



Anatomy

Faculty of Medicine - JU2017

Number >>

8

Doctor

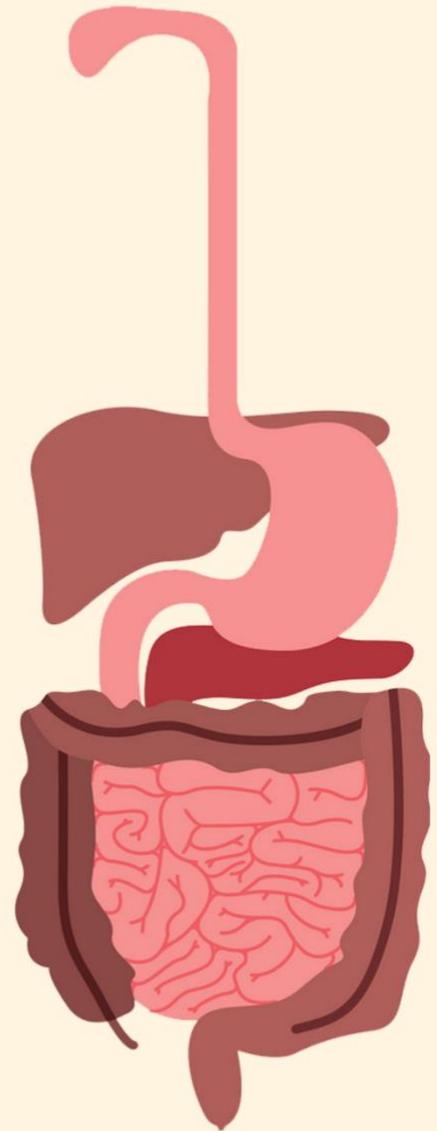
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2nd system - GI



For the comparison purposes refer to the last page where you can find a table that summarizes them.

😊 Enjoy 😊

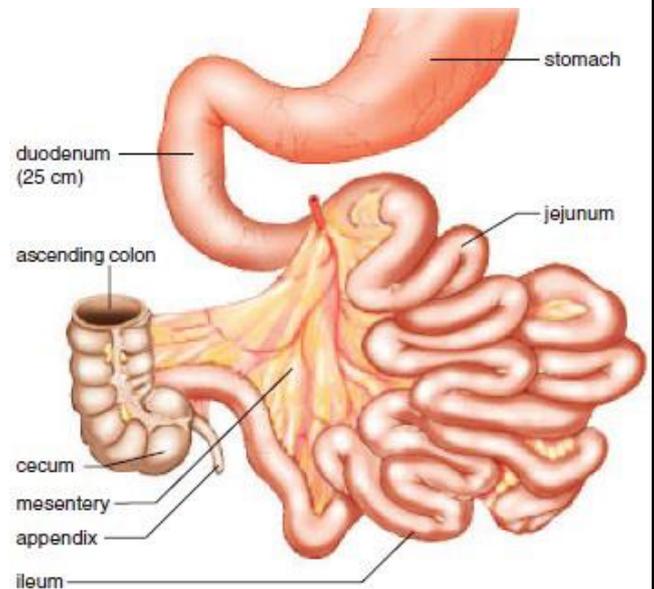
Jejunum and Ileum

-They're intraperitoneal and freely mobile so they're completely covered by peritoneum and has mesentery (2 layers of peritoneum) extending from posterior abdominal wall to attach to jejunum and ileum on its free edge.

-The jejunum and ileum measure about 20 ft (6 m) long >> the upper 2/5 is the jejunum & the lower 3/5 is the ileum but actually there's no landmark that separates the two from each other and the change is gradual from one to another, so we rely on distinctive features in their wall, diameter, and mesentery in order to differentiate between them.

-The jejunum begins at the duodenojejunal flexure (ligament of treitz that's attached to the right crus of diaphragm) and located in the upper part of the peritoneal cavity below the left side of the transverse mesocolon (upper to the left).

-The ileum is located in the lower part of the cavity and in the pelvis (lower to the right) and ends at the ileocecal junction where the cecum begins -remember that cecum is located in the right iliac fossa-



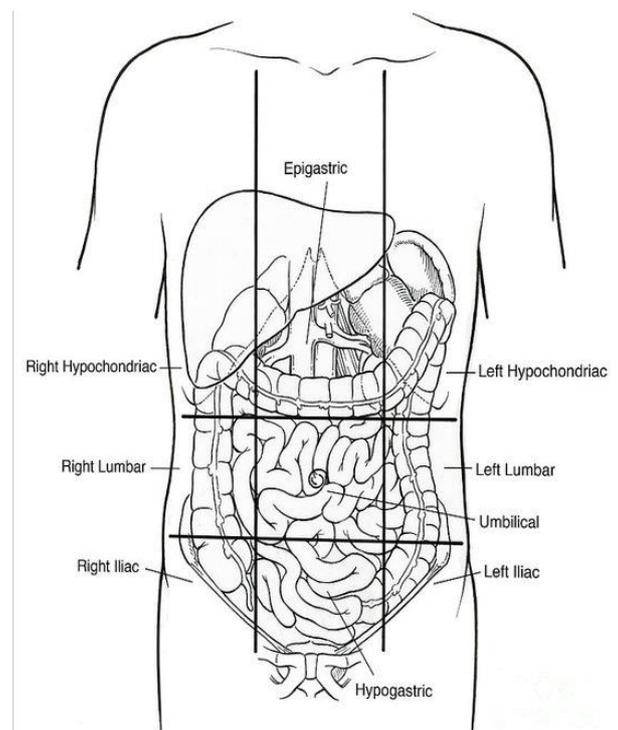
Function:

The main function of small intestine is absorption of nutritive material.

