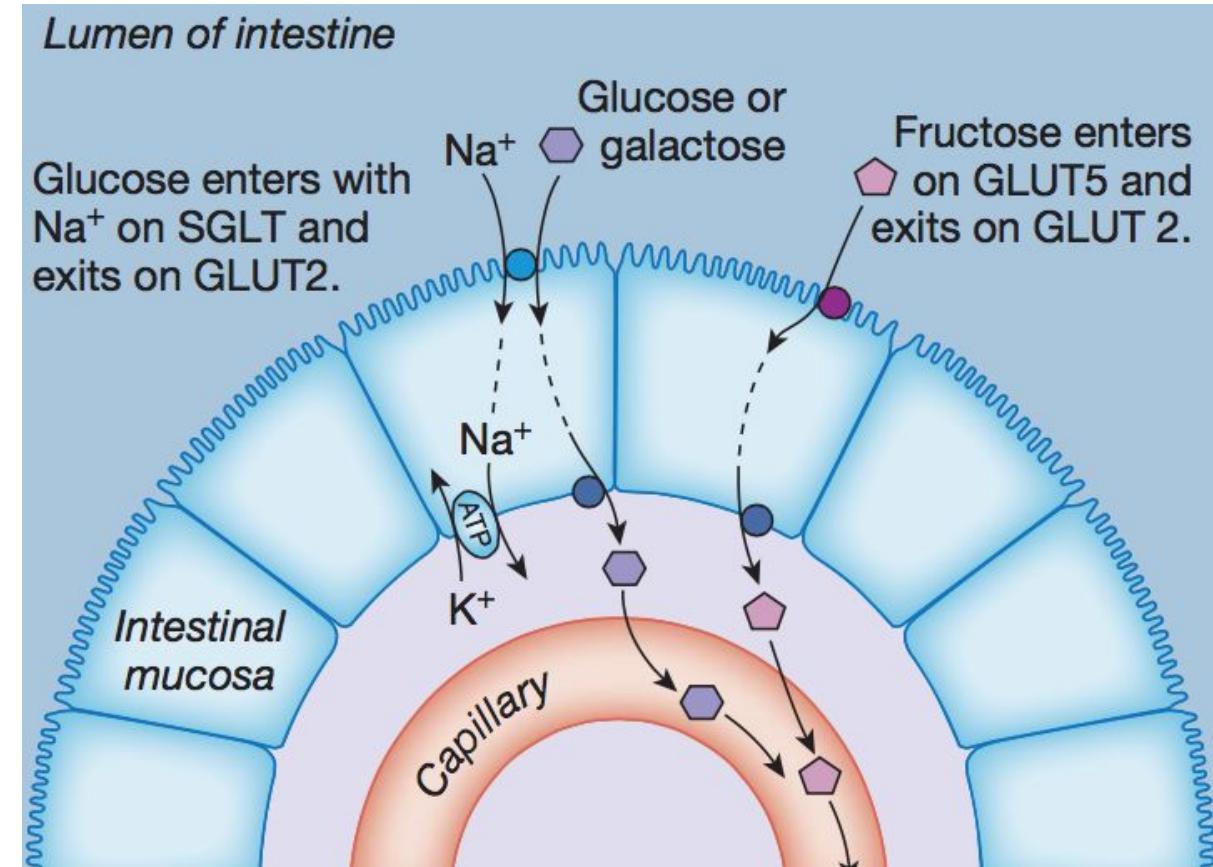
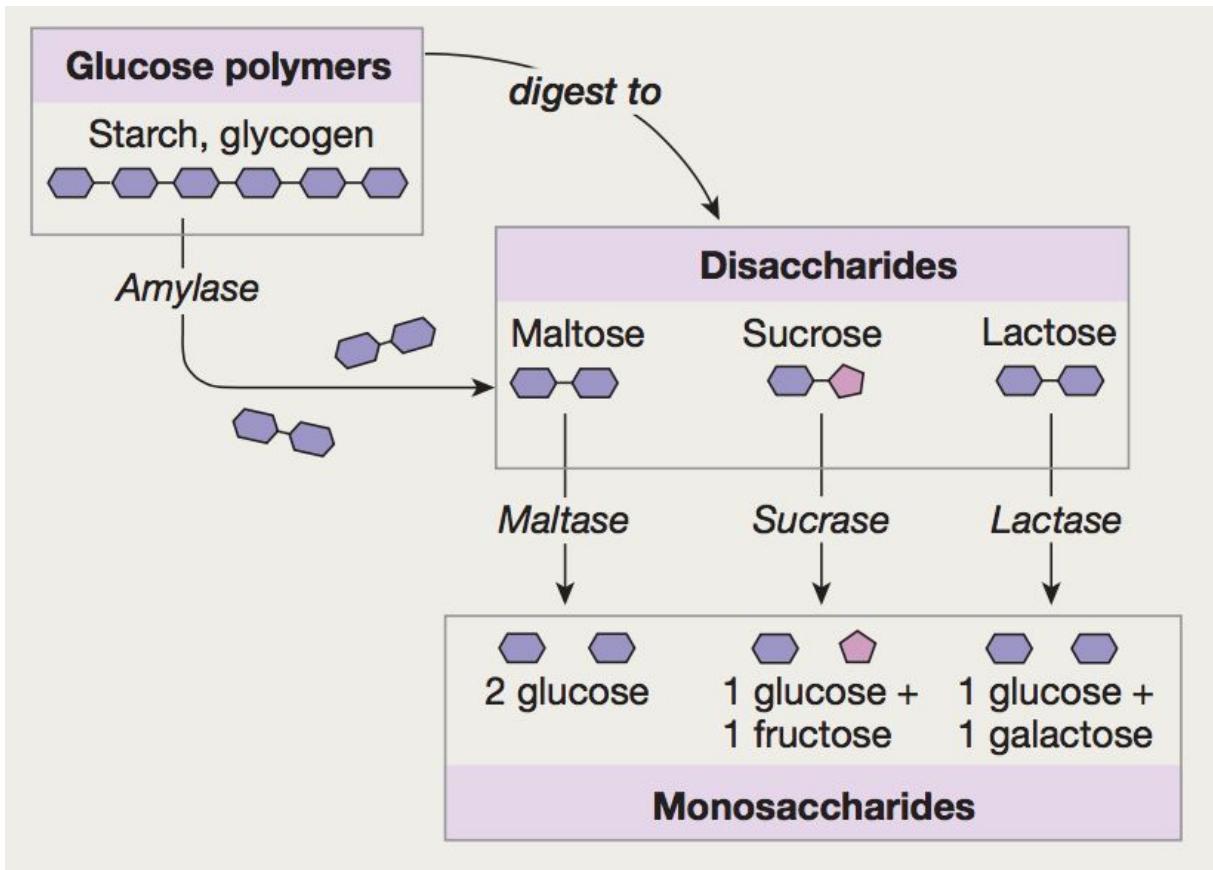


