



Anatomy

● Sheet

○ Slide

number

8

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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.

Anatomy of the Large Intestine

- ❑ Extends from ileocecal valve to anus
- ❑ Larger diameter than the small intestine
- ❑ 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

- ❑ **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). On one side of large intestine.
- ❑ **Sacculations, or Haustra** (helps in absorption of water and formation of

feces) formed by **Teniae coli**. It appears in the X-ray.

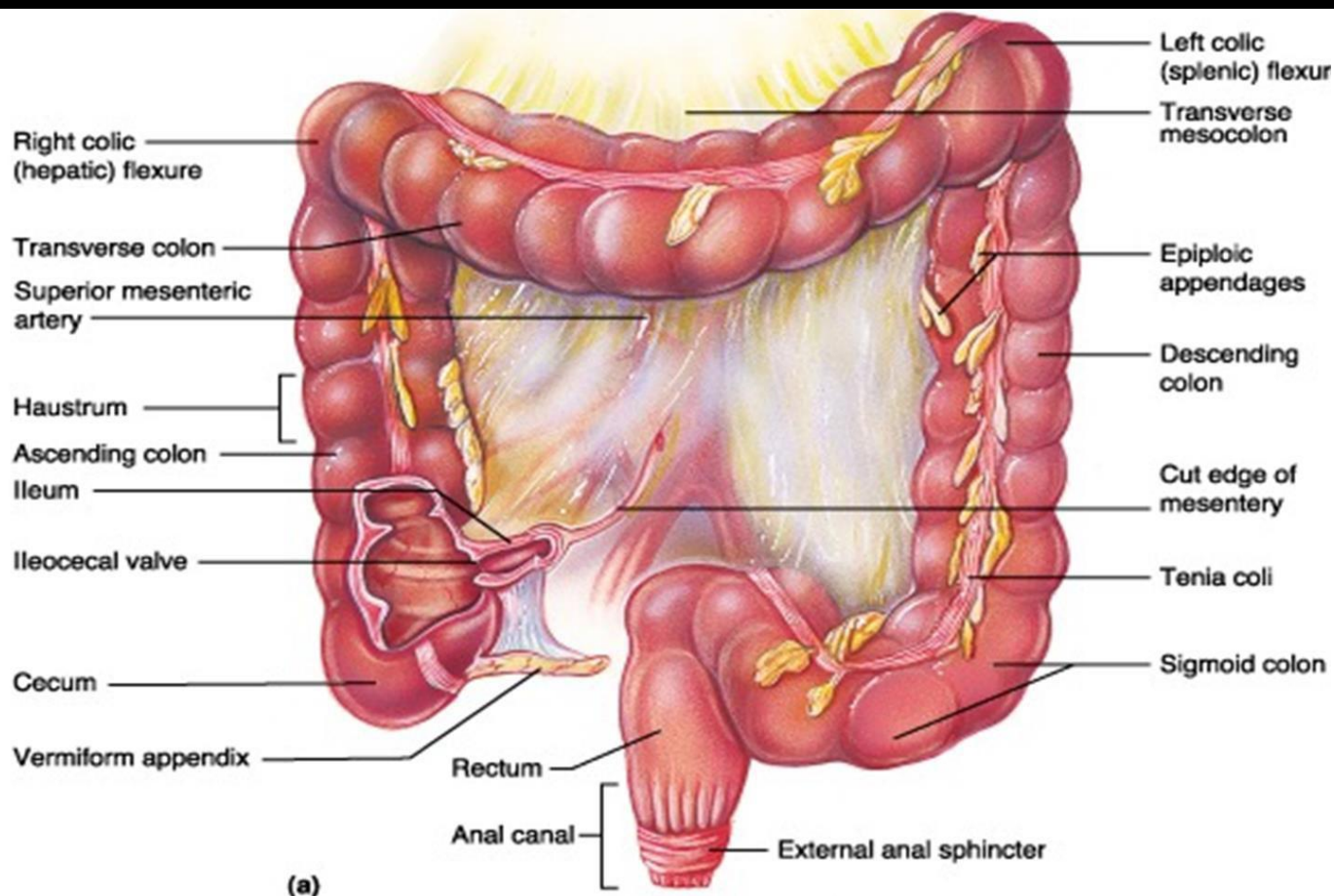
- Appendices epiploicae (or epiploic appendages) are adipose structures protruding from the **serosal** surface of the colon). Appendices epiploicae are not present in the **appendix, caecum and rectum**, but are found in all other areas of the large intestine.
- The functions of the large intestine: 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 for lubrication. In the lamina propria, glands of Lieberkühn (simple tubular with duct opening to the surface) 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.

Diagnosing diseases:

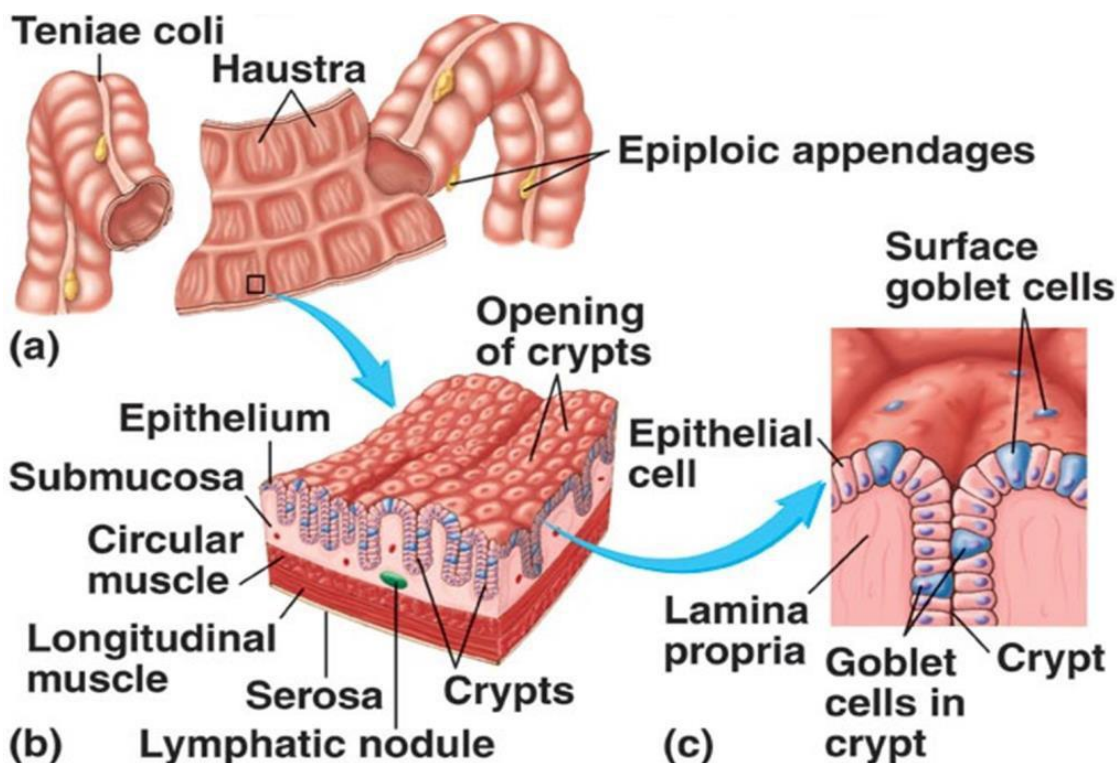
Colonoscopy is used in Diseases such as rectal cancer and colon cancer. It Can be diagnostic and therapeutic (removal of mucosal polyps).in tumors a Biopsy and resection is done then a colostomy.

Colostomy: a surgical operation in which the colon (sigmoid or transvers colon; they are mobile not fixed) is shortened to remove a damaged part and the cut end diverted to an opening in the abdominal wall.

Colonoscopy: thin flexible tube entered through the anal canal to descending colon, transverse colon, ascending colon reaching the cecum to look at the inner lining of the large intestine.



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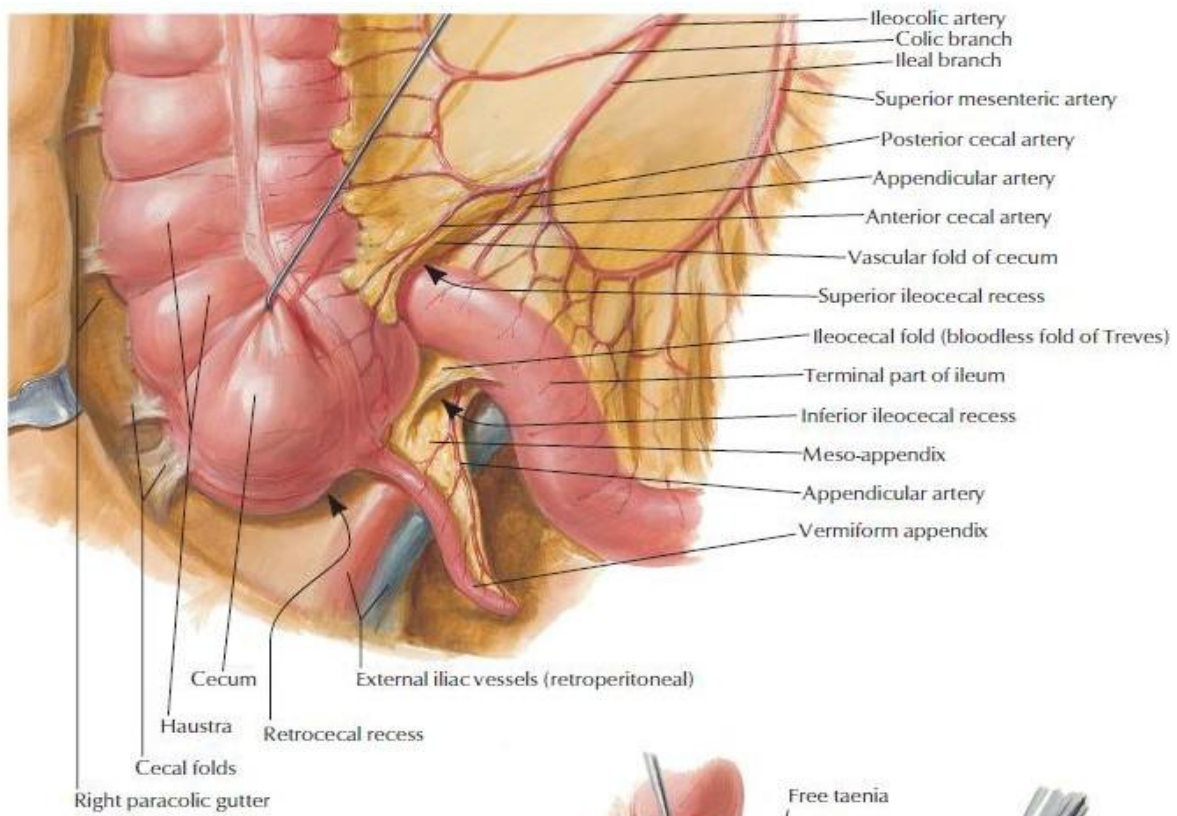
Caecum

- It is a blind-ended pouch. (ileum, appendix, and ascending colon open to it). Causing pressure which prevents regurgitation of material to ileum and helps material ascend in the ascending colon.
- Site: situated in the right iliac fossa (right inguinal region), above and parallel to the lateral ½ 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. Other books says it has a small mesentery that fixes it in the posterior abdominal wall.
- 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 and strangulated hernia** (when blood supply is cut). It will increase the pressure on the blood vessels causing gangrene which requires urgent treatment. Around the cecum or the duodenum between retroperitoneal and intraperitoneal organs