Our food is either carbohydrates, proteins, or fat and the digestion process turns them into glucose, amino acids, or fatty acids respectively. This simple material is the one that's absorbed in small intestine and they all have to go firstly to the liver by portal vein before entering the systemic circulation.

Location:

Small intestine (jejunum and ileum) is located in umbilical region surrounded by large intestine, so it's internal to large intestine.



Histology of small intestine:

We know that GI tract has 4 layers: mucosa, submucosa, muscular layer, serosa or adventitia (depending if the organ is intraperitoneal or retroperitoneal)

If intraperitoneal > serosa which is simple squamous epithelium
If retroperitoneal > adventitia which is connective tissue

As small intestine is intraperitoneal, so it's wall contain serosa not adventitia.

Mucosa:

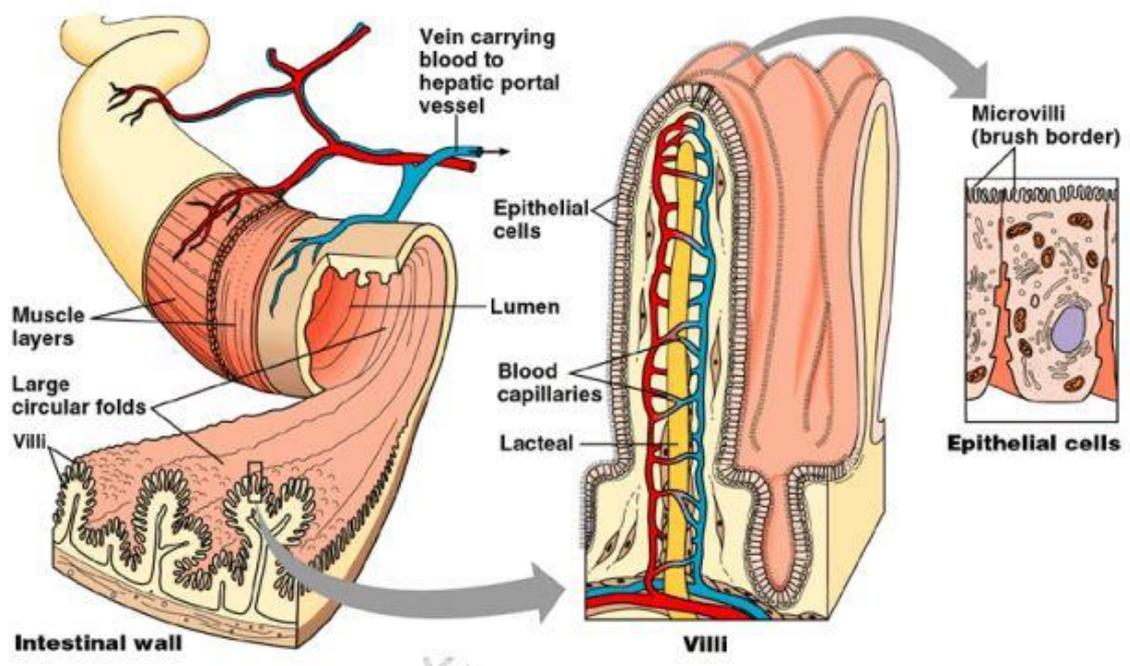
Contains villi and micro villi on the surface of villi to increase the surface area for absorption, and as we know the mucosa consists of 3 layers (lining epithelium, lamina propria, and muscularis mucosa which consists of 2-3 bands of smooth muscle).

*Lining epithelium:

-Epithelial absorptive cells: simple columnar with goblet cells (in stomach it's just simple columnar without goblet cells) and its function is absorption.

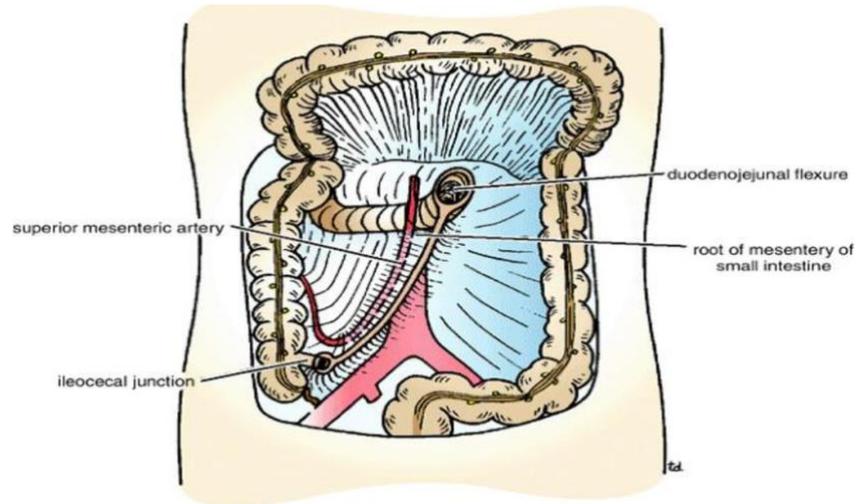
-Glands (intestinal crypts/ intestinal glands/ crypts of Lieberkühn): Have the same lining epithelium but its function is secretion. On the base of the glands there's **paneth** cells which is bactericidal cells and not found in large intestine.