Regulation of Gastric Acid Secretion





Carbohydrate Digestion and Absorption



Protein Digestion and Absorption

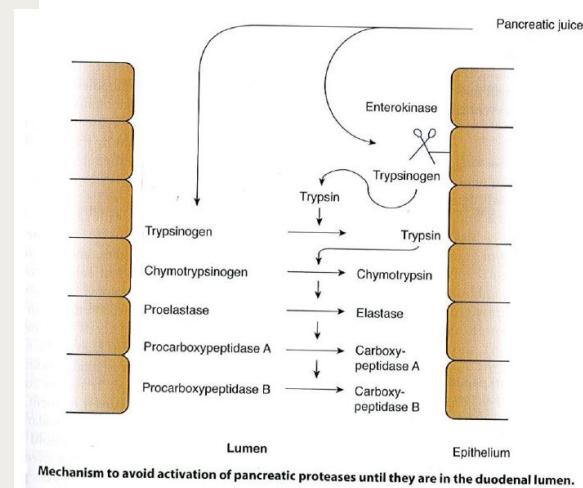
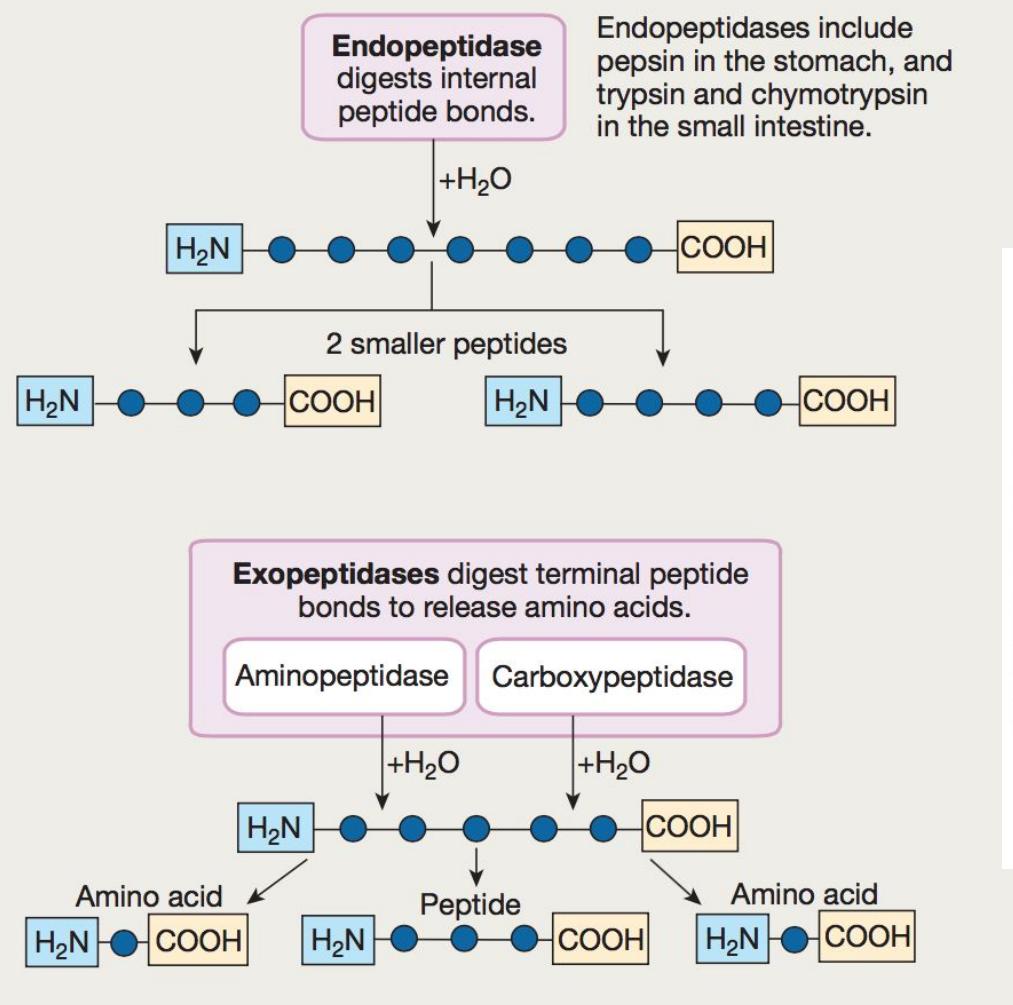
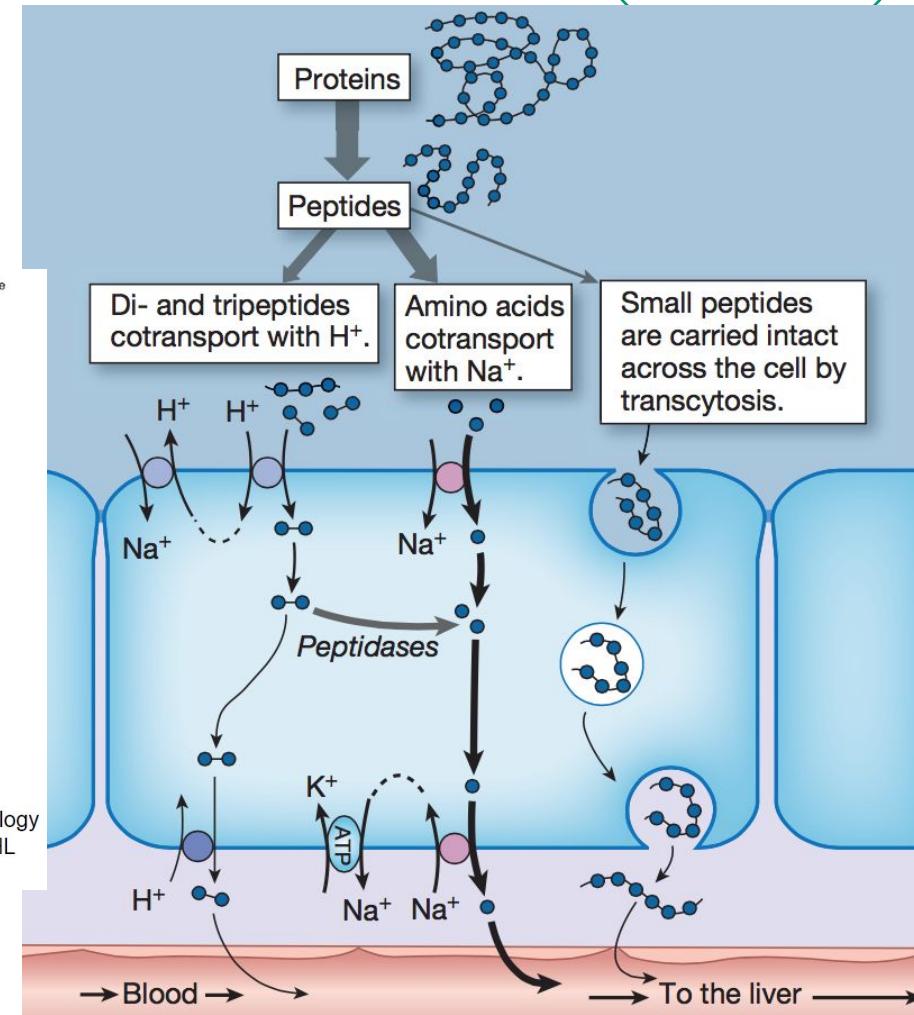
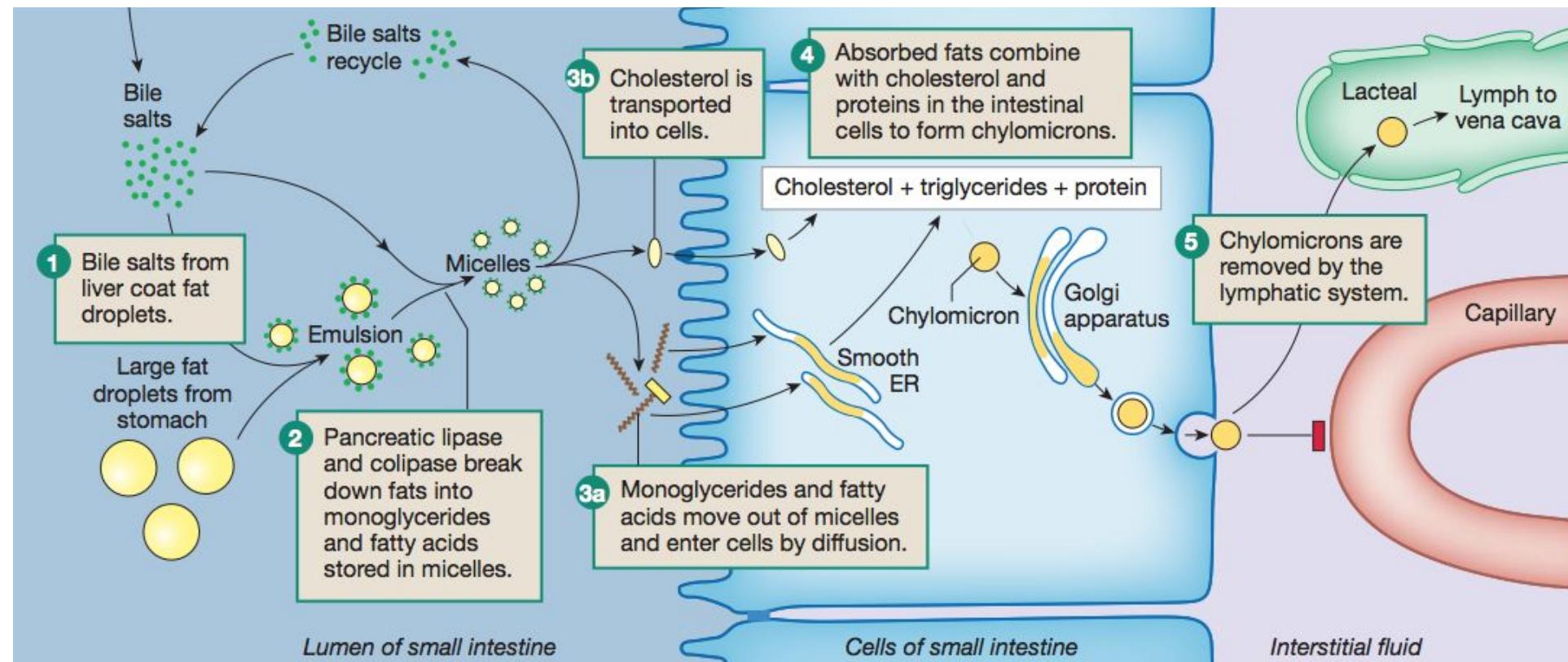
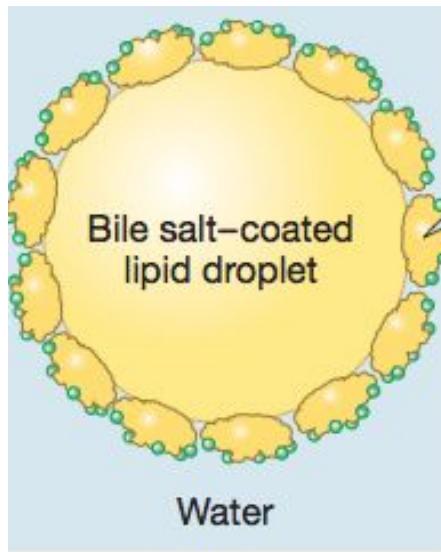


