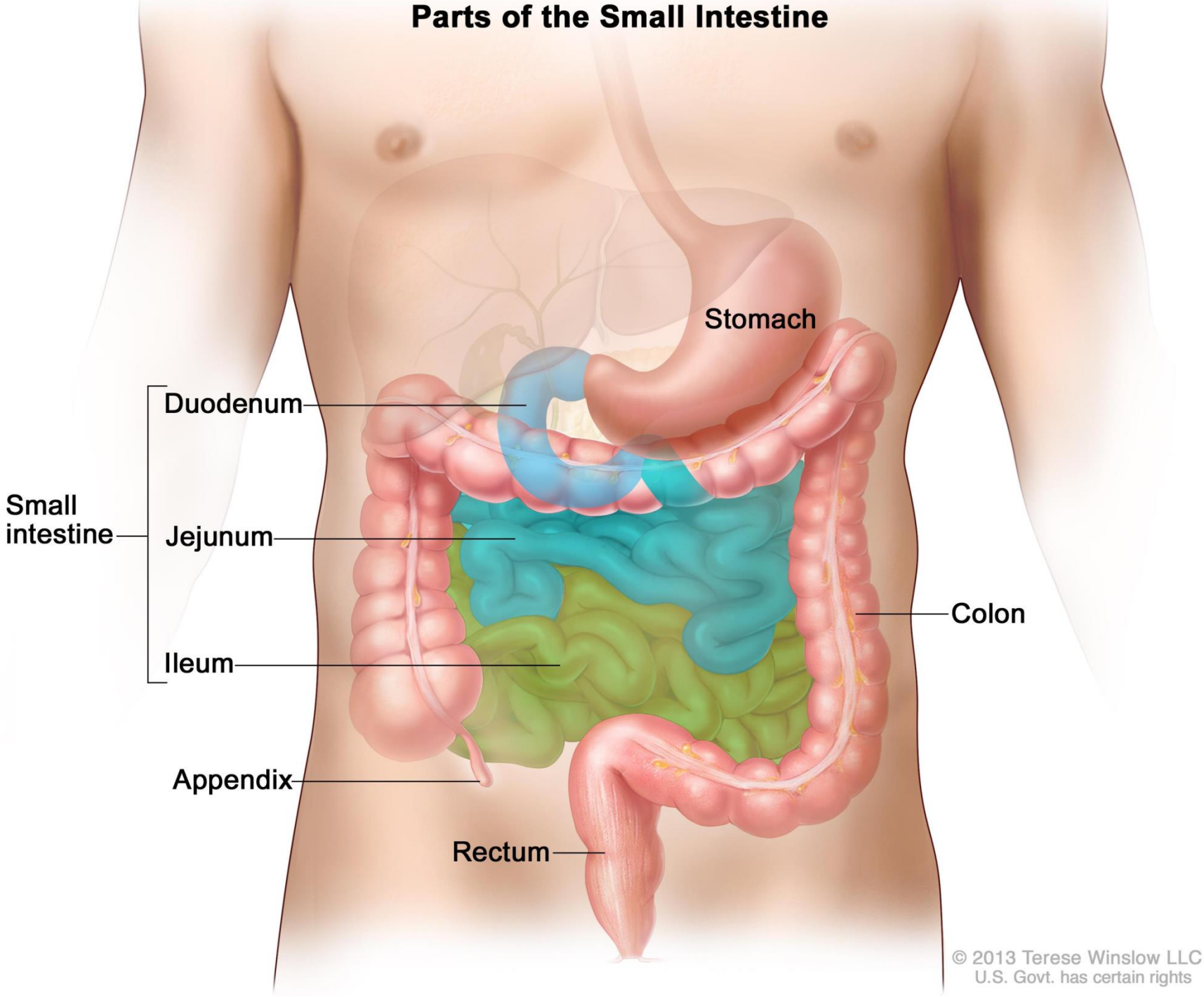
Small intestine

- located within the GIT.
- approximately 6.5m in the average person
- assists in the digestion and absorption of ingested food.
- It extends from the pylorus of the stomach to the **ileocaecal junction**, where it meets the large intestine at the ileocaecal valve.
- Anatomically, the small bowel can be divided into three parts; the duodenum, jejunum and ileum.

