



**THE**



**SYSTEM**

# Anatomy

Sheet

Slide

Handout

Number: **Sheet 6**

Subject: **Large Intestines**

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Date:

Price:

Introductory notes:

- This sheet was written in the same order as the slides, and everything in the slides is mentioned in this sheet.
  - The extra notes that were not mentioned in the slides are highlighted.
  - Pictures that contain arteries, veins and lymphatic vessels are in the last 3 pages.
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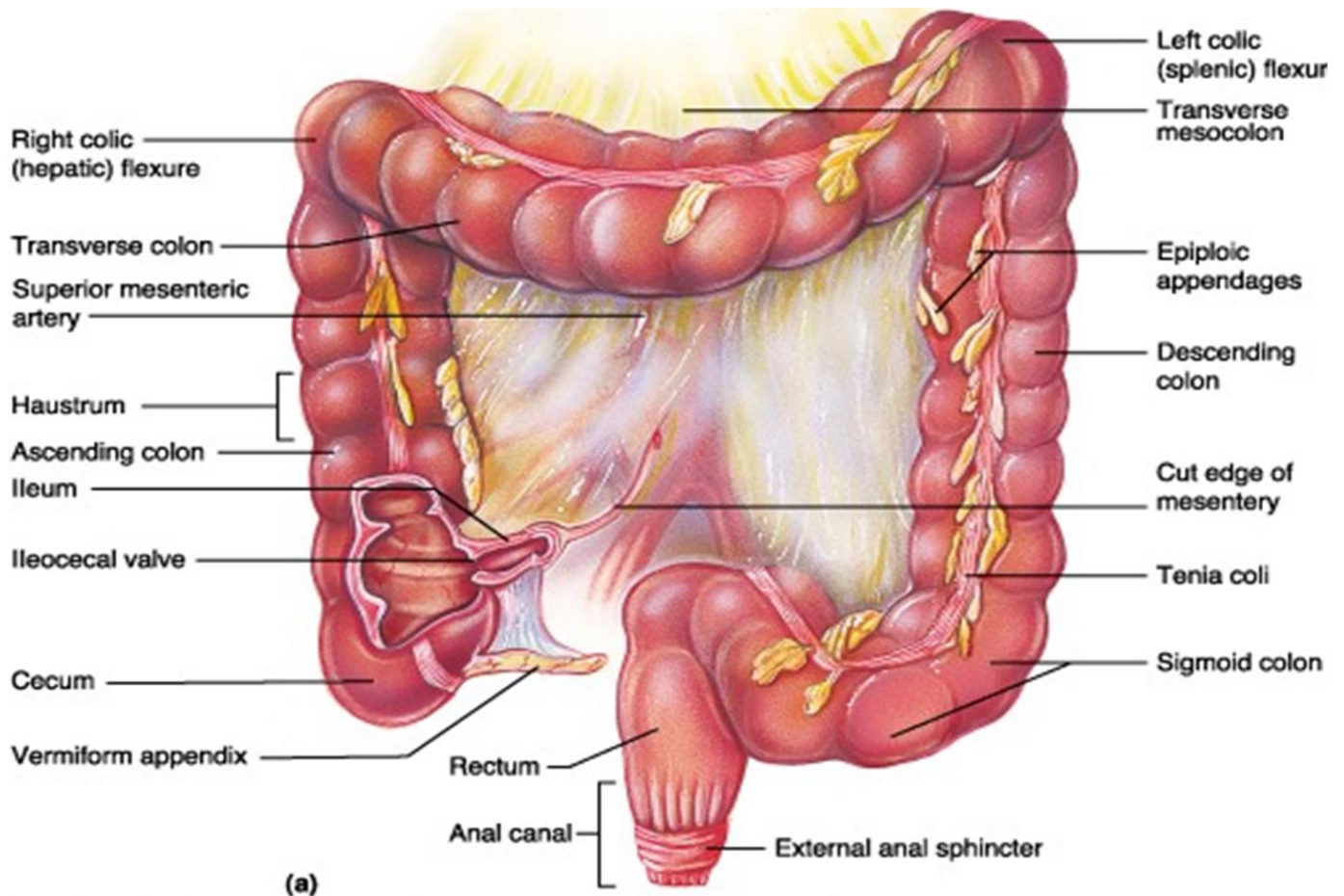
## ***Anatomy of the Large Intestine***

- Extends from ileocecal valve to anus
- Length = 1.5- 2.5m = 5 feet
- Unlike the length of the small intestine, which is constant (6 meters), the length of the large intestine varies among individuals.
- This variation is mainly found in the transverse and sigmoid colon.
- Regions:
  1. Caecum = 2.5 – 3 inches
  2. Appendix = 3 – 5 inches
  3. Colon:
    - (a) Ascending = 5 inches
    - (b) Transverse = 15 inches
    - (c) Descending = 10 inches
    - (d) Sigmoid = 10 – 15 inches
  4. Rectum = 5 inches
  5. Anal canal = 4 cm

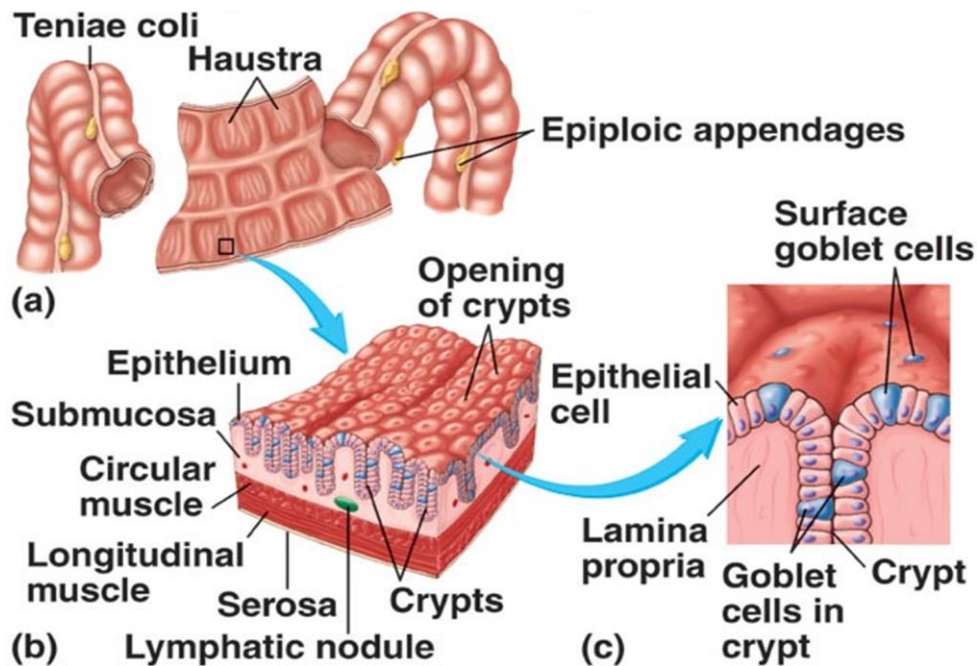
## ***General Features of the Large Intestine***

- **Sacculations, or Haustra:** caused by teniae coli (also taeniae coli). It appears in the X-ray.
- **Teniae coli** (three separate longitudinal ribbons of smooth muscle) are not present in the **appendix and rectum**. This marks a landmark for the base of the appendix as the teniae coli disappears at the level of the base of the appendix. This is significant for surgery; to reach the appendix, follow the teniae coli until its end (discussed later in the sheet).