Figure 27-3 from Ganong's Review of Medical Physiology
23rd Ed, Barrett KE, Barman SM, Boitano S, Brooks HL
McGraw Hill, NY, p455, ISSN 0892-1253



Lipid Digestion and Absorption



Case 1: Abdominal Pain



- A 32 year old woman presents to ED with abdominal pain.



Differential Diagnoses for Abdominal Pain



Upper abdominal pain syndromes

- RUQ pain**
 - Gallstones
 - Acute cholecystitis
 - Ascending cholangitis
 - Hepatitis
 - Chronic liver disease

- Epigastric pain**
 - AMI
 - Pancreatitis
 - Acute gastritis
 - PUD
 - GORD

LUQ pain

- Splenic rupture

Lower abdominal pain syndromes

- One side**
 - Appendicitis (RLQ)
 - Diverticulitis (LLQ)

- Either side**
 - Kidney stones
 - Pyelonephritis
 - Ectopic pregnancy*

Suprapubic or pelvic pain

- Cystitis
- Urinary retention*
 - Pregnancy*
 - PID*

Diffuse abdominal pain syndromes

- Bowel obstruction
 - IBD/IBS
 - Gastroenteritis
 - Constipation

Viral Hepatitis



	A&E	B&D	C
Transmission	Faecal-oral <ul style="list-style-type: none"> Contaminated food (e.g. shellfish) and drinks (including ice) Travel to endemic country 	Blood and other body fluids <ul style="list-style-type: none"> IV drug use Unsafe sex Tattoo/piercing Blood transfusions Perinatal (HBV) Co- or superinfection (HDV) 	Blood and other body fluids <ul style="list-style-type: none"> IV drug use (80%) Tattoo/piercing Blood transfusions Unsafe sex (rare)
Incubation period	Short	Long	Long
Infection type	Acute	Acute and chronic	Acute and chronic
Clinical features	Fever, malaise, nausea, vomiting, RUQ pain <input checked="" type="checkbox"/> jaundice, dark urine, pale stool, pruritus <input type="checkbox"/> resolution	When symptomatic, acute HBV infection is like HAV, chronic infection can be asymptomatic or symptomatic.	Asymptomatic in 85%, but majority (70-90%) develop chronic infection with non-specific symptoms and can develop cirrhosis or HCC.
Diagnosis	LFT, serology	LFT, serology	LFT, serology, confirmatory PCR
HCC risk	Nil	Yes	Yes
Treatment	Mostly supportive	Acute infection: Supportive +/- oral antiviral Chronic infection: Pegylated IFN-alpha for both; long term nucleoside/nucleotide analogues (e.g. tenofovir) for HBV; liver transplantation may be required	Acute infection: IFN-alpha or pegylated IFN-a (optimal timing and therapeutic regimen is unclear due to lack of data) Chronic infection (>6months): New direct-acting anti-virals (e.g. protease inhibitors, nucleotide polymerase inhibitor)
Vaccination	Inactivated viral protein (HAV) Nil for HEV in Australia	HBsAg vaccine protects against both	Nil

Hepatitis B serology



	HBsAg	Anti-HBs	Anti-HBc IgM	Anti-HBc IgG	HBeAg	Anti-HBe	HBV DNA
Acute infection							
Resolved infection							
Inactive chronic carrier state							
Active chronic infection							
Immunised							

Hepatitis B serology



	HBsAg	Anti-HBs	Anti-HBc IgM	Anti-HBc IgG	HBeAg	Anti-HBe	HBV DNA
Acute infection	+	-	+	-	+	-	+
Resolved infection	-	+	-/+	+	-	+	-
Inactive chronic carrier state	+	-	-	+	-	+	-
Active chronic infection	+	-	-	+	+	-	+
Immunised	-	+	-	-	-	-	-