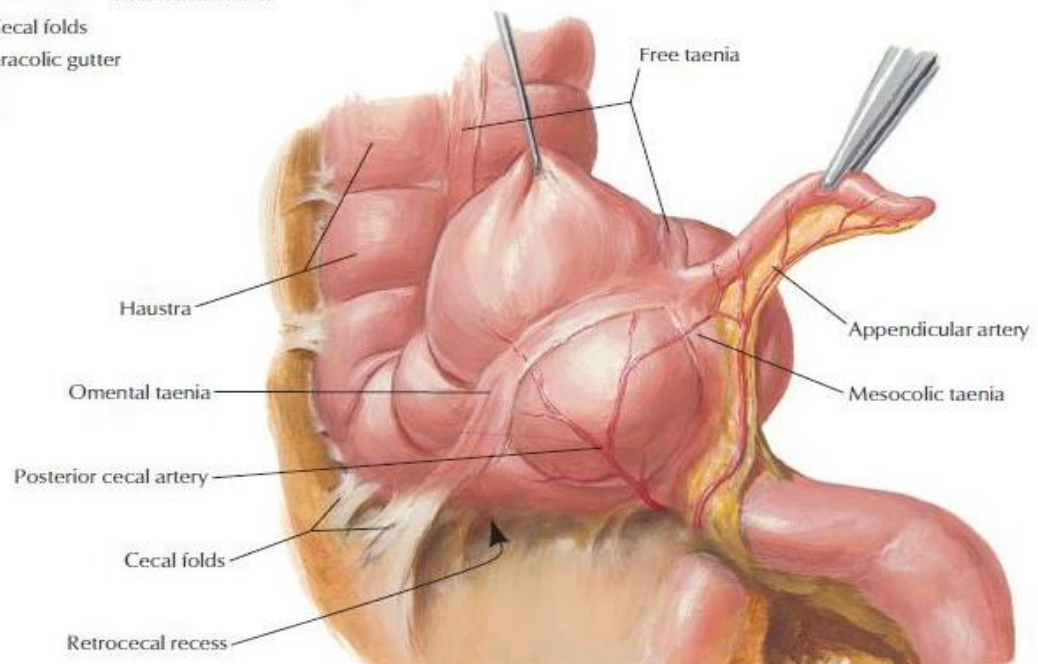
Why is there peritoneal folds?

Because the ileum is intraperitoneal and the cecum is fixed in the posterior wall of iliac fossa making folds of peritoneum. And around the cecum we'll have pouches or recesses.

- 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.



F. Netter M.D.



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 to anterior superior iliac spine
4. Posteromedially: the appendix if it is in the retrocecal space (which is common)