- Appendices epiploicae (or epiploic appendages) are adipose structures protruding from the **serosal** surface of the colon). Appendices epiploicae are not present in the **appendix, caecum and rectum**, but are found in all other areas of the large intestine.
- The functions of the large intestine: absorption of water, secretion of mucous and formation of feces. Histologically, the surface epithelium is formed by simple columnar cells (mucous and absorptive cells) with numerous goblet cells. In the lamina propria, glands of Lieberkühn are present but there are no Paneth cells. Moreover, the large intestine has a muscular layer (outer-longitudinal and inner-circular). Again, the longitudinal layers form teniae coli.



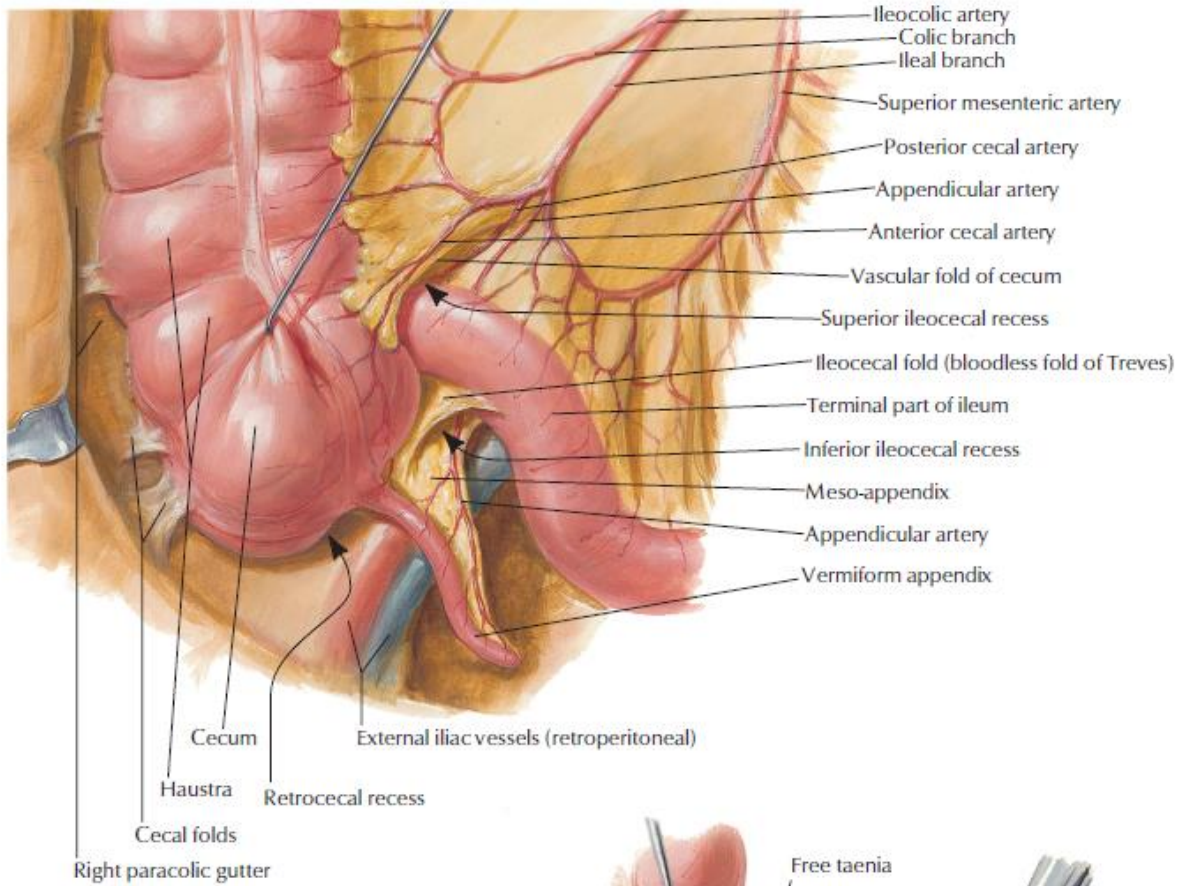
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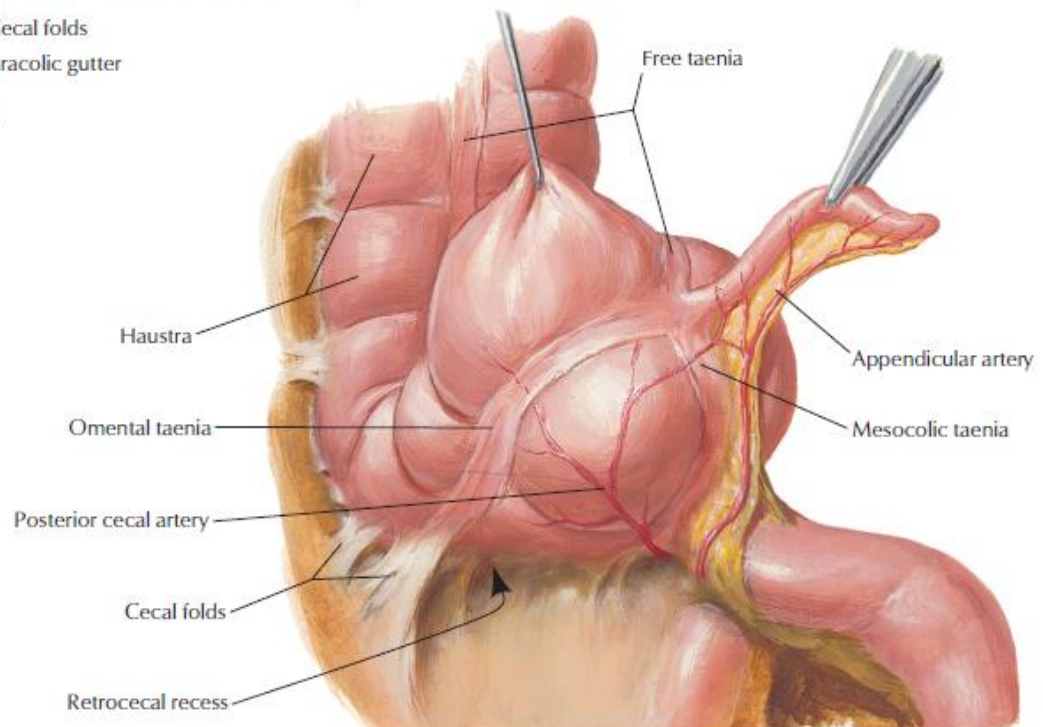
## Caecum

- It is a blind-ended pouch.
- Site: situated in the right iliac fossa (right inguinal region), above and parallel to the lateral  $\frac{1}{2}$  of the inguinal ligament.
- Size: about 2.5 – 3 inches in diameter
- According to many books, it is completely covered with peritoneum. However, the caecum is fixed in the right iliac fossa by peritoneum and it has a retrocecal space. Therefore, the peritoneum surrounds the caecum and fixes it to the fossa so it is not completely covered by peritoneum.
- Although it does not have a mesentery (**very rare property**), it possesses a considerable amount of mobility.
- The caecum is attached to:
  - a) Ascending colon
  - b) Posteromedially, the appendix, 1 inch below ileocecal valve
  - c) Medially: Ileum
- The presence of peritoneal folds in the vicinity of the caecum creates:
  - a) The superior ileocecal recesses (pouch)
  - b) The inferior ileocecal recesses
  - c) The **retrocecal recesses**. The appendix may be within it and sometimes the small intestine may enter in it. This case is also known as **internal hernia**. It will increase the pressure on the blood vessels causing gangrene which requires urgent treatment.