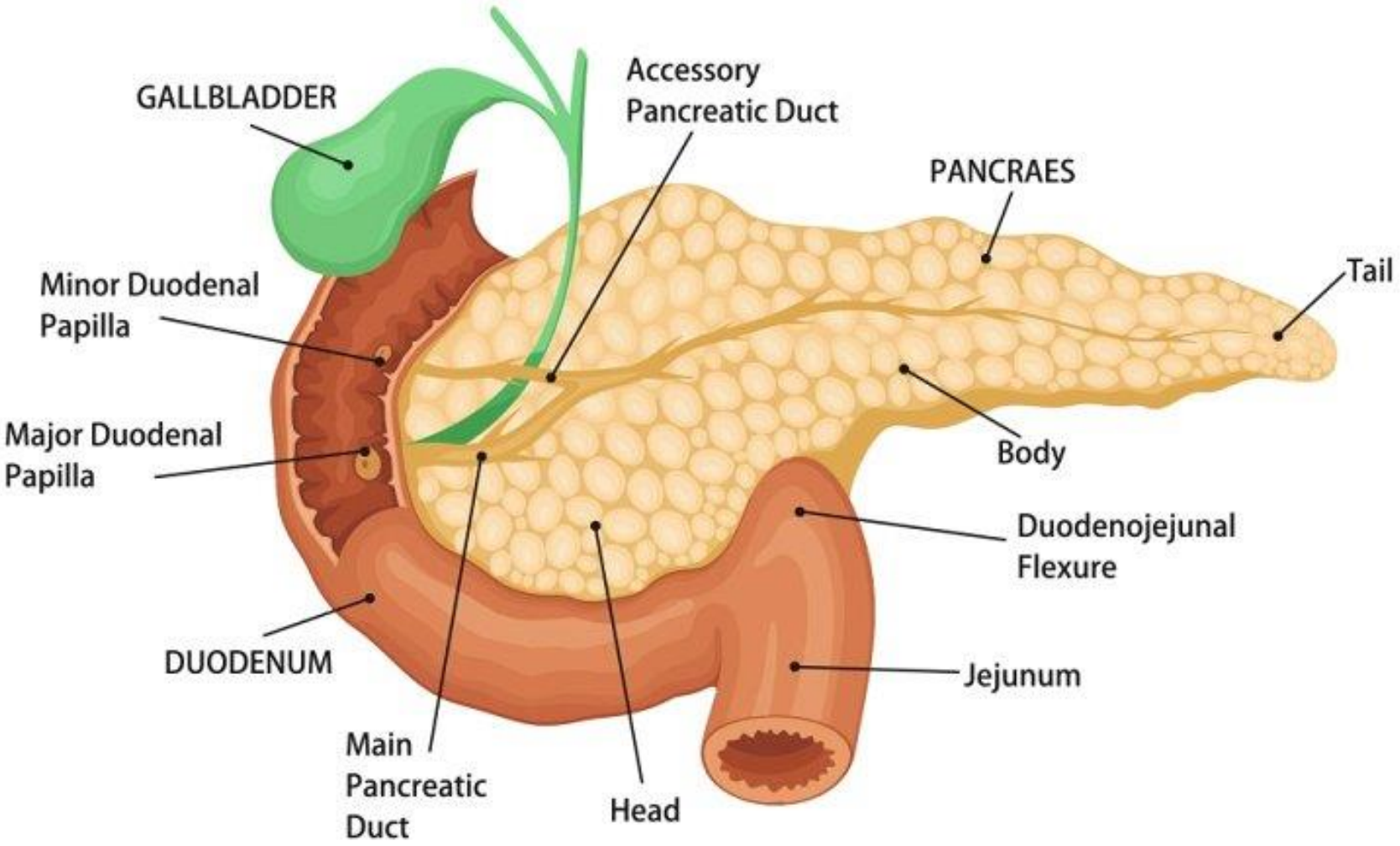
Parts of the Small Intestine



Duodenum

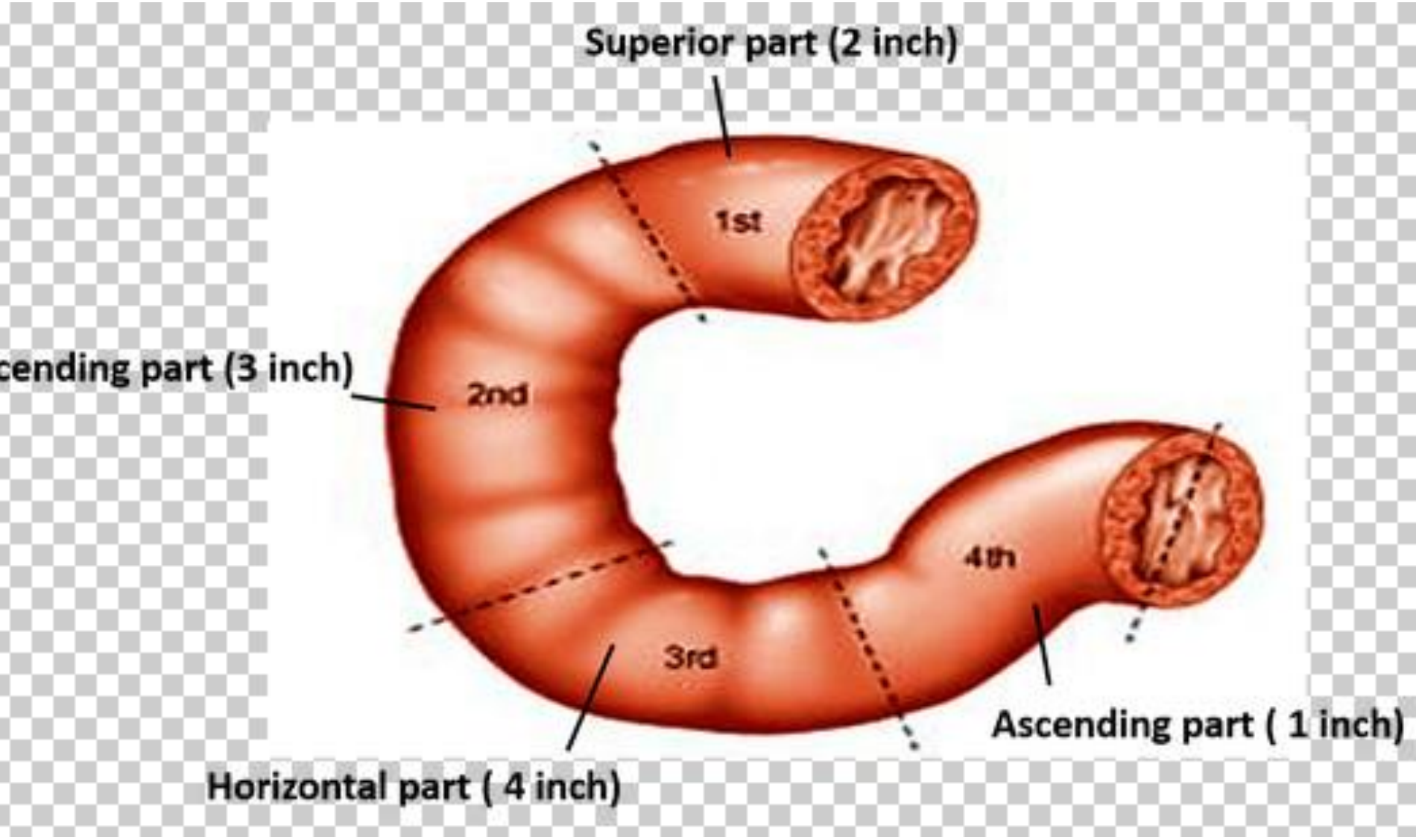
- The term duodenum is a Latin corruption of the Greek word, dudekadaktulos, meaning twelve fingers.
- **Definition and Location-** shortest, widest and most fixed part of the small intestine. It extends from the pylorus to the duodenojejunal flexure. It is curved around the head of the pancreas in the form of the letter 'C. The duodenum lies above the level of the umbilicus, opposite L1,L2,L3.

PANCRAES


GALLBLADDER
Accessory
Pancreatic Duct
PANCRAES
Tail
Minor Duodenal
Papilla
Major Duodenal
Papilla
Body
Duodenojejunal
Flexure
DUODENUM
Jejunum
Main
Pancreatic
Duct
Head

length and Parts- 25 cm long and is divided into the following four parts-

- First or superior part- 5 cm long.
- Second or descending part- 7.5 cm long.
- Third or horizontal part- 10 cm long.
- Fourth or ascending part- 2.5 cm long.


Superior part (2 inch)
1st
cending part (3 inch)
2nd
4th
3rd
Ascending part (1 inch)
Horizontal part (4 inch)

1. **Superior (Spinal level L1)**

The first part begins at the pylorus, and passes backwards, upwards and to the right to meet the second part at the superior duodenal flexure.

Relations-

Peritoneal Relations- The proximal 2.5 cm is movable. The distal 2.5 cm is fixed. It is retroperitoneal.

Visceral Relations-

- Anteriorly- Quadrate lobe of liver, gall bladder.
- Posteriorly- Gastroduodenal artery, bile duct and portal vein
- Superiorly - Epiploic foramen
- Inferiorly - Head and neck of the pancreas.

2. **Descending (L1-L3)** -begins at the superior duodenal flexure, passes downwards to reach the inferior duodenal flexure, to become continuous with the third part.

Relations-

Peritoneal Relations- It is retroperitoneal and fixed. Its anterior surface is covered with peritoneum, except near the middle, where it is directly related to the colon.