- **Medially:**

1. Small intestine (ileum)

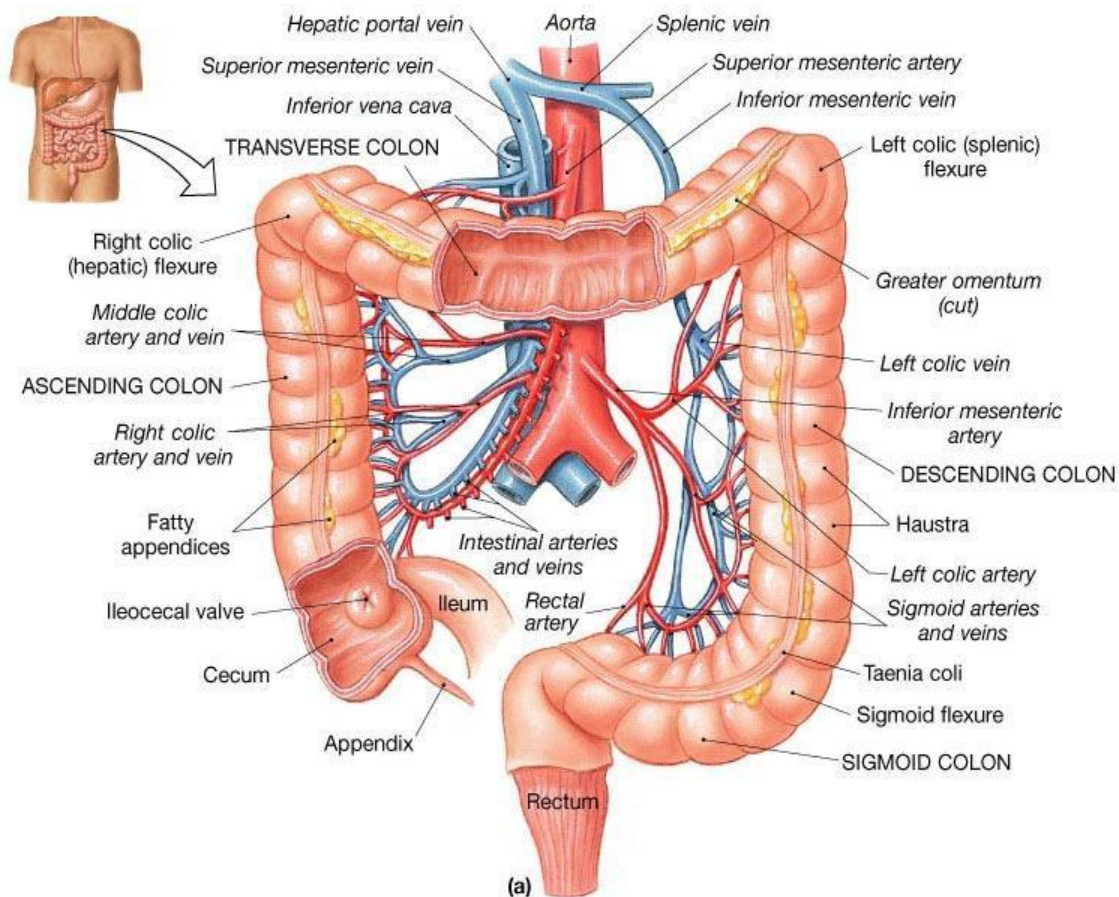
Blood Supply of Caecum

- **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

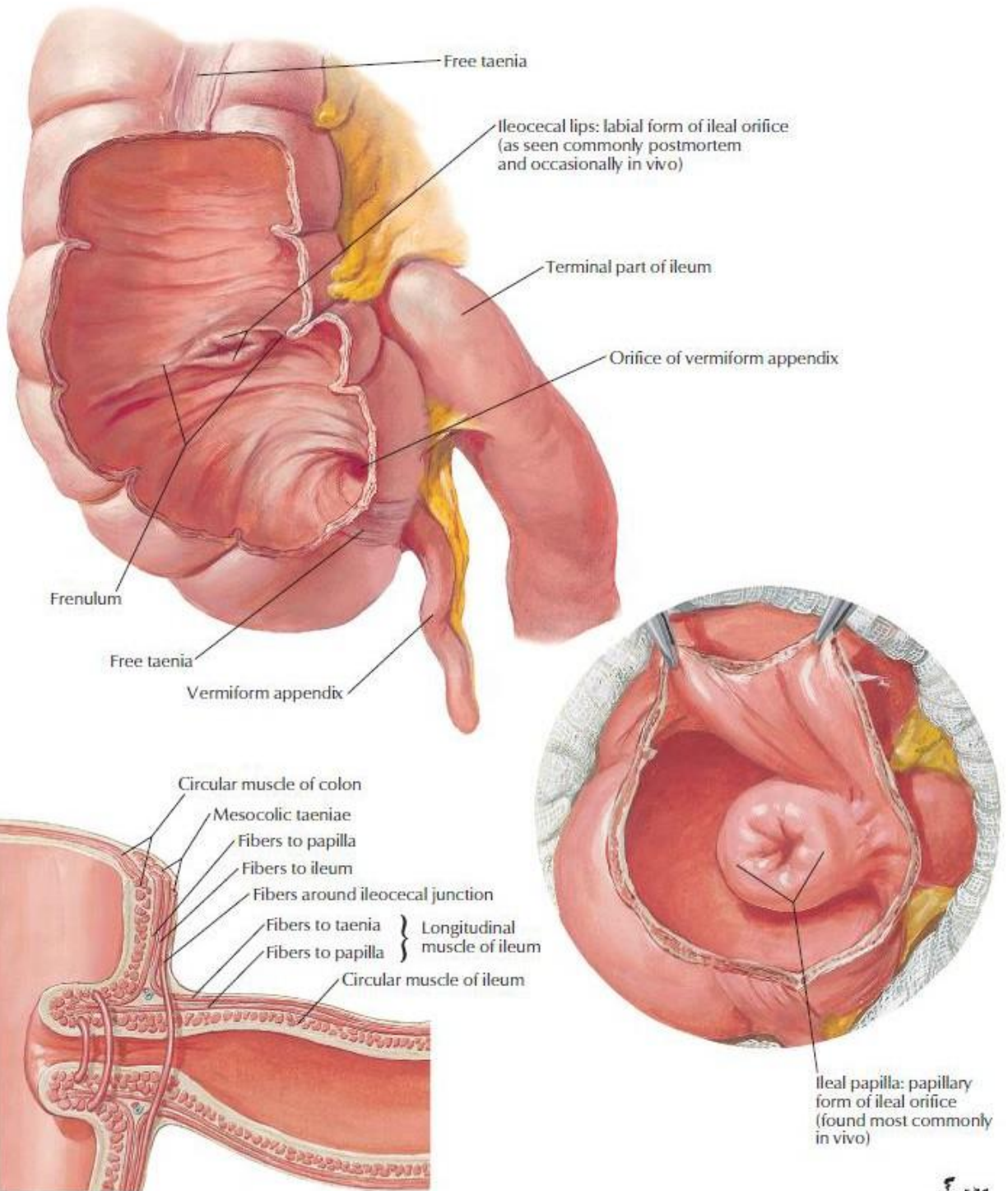
- The lymphatic vessels pass through several mesenteric nodes and eventually reach the superior mesenteric nodes around the origin of the superior mesenteric artery. Some of the nodes may be located on/near the veins (hence have the same names of the veins) and also drain into the superior mesenteric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

Nerve Supply of Caecum

- Branches from the sympathetic (superior sympathetic ganglia) 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

- Physiological valve
- A rudimentary structure
- Consists of two horizontal folds of mucous membrane to prevent regurgitation
- 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

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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.

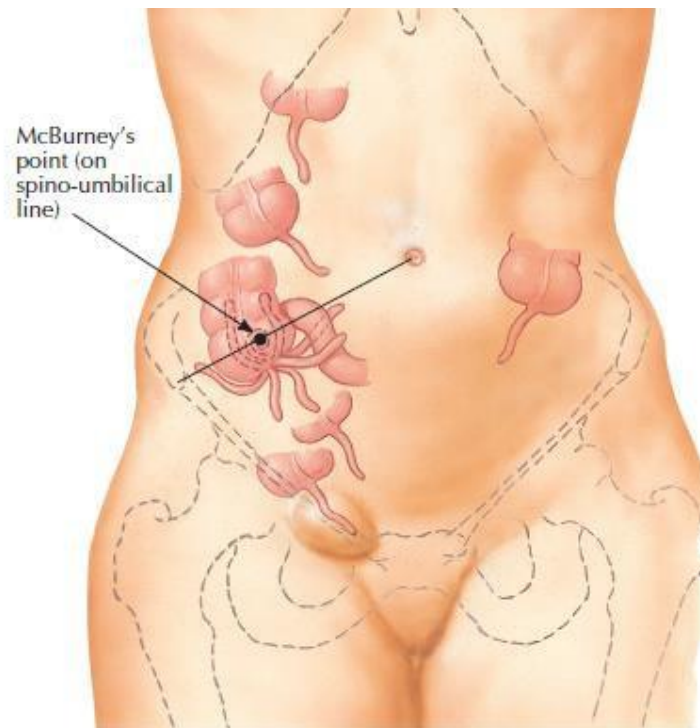
- **Peritoneum:**

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.