- The longitudinal muscle is restricted to three flat bands, the **teniae coli**, which converge on the base of the appendix and provide for it a complete longitudinal muscle coat.



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## ***Relations of Caecum***

- **Anteriorly:**

1. Coils of small intestine
2. The greater omentum
3. The anterior abdominal wall in the right iliac region

To examine the caecum, the doctor will place his hand above the inguinal ligament in the area of the right iliac fossa and apply pressure on the anterior abdominal wall.

- **Posteriorly:**

1. The psoas and the iliacus muscles which are inserted into the lesser trochanter of the femur
2. The femoral nerve between the two muscles
3. The lateral cutaneous nerve of the thigh
4. Posteromedially: the appendix if it is in the retrocecal space (which is common)

- **Medially:**

1. Small intestine (ileum)

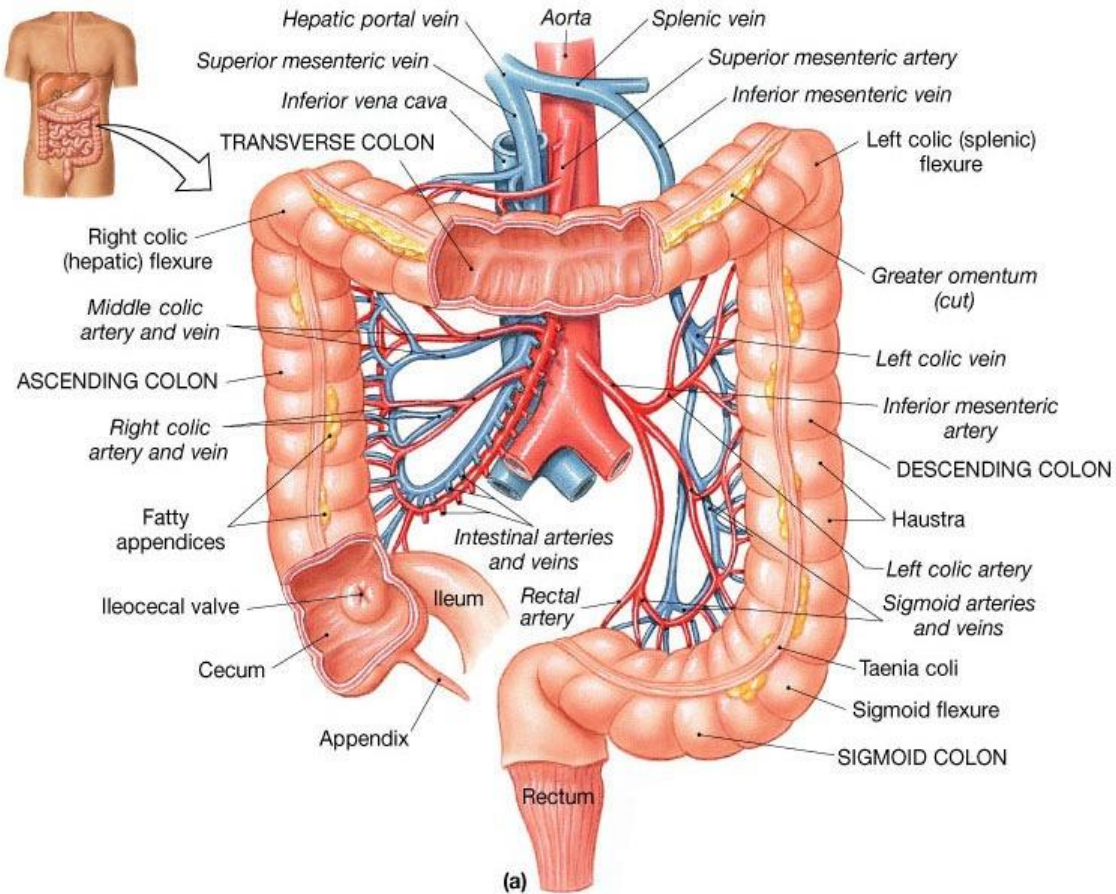
## ***Blood Supply of Caecum***

- **Arteries:**

1. Anterior and posterior cecal arteries are branches of the ileocecal artery which is a branch of the superior mesenteric artery.
2. Note: the superior mesenteric artery supplies the midgut by giving ileal, jejunal, right colic, middle colic and the ileocolic arteries.

- **Veins:**

1. Correspond to the arteries and drain finally into the superior mesenteric vein which joins the splenic vein behind the neck of pancreas to form the portal vein.
2. Note: we should know the relation between each artery and vein, which one is medial and who is the lateral, like: the superior mesenteric artery is on the left side of the vein. The inferior mesenteric artery is on the right side of the vein.



### ***Lymphatic Drainage of Caecum***

- The lymphatic vessels pass through several mesenteric nodes and eventually reach the superior mesenteric nodes around the origin of the superior mesenteric artery. Some of the nodes may be located on/near the veins (hence have the same names of the veins) and also drain into the superior mesenteric nodes.