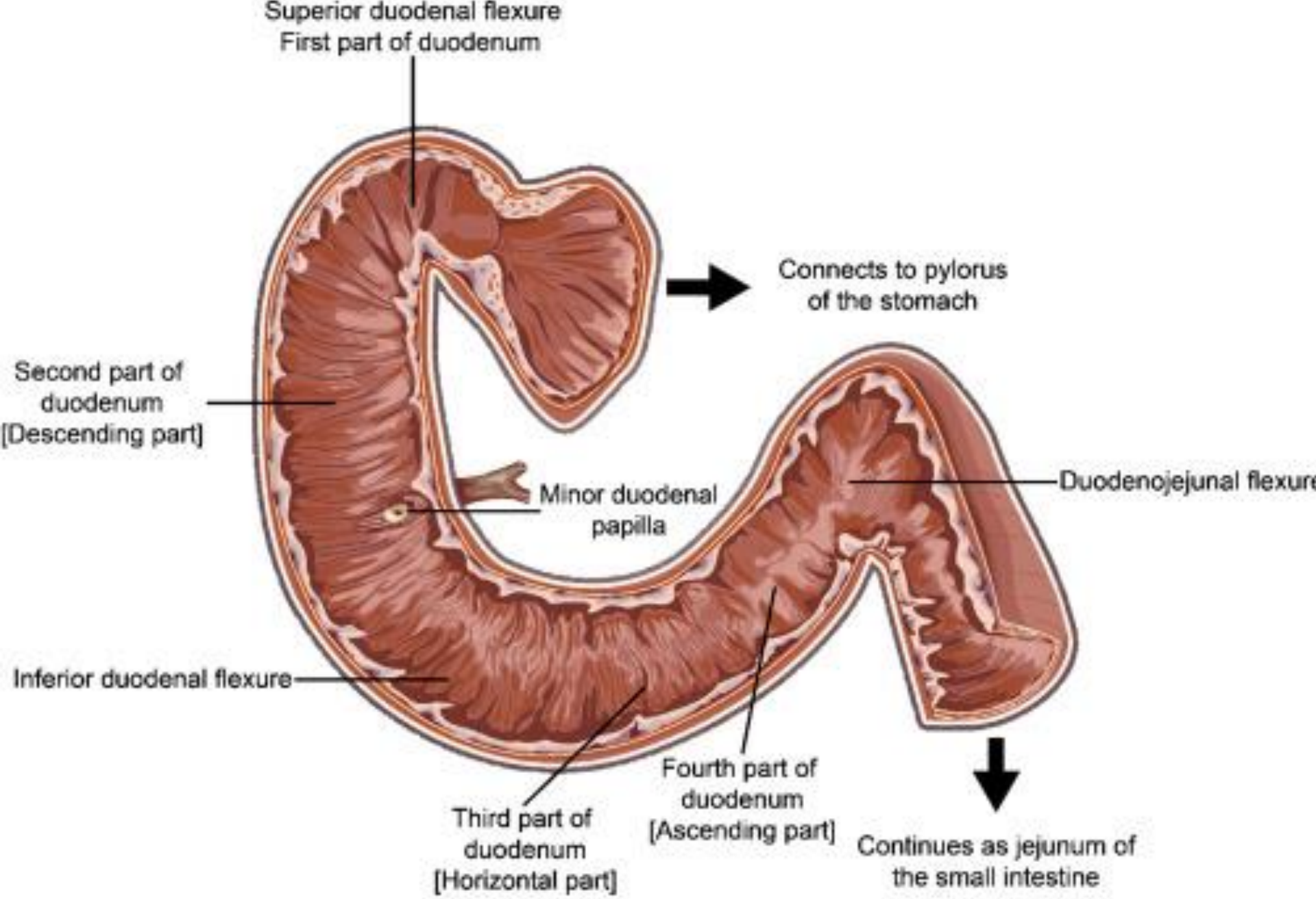
Visceral Relations

Anteriorly : (a) Right lobe of the liver; (b) transverse colon, (c) root of the transverse mesocolon.

Posteriorly: (a) Anterior surface of the right kidney, (b) right renal vessels, (c) right edge of the inferior vena cava, (d) right psoas major.

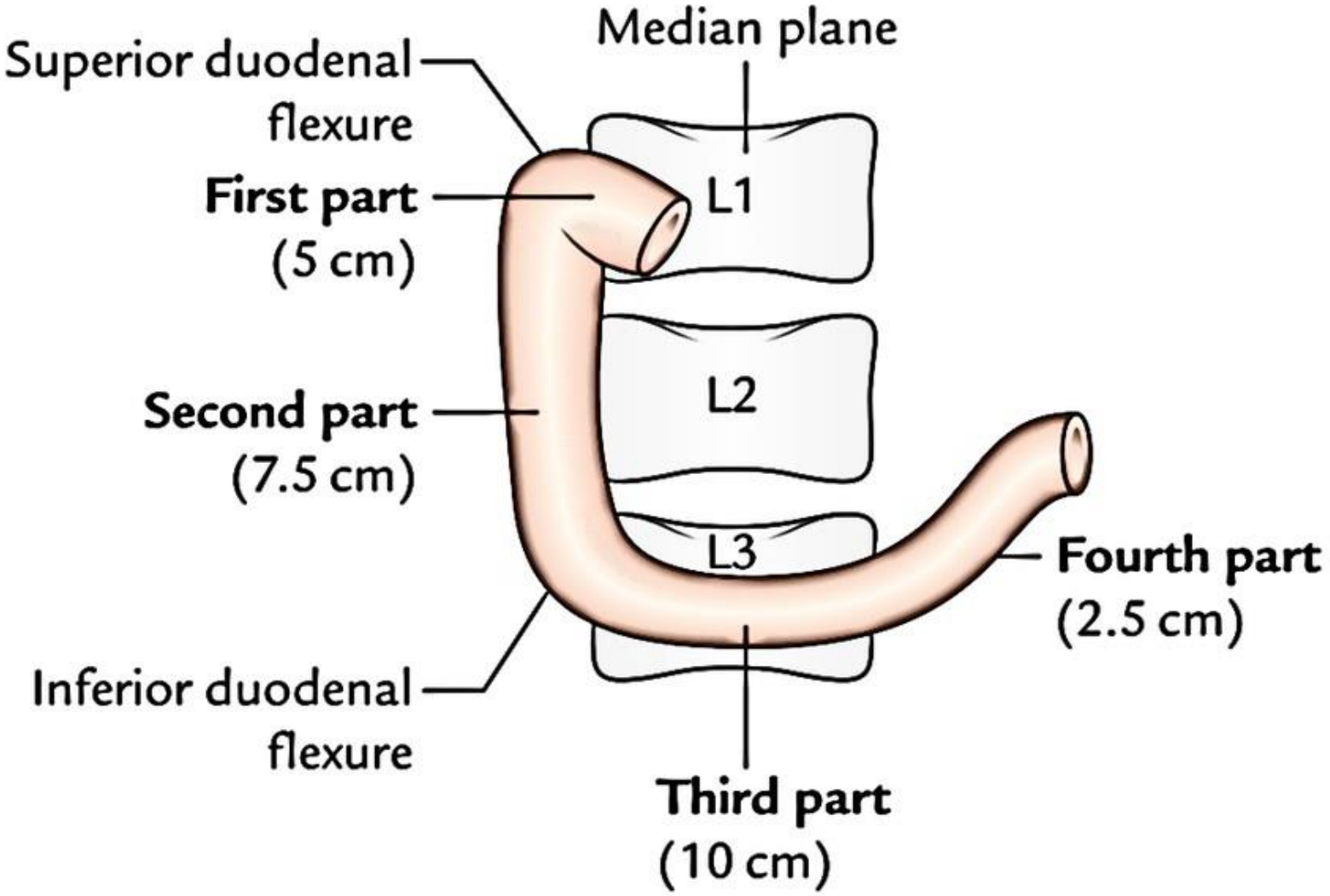
Medially : (a) Head of the pancreas and (b) the bile duct

Laterally : Right colic flexure


Superior duodenal flexure
First part of duodenum
Connects to pylorus of the stomach
Second part of duodenum [Descending part]
Minor duodenal papilla
Duodenojejunal flexure
Inferior duodenal flexure
Third part of duodenum [Horizontal part]
Fourth part of duodenum [Ascending part]
Continues as jejunum of the small intestine

Internal structure of 2nd part

1. The major duodenal papilla- is an elevation present posteromedially, 8 to 10 cm distal to the pylorus. The hepatopancreatic ampulla opens at the summit of the papilla.
2. The minor duodenal papilla- is present 6 to 8 cm distal to the pylorus, and presents the opening of the accessory pancreatic duct.