***Lamina propria**: loose connective tissue that contains connective tissue cells (fibroblasts, smooth muscle cells) and contains artery, vein, and **lacteal** which is a blind lymphatic vessel responsible for absorption of fat.



Mesentery of the small intestine: fan-shaped fold of peritoneum

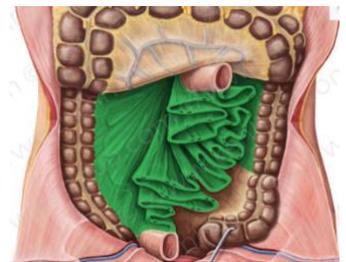
Formed by parietal peritoneum on posterior abdominal wall starting from the left side at the level of L2 at duodenojejunal flexure and descends obliquely downwards to the right side in front of right sacroiliac joint ending at ileocecal junction.



Root is 6 inches (15 cm) long while the free edge that's attached to small intestine is 6 meters long.

***Contents of the mesentery:** between the 2 layers of peritoneum

- 1-Superior mesenteric artery which forms arcades and vasa recta when reaching jejunum and ileum.
- 2-Superior mesenteric vein and its tributaries.
- 3-Nerves: sympathetic and parasympathetic.
- 4-Fat which is more in mesentery of ileum.

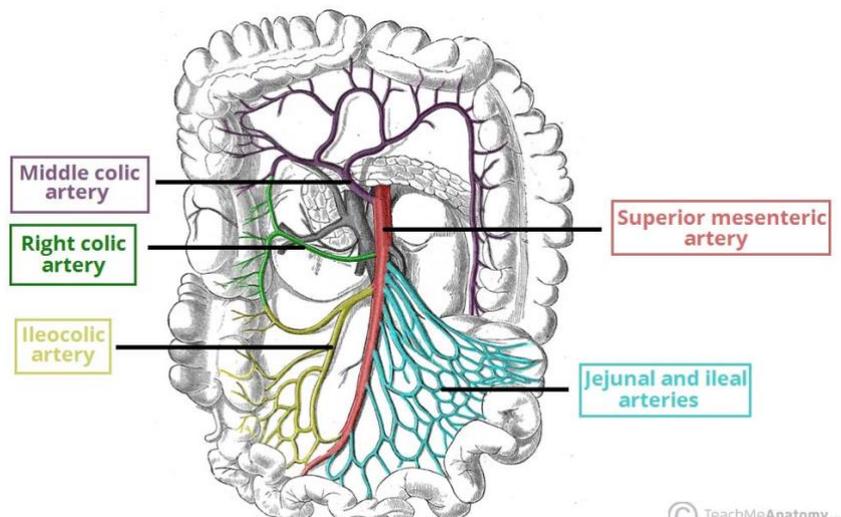


Blood supply of Jejunum & Ileum:

They are considered part of the midgut, so it's supplied by branches of superior mesenteric artery.

Superior mesenteric artery gives jejunal and ilial arteries that gives branches anastomose with one another to form a series of arcades.

At the end of superior mesenteric artery, it gives a branch called ileocolic artery that supplies end of ileum, cecum (by ant. And post. cecal arteries), beginning of ascending colon, and appendix.



**The intestinal branches arise from the left side of the artery and run in the mesentery to reach the gut. ** from slides

Venous drainage:

Tributaries of superior mesenteric vein unite to form superior mesenteric vein that ends behind the neck of pancreas uniting with the splenic vein forming portal vein (i.e. portal vein begins behind the neck of pancreas and ends in the liver and divides into right and left veins in porta hepatis).

- The veins correspond to the branches of the superior mesenteric artery

Lymphatic drainage:

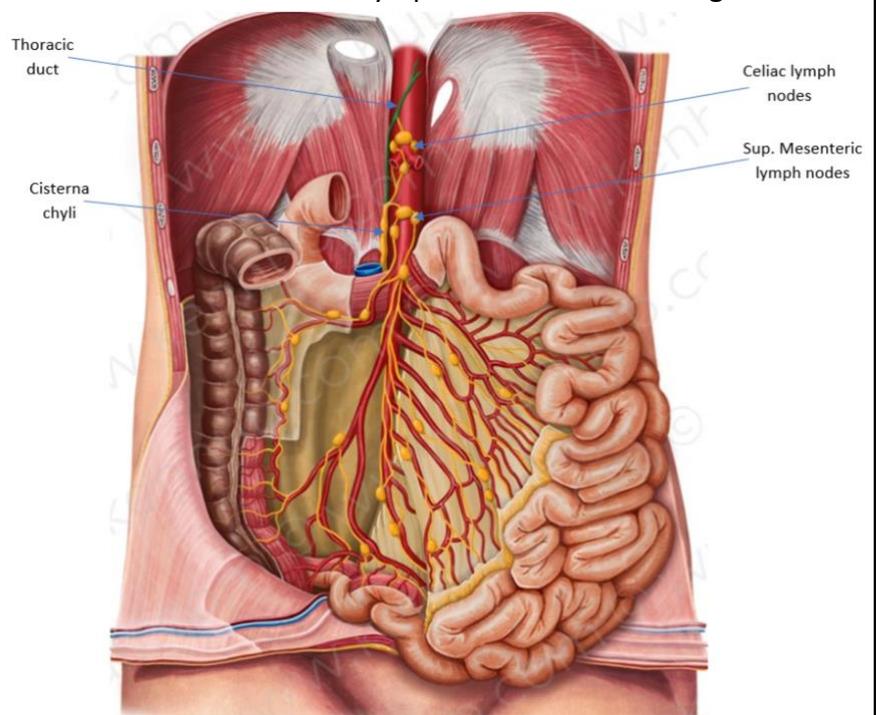
There are lymph nodes around:

Celiac trunk > called celiac lymph nodes > drains foregut

Origin of superior mesenteric artery > called superior mesenteric lymph nodes > drains midgut

Origin of inferior mesenteric artery > called inferior mesenteric lymph nodes > drains hindgut

So the small intestine is drained by superior mesenteric lymph nodes but the lymph vessels pass through many intermediate mesenteric nodes until reaching the superior mesenteric lymph nodes.

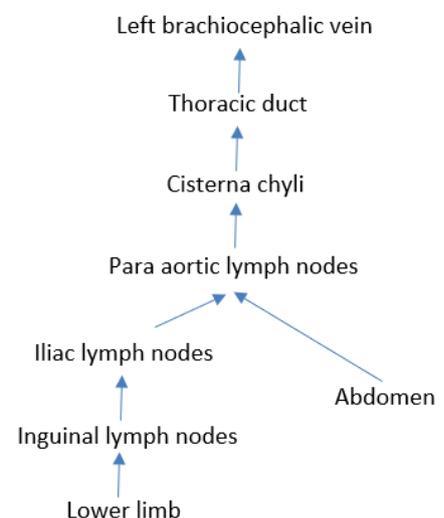


Pathway of lymphatic drainage:

Lower limb drains to inguinal lymph nodes then iliac lymph nodes and then para aortic lymph nodes while the abdomen drains to para aortic lymph nodes and all lymph is collected in cisterna chyli in the right side of aortic opening in diaphragm then thoracic duct starts from

cisterna chyli and ascends in chest receiving lymphatic drainage from chest and opens in the beginning of left brachiocephalic vein that's formed by left internal jugular and left subclavian veins.

-The importance of lymphatics is the absorption of fat and its destination is to the venous blood.

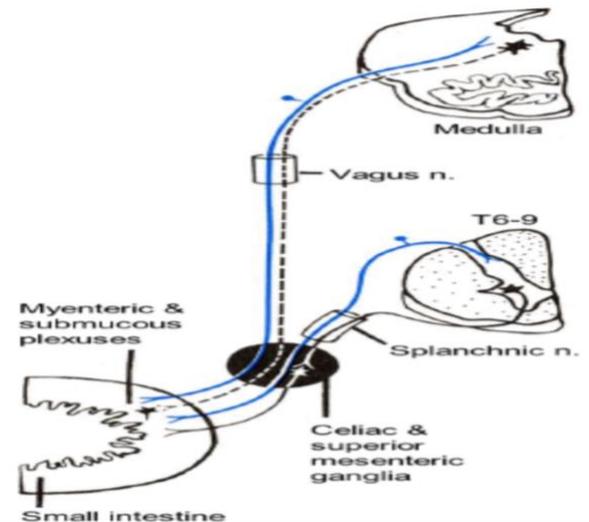


Nerve supply:

1-Sympathetic:

In GI, it innervates blood vessels and sphincters and its activation causes vasoconstriction and contraction of sphincters respectively.

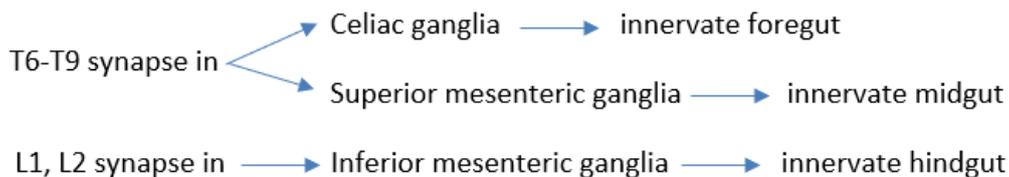
The nuclei of T6-T9 gives nerve fibers called preganglionic sympathetic fibers which accompany (walks with) spinal nerves forming splanchnic nerves and synapse in celiac ganglia around the origin of celiac trunk and superior mesenteric ganglia around the origin of superior mesenteric artery.



L1, L2 synapse in inferior mesenteric ganglia around the origin of inferior mesenteric artery.

After synapsing, the post ganglionic sympathetic nerves go to the organ (foregut, midgut, or hindgut).