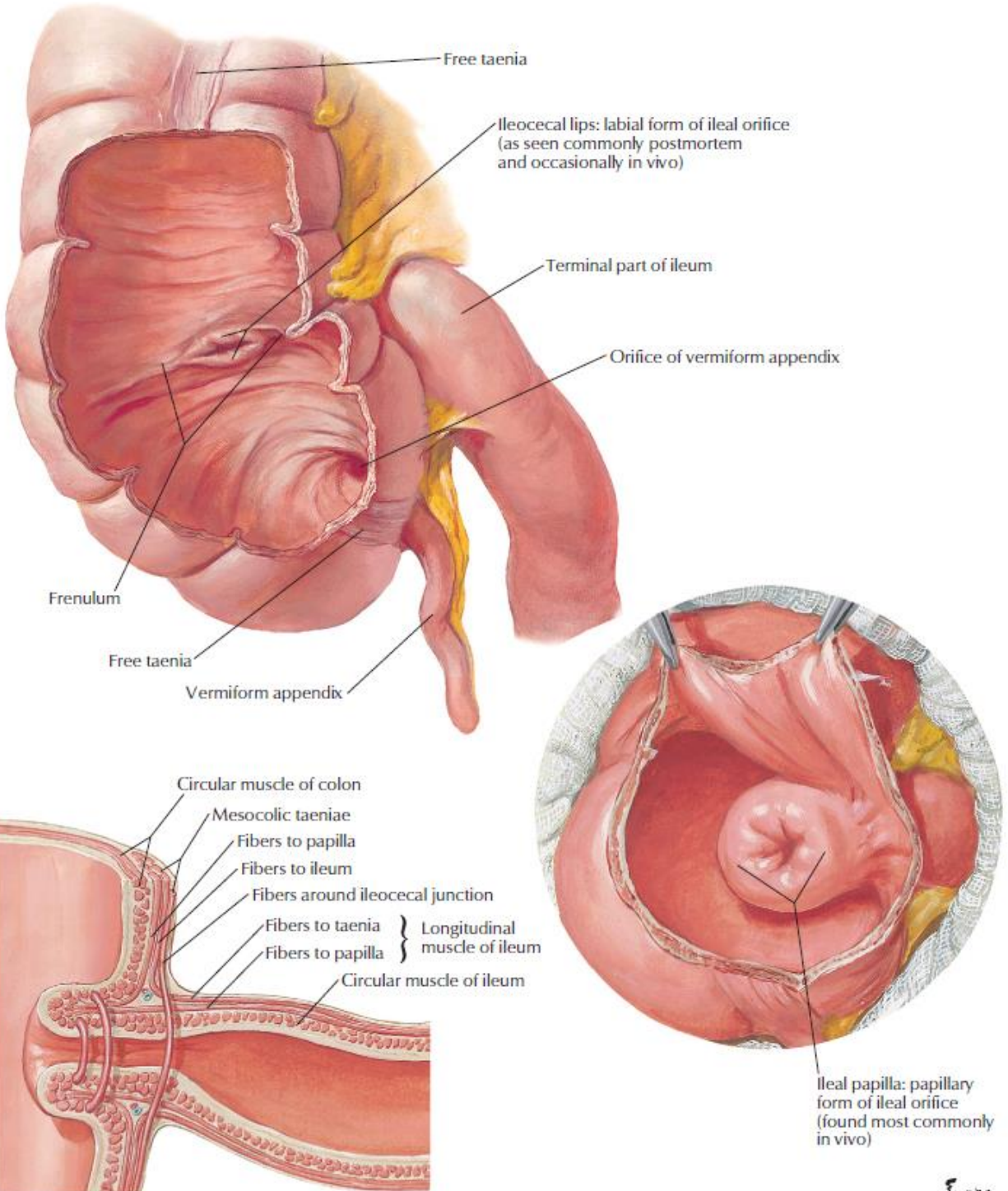
### ***Nerve Supply of Caecum***

- Branches from the sympathetic and parasympathetic (vagus) nerves form the superior mesenteric plexus.
- The vagus nerve gives parasympathetic innervation until the junction between the medial 2 thirds of the transverse colon and the lateral third (which is the end of the midgut).

## ***Ileocecal Valve***

- A rudimentary structure
- Consists of two horizontal folds of mucous membrane
- Project around the orifice of the ileum
- Anatomically, there is no thickening of the smooth muscle so it is not considered an anatomical sphincter. There is only two horizontal folding of mucosa at the opening of the ileocecal valve. This folding leads to closure of this junction by causing pressure on the caecum when it is extended, so the material will not go back to the ileum, instead it will go towards the ascending colon.
- These two folds of the mucosa are called: the superior ileocecal fold and the inferior ileocecal fold.
- Meanwhile, the Ileocecal sphincter formed by the circular smooth muscle layer of the lower part of the ileum plays an important role in the control of the flow of contents from the ileum into the colon.
- The smooth muscle tone is increased when the caecum is distended; the **gastrin hormone**, which is produced by the stomach, causes relaxation of the muscle tone (hormonal control).





Schema of muscle fibers at ileal orifice

*F. Netter M.D.*

## **Appendix**

It is very important clinically because of the frequent cases of the appendicitis (التهاب الزائدة الدودية). The treatment is surgery. This surgery is also known as "appendectomy" (discussed later). It is very important to do this surgery as soon as possible for the case of appendicitis because the expanded and swollen appendix (filled with fluids and blood) could rupture, leading to peritonitis.

- **Location and Description:**

1. It is a narrow and muscular tube.
2. Contains a large amount of lymphoid tissue (as nodules)  
It is also referred to as a *lymphatic organ*.
3. It has no role in digestion although it is in the GI tract.
4. It normally varies in length from 3 to 5 inches. However, due to the variation it may be very small (2cm) or very long up to 22 cm.
5. The base is attached to the posteromedial surface of the caecum about 1 inch (2.5 cm) below the ileocecal junction.
6. The remainder of the appendix is free.
7. Remember: the taeniae coli reach to the base of the appendix then disappear at this level.

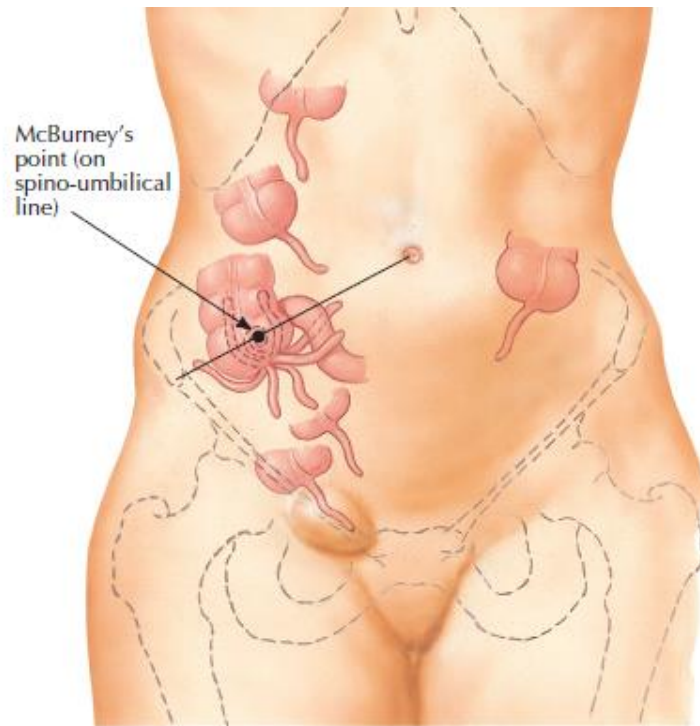
- **Peritoneum:**

1. It has a complete peritoneal covering, which is attached to the mesentery of the small intestine by a short mesentery of its own, the **mesoappendix**.
2. The mesoappendix contains the appendicular vessels, nerves and lymphatic vessels and nodes.

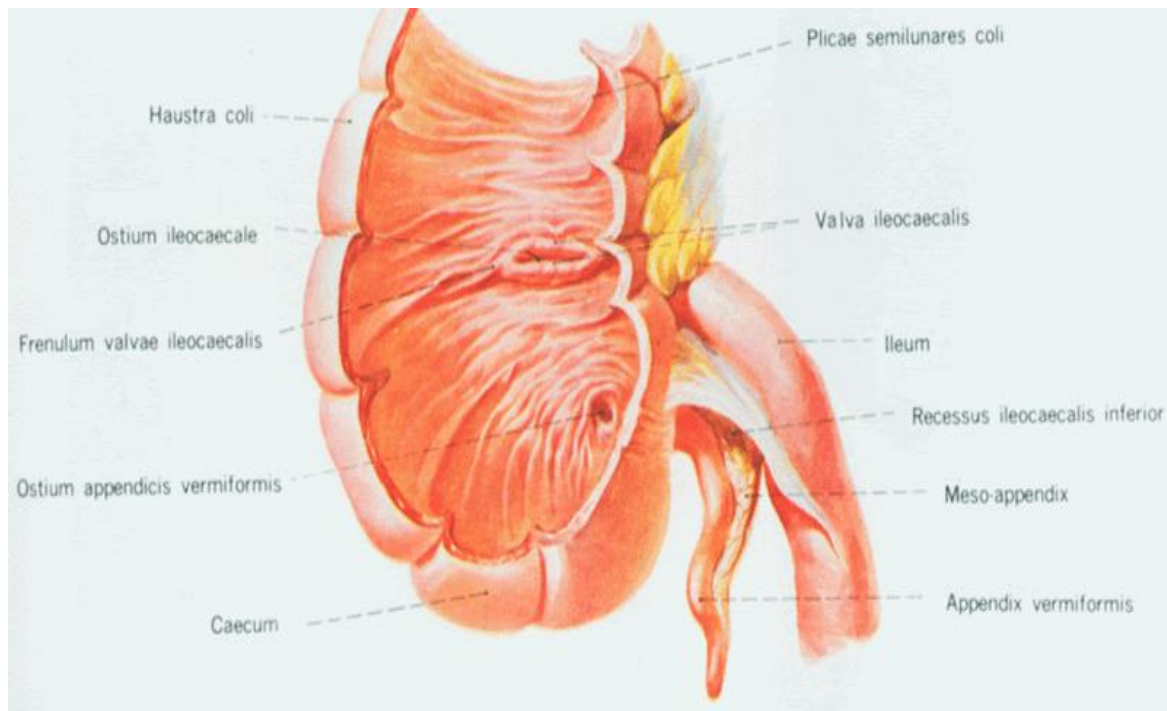
- **Position:**

The appendix lies in the right iliac fossa, and in relation to the anterior abdominal wall, it may be found in different positions, including:

- a) Retrocecal: in retrocecal recess behind caecum in 74% of the population
- b) Pelvic: in the pelvis related to right ovary and uterine tube (descends downwards to the pelvis) in 21% of the population  
Therefore, the clinical picture between retrocecal and pelvic is different.
- c) Subcecal: below caecum in 3.5% of the population
- d) Pre-ileal: in front of ileum in 1% of the population
- e) Post-ileal: behind the ileum → 0.5%



**Variations in position of appendix**

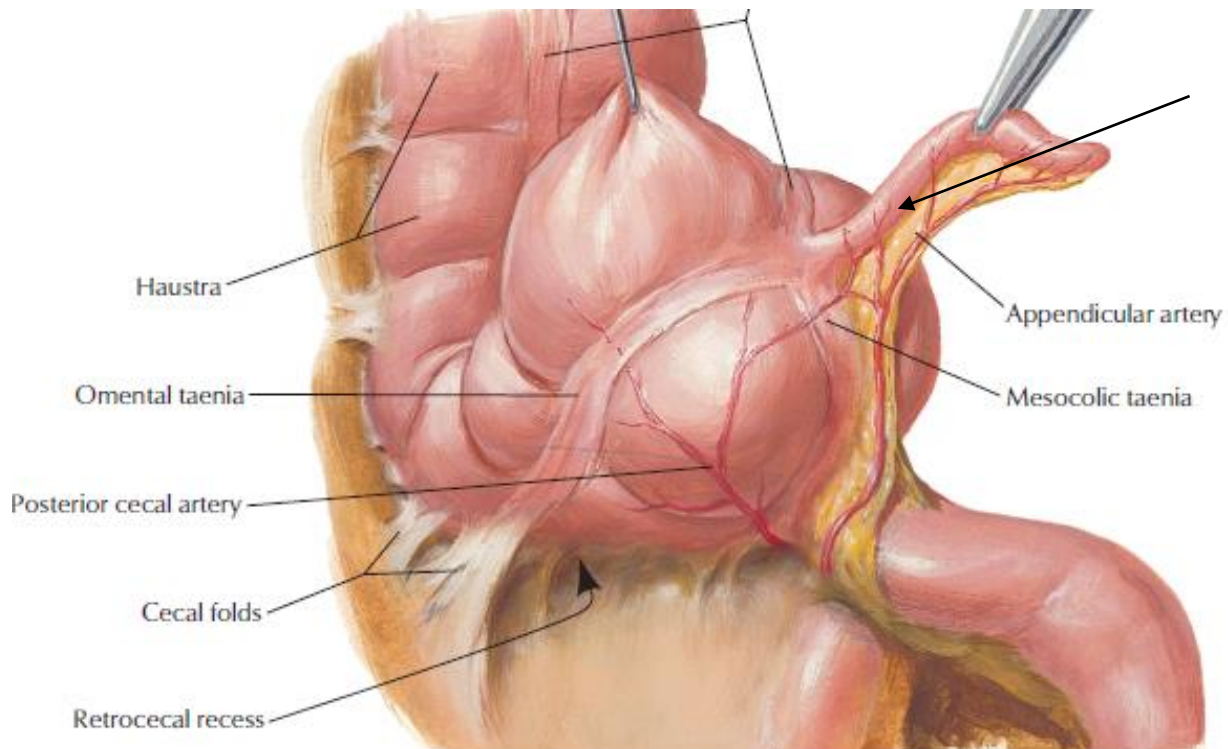


## ***Surface Anatomy of Appendix – McBurney's point***

- McBurney's line: the line between the anterior superior iliac spine and the umbilicus.
- The base of the appendix is situated: one third of the way up along the line joining the right anterior superior iliac spine to the umbilicus, in other words, in the point between the upper 2 thirds and the lower third of the line (McBurney's point).
- In the past, appendectomy was done by making an incision along the line between anterior superior iliac spine to the umbilicus. This incision, called McBurney's incision, passes through McBurney's point and is parallel to the inguinal ligament. Back then they used to separate the muscles and when reaching the peritoneum, they make an incision that leads directly to the base of the appendix.
- To reach the appendix during an **appendectomy**, follow the taeniae coli which converge toward the base of the appendix.
- Nowadays, appendectomy is done by a laparoscope that makes an opening around the umbilicus to reach the appendix.

## ***Blood Supply of Appendix***

- **Arteries:**
  1. The appendicular artery is a branch of the posterior cecal artery (ileocecal artery) which descends behind the ileum.
  2. Note: the superior mesenteric artery gives off a branch that is called the ileocecal artery which gives off a branch called posterior cecal artery.
  3. Appendicular artery runs in free margin of the mesoappendix .
- **Veins:**
  1. The appendicular vein drains into the posterior cecal vein to superior mesenteric vein.



### ***Lymphatic Drainage of Appendix***

- The lymph vessels drain into one or two nodes lying in the mesoappendix which eventually drain into the superior mesenteric nodes.

### ***Nerve Supply of Appendix***

- The appendix is supplied by the sympathetic from the superior mesenteric plexus and parasympathetic (vagus) nerves.
- Afferent nerve fibers concerned with the conduction of visceral pain from the appendix accompany the sympathetic nerves and enter the spinal cord at the level of the 10th thoracic segment. T10 also supplies the skin around the umbilicus. Thus, the patient will feel pain *around* the umbilicus at the beginning of the inflammation of appendix (appendicitis). Then, it will be concentrated in the region of the right iliac fossa.
- The peritoneum over the appendix is innervated by the 10<sup>th</sup> intercostal nerve = **skin of umbilicus.**

## ***Clinical Notes***

- Acute appendicitis is uncommon in the two extremes of life.
- Thrombosis of appendicular artery completely cuts off the blood supply which results in gangrene since there is just one artery for appendix. This results in perforation and fluids from the appendix will drain into the right paracolic gutter (which is a space on the right side of the ascending colon).
- While in acute cholecystitis, there will be no gangrene because more than one artery supplies the gallbladder because it is embedded in the liver and takes blood supply from it directly.
- When the appendix is inflamed, it will be expand increasing its length, congestion and obstruction of the lumen will occur and it will be filled with fluids and blood. So it is very important to treat it immediately to avoid its rupture that causes a very dangerous condition known as peritonitis.
- The treatment is removal of the appendix surgically (Appendectomy) which include 4 steps:
  1. Make 2 ligations in each vein and artery.
  2. Cut between the 2 ligations to prevent bleeding.
  3. Stitch around the base of the appendix in and out in a circular manner so when the ends of the stitches are pulled, the base will be closed.
  4. Cut the appendix from the base.