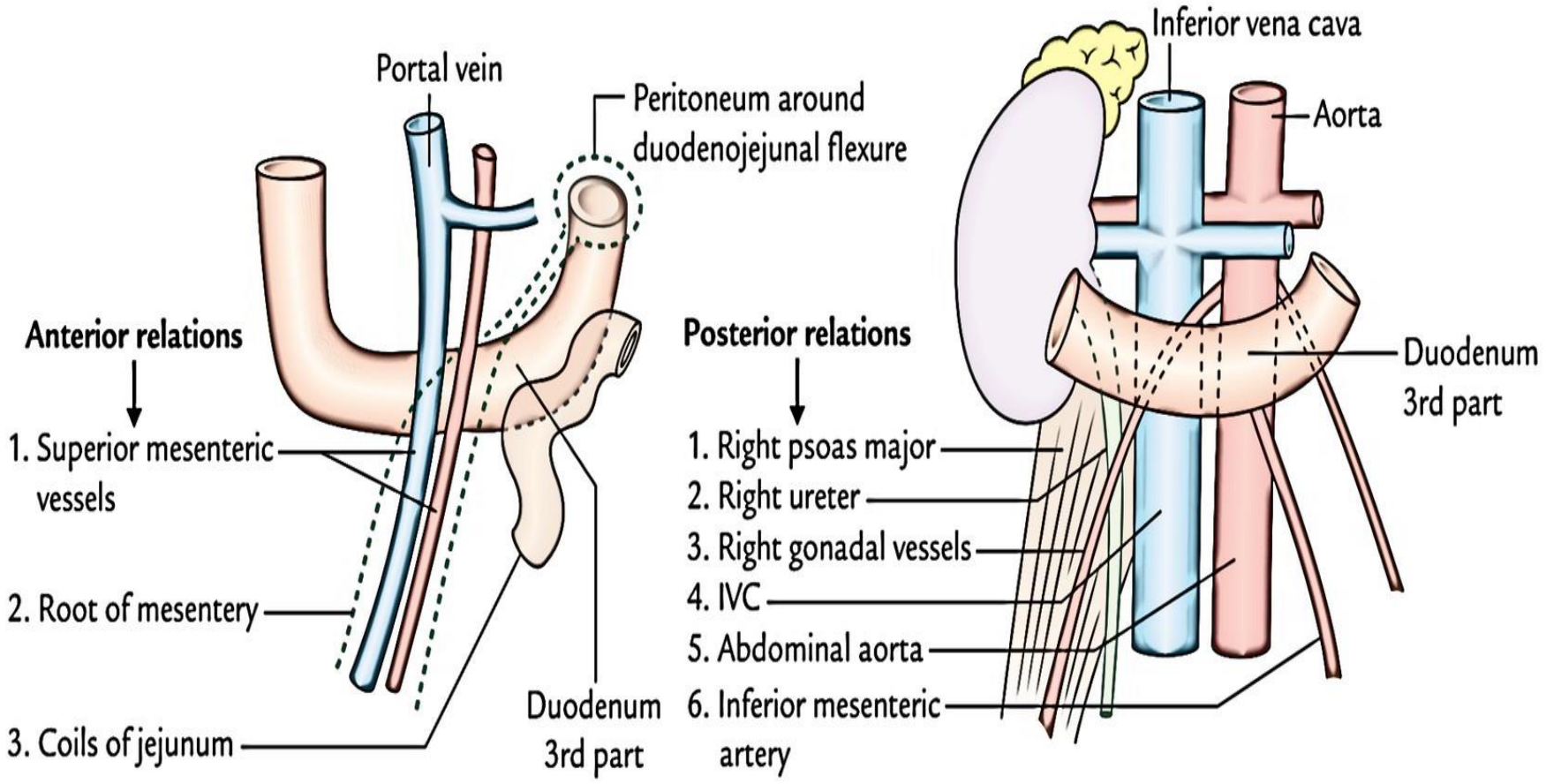

Median plane
Superior duodenal flexure
First part (5 cm)
L1
L2
Second part (7.5 cm)
L3
Fourth part (2.5 cm)
Inferior duodenal flexure
Third part (10 cm)

3. **horizontal part (L3)-**

It begins at the inferior duodenal flexure, on the right side of the lower border of the L3. It passes almost horizontally and slightly upwards in front of the inferior vena cava, and ends by joining the fourth part in front of the abdominal aorta.

Relations-

Peritoneal Relations- It is retroperitoneal and fixed. Its anterior surface is covered with peritoneum, except in the median plane, where it is crossed by the superior mesenteric vessels and by the root of the mesentery.


Portal vein
Peritoneum around duodenojejunal flexure
Anterior relations
1. Superior mesenteric vessels
2. Root of mesentery
3. Coils of jejunum
Duodenum 3rd part
Inferior vena cava
Aorta
Posterior relations
1. Right psoas major
2. Right ureter
3. Right gonadal vessels
4. IVC
5. Abdominal aorta
6. Inferior mesenteric artery
Duodenum 3rd part

Visceral Relations

- Anteriorly : (a) Superior mesenteric vessels and (b) root of mesentery
- Posteriorly: (a) Right ureter, (b) right psoas major, (c) right testicular or ovarian vessels, (d) inferior vena cava, and (e) abdominal aorta with origin of inferior msenteric artery.
- Superiorly : Head of the pancreas with uncinate process
- Inferiorly : Coils of jejunum

4. **Ascending Part (L3-L2)-** It runs upwards on or immediately to the left of the aorta, up to the upper border of the L2, where it turns forwards to become continuous with the jejunum at the duodenojejunal flexure.

Relations

Peritoneal Relations- It is mostly retroperitoneal. The terminal part is suspended by the uppermost part of the mesentery, and is mobile.

Visceral Relations

- Anteriorly : (a) Transverse colon, (b) transverse mesocolon, (c) lesser sac, and (d) stomach.
- Posteriorly : (a) Left sympathetic chain, (b) left psoas major, (c) left renal vessels, (d) left testicular vessels, and (e) inferior mesenteric vein
- To the right: Attachment of the upper part of the root of the mesentery .
- To the left: (a) Left kidney and (b) left ureter.
- Superiorly : Body of pancreas

Arterial Supply

- The duodenum develops partly from the foregut and partly from the midgut. The opening of the bile duct into the second part of the duodenum represents the junction of the foregut and the midgut.
- Upto the level of the opening, the duodenum is supplied by the superior pancreaticoduodenal artery, and below it by the inferior pancreaticoduodenal artery

- **Venous Drainage** - drain into the splenic, superior mesenteric and portal vein.
- **Lymphatic Drainage**- pancreaticoduodenal nodes, hepatic nodes, and through them to the coeliac nodes; and partly to the superior mesenteric nodes and ultimately via intestinal lymph trunk into the cisterna chyli.