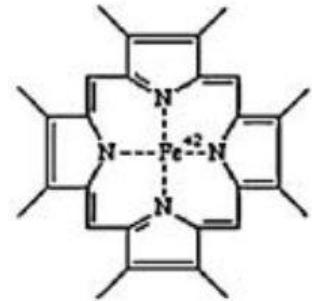
Case 2: Jaundice



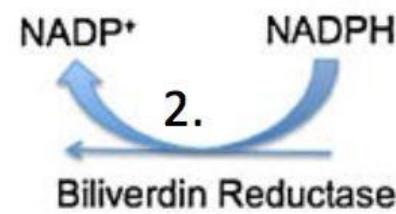
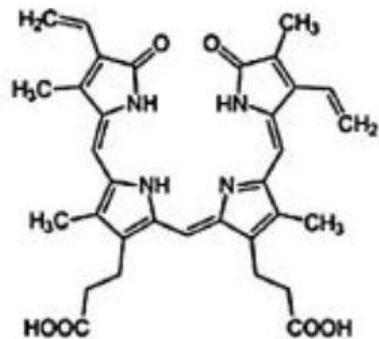
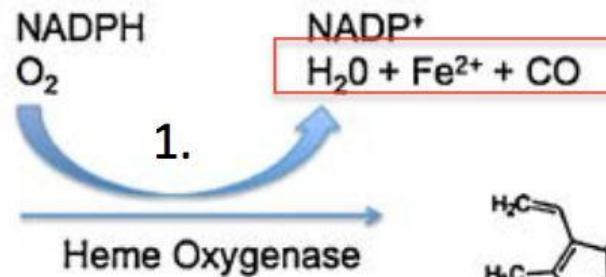
- A 68 year old man presents to ED with jaundice.



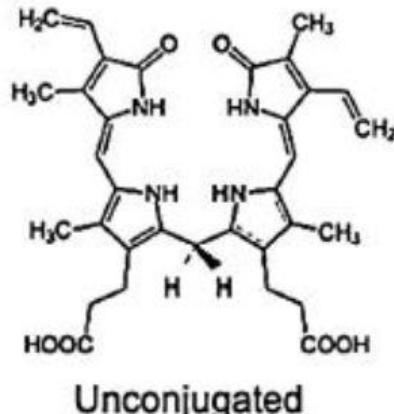
Bilirubin Metabolism



Heme

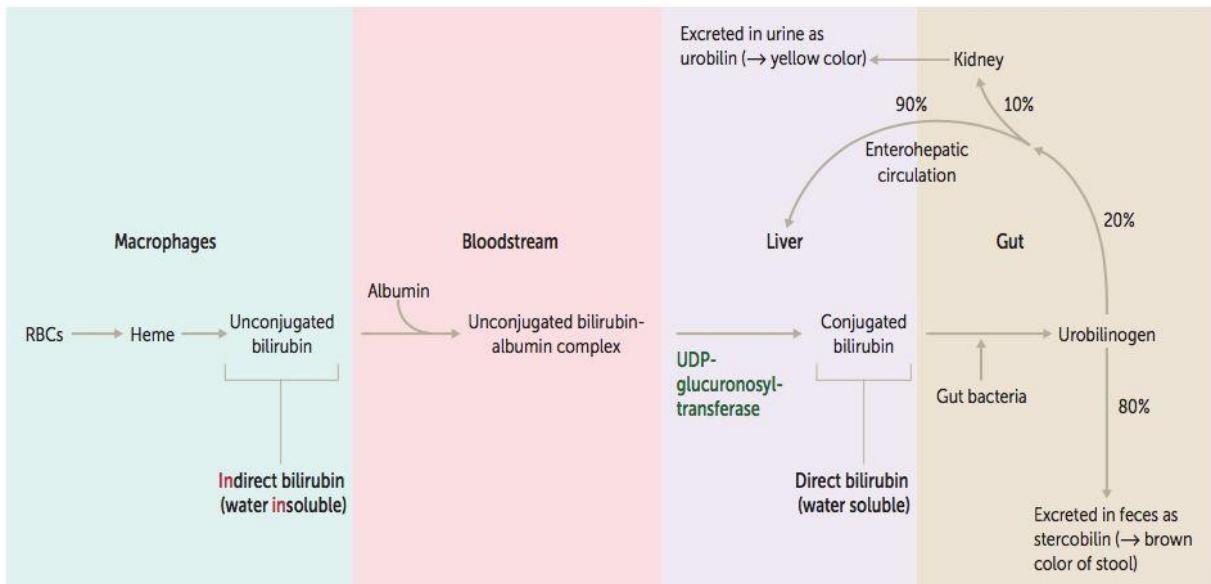
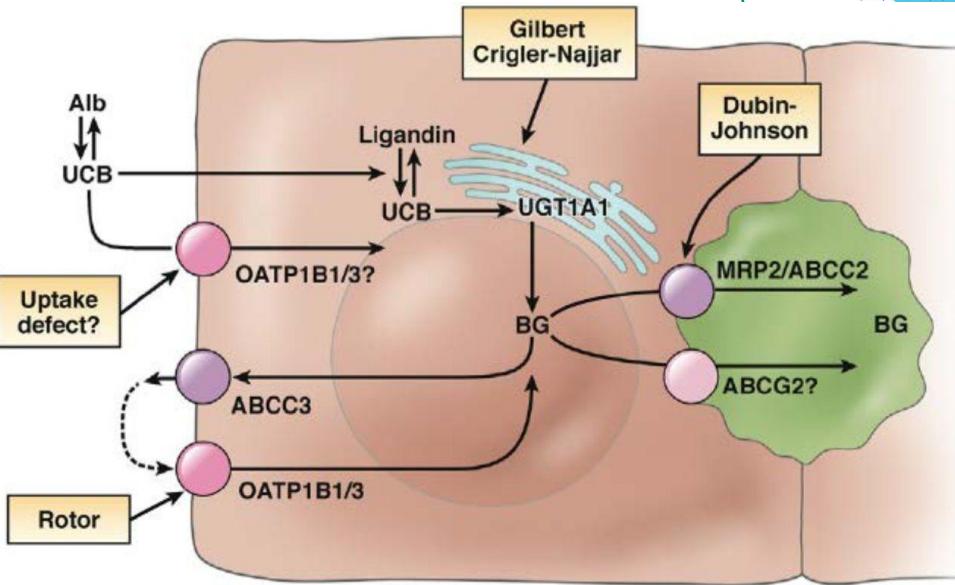