## ***Ascending Colon***

- Most of the relations of the ascending colon are the same as the descending colon except for few structures, due to the difference in the length between the two (the descending colon is longer, it descends until the level of iliac fossa).
- Ascending colon is on the right side while the descending is on the left side.
- **Location and Description**
  1. The ascending colon is about 5 inch. (13 cm) long
  2. Lies in the right lower quadrant.
  3. It extends upward from the caecum to the inferior surface of the right lobe of the liver, where it turns to the left, **forming the right colic flexure** (hepatic flexure). On the other side, there is the left colic flexure (splenic flexure) which is found on a higher level than the right flexure and is attached to the diaphragm by a ligament called the phrenicocolic ligament, and above the ligament is the spleen.
  4. It becomes continuous with the transverse colon. Taeniae coli, sacculations & appendices epiploicae are present.

- **The peritoneum**

1. It covers the front and the sides of the ascending colon.
2. It is fixed to the posterior abdominal wall. This fixation results in the formation of the paracolic gutter.
3. Again, any infection or fluids may pass through the gutter to reach the area below the diaphragm (subphrenic).
4. Therefore, the ascending and descending colons are retroperitoneal.

### ***Relations of Ascending Colon***

- **Anteriorly:**

1. Coils of small intestine: the ascending colon is on the right side so its relation is with the ileum. While the descending colon is on the left side, so it is related to the jejunum.
2. The greater omentum: descends from the greater curvature of the stomach as 2 layers of peritoneum then ascends back as 2 layers. The greater omentum is considered the policeman of the abdomen due to the fact that it localizes the infection by surrounding the infected area. This means if the appendix is surrounded by the greater omentum, there might be an infection in it.
3. The anterior abdominal wall

- **Posteriorly:**

1. The iliacus
2. The iliac crest
3. The quadratus lumborum
4. The origin of the transversus abdominis muscle
5. The lower pole of the right kidney
6. The iliohypogastric nerve
7. The ilioinguinal nerve

## ***Blood Supply of Ascending Colon***

- **Arteries:**

1. The ileocolic & right colic branches of the **superior mesenteric artery** supply this area. The right colic artery is the main artery that supplies the ascending colon.
2. Note: the ileocolic artery supplies the ileum, caecum and the beginning of the ascending colon.

- **Veins:**

1. The veins correspond to the arteries and drain into the superior mesenteric vein.

## ***Lymphatic Drainage of Ascending Colon***

- Lymph nodes lying along the course of the colic blood vessels drain into the superior mesenteric nodes.

## ***Nerve Supply of Ascending Colon***

- Sympathetic nerves from the superior mesenteric plexus and parasympathetic (vagus) nerves.



## ***Transverse Colon***

- **Location and Description**

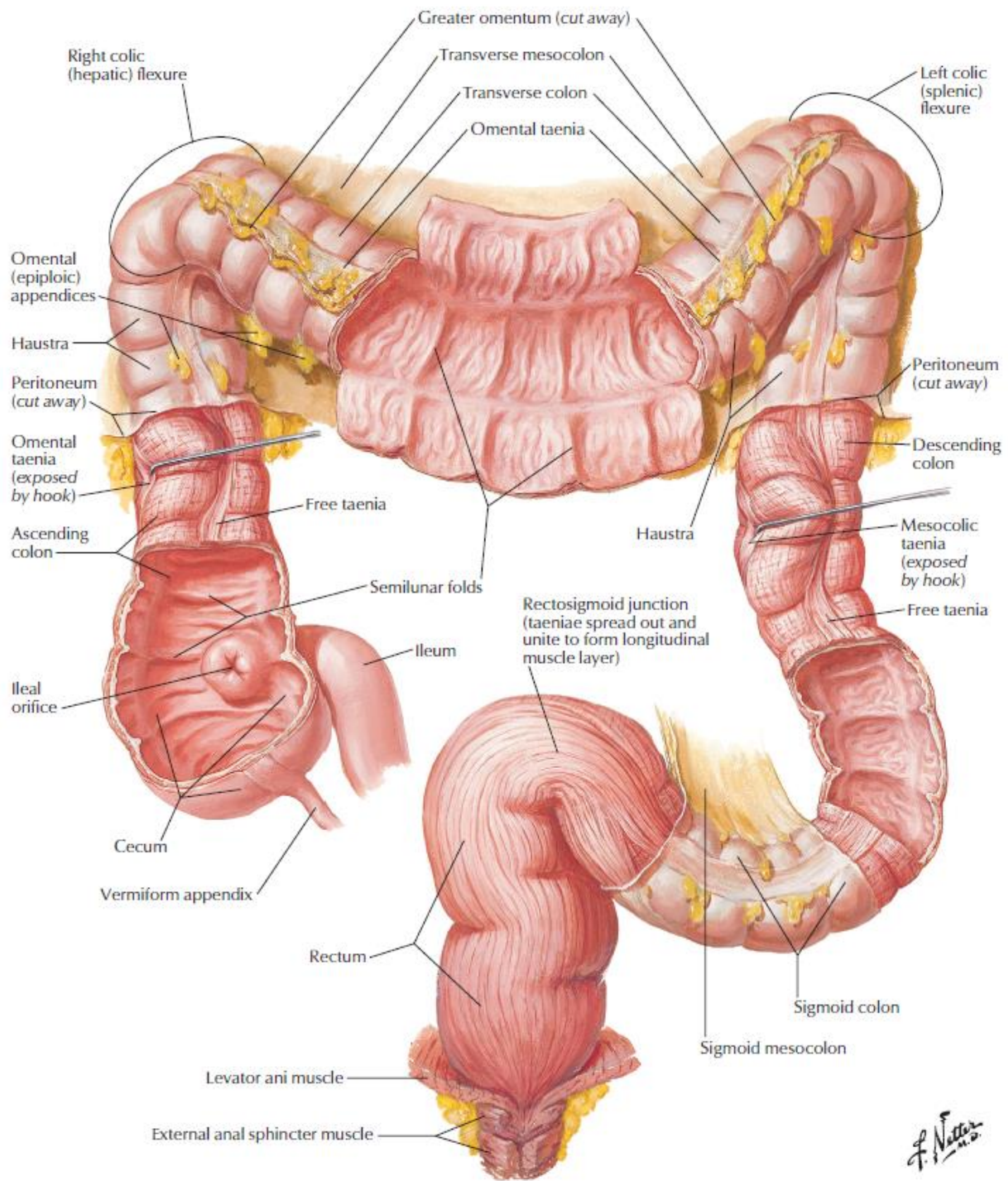
1. The transverse colon is about 15 in. (38 cm) long
2. It is intraperitoneal, completely covered by peritoneum.
3. Extends across the abdomen
4. It is located in the umbilical region.
5. It begins at the right colic flexure below the right lobe of the liver
6. Hangs downwards
7. Suspended by the transverse mesocolon from the pancreas
8. It ascends to the left colic flexure below the spleen (note that the spleen is anterior to the pancreas).
9. The left colic flexure is higher than the right colic flexure and is suspended from the diaphragm by **the phrenicocolic ligament.**
10. Taeniae coli, sacculations & appendices epiploicae are present

- **The Transverse Mesocolon = mesentery of the transverse colon**

1. It suspends the transverse colon from the anterior border of the pancreas.
2. The mesentery is attached to the superior border of the transverse colon.
3. The posterior layers of the greater omentum are attached to the inferior border.
4. The position of the transverse colon is extremely variable and may sometimes reach down as far as the pelvis.