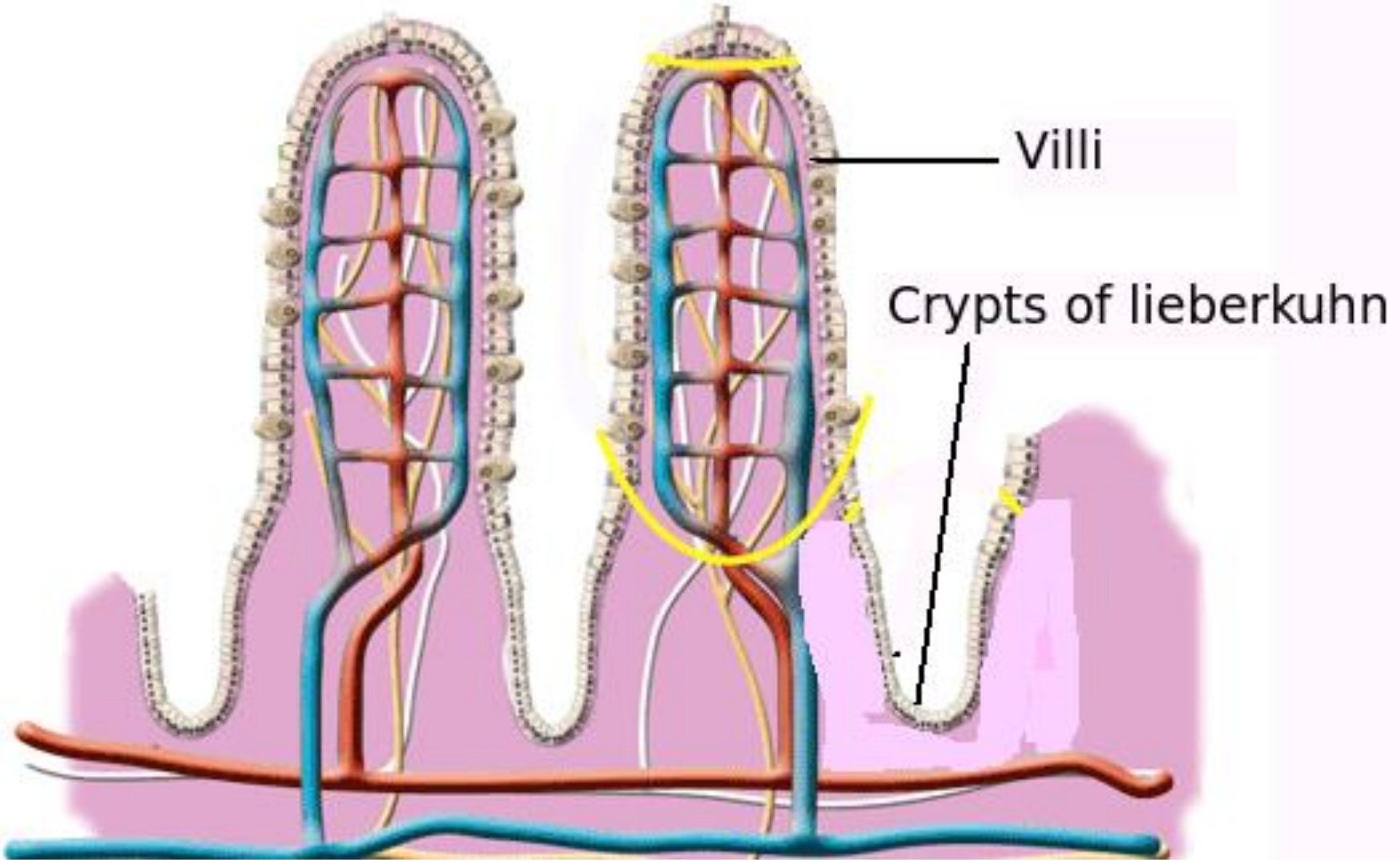
Nerve Supply-

- Sympathetic - T9-T10
- parasympathetic -vagus

HISTOLOGY

4 layer-

1. Mucous membrane: Shows evaginations in the form of villi and invaginations to form crypts of Lieberkuhn.
2. Submucosa- is full of mucus secreting Brunner's glands.
3. The muscularis layer- comprises outer longituainal and inner circular layer of muscle fibres.
4. Outermost layer is mostly connective tissue.


Villi
Crypts of lieberkuhn

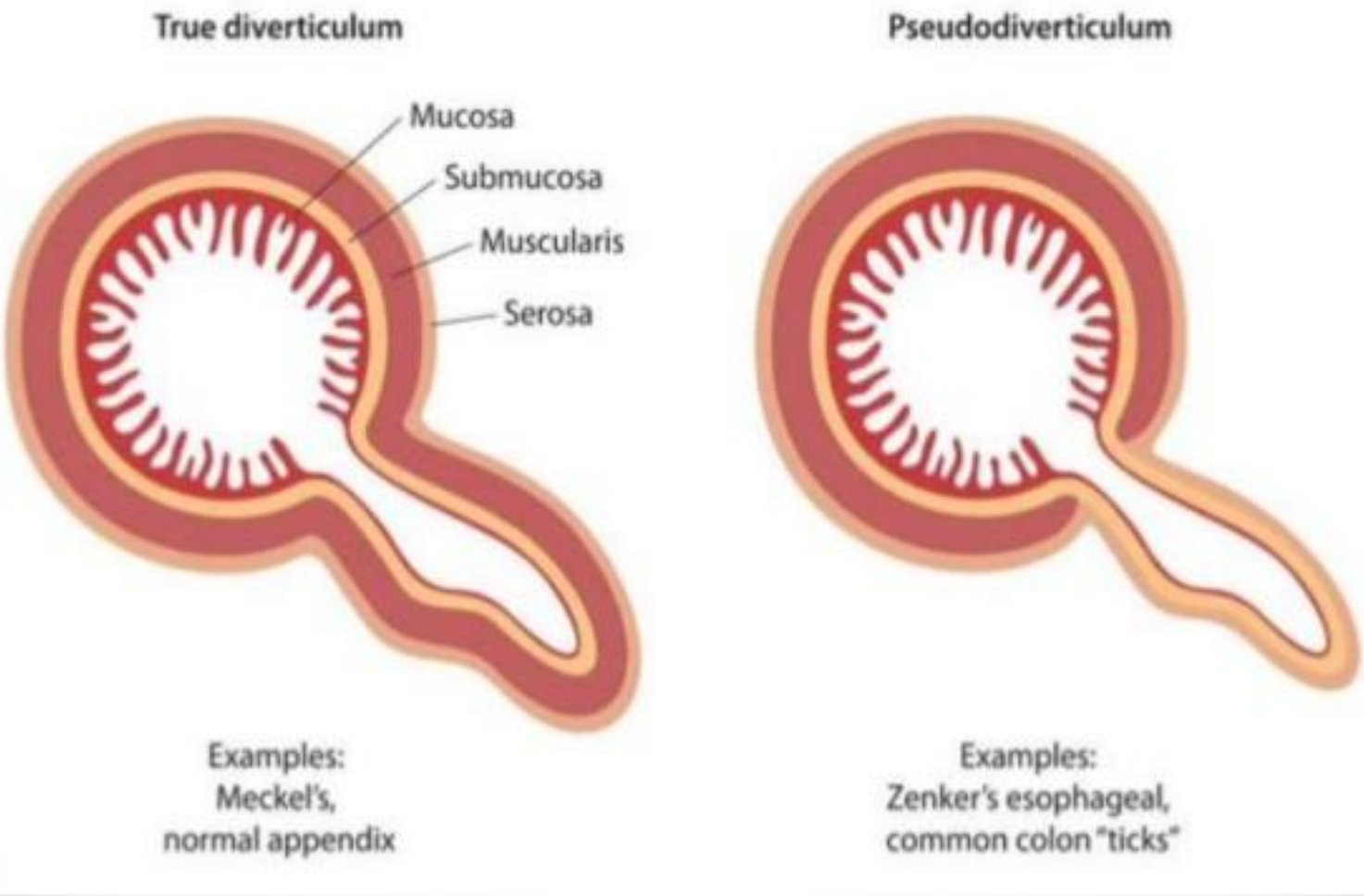
Applied aspect

1. Duodenal ulcer/ peptic ulcer- is the erosion of the mucosa in the duodenum. Duodenal ulcers are most likely to occur in the **superior portion** of the duodenum. The most common causes of duodenal ulcers are *Helicobacter pylori* infection and chronic NSAID therapy.

- The ulcer pain located at the right half of epigastrium is relieved by meals and reappears on an empty stomach.

2. Duodenal diverticula- are fairly frequent. They are seen along its concave border, generally at points where arteries enter the duodenal wall.
3. Congenital stenosis- obstruction of the second part of the duodenum may occur at the site of the opening of the bile duct. Other causes of obstruction are (i) an annular pancreas; (ii) pressure by the superior mesenteric artery; or (iii) contraction of the suspensory muscle of the duodenum.