Biliverdin

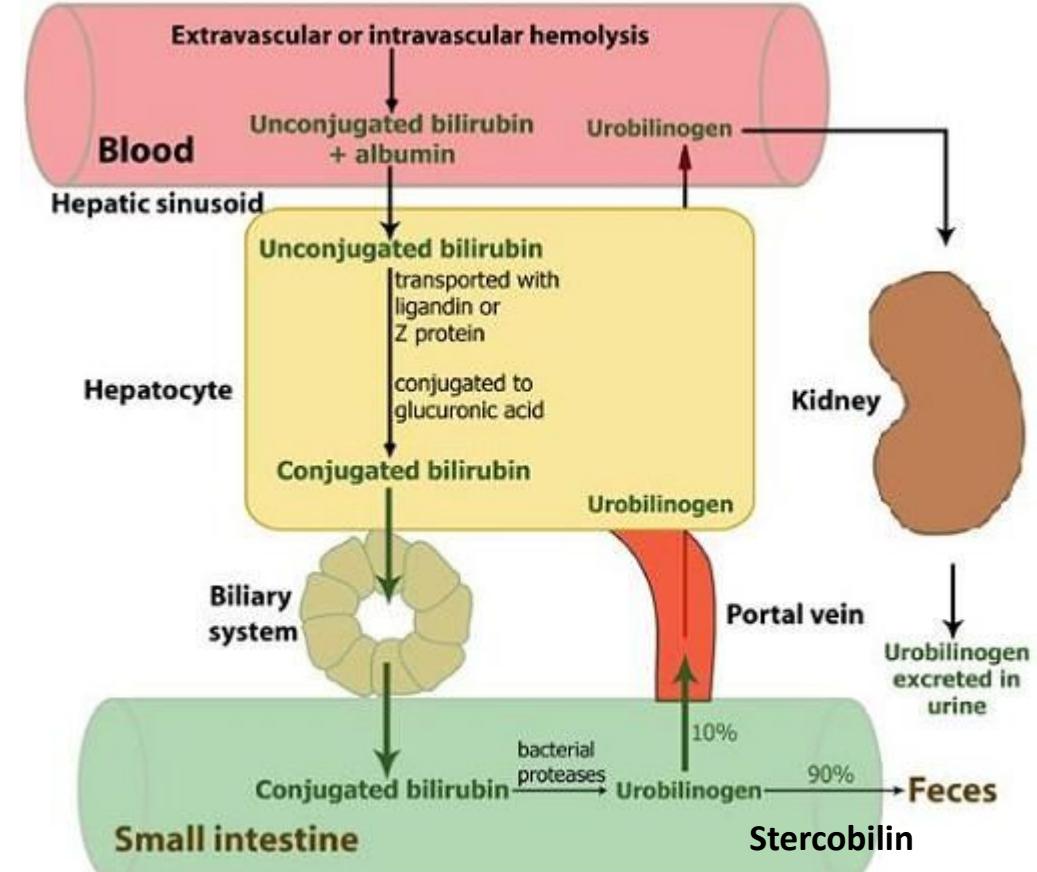
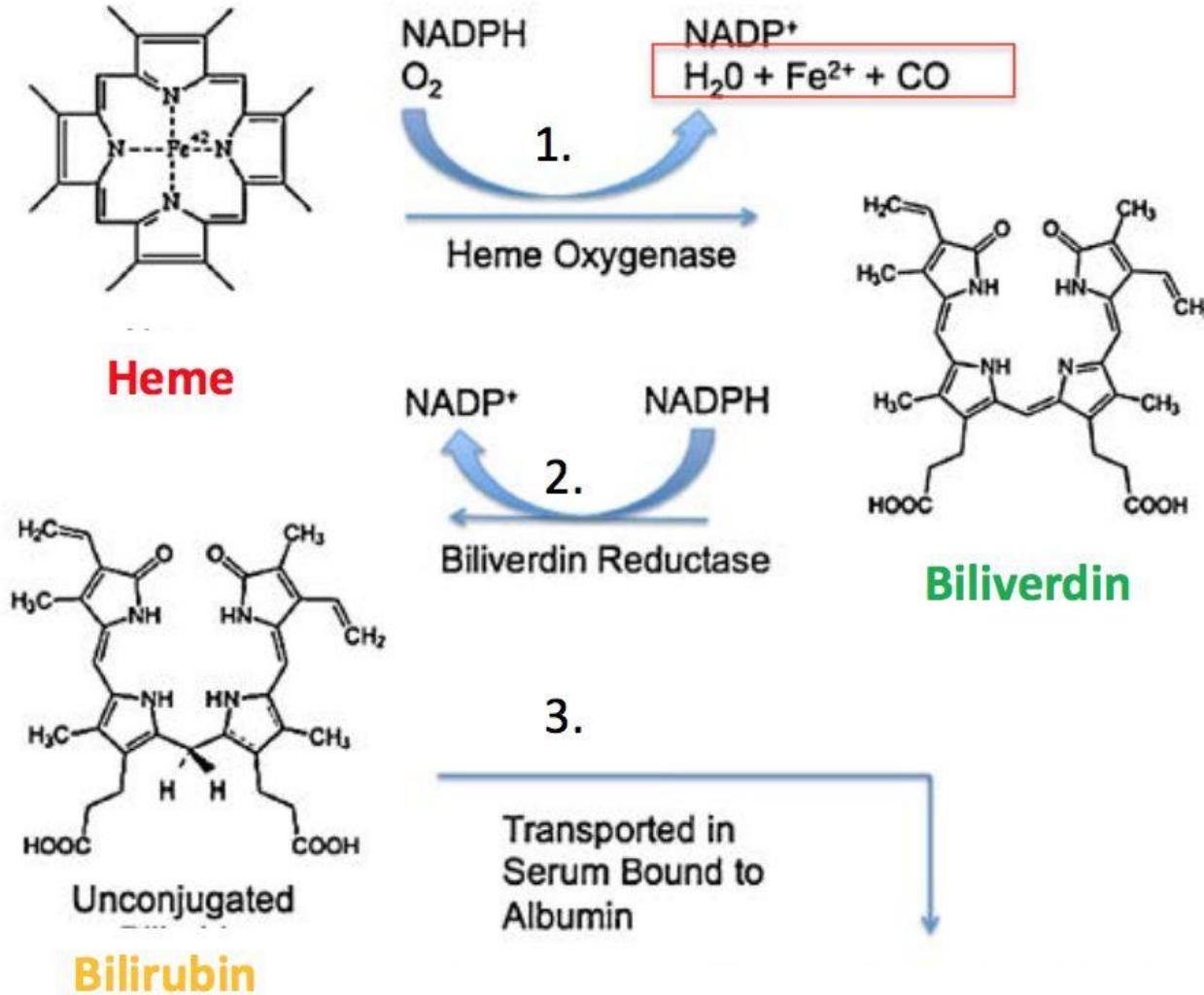