- **The transverse colon is divided into:**

1. **Proximal 2 thirds: midgut (supplied by the superior mesenteric artery)**
2. **Lateral third: hindgut (supplied by inferior mesenteric artery)**



## ***Relations of Transverse Colon***

- **Anteriorly:**
  1. The greater omentum
  2. The anterior abdominal wall (umbilical and hypogastric regions)
- **Posteriorly:**
  1. The second part of the duodenum
  2. The head of the pancreas
  3. The coils of the jejunum and ileum: this depends on the mesentery of the transverse colon: if short, then it's anterior; if long, then it's posterior.

## ***Blood Supply of Transverse Colon***

- **Arteries:**
  1. The proximal two thirds are supplied by the middle colic artery, which is a branch of the superior mesenteric artery.
  2. The distal third is supplied by the left colic artery, which is a branch of the inferior mesenteric artery.
- **Veins:**
  1. The veins correspond to the arteries and drain into the superior & inferior mesenteric veins.

## ***Lymphatic Drainage of Transverse Colon***

- The proximal two thirds drain into the colic nodes and then into the superior mesenteric nodes.
- The distal third drains into the colic nodes which drain into the inferior mesenteric nodes.

## ***Nerve Supply of Transverse Colon***

- The proximal two thirds are innervated by sympathetic and vagal nerves through the **superior mesenteric plexus**.

- The distal (lateral) third is innervated by parasympathetic (S2, 3, 4 nerves) and sympathetic (pelvic splanchnic nerves) through **the inferior mesenteric plexus (called hypogastric plexus)**.

## ***Descending Colon***

- **Location and Description:**
  1. The descending colon is about 10 in. (25 cm) long.
  2. It extends downward from the left colic flexure, to the pelvic brim, where it becomes continuous with the sigmoid colon.
  3. Taeniae coli, sacculations & appendices epiploicae are present
- **The peritoneum**
  1. It covers the front and the sides and binds it to the posterior abdominal wall so it is retroperitoneal.

## ***Relations of Descending Colon***

- **Anteriorly:**
  1. Coils of small intestine
  2. The greater omentum
  3. The anterior abdominal wall
- **Posteriorly:**
  1. The lateral border of the left kidney
  2. The origin of the transversus abdominis muscle
  3. The quadratus lumborum
  4. The iliac crest
  5. The iliacus
  6. The left psoas\*
  7. The iliohypogastric and ilioinguinal nerves
  8. The lateral cutaneous nerve of the thigh\*
  9. The femoral nerve\*

The structures marked with an asterisk (\*) are related to the descending colon but not the ascending colon. **The descending colon descends to the pelvis.**

## ***Blood Supply of Descending Colon***

- **Arteries:**

1. The left colic and the sigmoid branches of the inferior mesenteric artery

- **Veins:**

1. The veins correspond to the arteries. The veins drain into the inferior mesenteric vein which in turn drains in the splenic vein. The splenic vein and the superior mesenteric vein join together to form the hepatic portal vein.

## ***Lymphatic Drainage of Descending Colon***

- Lymphatic drains into the colic lymphatic nodes & the inferior mesenteric nodes around the origin of the inferior mesenteric artery.

## ***Nerve Supply of Descending Colon***

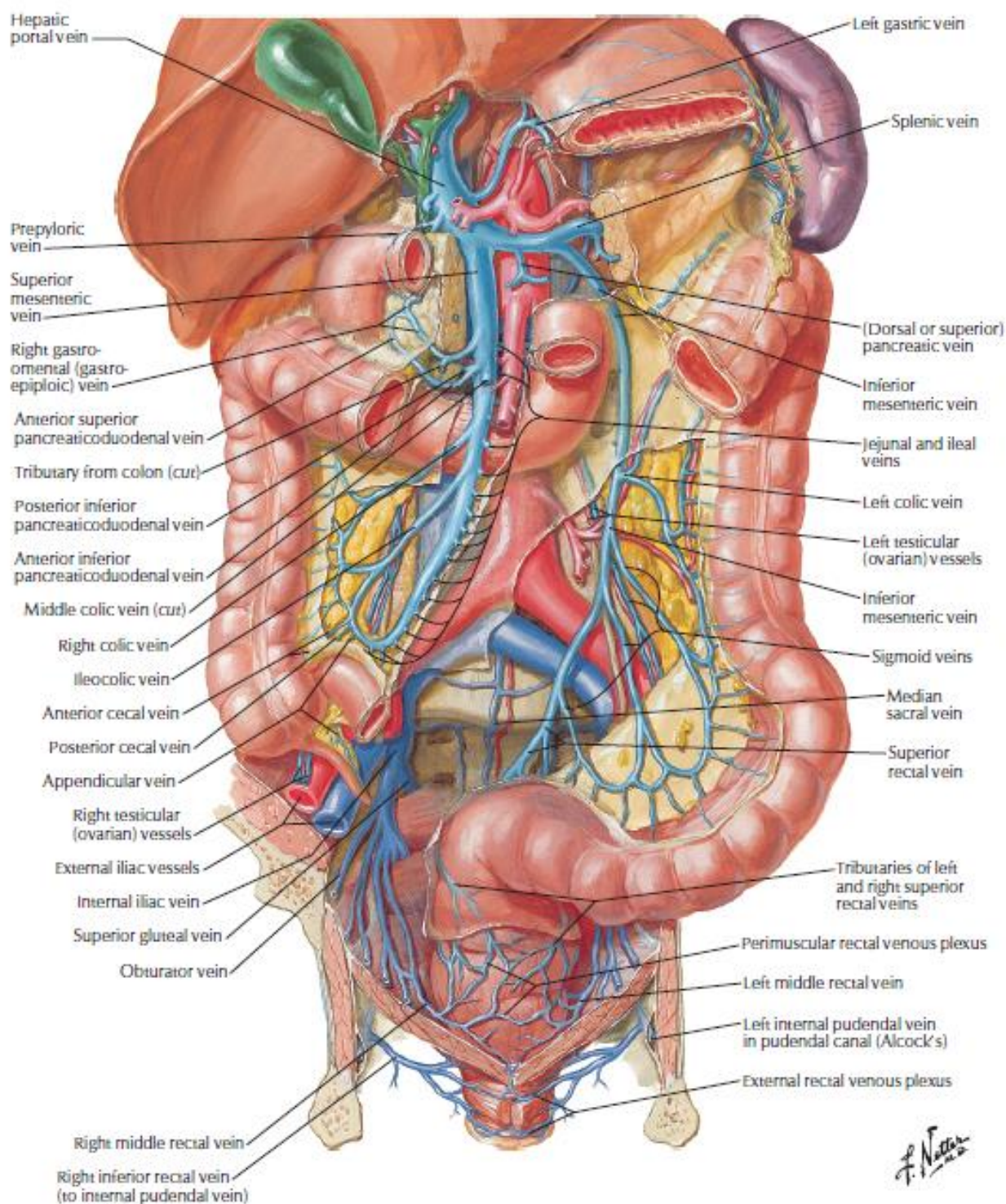
- The sympathetic innervation is through the inferior mesenteric plexus and parasympathetic through the pelvic splanchnic nerves (S2, 3, 4).