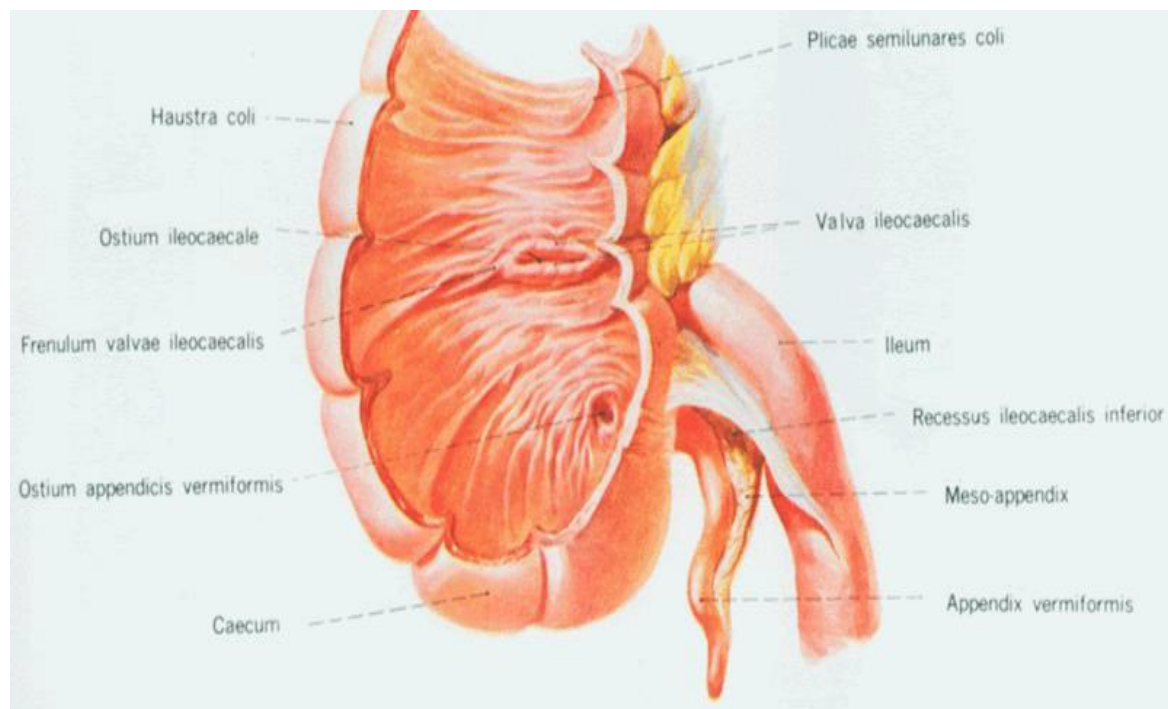
- **Position:**

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

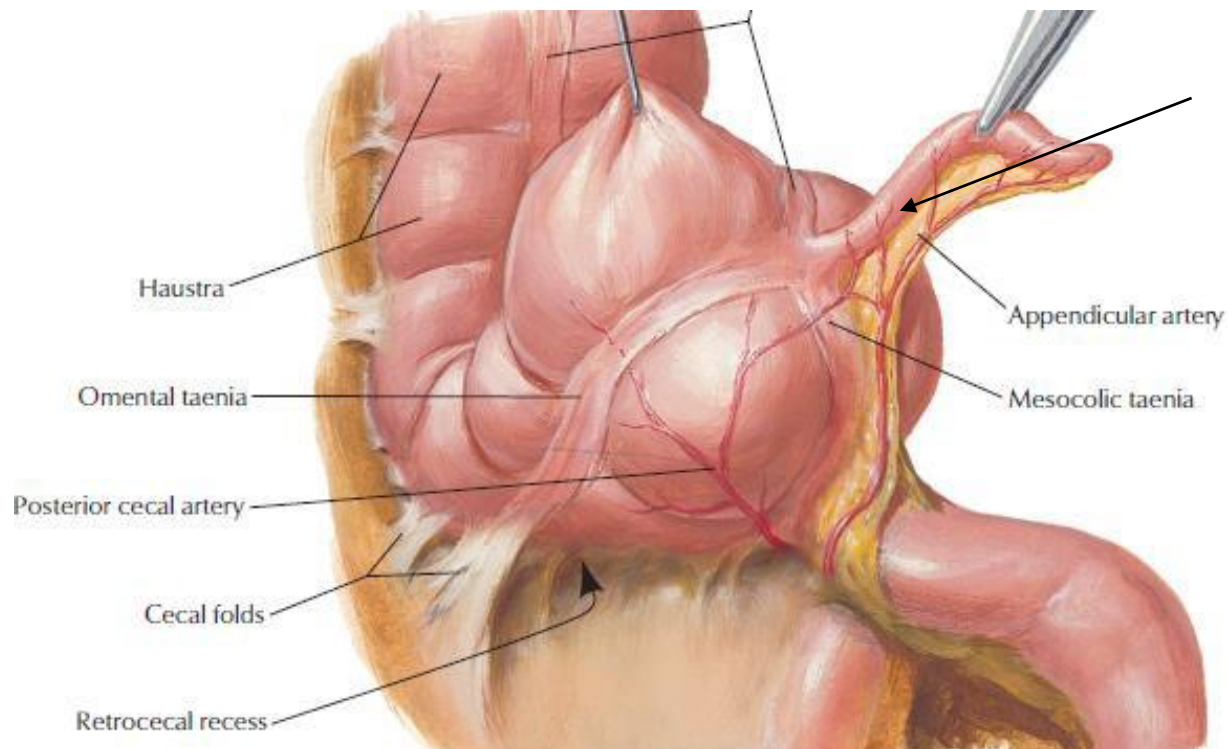


Surface Anatomy of Appendix – McBurney's point

- 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 10th 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 (above right iliac fossa) 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 (groove).
3. Again, any infection or fluids may pass through the gutter to reach the area below the diaphragm (subphrenic) and pelvis. It can't reach the diaphragm on the left side only the pelvis because it's closed by ligament.
4. Therefore, the ascending and descending colons are retroperitoneal.