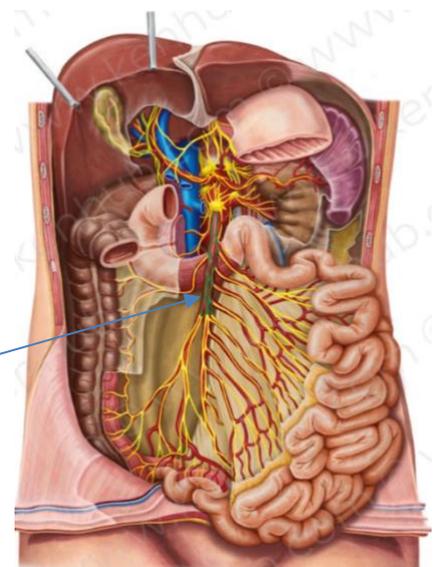
**Splanchnic nerve: Spinal nerve that carries preganglionic sympathetic fibers.



2-Parasympathetic: comes from the brain (medulla oblongata)

Transmitted by vagus nerve (X) which gives parasympathetic innervation to the extent of lateral 1/3 of transverse colon (i.e. innervates fore gut and midgut while hind gut gets parasympathetic innervation from S2,S3,S4).

Vagus nerve originates from vagal nucleus in medulla oblongata and then descends from brain through neck and thorax around oesophagus as right and left vagal nerves on the right and left of oesophagus respectively, then it cross diaphragm around oesophagus and enter the abdomen. Around the stomach, the right vagal nerve becomes posterior and the left vagal nerve becomes anterior. It passes in the ganglia without synapsing because it'll synapse in the wall of the organ (i.e. in the myenteric plexus of stomach and small intestine) and give short post ganglionic fibers which go to the glands (secretomotor) & to smooth muscles (which responsible for peristaltic movement).



3-Nerves from the superior mesenteric plexus.

Congenital anomaly of small intestine

Meckel's Diverticulum: small plugging in the wall of ileum

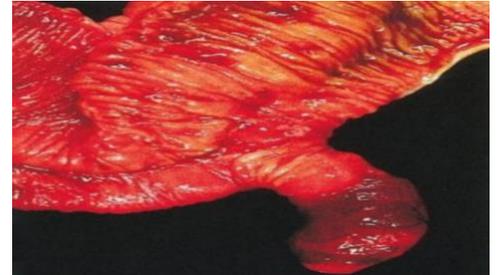
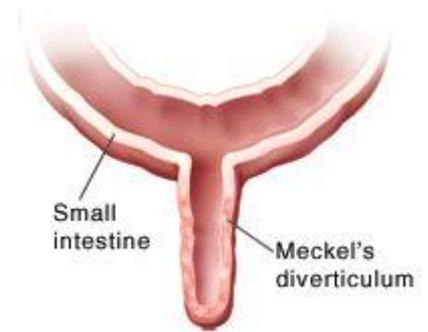
-Vitelline duct: A duct between umbilicus and ileum that should undergo obliteration and fibrosis before birth so it closes completely. But if it stayed open, secretion of ileum will exit from umbilicus.

Some times it's obliterated but forms a small diverticulum that contains either gastric or pancreatic tissue, and usually causes inflammation that's similar to appendicitis with the same symptoms (severe pain in the right iliac fossa).

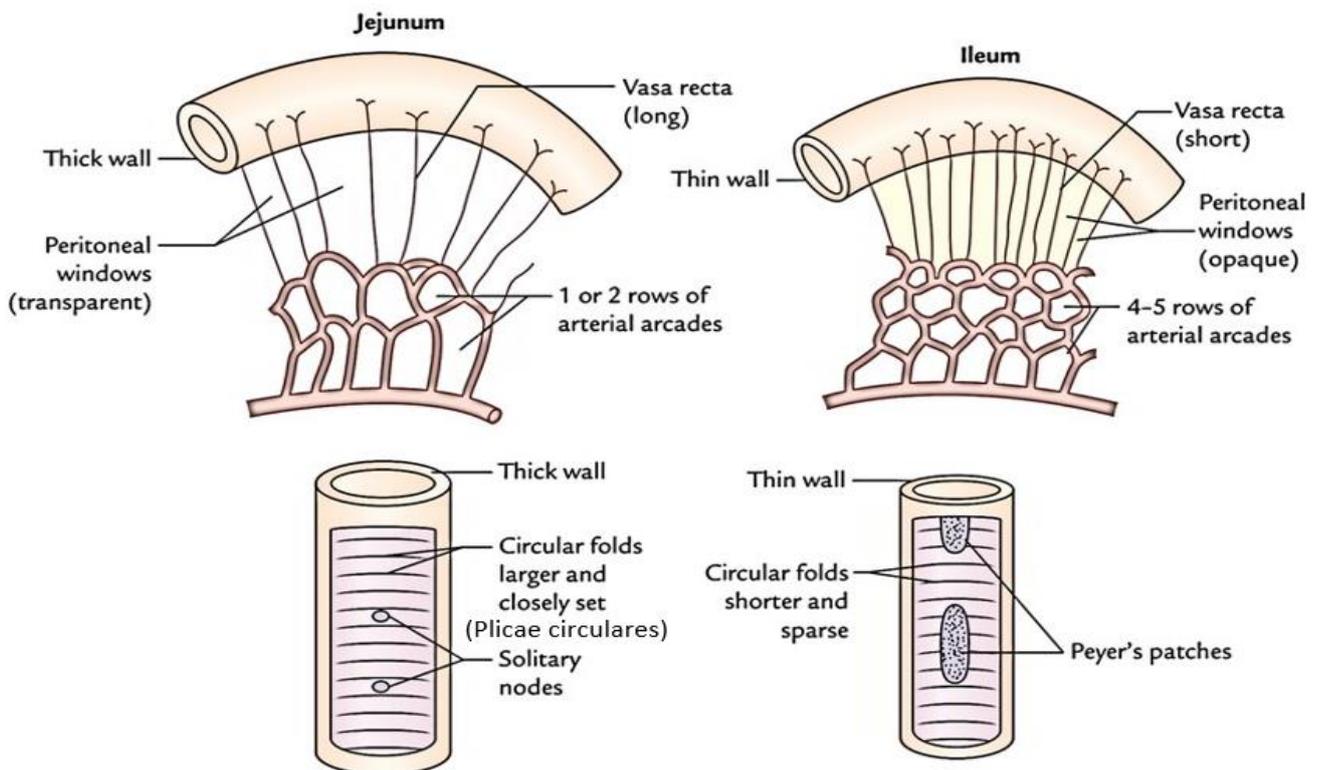
-Complications: Inflammation/ Perforation which can cause peritonitis/ Bleeding.