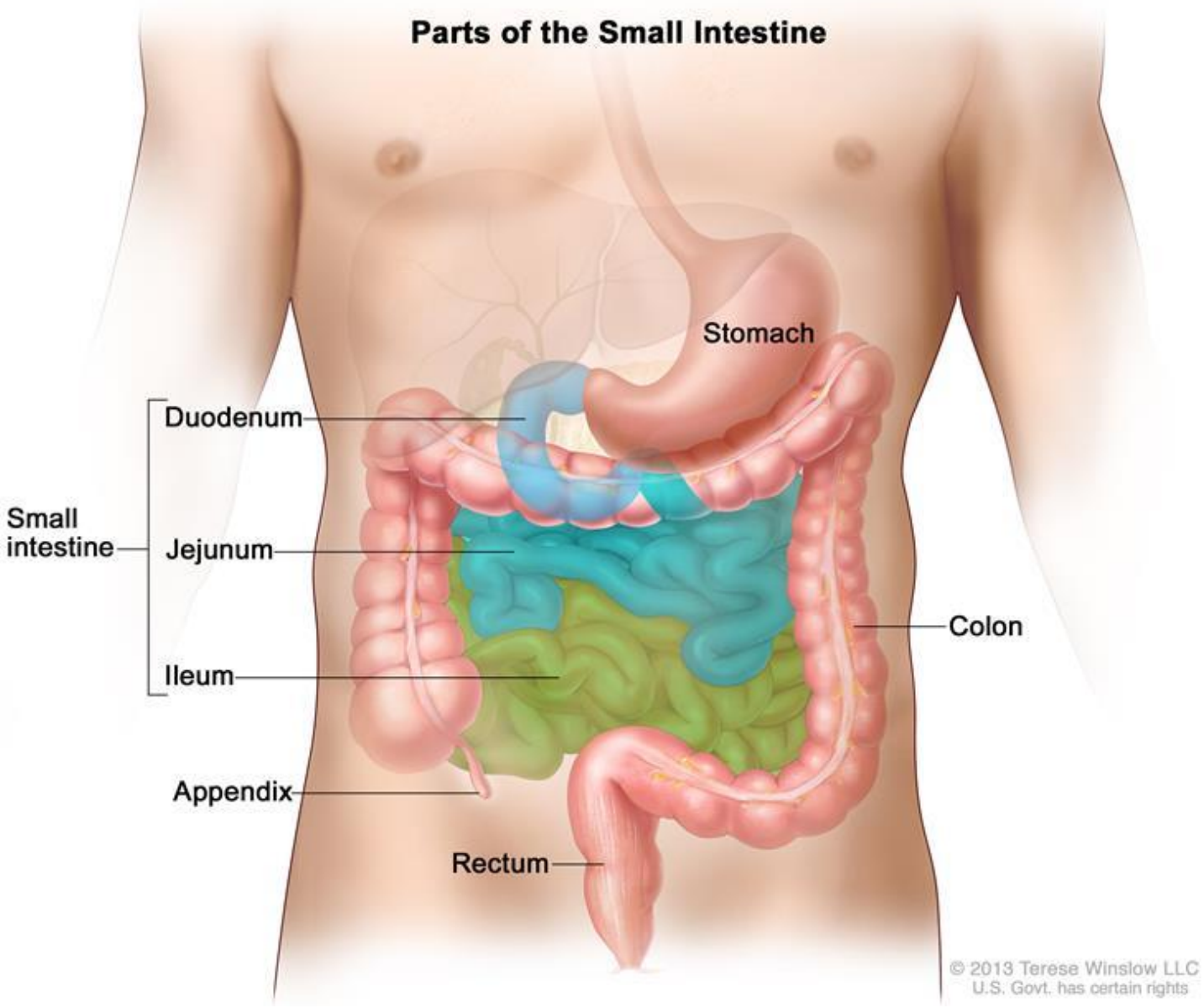
True & false diverticula

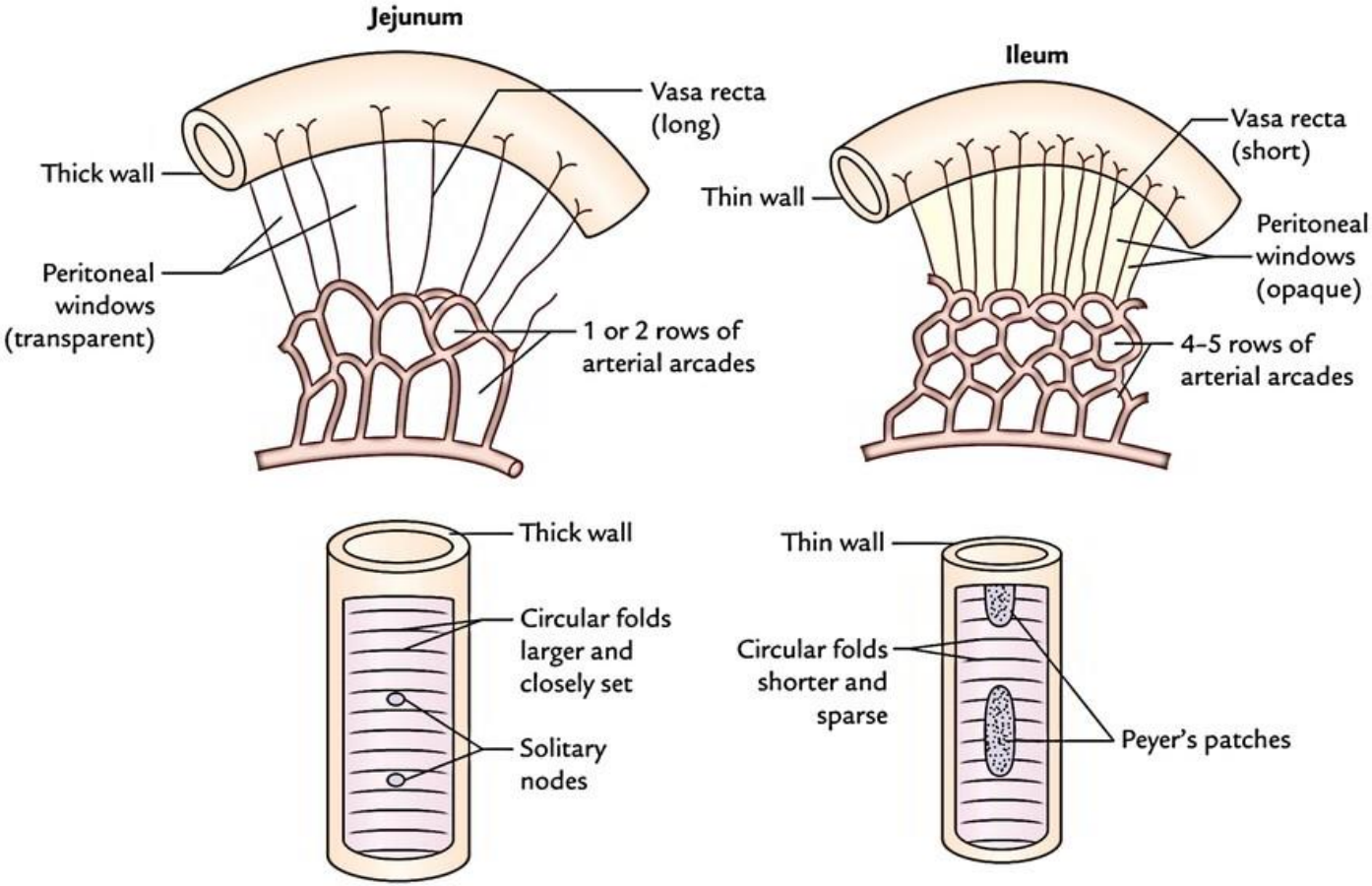


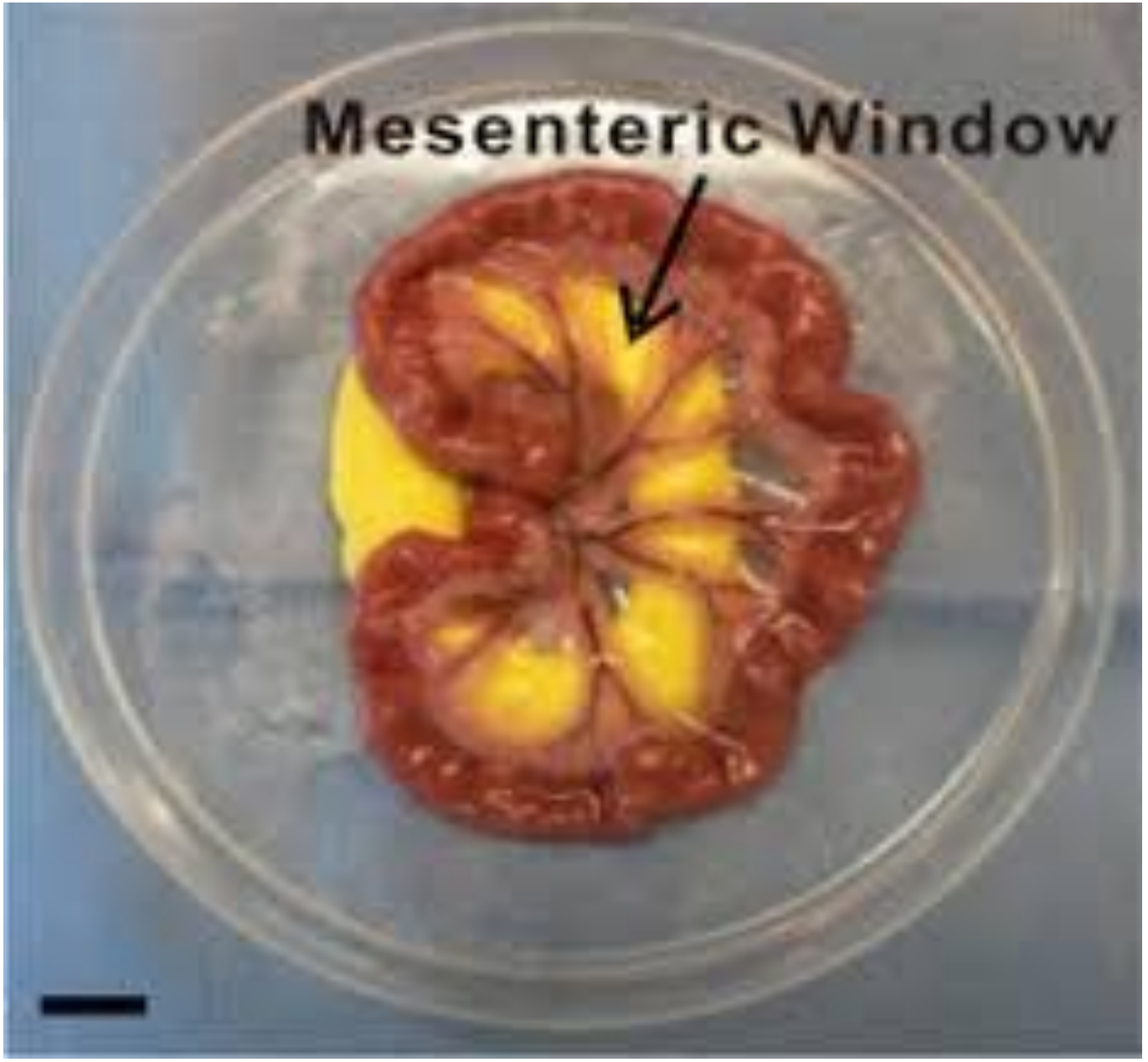
Differences between jejunum and ileum

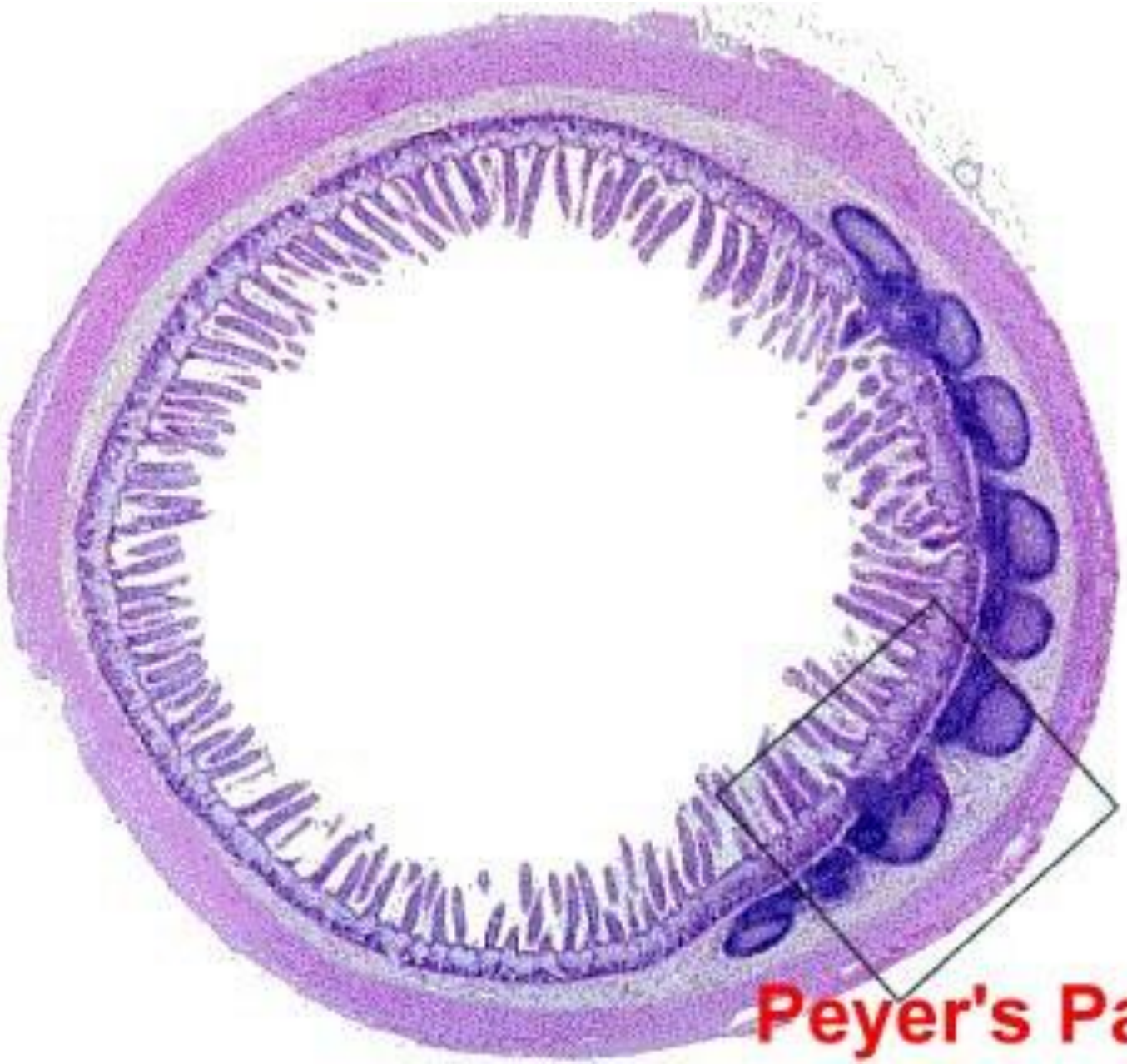
Feature	Jejunum	Ileum
1. Location	Occupies upper and left parts of the intestinal area	Occupies lower and right parts of of the intestinal area
2. Walls	Thicker and more vascular	Thinner and less vascular
3. Lumen	Wider and often empty	Narrower and often loaded
4. Mesentery	(a) Windows present (b) Fat less abundant (c) Arterial arcades, 1 or 2 (d) Vasa recta longer and fewer	(a) No windows (b) Fat more abundant (c) Arterial arcades, 3 or 6 (d) Vasa recta shorter and more numerous
5. Circular mucosal folds	Larger and more closely set	Smaller and sparse

Feature	Jejunum	Ileum
6. Villi	Large, thick (leaf-like) and more abundant	Shorter, thinner (finger-like) and less abundant
7. Peyer's patches	Absent	Present
8. Solitary lymphatic follicles	Fewer	More numerous


Parts of the Small Intestine
Stomach
Duodenum
Small intestine
Jejunum
Ileum
Colon
Appendix
Rectum
© 2013 Terese Winslow LLC
U.S. Govt. has certain rights


Jejunum
Vasa recta (long)
Thick wall
Peritoneal windows (transparent)
1 or 2 rows of arterial arcades
Ileum
Vasa recta (short)
Thin wall
Peritoneal windows (opaque)
4–5 rows of arterial arcades
Thick wall
Circular folds larger and closely set
Solitary nodes
Thin wall
Circular folds shorter and sparse
Peyer's patches


Mesenteric Window


Peyer's Patches

Blood Supply

- Jejunal and ileal branches of SMA, and are drained by corresponding veins.