Importance of the paracolic gutter:

In a severe case of appendicitis, the infection has spread and abscess is formed. The patient will most likely sleep on the right side (side of infection). And is always laying down therefore the abscess will accumulate on the lateral side and will spread to the diaphragm, to Morrison's pouch (between liver and kidney) or sub-phrenic on the right side (open with the gutter). And treatment is drainage of the abscess. From this history a good doctor will know that there is abscess and will know where to search for it.

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

Note: the ascending colon can be felt on the lumbar region anteriorly (after the anterior abdominal wall) specially if there is distention or a mass

- **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** (from midgut) supply this area. The right colic artery is the main artery that supplies the ascending colon.
2. the middle colic artery supplies the upper part of the ascending colon and mainly the transverse colon
3. 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 (the greater omentum from the stomach descends downward then upward and covers upper and lower surfaces of the transverse colon).
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 then ends at 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** (very important; prevent spreading of infections upward).
10. Taeniae coli, sacculations & appendices epiploicae are present

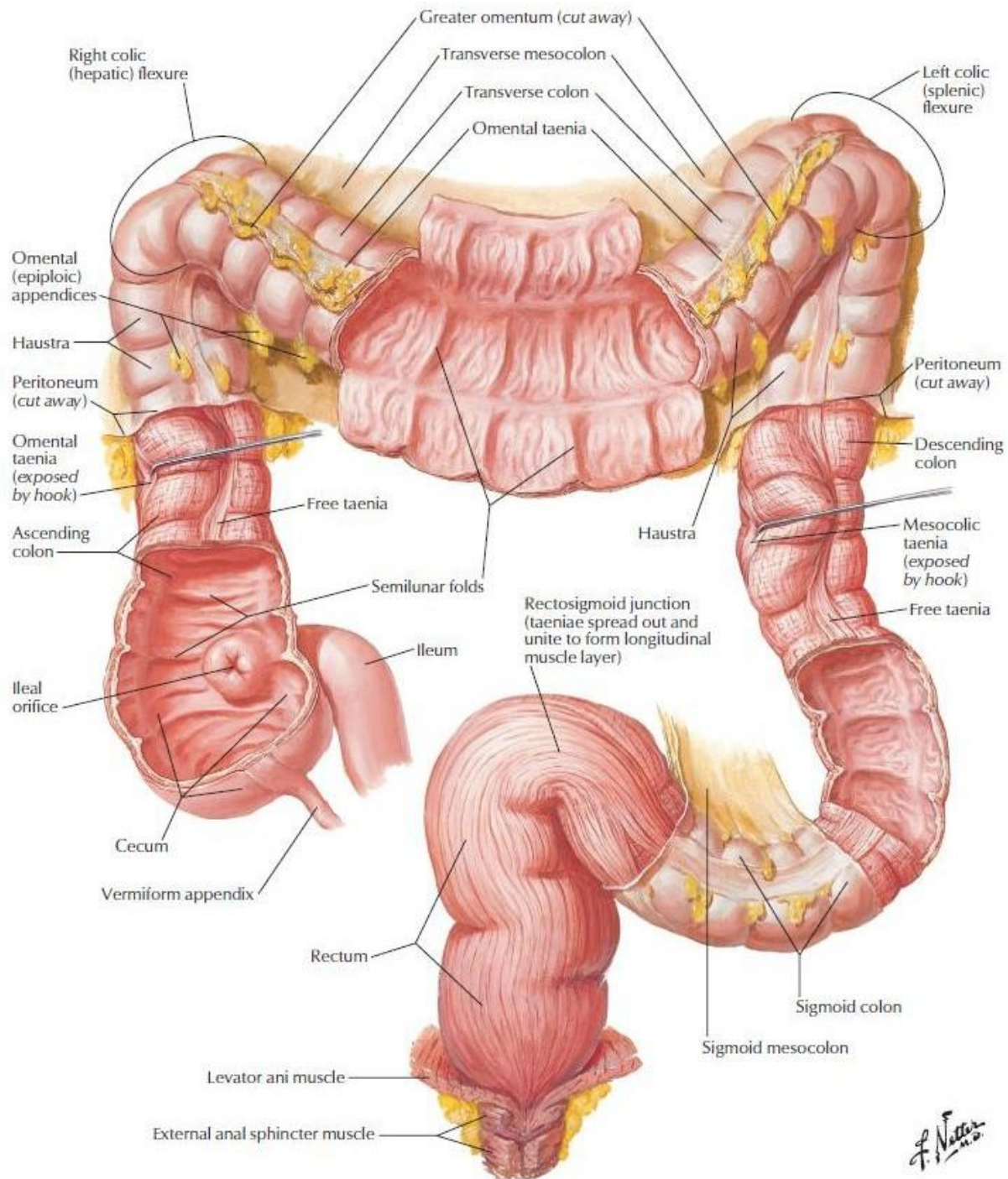
- **The Transverse Mesocolon** = mesentery of the transverse colon (mobile structure)

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.

Note: the mesocolon extends to (and ends at) the anterior border of the pancreas

? 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) if the mesentery is long it will descend downward to the hypogastric region.

- **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.
- 3.

Note: Arcades and vasa recta are mainly for jejunum and ileum. And in the large intestine we have Marginal artery: continuous artery that anastomoses between the end arteries of the large intestine.

- **Veins:**

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

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 sacral spinal nerve) 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 (left iliac fossa), 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 is longer and it descends to the pelvis.

Blood Supply of Descending Colon

- **Arteries:**

1. The left colic and the sigmoid branches of the inferior mesenteric artery (From hindgut)

- **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 sacral spinal nerve).