-Its characters:

- a congenital anomaly of the ileum
- Present in 2% of people
- 2 feet from ileocecal junction
- 2-inch-long
- Remains of vitelline duct of embryo



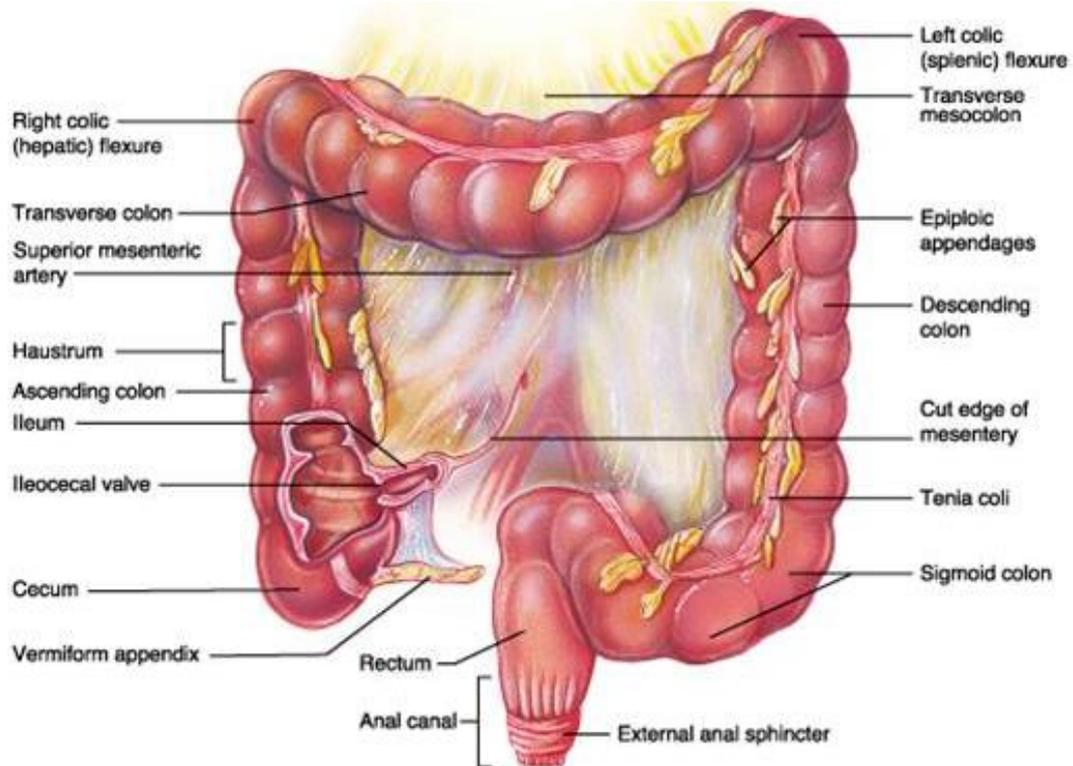
Comparison between jejunum and ileum



Difference between Jejunum & Ileum

	jejunum	Ileum
length	Proximal 2/5	Distal 3/5
site	in the upper part of the peritoneal cavity below the left side of the transverse mesocolon	in the lower part of the cavity and in the pelvis
wall	thicker wall & redder	Thinner & less redder
Arcades in mesentery	<ul style="list-style-type: none"> - simple, only one or two arcades - with long infrequent branches - Long vasa recta 	<ul style="list-style-type: none"> numerous short terminal vessels arise from a series of three or four or even more Arcade - Short vasa recta
Fat in mesentery	<ul style="list-style-type: none"> - the fat is deposited near the root - it is scanty near the intestinal wall - Less in amount → appear window Window = arcades 	<ul style="list-style-type: none"> - the fat is deposited throughout mesentery - Big amount - No window appear - Can't see arcades and vasa recta until removing a layer of peritoneum
Diameter	wider	smaller
villi	numerous + Longer	Less numerous + shorter
Plicae circularis (the permanent enfolding of the mucous membrane & submucosa)	They are: <ol style="list-style-type: none"> 1- larger 2- more numerous 3- closely set 	they are: <ol style="list-style-type: none"> 1- smaller 2- more widely separated 3- in the lower part they are absent.
Lymphatic follicles	No or few	Aggregations of lymphoid tissue (Peyer's patches) are present in the mucous membrane