**Unconjugated
Bilirubin**

Transported in Serum Bound to Albumin



Bilirubin Metabolism



Differential Diagnoses for Jaundice

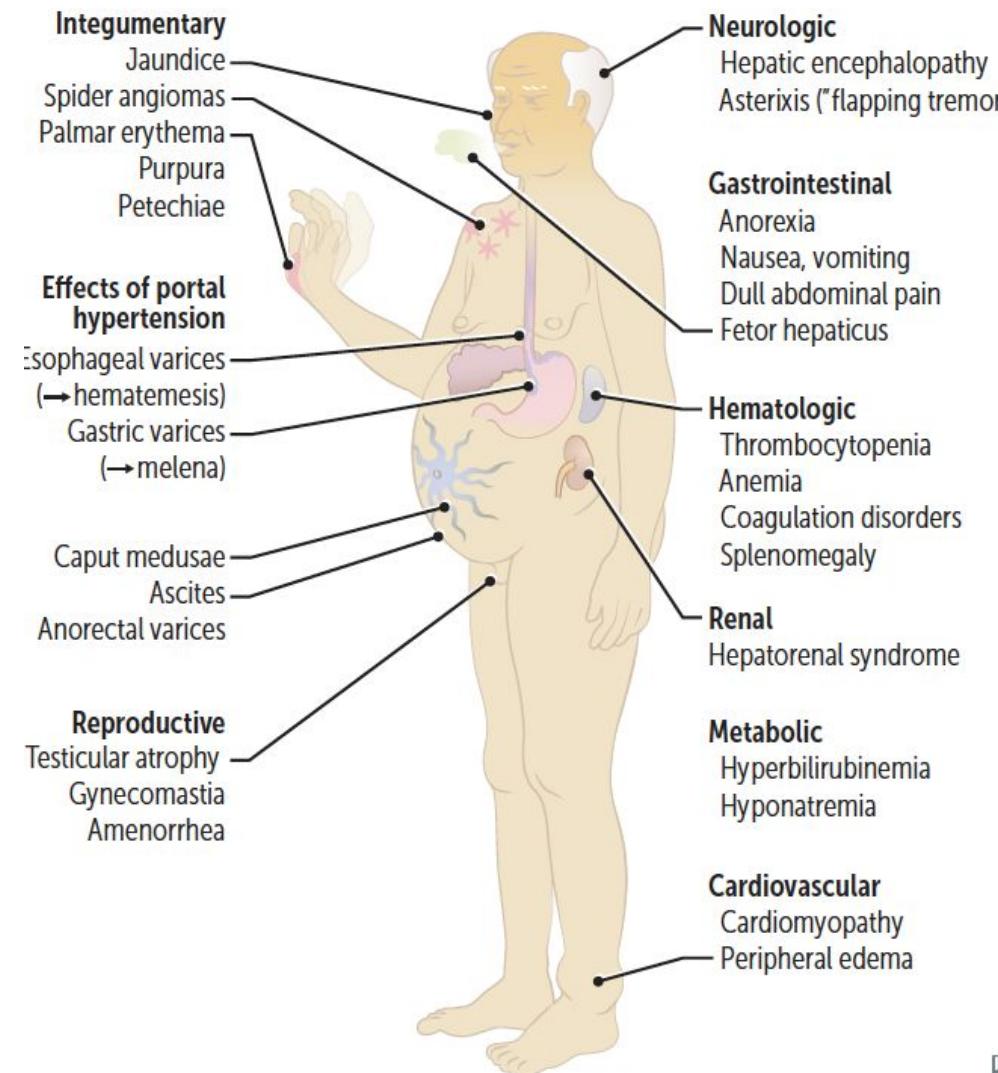


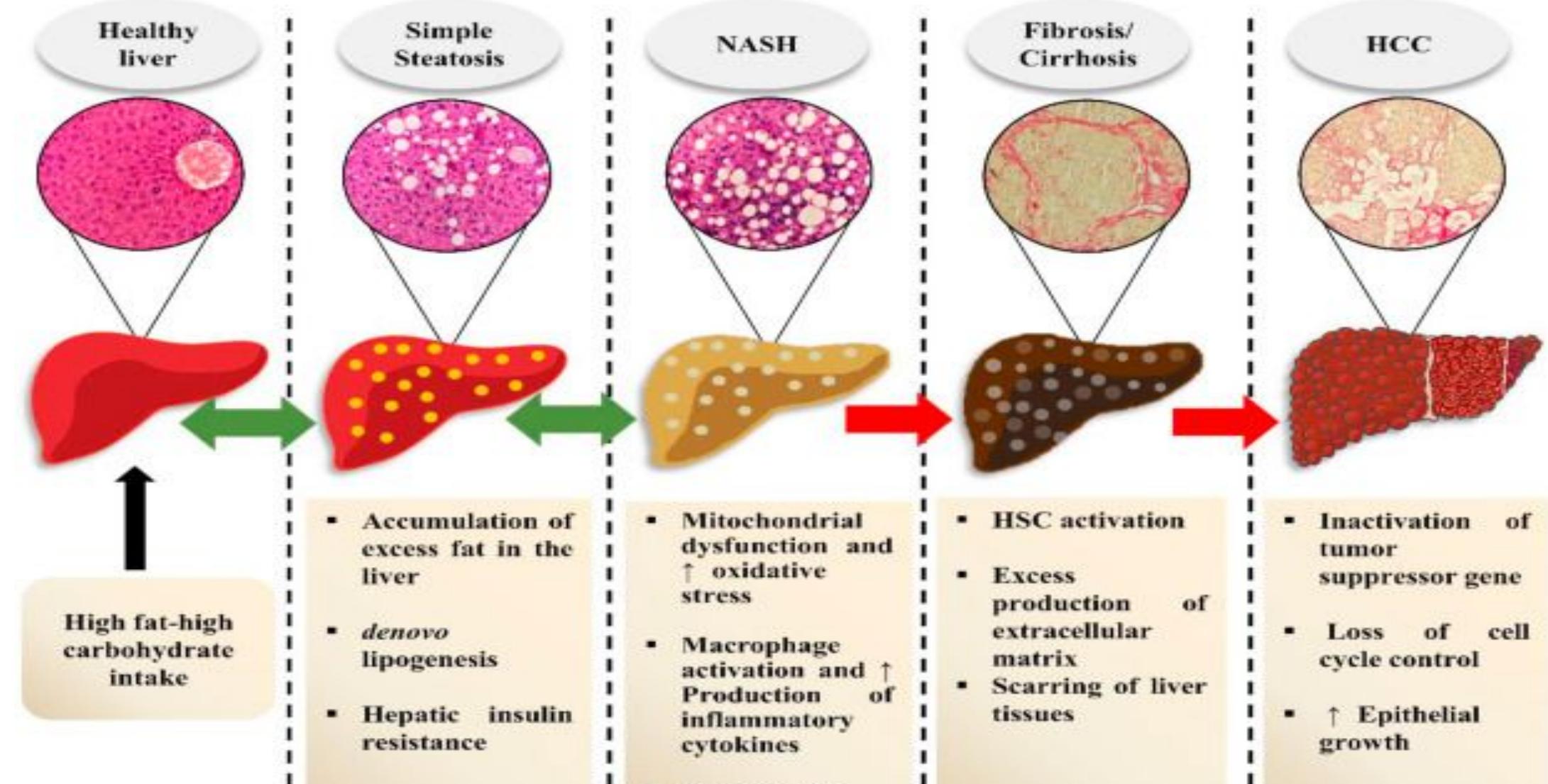
Pre-hepatic	Intra-hepatic	Post-hepatic
<ul style="list-style-type: none">• Malaria• Sickle cell anaemia• Thalassemia• Septicaemia• G6PD deficiency	<ul style="list-style-type: none">• Viral hepatitis• Alcoholic hepatitis• Autoimmune hepatitis• Hepatocellular carcinoma (HCC)	<ul style="list-style-type: none">• Choledocholithiasis• Cholangiocarcinoma and pancreatic cancer• Pancreatitis

Chronic Liver Disease and Cirrhosis



- **Definition:**
 - Disease of liver >6 months
- **Causes:**
 - Chronic viral hepatitis
 - Alcoholic liver disease
 - Non-alcoholic fatty liver disease (NALFD)
- **Clinical features:**
 - Obstruction of blood flow through liver
 - Reduction in liver function





Management of Cirrhosis



- Slow or reverse the progression of liver disease
 - Hepatitis B & C
 - Alcohol
- Prevent superimposed insults to the liver
 - Vaccinations
 - Avoidance of hepatotoxins
- Identify medications that require dose adjustments or should be avoided entirely
- Manage symptoms and laboratory abnormalities
 - Ascites
 - Hyponatremia
 - Thrombocytopenia or elevated INR
- Prevent, identify, and treat complications of cirrhosis
 - Variceal bleeding
 - HCC
 - SBP
 - Hepatic encephalopathy