Lymphatic Drainage

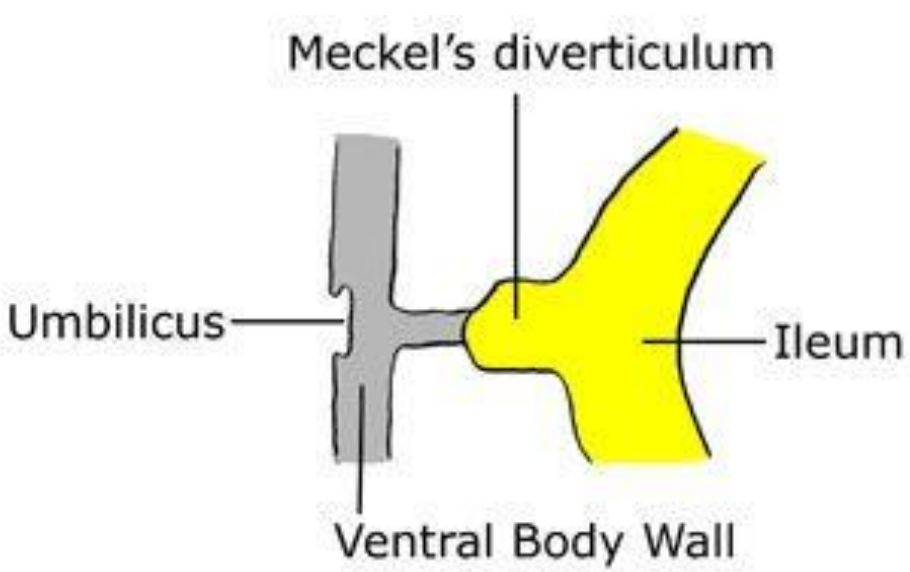
mesenteric nodes drain into superior mesenteric nodes.

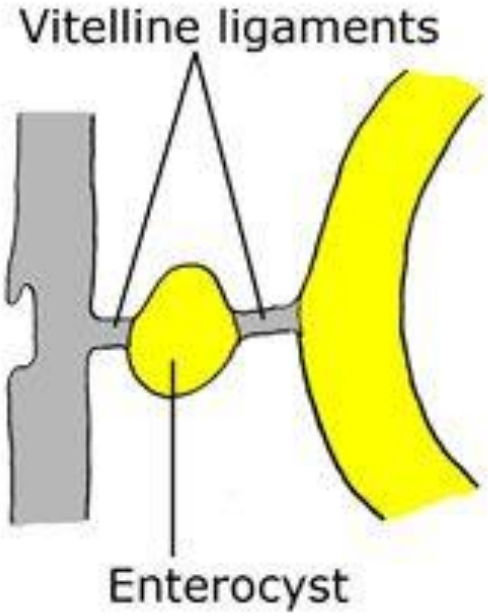
Nerve Supply

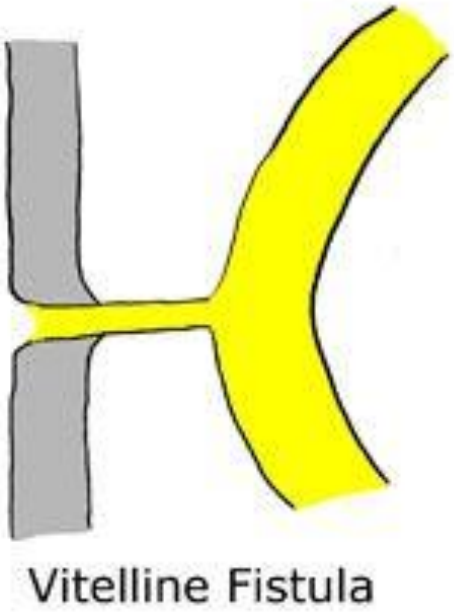
- Sympathetic - T9-T11
- parasympathetic -vagus

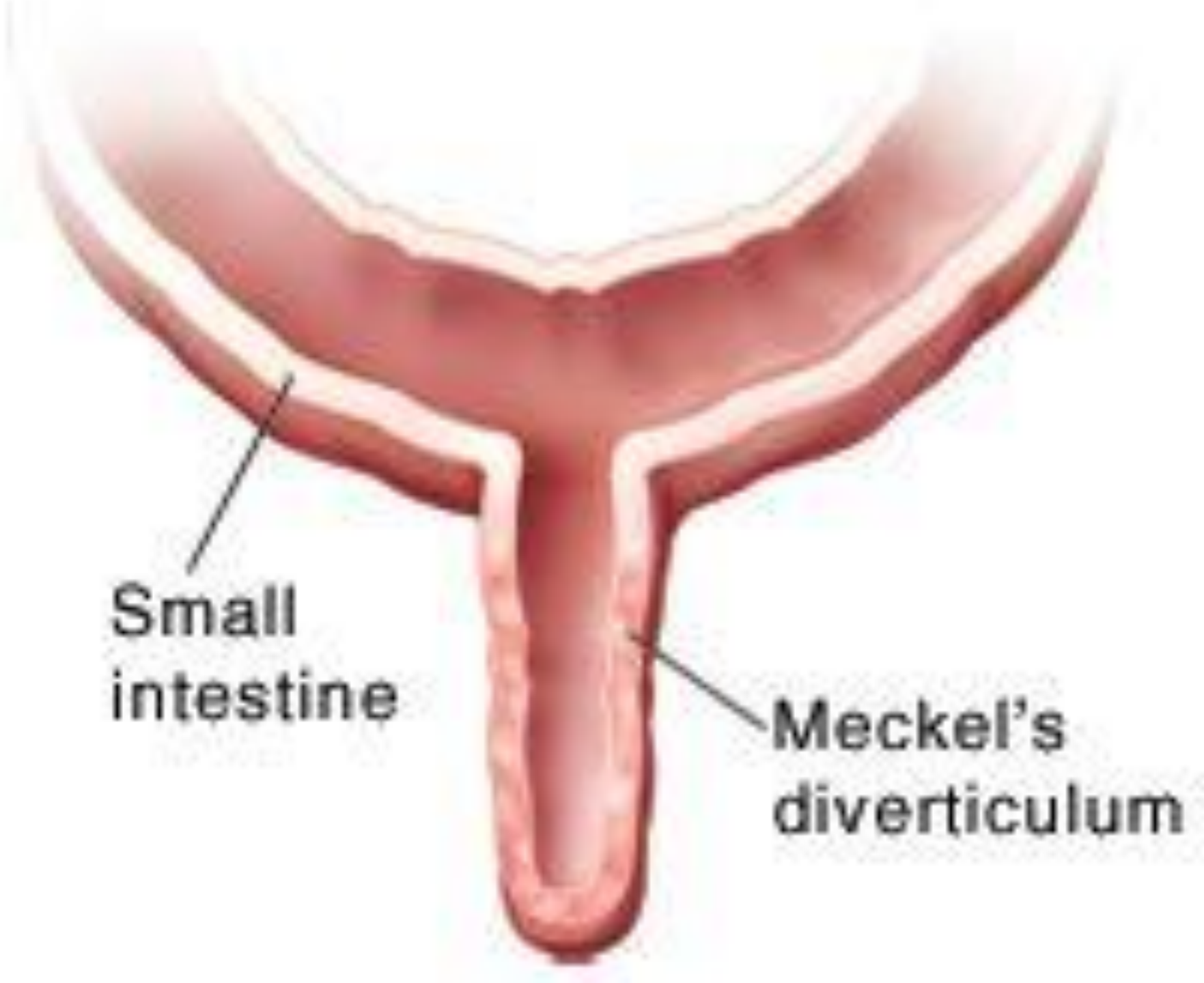
CLINICAL ASPECT

- **Ileal Diverticulum (of Meckel)-** is the persistent proximal part of the vitellointestinal duct which is present in the embryo, and which normally disappears during the 6th week of intrauterine life.
- It occurs in 2% subjects.
- Usually it is 2 inches or 5 cm long.
- It is situated about 2 feet or 60 cm proximal to the ileocaecal valve, attached to antimesenteric border of the ileum.
- Its calibre is equal to that of the ileum.
- Its apex may be free or may be attached to the umbilicus, to the mesentery, or to any other abdominal structure by a fibrous band.


Meckel's diverticulum
Umbilicus
Ileum
Ventral Body Wall


Vitelline ligaments
Enterocyst


Vitelline Fistula


Small intestine
Meckel's diverticulum