Large Intestine



*Extends from ileocecal valve to anus

* Length = 1.5- 2.5m = 5 feet

* Regions

– Cecum = 2.5- 3 inch

– Appendix= 3-5 inch

– Colon

- Ascending= 5 inch

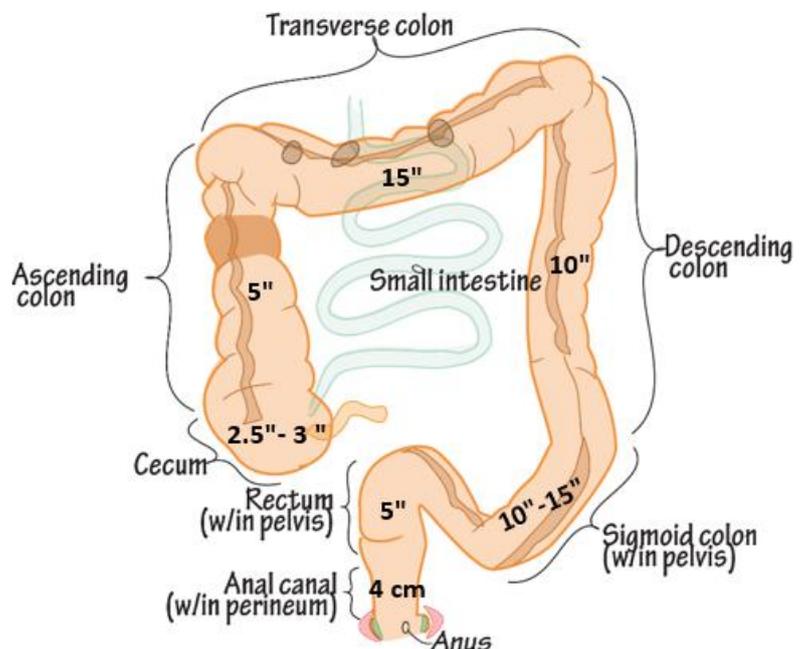
- Transverse= 15 inch

- Descending= 10 inch

- Sigmoid colon = 10 – 15 inches

– Rectum= 5 inch

– Anal canal= 4 cm



Function: Absorption of water and formation of feces (stool)

General features of large intestine >>> Not found in small intestine.

1- Sacculation= Haustra

2- Tenia coli: three separate longitudinal ribbons of smooth muscle originate from outer longitudinal muscle.

Found all over large intestine except appendix and rectum.

-It's found only on one side and that's why its contraction causes the formation of sacculations/ haustra (i.e. presence of tenia coli is the reason of sacculations/ haustra formation).

-It's a landmark for the base of appendix, so when appendix is retrocecal we track tenia coli until it ends where it indicates the base of appendix.

3- Appendices epiploica: (adipose structures protruding from the serosal surface of the colon). Found all over large intestine except appendix, Cecum and rectum.

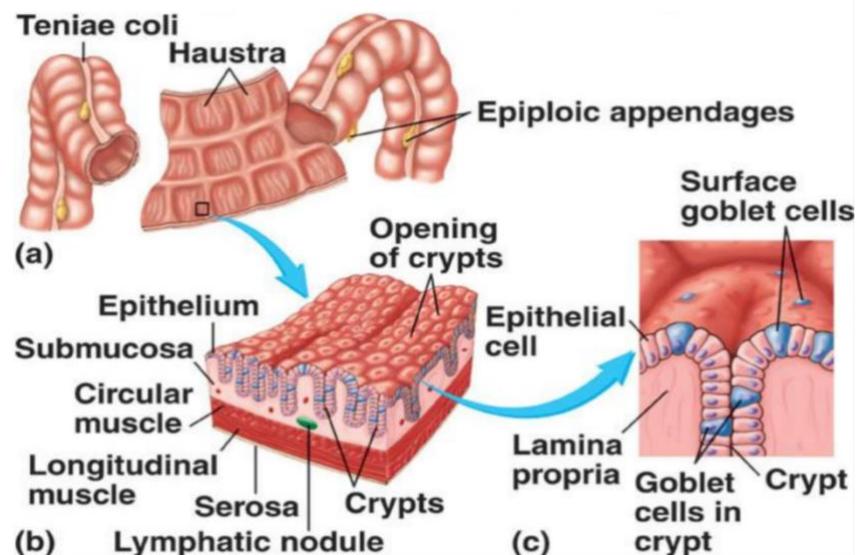
Histology:

-Has no villi (straight surface)

-Lining epithelium: simple columnar epithelium

with numerous goblet cells (same as small intestine but with numerous goblet cells); because it needs them for lubrication of hard pieces of stool.

-Glands (crypts of Lieberkühn) on base doesn't have **paneth** cells but contains lymphatic nodules.



Cecum

- It is a blind-ended pouch

- **Location:** situated in the right iliac fossa, above the lat 1/2 of inguinal ligament lying above iliacus muscle and psoas major muscle.

- **Size:** It is about 3 inch in diameter

- Completely covered with peritoneum and it possesses a considerable amount of mobility, although it does not have a mesentery.