- Determine the appropriateness and optimal timing for liver transplantation

Gastrointestinal Exam



- Metabolic flap: instruct patient to hold for 15 seconds.
- Spider naevi: SVC distribution - remember to inspect the BACK (esp. the back of the neck)
- Position: FLAT bed, ask patient to lie down on one pillow, drop pants down to hip bone, arms by their sides and legs uncrossed
- Pain: always ask if the patient has any pain **at the start** of the exam and identify the location. Start palpating **away** from the pain and move towards it.
- Inspection of the abdomen: allow a few breaths to watch the rise and fall of the abdomen
- Palpation: watch the patient's face for any reaction; deep palpation should be DEEP
- Palpation for liver and spleen: Ask the patient to breathe in while pushing into their abdomen with your edge the hand (index finger portion), do not move hand during this time
- Liver span: measure in the mid-clavicular line; normal span is 12-13cm
- Palpation of the kidneys: the anterior hand is flat and firm - feel for the kidneys with fingers and not the heel of the hand
- Answer the question in a systematic way!

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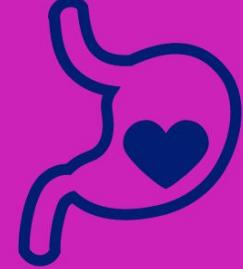
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THANK YOU

YOU ARE ALL GONNA ACE YOUR GI BLOCK!



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