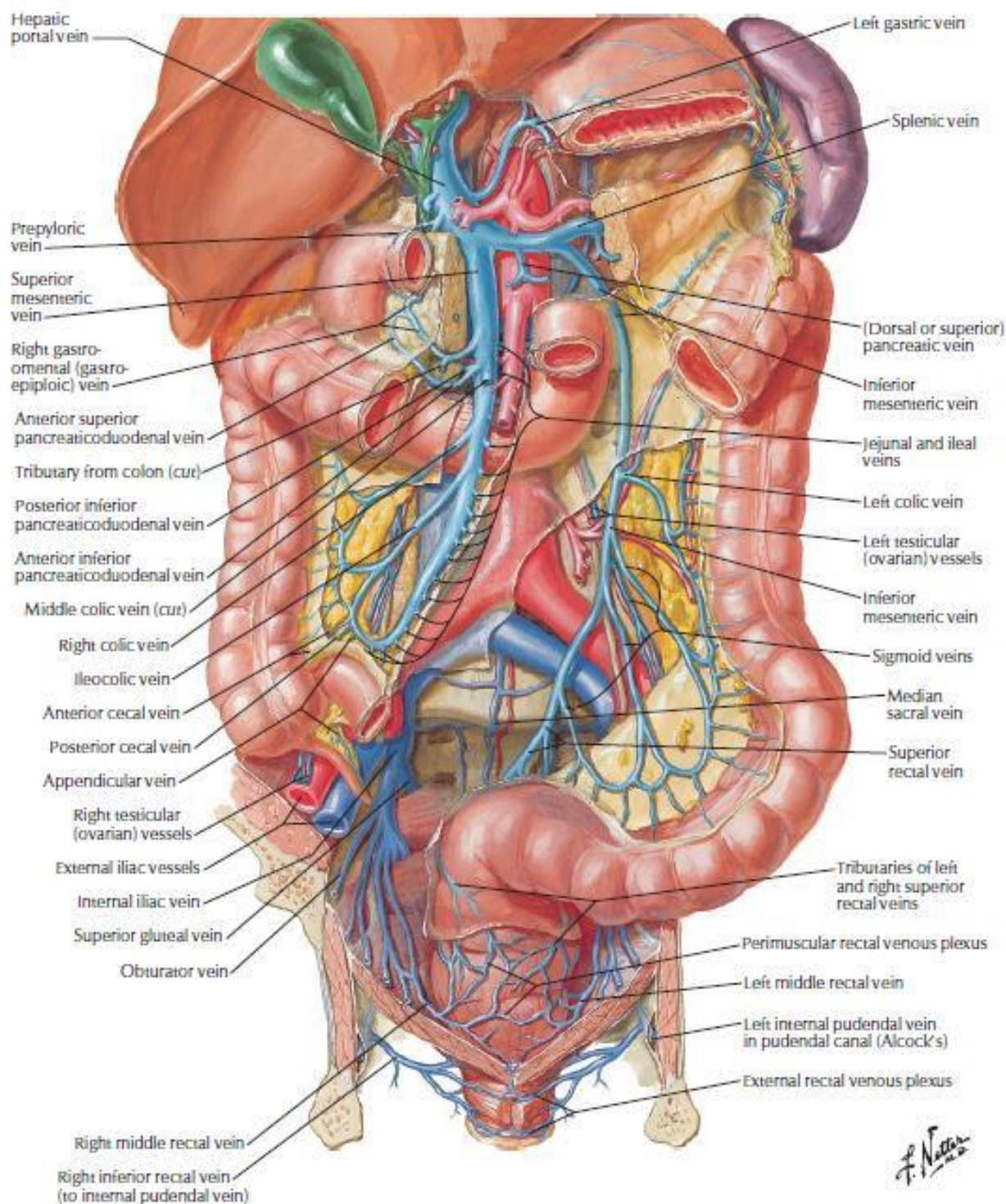
Sorry for any mistakes,

Wish you all best of luck~

Revised and Edited by: Amer Sawalha

Veins of Large Intestine

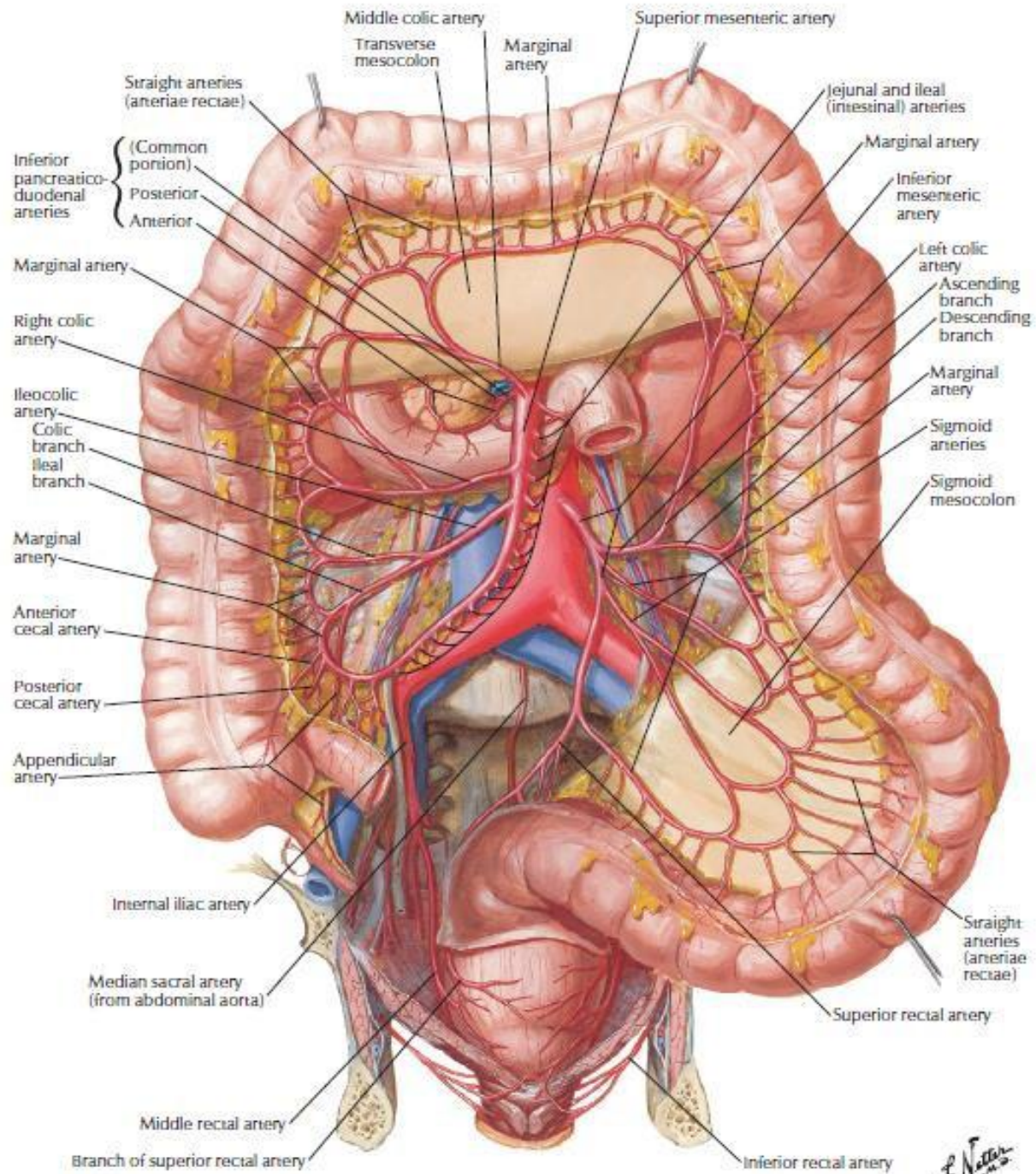