*Sorry for any mistakes,*

*Wish you all best of luck~*

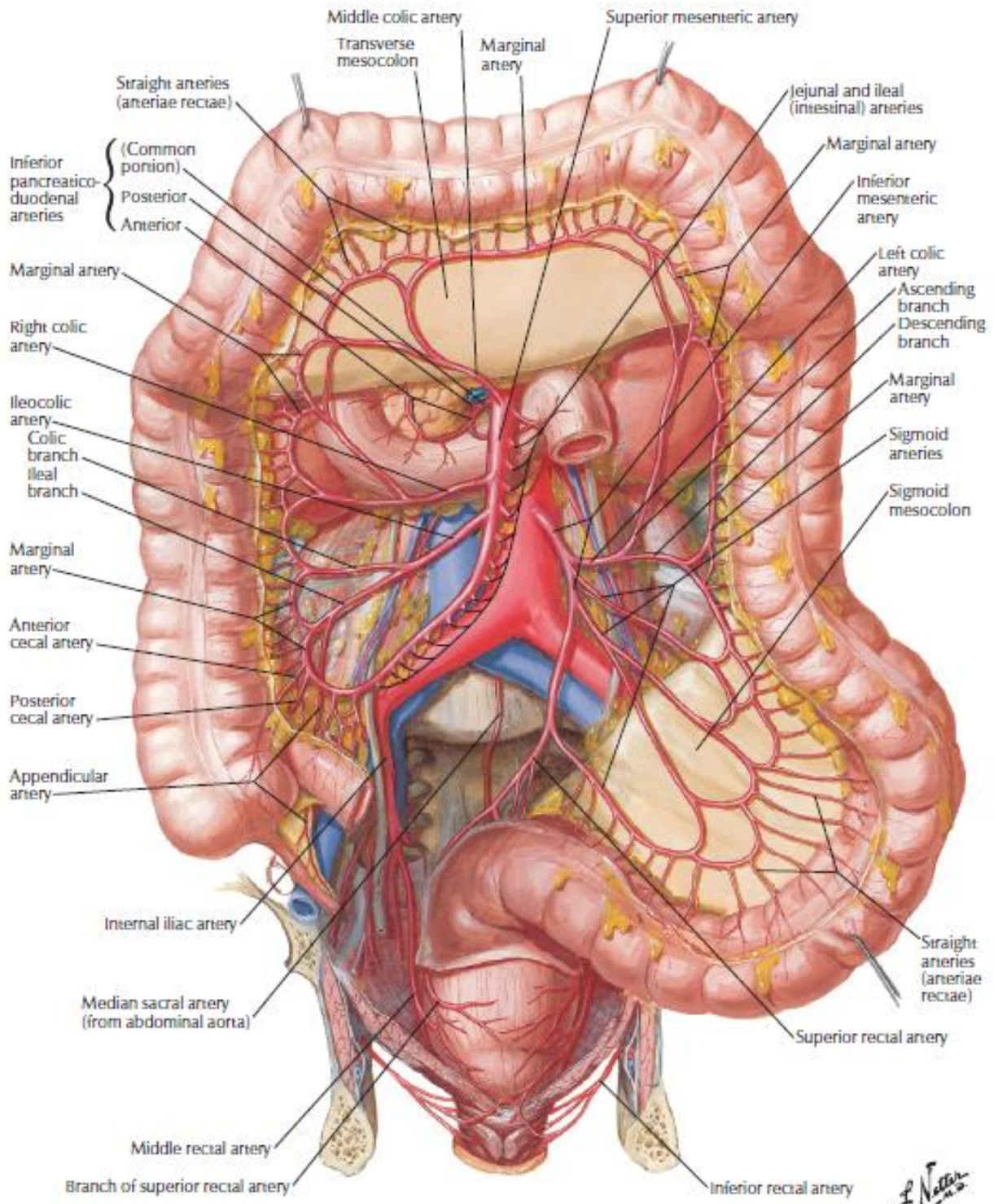
## Veins of Large Intestine

For veins of rectum see also



# Arteries of Large Intestine

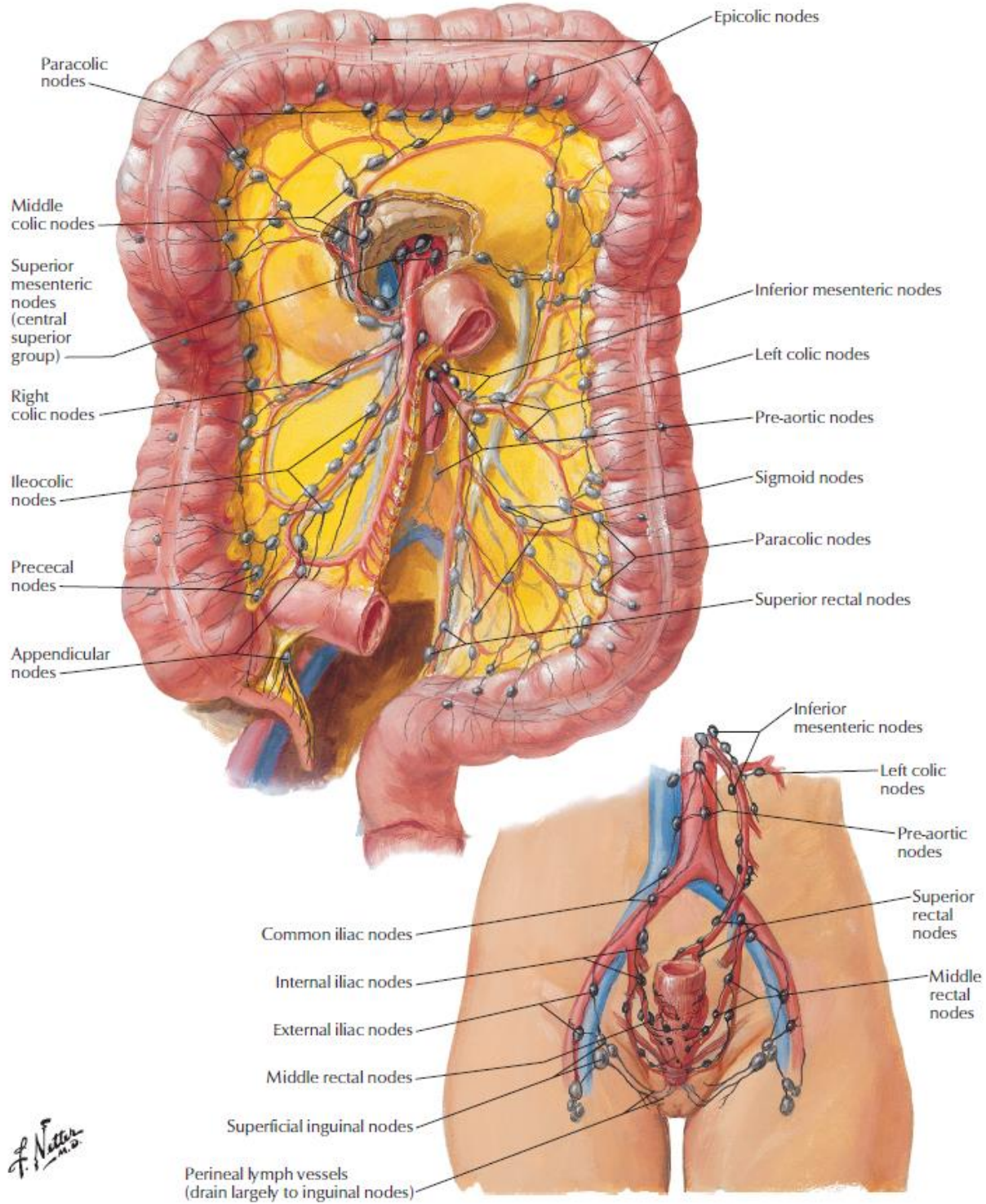
For arteries of rectum see also



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# Lymph Vessels and Nodes of Large Intestine

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