There are many hypotheses about the covering peritoneum of cecum:

1. Cecum is covered by peritoneum and can have short mesentery. (the one we rely on)
2. Cecum is fixed to the right iliac fossa and covered by peritoneum from all directions except an area posteriorly without peritoneum.

- Attached to:

- Superiorly: Ascending colon
- posteromedial surface is the appendix, 1 inch below ileocecal valve
- medially: Ileum (what specializes ileocecal opening is the presence of mucosal fold on it that closes the ilium when the pressure inside the cecum increases, so no regurgitation of material from cecum to ilium happens.)

Cecum has 3 openings



Ileocecal opening is considered physiologically a valve but anatomically it's an opening because there's no circular smooth muscle around it.

- The presence of peritoneal folds in the vicinity of the cecum creates
 - The superior ileocecal recesses
 - The inferior ileocecal recesses
 - The retrocecal recesses. > very common site of appendix.

These recesses can form internal hernia.

- The longitudinal muscle is restricted to three flat bands, the taenia coli, which converge on the base of the appendix and provide for it a complete longitudinal muscle coat.
- It has tenia coli on it but there's no appendices epiplolca.

Relations of cecum

- Anteriorly:
 - Coils of small intestine, specifically ilium.
 - the greater omentum
 - the anterior abdominal wall in the right iliac region where we test the patient's cecum.
- Posteriorly:
 - The psoas and the iliacus muscles
 - the femoral nerve
 - and the lateral cutaneous nerve of the thigh passing to the anterior superior iliac spine.
 - external iliac vessels in iliac fossa passing below inguinal ligament to give femoral artery.
- Postero- medially: The appendix is commonly > retrocecal common.
- Medially: - Small intestine(ileum)

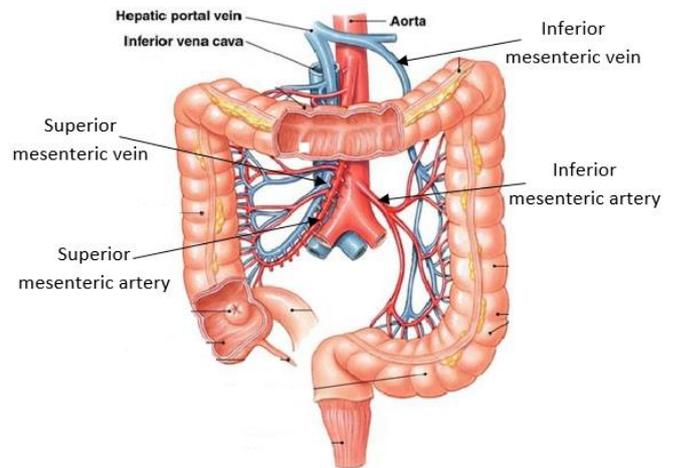
Blood Supply of cecum Arteries

- Anterior and posterior cecal arteries ◊ a branch of Superior mesenteric artery

Venous drainage:

The veins correspond to the arteries (anterior and posterior cecal veins) and drain into the superior mesenteric vein.

Relation between mesenteric arteries and veins (either superior or inferior): Arteries are medial and veins are lateral.



Lymphatic Drainage of cecum

The lymph vessels pass through several mesenteric nodes and finally reach the superior mesenteric nodes.

Nerve Supply of cecum

- Branches from the sympathetic and parasympathetic (vagus) nerves form the superior mesenteric plexus.
 - Parasympathetic: from vagus nerve.
 - Sympathetic: from greater splanchnic nerve (T6-T9) that synapses in celiac ganglia and superior mesenteric ganglia.

Ileocecal Valve

- A rudimentary structure
- consists of two horizontal folds of mucous membrane
- Project around the orifice of the ileum.
- The valve plays little or no part in the prevention of reflux of Cecal contents into the ileum.
- The circular muscle of the lower end of the ileum (called the ileocecal sphincter by physiologists) serves as a sphincter and controls the flow of contents from the ileum into the colon.
- The smooth muscle tone is reflexly increased when the cecum is distended; the gastrin hormone, which is produced by the stomach, causes relaxation of the muscle tone. ****from slides****



	Duodenum	Small Intestine	Large Intestine
Peritoneal coverage	Retroperitoneal except the 1 st and last inches	Intraperitoneal	Intraperitoneal
Diameter		Narrower	Wider
Length	10"	6 meters	1.5-2.5 meters
Parts	1 st Part: 2" 2 nd part: 3" 3 rd part: 4" 4 th part: 1"	Jejunum: first 2/5 Ilium: last 3/5	Cecum: 2.5"- 3" Appendix= 3-5" Colon - Ascending: 5" - Transverse: 15" - Descending: 10" - Sigmoid colon: 10" – 15" Rectum: 5" Anal canal: 4 cm
Function	Digestion of fat.	Absorption of nutritive material.	Absorption of water and formation of feces (stool).
Location	epigastric and umbilical regions	umbilical region surrounded by large intestine, so it's internal to large intestine.	
Histology	-Simple columnar cells with goblet cells -Has leaf like villi. -Brunner's glands in submucosa (secrete alkaline secretion)	-Simple columnar cells with goblet cells -Has villi and microvilli. -Paneth cells that are bactericidal cells on base of crypts of Lieberkühn.	-Simple columnar cells with numerous goblet cells. -No villi and microvilli (straight surface). -No Paneth cells. -Has lymphatic nodules