For veins of rectum see also



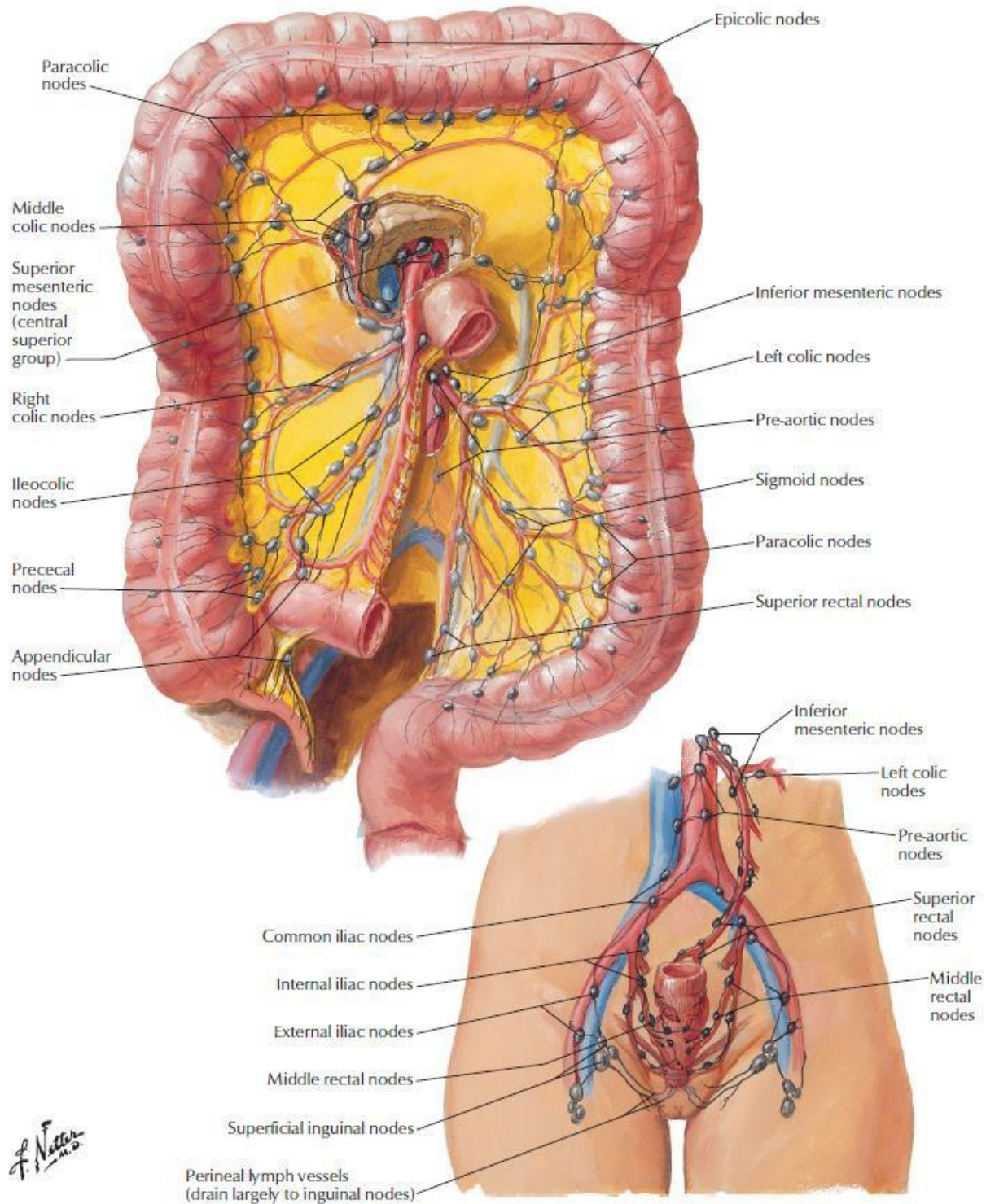
Arteries of Large Intestine

For arteries of rectum see also

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